

Substation: Components, Testing, and Interpretation - Hands-On

4 Days, 2.8 CEUs

Substation maintenance is a major part of any utility or plant maintenance program. Equipment failures usually result in significant downtime because of long delays in equipment replacement. However, most of these failures can be detected and prevented.

This course is the hands-on component of the Substation: Component, Testing, and Interpretation (SCTI) virtual class; it is the last step to certification. Labs have been designed to help the technician perform the needed tests to locate weak or faulty components in the substation system, to analyze and interpret results, to perform measurements and adjustments, and to identify key lubricating components, while complying with manufacturers', NETA and IEEE standards.

The course is designed to aid skilled qualified substation maintenance technicians to perform the required maintenance and testing of equipment in industrial and utility substations.

Pre-Requisites:

Participant must have taken the Substation: Components, Testing, and Interpretation virtual class and passed the exam successfully.

Lab and Classroom Attire

AVO Training Institute is committed to the personal safety of each participant and require long pants and ANSI rated “safety-toe” work shoes for lab activities. Open-toe shoes and shorts are not considered appropriate attire for the classroom.

Learning Objectives:

To receive 2.8 CEUs, participants must attend 4 days of class (28 contact hours) and must have attained a minimum grade of 80% in the virtual SCTI final exam. Upon completion of this course the participant will demonstrate that he/she is able to:

- Perform AC and DC electrical testing in accordance with manufacturer's recommendations, NETA and IEEE Standards.
- Analyze and interpret results.
- Carry out measurements and adjustments.
- Recognize key lubricating components, and cleaning measures to avoid equipment malfunction.

SCOPE

Day 1* (7 contact hours)

- I. Introduction
- II. Lab 1 - Switchgear
 - A. Contact Resistance of Switch
 - B. Insulation Resistance Test
 - C. Dielectric Withstand Test
 - D. Bolted Connection Resistance Test on Busgear (optional)
 - E. Insulation Resistance Test on Busgear (optional)
 - F. Dielectric Withstand Test on Busgear (optional)

Day 2 (7 contact hours)

- III. Lab 2 - Circuit Breakers
 - A. Vacuum Circuit Breaker
 - Contact Erosion Test
 - Contact Resistance Test
 - Insulation Resistance Test

- Dielectric Withstand Test
- Vacuum Bottle Integrity Test
- B. Air Circuit Breakers
 - Contact Resistance Test
 - Contact Measurements
 - Insulation Resistance Test
 - Dielectric Withstand Test (optional)
- C. Oil Circuit Breakers
 - Tank Loss Index Test
 - Capacitance Test
 - Power Factor Test

Day 3 (7 contact hours)

- IV. Lab 3 - Transformers
 - A. Insulation Resistance Test
 - B. Winding Resistance Test (single coil)
 - C. Power Factor Testing
 - D. Core Excitation Testing

- E. Power Factor Testing of Bushings
- F. Turns Ratio Testing
- G. Single Phase Turns Ratio Testing (optional)
- H. Dual Coil Winding Resistance Test (optional)
- I. CT Multi-Tap Test

Day 4 (7 contact hours)

- V. Lab 4 - Ancillary Tests
 - A. Oil Dielectric Breakdown Testing (optional)
 - B. Core Ground Testing (optional)
 - C. Liquid Insulating PF Testing (optional)
 - D. Instrument Transformers
- VI. Conclusion (3 hrs)
 - A. Review of lab questions

AVO Training Institute is accredited by the International Association for Continuing Education and Training (IACET) and is accredited to issue the IACET CEU

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

EQUIPMENT LIST
SCTI HANDS ON

REVISED: March 2021 BY: I. Baraybar
COURSE OPN232, Rev 2
4.5 days

TEXT
NO TEXTBOOK

(*Client must provide when course is offered onsite)

EQUIPMENT

1 / CLASS	10 kV INSULATION RESISTANCE TESTER
2 / CLASS	MICRO-OHMMETER 100A MINIMUM (DLRO)
1 / CLASS	MOM-2
1 / CLASS	POWER FACTOR TEST SET (DELTA 4000)
1 / CLASS	60/80 kV OVERPOTENTIAL TESTER AC OR DC (DC PREFERRED)
1 / CLASS	VOLTAGE DETECTOR (MEDIUM VOLTAGE)
1 / CLASS	STATIC DISCHARGE STICK (60/80 kV)
1 / CLASS	TRANSFORMER OHMMETER
1 / 2 STUDENTS	670511 OIL TEST CELL
1 / 2 STUDENTS	RUBBER BLANKET
1 / CLASS	MEGGER MRCT TESTER
1 / CLASS	TRANSFORMER TURNS RATIO TESTER (TTR)
1 / CLASS	SINGLE PHASE TRANSFORMER TURNS RATIO TESTER (TTR)

PERSONAL PROTECTIVE EQUIPMENT

*1 / CLASS	SET OF GROUNDING CABLES (BALL TYPE DALLAS ONLY)
*2 / CLASS	TESTED, CLASS 4, GLOVES (SIZE 9, 10 & 11)
*1 / CLASS	INSULATED QUICK RELEASE GRIPALL STICK
*1 / STUDENT	SAFETY GLASSES

FIXED EQUIPMENT

*1 / CLASS	5-15 kV VACUUM CIRCUIT BREAKER W/INSTRUCTION MANUALS AND CONTROL PRINTS
*1 / CLASS	5-15 kV AIR CIRCUIT BREAKER W/INSTRUCTION MANUALS AND CONTROL PRINTS
*1 / CLASS	THREE PHASE 500 kVA (MINIMUM) LIQUID FILLED TRANSFORMER (PREFER TAPPED PRIMARY AND SECONDARY) AND INSTRUCTION MANUAL
*2 / CLASS	CONDENSER BUSHINGS

OPTIONAL FIXED EQUIPMENT

- *1 / CLASS 5-15 kV AIR CIRCUIT BREAKER W/INSTRUCTION MANUALS AND CONTROL PRINTS
- *1 / CLASS VACUUM BOTTLES (1 BROKEN, 1 GOOD)
- *1 / CLASS LINE UP OF SWITCHGEAR (5 or 15 kV). IT SHOULD HAVE AT LEAST 3 CUBICLES WITH CIRCUIT BREAKERS AND SOURCE DISCONNECT SWITCH, PREFERABLY WITH CURRENT LIMITING FUSES.

TOOLS

- 2 / CLASS TOOL BOX WITH HAND TOOLS
- 1 / STUDENT SCIENTIFIC CALCULATOR
- *1 / CLASS 3/8 INCH DRIVE TORQUE WRENCH (20 OR 30 TO 200 in.lb.)
- *1 / CLASS 1/2 INCH DRIVE TORQUE WRENCH (0-140 ft.lb.)

SUPPLIES

- 2 / CLASS PACKAGE OF LINT FREE TOWELS
- 1 / CLASS PACKAGE OF RED SCOTCH BRITE
- *1 / CLASS 1 PT. DENATURED ALCOHOL
- *1 / CLASS TUBE/CAN CONDUCTIVE LUBE (NO-OX-ID SPECIAL GRADE A)
- *1 / CLASS TUBE/CAN NON-CONDUCTIVE LUBE (MOBIL 28 OR EQUIVALENT)