Basic Electrical Troubleshooting

4 Days, 2.8 CEUs

Effectively troubleshooting electrical systems is an essential skill for any technician responsible for maintenance in an industrial, commercial or utility facility. The inexperienced troubleshooter may "chase the voltage" or mistake symptoms for problems – which leads to replacing the same parts repeatedly. Technicians who understand effective electrical troubleshooting techniques can save their organization money by properly identifying faulty components and preventing accidents and equipment damage that can occur from failures. Utilizing safe, effective troubleshooting techniques also ensures compliance with OSHA 1910.333(a)(1) which covers the requirements for de-energized work.

This hands-on course is intended for electricians and technicians responsible for troubleshooting electrical system problems and supervisors responsible for overseeing troubleshooting electrical system problems. The class participant should have 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 2.8 CEUs, participants must attend 4 days of class (28 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 participant will demonstrate that he/she is able to:

- Apply formulas derived from Ohm's law and Kirchhoff's law to solve for electrical values in circuits.
- Describe hazards of electrical work and means to work safely.
- Utilize electrical test equipment safely and correctly.
- Identify common electrical components and their general applications in circuits.
- Practice systematic, deenergized troubleshooting methods for common control circuits.

SCOPE

Day 1* (7 Contact Hours)

I. Introduction (0.5 hours)
- A. Schedule
- B. Course Outline

II. Electrical Theory Review (1.5 hours)
- A. Electrical Circuits
- B. Amps, Volts, & Ohms
- C. Ohm's Law
- D. Kirchhoff's Law
- E. Solving for Unknown Values in Series, Parallel, and Combination Circuits

AM Break

III. Electrical Safety (2 hours)
- A. Electrical Hazards
- B. Electrical Risk Assessment
- C. Electrical Safe-work practices
  1. Electrical Work Procedures
  2. LOTO
  3. Work Protection Boundaries
  4. PPE Selection

Lunch

IV. Electrical Test Instrument Operation (3 hours)
- A. Voltmeters
- B. Ammeters
- C. Ohmmeters
  1. 2-Wire Resistance Measurements (DMM)
  2. 3-Wire Resistance Measurements (Megohmmeter)
  3. 4-Wire Resistance Measurements (DLRO)

PM Break
- D. Digital Multimeter Safety
- E. Miscellaneous Meters
  1. Frequency meters
  2. Infrared & Acoustic
  3. Power Quality Analyzers
  4. Thermometers
  5. Tachometers
  6. Lumen meters (footcandles)
  7. Phase sequence meters
  8. Power Factor meters

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

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Basic Electrical Troubleshooting

4 Days, 2.8 CEUs

SCOPE (continued)

Day 2 (7 Contact Hours)

V. Electrical Components and Circuits (7 hours)
- A. Passive & Active Circuit Components
  - 1. Insulation & Conductors

AM Break
- B. Lab
  - 1. Generators, Transformers, & Batteries (Line)
  - 2. Lights, Heaters, Motors, & Solenoids (Load)

Lunch
  - 3. Indicators (lights)
  - 4. Switches
    - i. NO & NC / MAIN-MOM
    - ii. Limit Switches

PM Break
  - 5. Control Relays
  - 6. Timers

Day 3 (7 Contact Hours)

V. Electrical Components and Circuits (continued) (7 hrs)
  - 7. Proximity Sensors
  - 8. Contactors & Motor Starters

AM Break
- C. Electrical Circuits Illustrated in Ladder Diagrams
  - 1. Industrial Electrical Symbols

Lunch
  - 2. Logic (IOs)

PM Break
  - 3. Ladder Information

Day 4 (7 Contact Hours)

VI. Electrical Troubleshooting Steps (6 hours)
- A. Shorts and Opens
- B. Troubleshooting Test Procedures

AM Break
- C. Troubleshooting by Dividing Control Elements in Half (Divide and Conquer)
- D. Measuring Amps, Volts & Ohms in a Circuit

Lunch
- E. Measuring Current
- F. Rules for Troubleshooting

PM Break

VII. Conclusion (1 hour)
- A. Review
- B. Final Exam

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STANDARD EQUIPMENT LIST
BASIC ELECTRICAL TROUBLESHOOTING

REVISED 7/11/19 C. HELMICK
COURSE NUMBER 410, REV.1
4 DAYS

TEXT

1 / STUDENT	*BASIC ELECTRICAL TROUBLESHOOTING* COURSE NUMBER 410 REV1, MAY 2019

HANDOUT

1 / STUDENT	*UGLY'S ELECTRICAL REFERENCES* LATEST EDITION

EQUIPMENT

1 / STUDENT	CALCULATOR
1 / CLASS	TRAINER WITH ACCESSORIES
1/ CLASS	BET TOOL BOX
1 / CLASS	DIGITAL MULTI-METER (CAT III)
1 / CLASS	SPERRY AMPCLAMP
1/ CLASS	AMPCLAMP W/120V SPLITTER
1/ CLASS	INSULATION RESISTANCE TESTER (1 kV)
1 / CLASS	CONTROL TRANSFORMER (480P-240/120S)
1/ CLASS	MOTOR WITH TURN TO TURN SHORT
1 / CLASS	MOTOR VISIBLE DAMAGE
1 / CLASS	9-LEAD, FRACTIONAL HP DUAL VOLTAGE MOTOR
1 / CLASS	ALLEN BRADLEY MOTOR STARTER