

Electrical Troubleshooting

Course 210: Electrical Troubleshooting

Covers use of schematic diagrams, determining sequence of operation, and use of building diagrams and single-line diagrams. Includes troubleshooting procedures for control circuits and combination starters. Explains troubleshooting practices on DC and AC motors, identifying unmarked leads on three-phase delta and Y-connected motors, and troubleshooting lighting systems.

TPC Training is accredited by IACET to offer **1.0 CEU** for this program.



Lesson 1: Troubleshooting with Electrical Schematics

Topics

Standard Symbols and Diagram Identification; Elementary Diagrams; Reading the Schematic Diagram; Power Circuit; Control Circuit; Motor-Starting Circuit; Identifying Conductors; Numbering Components; Locating Relay Contacts; Control-Panel Layouts; Sequence of Operation; Related Schematic Information

Objectives

- Identify a control relay on an electrical schematic.
- State the NEC requirements for fuses in ungrounded conductors.
- Explain component numbering on electrical schematics.
- Explain how conductors in a motor-control circuit are identified.

Lesson 2: Troubleshooting with Building Drawings

Topics

Architectural Drawings; Materials for Construction; Installation Drawings and Diagrams; Riser Diagrams; Substation Drawings; One-Line Diagrams; Electrical Symbols on Blueprints; Building Lighting Diagrams; Power Installation Drawings; Circuit Tracing

Objectives

- Name the kinds of drawings used by electrical specialists.
- Identify electrical symbols commonly used for building diagrams.
- Describe a one-line diagram.
- Discuss the different types of drawing characteristics.

Lesson 3: Troubleshooting Control Circuits

Topics

Control-Circuit Functions; Trouble Conditions; Conditions of Protection; Pushbutton Control Circuits; Sequence-Control Circuits; Troubleshooting Control Circuits; Overload-Protection Circuits; Troubleshooting a Motor Circuit

Objectives

- Explain how severe three-phase voltage unbalance affects a three-phase motor.
- List the advantages of inherent protection.
- Explain how undervoltage release works.
- Describe how to troubleshoot a motor circuit.

Lesson 4: Troubleshooting Combination Starters

Topics

Troubleshooting Control Circuits; Instruments for Troubleshooting; Troubleshooting a Starter; Step-by-Step Troubleshooting Procedures; Troubleshooting Problems; Steps in Locating Problems; Troubleshooting Control Relays; Using Relay-Troubleshooting Charts; Latching-Relay Contact Checks; Timing-Relay Checks; Replacing Relay Coils

Objectives

- List the reasons why a magnet coil burns or short-circuits.
- List the steps in troubleshooting a defective motor.
- Explain how a mechanical latching relay works.
- Explain how an electronic timing relay operates.

Lesson 5: Troubleshooting Control Devices

Topics

Reversing Controllers; Using a Checking-Sequence Chart; Autotransformer Starters; Multispeed Motor-Starter Controls

Objectives

- Demonstrate how to reverse the rotation of a three-phase induction motor.
- Explain the function of limit switches in reversing-motor applications.
- Describe how to use a checking-sequence chart.
- Select the best starter for use where it is undesirable to put a heavy load on the power supply.
- Explain how to change the speed of a squirrel-cage motor.

Lesson 6: Troubleshooting Special Controls

Topics

Selenium Rectifiers; Unbalance in Three-Phase Rectifiers; Selenium-Rectifier Life; Testing Rectifier Diodes; Testing Three-Phase Rectifiers; Electric-Pneumatic Control Circuits; Speed, Size and Safety Comparisons; Comparing Relays and Valves; Control-System Logic; Producing Memory with Feedback; Static Control and Logic; Logic Functions; Time-Delay Element

Objectives

- Explain the effects of age on a selenium rectifier.
- Name the protective devices used in electrical systems and pneumatic systems.
- State the definition of a bistable device.
- List the functions of a static control device.

Lesson 7: Troubleshooting DC Motors

Topics

Problems in DC Motors; Commutator Discoloration; Brush Sparking; Open Armature Winding; Electrical Vibration; Mechanical Vibration; Stationary Parts of the Motor; Brush Problems; Bearings; DC Motor Controls; Drum Controllers; Problems Caused by Fire and Flood

Objectives

- List causes of electrical and mechanical vibration in a dc motor.
- Explain how oil saturation affects brushes in a dc motor.
- Explain how maximum bearing operating temperature is determined.
- List problems in the motor control that can cause sudden or unexpected changes in motor speed.
- Explain how to salvage a water-soaked motor.

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Lesson 8: Troubleshooting AC Motors

Topics

Failures in Three-Phase Motors; Grounded Stator Windings; Shorted Pole-Phase Groups; Reversed Pole-Phase Groups; Short-Circuited Phases; Reversed Phases; Open Circuits; Incorrect Voltage Connections; Identifying Y Connections; Identifying Delta Connections; Troubleshooting Split-Phase Motors; Grounded Windings; Open Circuits in Split-Phase Motors; Short-Circuited Windings; Noisy Operation

Objectives

- Identify various kinds of three-phase motor failures.
- Demonstrate how to conduct a balanced-current test on a three-phase, Y-connected winding.
- List the symptoms of a reversed phase in a three-phase winding.
- Explain how to identify external leads that have become defaced.
- Demonstrate how to test for an open circuit in a split-phase motor.

Lesson 9: Troubleshooting Lighting Systems

Topics

Planned Lighting Maintenance; Troubleshooting Basics; Troubleshooting Fluorescent Lighting Systems; Troubleshooting Dimmable Fluorescent Lighting Systems; Troubleshooting HID Lighting Systems; Troubleshooting Dimmable HID Lighting Systems; Troubleshooting Incandescent Lamps; Troubleshooting Occupancy Sensors and Other Switching Controls

Objectives

- Describe the elements of a planned maintenance program.
- Explain the function of lamps, ballasts, and lighting controls.
- Describe the basic troubleshooting process.
- Detail how to troubleshoot common lamp ballast system problems.
- Describe lighting system commissioning.
- Detail how to troubleshoot common occupancy sensor and dimming system problems.

Lesson 10: Saving Time in Troubleshooting

Topics

Preliminary checks; Analyzing the complaint; Checking refrigerant pressures; Sequence of Operation; Developing the Graph and Log; Tracing Circuit Problems; Troubleshooting Before Installation; Troubleshooting After Installation; Standardizing Prints; Equipment Changes and Modifications; Motor-Location File

Objectives

- Name and describe the elements of a sequence of operation.
- List the features that must appear on an elementary wiring diagram to make it comply with JIC standards.
- List the steps in troubleshooting a new machine.
- List the information to be included in a motor location file.
- Select the best method for identifying a motor.