ELECTRICAL TECH SKILLS

MAXIMIZE YOUR WORKFORCE

ELECTRICAL QUALIFICATION IN JUST 4 DAYS

FUNDAMENTALS OF ELECTRICAL MAINTENANCE

PROGRAM OVERVIEW

ElectricalTechSkills.com

Fundamentals of Electrical Maintenance course

Minimizing Downtime:
The Value of Efficient Troubleshooting

An electrical technician who can systematically troubleshoot and safely repair their plant's equipment will ultimately add to their organization's bottom line. The untrained technician unnecessarily:

- Replaces costly parts
- Must wait for technical support from engineering, the supervisory staff, or the manufacturer's support organization.
- Sometimes installs parts incorrectly, resulting in damaged equipment.

The training professionals at **ETS** have designed a course that will give your technicians the skills and knowledge they need to become safe and technically proficient.

The **Fundamentals of Electrical Maintanence** course begins with basic electrical theories and ends with more advanced electrical maintenance troubleshooting concepts. The course combines classroom lectures with hands-on activities that have the students building and troubleshooting circuits utlizing industrial electrical equipment, components, drawings and test equipment.

Who Should Attend?

This hands-on course is intended for new or experienced electricians and technicians that install, maintain, repair or troubleshoot industrial electrical equipment rated 600 volts or less.

Need more information?
Contact us!

Electrical Tech Skills: 11699 Brookpark Road • Cleveland, Ohio 44130

216-626-5948 | info@ElectricalTechSkills.com

CLASS SYLLABUS

Module 1: Basic Electrical Theory

The lesson material will be a combination of classroom lecture and hands-on exercises that start with electrical basic theory and finish with more advanced troubleshooting concepts. The students will use breadboards to

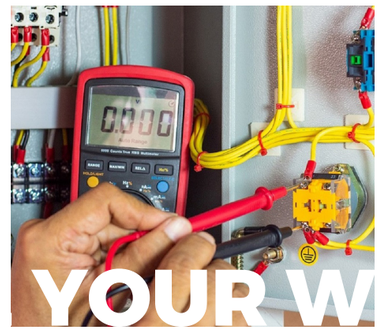
build circuits, take volt, ohm and current measurements that will verify their previously calculated values. At the completion of this module the student will be able to identify common circuit malfunctions such as opens and shorts utilizing test instruments.

Understand Basic Electrical Concepts

- Basic atomic structure
- Direct Current (DC)
- Alternating Current (AC)
- Volts / Ohms / Amps
- Insulators / Conductors
- Ohm's law
- Circuit Construction
- Basic Troubleshooting Techniques

