HVAC Electrical Fundamentals

Seminar Length: 2.0 Days

Course Benefits:
This course is intended to improve a technician’s ability and confidence when electrically troubleshooting commercial HVAC equipment. The course will broaden the technician’s capabilities to troubleshoot controls and other electrical circuits by teaching an understanding of practical electrical theory as applied to the products and components found in HVAC. The information and skills learned should greatly decrease service diagnosis time and take the guesswork out of isolating problems found in single- and three-phase air conditioning and heating products.

References required:
Required student materials are provided for each attendee.

Specific Course Objectives:
- Define and use fundamental electrical terms, laws and formulas for understanding what electricity is and what it does.
- Understand the basic logic of series and parallel circuits.
- Understand proper use of multi-meters for troubleshooting circuits.
- Increase confidence and ability to read complex wiring diagrams.
- Understand safeties and component operation in Trane equipment.
- Become familiar with the main characteristics of single-, and three phase motors and associated controls.
- Learn a systematic, efficient method for electrical troubleshooting, to be applied to all major HVAC products.

Outline:

A. Introduction
   1. Course Content
   2. Study Guide
   3. Safety - General

B. Troubleshooting Fundamentals
   1. Electrical Flow, Conductors and Insulators
   2. Magnetism
   3. Voltage, Current, and Resistance; Ohm’s Law
   4. Power, Safety, Volt-Ohm Meters

C. Direct Current and Basic Control
   1. Series Flow Logic
   2. Parallel Flow Logic

D. Alternating Current
   1. Single Phase
   2. 3 Phase
   3. Rating Transformers
   4. Effects On Circuits
      a. Capacitance & Inductance
      b. Resistance
   6. Resistive, Inductive and Capacitive Circuits
      a. Power
      b. Power Factor
      c. Horsepower

E. Motors
   1. Single-Phase Motors
   2. Starting Methods
   3. Three-Phase Motors and Starters
   4. Identifying Failure Modes:
      a. Insulation Failures,
      b. Ground Faults,
      c. Shorts,
      d. Opens,
      e. Internal Overload,
      f. Single-Phasing,
      g. Voltage, Current Unbalance

F. Controls & Safeties –
   1. Operation,
   2. Troubleshoot HVAC Electrical Components
   3. How they Operate
   4. How to Adjust
   5. How to Troubleshoot
   6. Using Meters to Identify
   7. Proper Phasing (3 phase)
   8. Failure Modes
   9. Calculating Voltage and Current Unbalance
   10. Identifying Single-Phase Compressor Motor Terminals

G. Wiring Diagrams
   1. Understanding Trane Standardized Diagrams
   2. Flow logic
   3. Troubleshooting from Diagrams