

Circuit Breaker Maintenance, Low Voltage

4.5 Days, 3.2 CEUs

Low voltage circuit breakers are one of the most critical elements, and of the most unacknowledged, overcurrent protection devices in any power system. Increased exposure to moisture and contaminants makes this type of circuit breaker very susceptible to failure. With proper maintenance, technicians can prevent nuisance trips, and ensure tripping operations execute as required. In addition to improving electrical system reliability by ensuring optimum fault clearing times, well maintained circuit breakers minimize the arc flash hazard energy levels that technicians can be exposed to during a fault. This course seeks to expound upon the science of a circuit breaker, the prescribed maintenance to increase its longevity, and how to read a wide variety of time characteristic curves.

Participants in this class will visually and electrically inspect circuit breakers according to manufacturer and NETA MTS requirements. Based on results of the tests, technicians should be able to make pass/fail decisions on circuit breakers.

This hands-on course is intended for new or experienced electricians and technicians that install, maintain, repair or troubleshoot power circuit breakers rated less than 1,000 volts AC and equipped with electromechanical or solid-state tripping devices.

Lab and Classroom Attire

AVO is committed to the personal safety of each participant and requires safety glasses, long pants, and ANSI rated "safety-toe" work shoes for lab activities. Lecture courses may involve a tour of a work or shop area and for this reason open-toe shoes and shorts are not considered appropriate attire for the classroom.

Learning Objectives

To receive 3.2 CEUs, participants must attend 4.5 days of class (32 contact hours) and attain a minimum average grade of 80% (overall grade will consist of 50% lab practice and 50% final exam). Upon completion of this course and lab practice, the participants will demonstrate that they are able to:

- Describe the different types of circuit breakers, their components, and functions.
- Perform circuit breaker and cabinet service maintenance service safely.
- Interpret and utilize time characteristic curves.
- Demonstrate all standard tests performed on a circuit breaker.

SCOPE

Day 1* (7 contact hours)

- I. Introduction (0.5 hr)
- II. Introduction To Circuit Breaker Maintenance (1.5 hrs)
 - A. Need for Maintenance
 - B. Technical Literature
 - C. Trained Personnel
 - D. Spare Parts
 - E. Tools and Test Equipment
 - F. Approach Boundaries for Energized Work

III. Circuit Breaker Fundamentals (3 hrs)

- A. Definitions
- B. Nameplate Data
- C. Model Designation
- D. Components
- E. Operating Principles

III. Circuit Breaker Fundamentals (cont'd)

- D. Operating Principles (2 hrs)
 1. Mechanical Operation
 2. Electrical Operation

Day 2 (7 contact hours)

IV. Circuit Breaker and Cabinet Service (2 hrs)

- A. Circuit Breaker Removal
 1. Removal Procedure
 2. Racking Position
- B. Cabinet Service
- C. Circuit Breaker Service
- D. Testing
- E. Restoration of Service

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

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SCOPE (continued)

V. Overcurrent Protective Devices (5 hrs)

- A. History
- B. Series Trip Device Operation
- C. Solid-State Trip Device Operation
- D. Overcurrent Trip Device Malfunctions
- E. Curve Interpretation for a Direct-Acting Trip Device

Day 3 (7 contact hours)

- V. Overcurrent Protective Devices (cont'd) (3 hrs)
 - F. Long-Time Delay Band
 - G. Short-Time Delay Band
 - H. Instantaneous Current Curve
 - I. Solid State Trip Devices
 - J. Zone-Selective Interlocks
 - K. Interpretation of a Solid-State Curve
 - L. Testing Solid-State Trip Devices

VI. Lab (4 hrs)

- A. High Current Testing of Trip Devices (Primary Injection Method)

Day 4 (7 contact hours)

- VII. Overcurrent Protective Devices (7 hrs) (cont'd)
 - Practical Exercises
 - 1. Reading Overcurrent Devices
 - 2. Calculating Device Operating Times

Day 5 (half day) (4 contact hours)

- VIII. Miscellaneous (2.5 hrs)
 - A. Records and Recordkeeping
 - B. New Circuit Breakers
 - C. Storage of New Circuit Breakers
 - D. Checkout and Testing of New Circuit Breakers
 - E. Storage of Spare Breakers
- IX. Conclusion (1.5 hrs)
 - A. Review
 - B. Final Exam



STANDARD EQUIPMENT LIST

Battery Maintenance & Testing

Course Number: 475A

REVISED: 9/27/2022

BY: Cory Marchant

DAYS: 4 DAYS

***ON-SITE COURSES

*CLIENT MUST PROVIDE EQUIPMENT

TEXT (PER 1 STUDENT)	
QUANTITY	ITEM
1	BATTERY MAINTENANCE & TESTING , 475A
1	NFPA 70E (CURRENT EDITION)
1	IEEE STD 450 (CURRENT EDITION) ***TO BE RETURNED***

MATERIALS NEEDED (PER CLASSROOM)	
QUANTITY	ITEM
*1	PROJECTOR OR TV WITH PROJECTION CAPABILITIES
*1	DRY ERASE BOARD WITH MARKERS AND ERASERS
*10	STUDENT TABLES
*10	STUDENT CHAIRS

EQUIPMENT LIST (PER CLASS)	
QUANTITY	ITEM
1	BITE 2 OR 3 (BATTERY IMPEDANCE TESTER) OR EQUIVALENT
1	DLRO W/ LONG LEADS
1	AC/DC CLAMP-ON AMMETER
1	DIGITAL HYDROMETER
1	DIGITAL MULTIMETER (DMM)
1	INSULATED FLASHLIGHT
1	INSULATED FLAT MIRROR
1	ASSORTED INSULATED WRENCHES
*1	BATTERY BANK (VLA, VRLA, AND/OR Ni-Cad)
*1	DC BATTERY CHARGER (RECTIFIER) CONNECTED TO BANK
*1	BODY/EYE WASH STATION

PERSONAL PROTECTIVE EQUIPMENT (PER CLASS)	
QUANTITY	ITEM
1	CLASS 00 GLOVES W/ PROTECTORS
1 BOX	DISPOSABLE NITRILE GLOVES
2	SAFETY GOGGLES (HIGH IMPACT, Z87.1+)
2	ACID RESISTANT FACE SHIELD (HIGH IMPACT,Z87.1+)
2	PROTECTIVE (CHEMICAL RESISTANT) GLOVES
1 BOX	CHEMICAL RESISTANT FR RATED APRON

FOR VIRTUAL CLASSES:

CONTENT MATERIAL WILL BE PROVIDED IN DIGITAL FORMAT