Use and Limitations of Test Equipment

- Volt Meters
- Ohm Meters
- Amp Meters



MAXIMIZE YOUR WORKFORCE

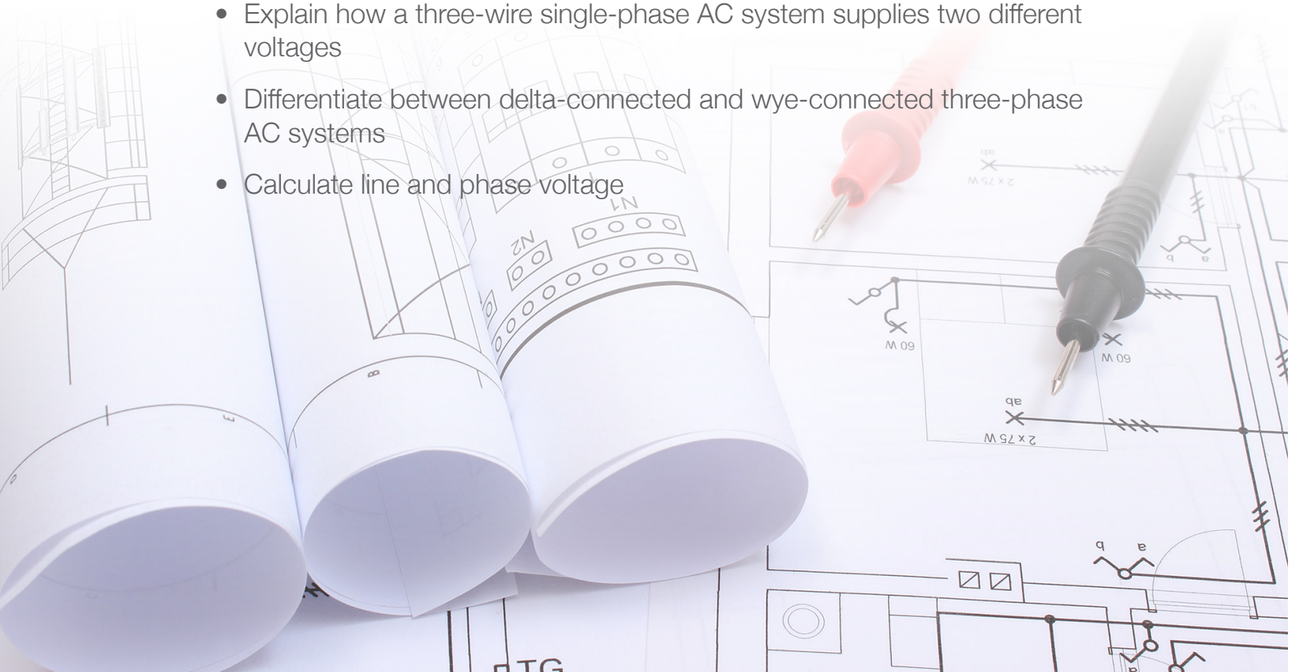
CLASS SYLLABUS

Module 2: Alternating Current

At the completion of this module, the student will understand what alternating current is, how it works, and what factors affect the operation and maintenance of AC equipment such as motors, transformers, and distribution equipment.

Learning Outcomes

- Describe single and three-phase alternating current
- Understand how alternating current is generated
- Explain the principals of electromagnetism
- Explain how current flow and polarity change in AC circuits
- Explain what frequency is and how it is measured
- Define peak value, peak-to-peak value, and effective value with respect to AC voltage and current
- Explain the difference between single-phase and three-phase AC systems
- Explain how a three-wire single-phase AC system supplies two different voltages
- Differentiate between delta-connected and wye-connected three-phase AC systems
- Calculate line and phase voltage



Module 3: Transformers

Electric transformers are utilized in most electrical equipment. Transformers can either step-up or down voltages to provide a safer level for equipment controls that will be interacted with by plant employees. Even though

transformers do not contain any moving parts they can fail due to improper maintenance or overloading. This module will explain how a transformer operates, how to determine the correct size, and identify common malfunctions.

Learning Outcomes

- Explain how a transformer operates
- Identify common uses of transformers
- Describe the components that make-up a transformer
- Determine the turns ratio of a transformer
- Compare and contrast three-phase and single-phase transformers
- Read transformer nameplate information
- Explain transformer wye and delta configurations
- Calculate phase and line voltages
- Determine transformer sizing based on load
- Calculate short circuit current
- Discuss transformer malfunctions

CLASS SYLLABUS

Module 4: Electrical Motor Operation and Troubleshooting

This module starts with the basics of electric motors and control techniques thorough fundamental motor maintenance and identification of common electric motor failures. This module will have the students building and troubleshooting both basic and specialized motor control circuits, as well as, wiring three-phase electric motors for both high and low voltage based on the information they glean from the motor's nameplate. The students will learn how to identify shorted and open windings by using test equipment such as volt/ohm meters and insulation resistance testers.

Learning Outcomes

- Identify the parts of an electric motor
- Explain the operation of a synchronous electric motor
- Given name plate data properly connect a three-phase electric motor
- Using test equipment identify the cause of a malfunctioning electric motor
- Troubleshoot open and shorted motor windings
- Clean, inspect, and repair a NEMA rated motor starter

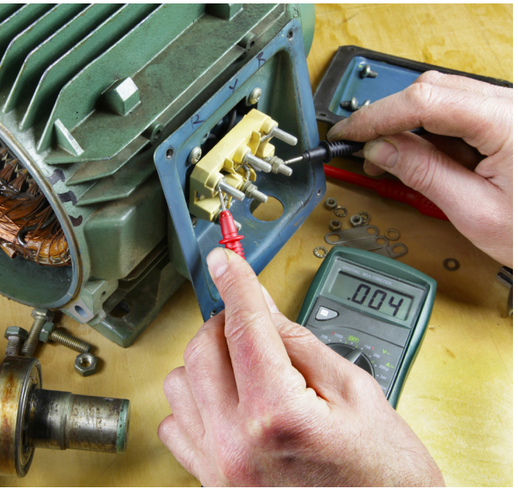
Module 5: Motor Control Wiring and Troubleshooting

