

Cable Testing and Diagnostics, Medium Voltage

4.5 Days, 3.2 CEUs

Medium voltage cable systems are the backbone of electrical systems worldwide, yet often they are the most ignored part of the power system – **until there is a failure**. Cable systems today have higher failure rates than ever before due to aging, environmental stresses and improper installation. While the ability to efficiently locate faults can greatly reduce downtime, an effective cable testing program can help technicians in prioritizing cable repair prior to failure. This helps prevent unplanned outages, equipment damage and electrical accidents and ultimately reducing costs.

This hands-on course is intended for new or experienced electricians and technicians that install, maintain, repair or troubleshoot 5-35 kV solid dielectric power cables.

The student should have some field experience and basic knowledge of AC/DC electricity.

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, the participant 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 and 50% final exam). Upon completion of this course and lab practice, the participant will demonstrate that he/she is able to:

- Identify medium voltage cable components and causes of failure.
- Utilize safe work practices for cable testing per OSHA and industry consensus standards.
- Interpret current industry cable testing standards and procedures.
- Perform and analyze results of:
 - Insulation Resistance Tests (DAR and PI).
 - Withstand Tests (DC, AC & VLF).
 - Diagnostic Field Tests (Tan Delta & PD).
- Outline the benefits gained by establishing a Conditioned Based Cable Maintenance Program.

SCOPE

<p>Day 1* (7 contact hours)</p> <p>I. Introduction (0.5 hours)</p> <ul style="list-style-type: none"> A. Schedule B. Course outline <p>II. Introduction To Medium Voltage Cable Testing (1.5 hr)</p> <ul style="list-style-type: none"> A. Purpose of Power Cables B. Cable Components & Operation C. Cable Insulation D. Types of Tests Performed on Medium Voltage Cables E. General Guidelines for Cable Testing Safety 	<p>AM Break</p> <p>III. Cable Testing Standards (2 hr)</p> <ul style="list-style-type: none"> A. Institute of Electrical and Electronics Engineers (IEEE) B. National Fire Protection Association (NFPA) C. International Electrical Testing Association (NETA) D. Association of Edison Illumination Companies E. Insulated Cable Engineers Association (ICEA) F. American National Standards Institute (ANSI) 	<ul style="list-style-type: none"> G. American Society for Testing of Materials (ASTM) H. International Electro-Technical Commission (IEC) I. International Council on Large Electrical Systems (CIGRE) <p>Lunch</p> <p>IV. Insulation Resistance Testing (IR) (3 hrs)</p> <ul style="list-style-type: none"> A. Safety Precautions B. Theory of Test <p>PM Break</p> <ul style="list-style-type: none"> C. Evaluating Resistance Measurement
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*Class scheduling times may vary based on discussions and size of class

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SCOPE (continued)

Day 2 (7 contact hours)

- V. Field Tests (Withstand Tests) (4 hrs)
 - A. Safety Precautions
 - B. Voltage Withstand Tests
 - C. Alternating Current (AC Line Frequency) Withstand Test
 - D. Very Low Frequency (VLF) Withstand Test
 - E. Test Equipment Connections
 - F. Direct Current (DC) Withstand Test
- AM Break
- G. Current Avalanche
- H. Other Unusual Currents
- I. Ionization Control
- J. Voltage Regulation
- K. Insulation Resistance
- L. Testing Intervals and Values
- Lunch
- VI. Field Tests (Withstand Tests) (3 hrs)
 - A. D.A.R., P.I. and I.R. labs
- PM Break
- B. V.L.F. Withstand testing lab
- C. D.C. Withstand testing lab

Day 3 (7 contact hours)

- VII. Field Tests (Diagnostics Tests).... (7 hours)
 - A. Dissipation Factor Testing
 - B. Analyzing Tan Delta Test Results
- AM Break
- C. Test Area Safety
- D. Interpreting Test Data
- E. Technical Analysis
- Lunch
- F. PD Test Equipment Set-Up
- G. Interpreting Test Data
- PM Break
- H. Other Cable Tests
- I. Shield Testing
- Day 4 (7 contact hours)**
- VIII. Testing Labs (7 hours)
 - A. VLF Tan Delta lab
- AM Break
- A. VLF Tan Delta lab (cont'd)
- Lunch
- B. Partial Discharge lab
- PM Break
- B. Partial Discharge lab (cont'd)

Day 5 (half day) (4 contact hours)

- IX. Condition Based Maintenance of Medium Voltage Cables "Notes from Underground" (3 hrs)
- AM Break
- X. Conclusion (1 hr)
 - A. Review
 - B. Final Test

STANDARD EQUIPMENT LIST

CABLE TESTING & DIAGNOSTICS

MEDIUM VOLTAGE

UPDATED –NOVEMBER 2017 BY: MARK FRANKS
COURSE NUMBER 131 REV.3 NOVEMBER 2017
4 1/2 DAYS

TEXT

1 / STUDENT *CABLE TESTING & DIAGNOSTICS, MEDIUM VOLTAGE
REV .3, NOV 2017*

INCLUDE: USB WITH APENDICES (EQUIPMENT
MANUALS)

EQUIPMENT

1 / CLASS MEGGER VLF SIN 45 WITH LEADS AND MANUAL
1 / CLASS MEGGER TDS NT PARTIAL DISCHARGE TEST SET WITH HV
FILTER, LEADS, MANUAL
1/ CLASS COMPUTER WITH PDS 60 SOFTWARE AND HARDWARE KEY
AND MANUAL
1 / CLASS MEGGER 70 KV DC DIELECTRIC TEST SET WITH LEADS AN
MANUAL
1 / CLASS MEGGER TELEFLEX TIME DOMAIN REFLECTOMETER WITH
LEADS AND MANUAL
1 / CLASS MEGGER 10 KV MODEL MIT 1025 INSULATION RESISTANCE
TESTER WITH LEADS AND MANUAL

DEVICES

2 / CLASS RUBBER GLOVES SIZE 10
2 / CLASS BIDDLE GROUNDING STICK
1 LOT/CLASS BARRIER (DALLAS ONLY)
1 LOT/CLASS BARRIER CONES (DALLAS ONLY)
2 / CLASS 25 FT EXTENSION CORDS
1/ CLASS CLASS 4 SALISBURY RUBBER BLANKET
2 / CLASS 3 PHASE URD GROUNDING SETS S
2 / CLASS LIVE LINE TOOL (SHOT GUN STICK)
2 / CLASS HARD HAT AND FACE SHIELD
6 / CLASS 15 KV JUMPERS WITH ELBOWS
3 / CLASS 15 KV FEED THROUGH DEVICES
6 / CLASS 15 KV PARKING STANDS
1 / CLASS PENTA SOCKET & RATCHET TOOL
6 / CLASS ELBOW TEST PROBES
1 / CLASS ELBOW PULLER
1/ CLASS HV ELBOW CONNECTOR FOR TDS NT

MISCELANEOUS MATERIALS

STANDARD EQUIPMENT LIST
CABLE TESTING & DIAGNOSTICS
MEDIUM VOLTAGE

A/V EQUIPMENT

1 / CLASS	COMPUTERIZED PROJECTOR
1 / CLASS	WHITEBOARD WITH MARKERS
1 / STUDENT	SAFETY GLASSES