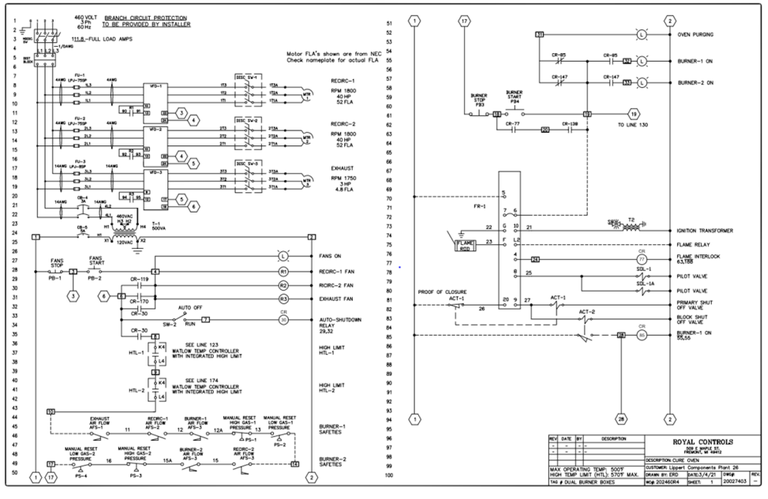
This module provides the student with the necessary understanding of motor control devices such as limit switches, motor starters, and relays and their symbols used on electrical diagrams.

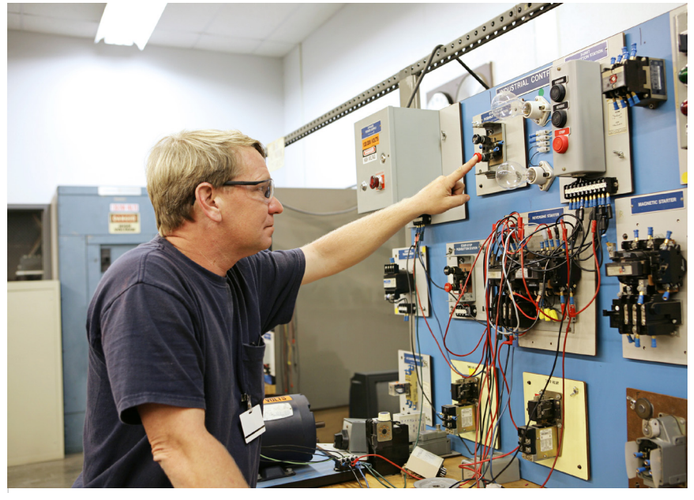
Students will build common motor control stop and start circuits using real world equipment from ladder diagrams. Troubleshooting techniques will be explained and performed as part of this intensely hands-on module.

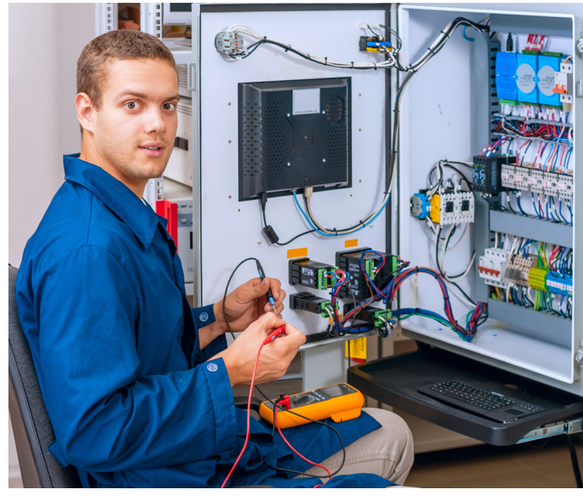
Learning Outcomes

- Identify electrical components and their symbols on electrical drawings
- Read a ladder diagram and explain the operation logic
- Explain the operation of relays
- Build a 3-wire motor control circuit
- Perform basic troubleshooting of motor control circuits using test equipment
- Interpret a common MCC bucket wiring diagram









CLASS SYLLABUS

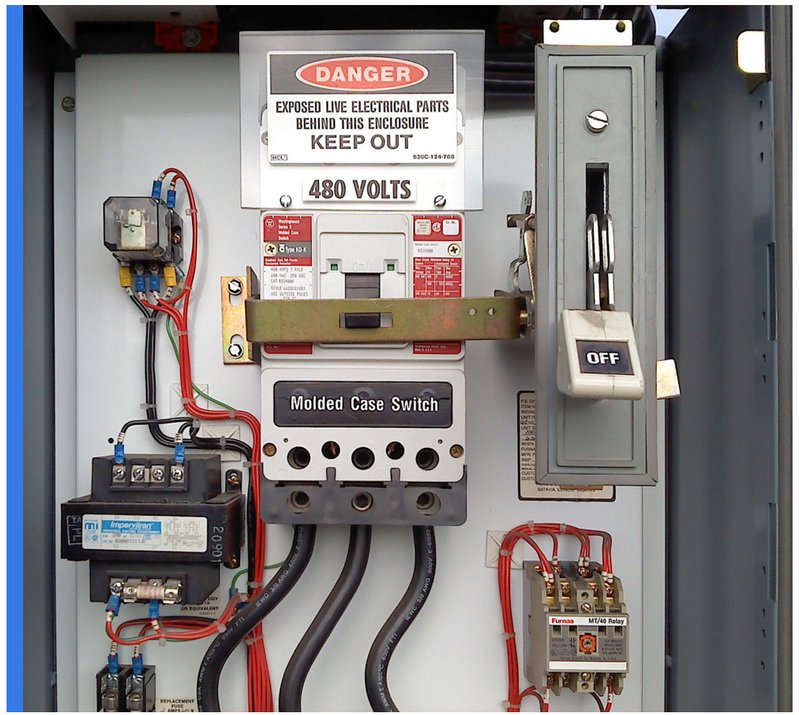
Module 6: Over Current Protection

Over Currents Protection Devices protect equipment and conductors by opening the circuit when predetermined values or parameters are met.

Over current protection devices include fuses, circuit breakers and thermal overloads. In this module, the student will learn the different types of fuses and circuit breakers, how they operate and how they protect circuits from both short circuit and overload conditions.

Learning Outcomes

- Compare and contrast a short circuit, overload, and ground fault
- Explain fuse current, voltage, and interrupt ratings
- Discuss current limiting fuse operation
- Explain rejection type fuse holders and fuses
- Explain the operation of single and dual element fuses
- Identify the components of low voltage circuit breakers
- Discuss the operation of low voltage circuit breakers
- Explain how thermal overloads operate

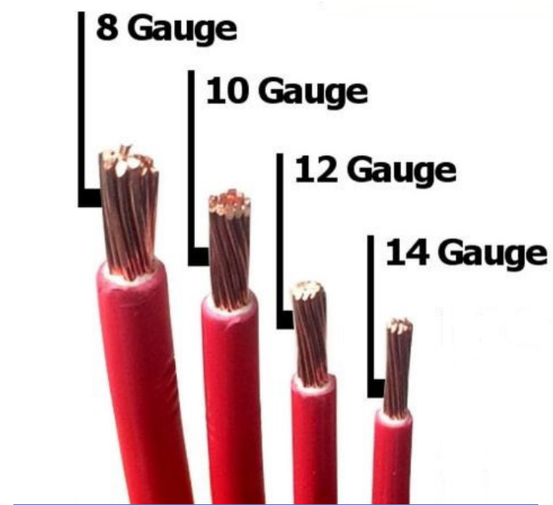


Module 7: Components for Electrical Construction

Industrial Electricians need a basic understanding of the **National Electric Code** to ensure that safety requirements are met when installing new or replacing old equipment. In this module, the student will learn the different wire types, their ampacities and how many conductors can safely be installed in conduits. Wire splicing methods will be discussed such as the safe use of twist-on connectors.

Learning Outcomes

- Compare and contrast wires and cables
- Determine a wire size base on American Wire Gauge Standards
- Determine the Ampacity of a wire in accordance with the **National Electric Code**
- Identify the different insulations used on common industrial wires
- Properly splice and insulate motor connections
- Identify different types of electrical raceways and when they are used



CLASS SYLLABUS

Module 8: Variable Frequency Drive Operation and Troubleshooting

A Variable Frequency Drive (VFD) is a type of motor controller that drives an electric motor by varying the frequency and voltage supplied to the electric motor.

In this module, the student will learn how a **VFD** operates, how to install inputs and output for proper operation, program various parameters, and troubleshoot malfunctions by retrieving and deciphering fault codes. This is a hands-on module in which the students will install, program, operate and troubleshoot real world **VFD** applications.

Learning Outcomes

- Explain the basic theory and applications of **Variable Frequency Drives**
- Explain Internal operation of a **VFD**
- Describe the Installation and maintenance requirements
- Perform installation of real-world field I/O controls
- Explain 0-10v & 5-20ma signal generation and input
- Perform **VFD** basic Programming
- Identify parameters and settings
- Troubleshooting the **VFD** and Field I/O

Module 9: NFPA 70E Electrical Safety

Module 9 will explain the safety related work practices stated **(NFPA) 70E**. Students will obtain the knowledge and skills needed to keep themselves and other employees safe from shock and arc flash hazards. At the completion of this course, students will understand how to assess electrical hazards and their associated risks, devise safe work plans, know when, where and why to use shock and arc flash hazard personal protective Equipment.

Learning & Enabling Objectives

- Identify shock and arc flash hazards and required PPE
- Interpret arc flash hazard warning labels
- Learn how to set-up arc flash and shock protection boundaries
- Understand the requirements for performing energized work
- Establish an electrically safe work condition

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