

Craft Skils Training Catalog





GP Strategies provides a well-established technical training approach to achieve world-class workforce competencies. With decades of deep industrial experience and measurable results, we can offer your organization a full spectrum of bestpractice performance learning programs:

- Precision maintenance
- Craft skills
- Operator care
- Operations
- Reliability
- · Health and safety
- Regulatory compliance

Unique **Training Programs**

More hands-on training. In addition to eLearning, all our customized training programs and on-site courses are designed with at least 60% hands-on lab instruction to increase knowledge retention and improve performance.

Subject matter expertise. Our specialist instructors bring industryspecific experience to help you develop a multi-disciplined workforce with relevant skills for the evolving marketplace.

A proven record of success. For over 55 years, we have partnered with our clients to design, develop, and implement comprehensive training programs that deliver demonstrated return on investment.



A Systematic Approach

Our training platform is crafted to deliver maximum benefits to your workforce based on a progression through four competency levels:



We often begin with a customer-needs or gap analysis to fully understand your situation and recommend the best design, courseware, and delivery to meet your organization's unique needs. However, we can also provide off-the-shelf training to support organizations that have a structured learning program already in place.



Precision Maintenance Training Model

As today's most skilled workers near retirement and the shortage of new talent continues, the demand for multi-skilled technicians becomes more urgent. Our training solutions deliver targeted maintenance upskilling to satisfy your requirements for skilled, plant, and

process-specific labor.

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Our task-based instructional systems design (ISD) approach lays the foundation for our maintenance training skills development process. But to achieve the proficiency outcomes essential for qualified maintenance technicians, we integrate ISD methodology with our Precision Maintenance Training Model.

This model defines our hands-on approach to practical, cost-effective training, and serves as the structure to provide entry-level employees with the core skills and competencies needed to become qualified maintenance technicians. For new hires to progress, they must demonstrate the appropriate knowledge and skills as they complete the foundational (0), fundamentals (1), and applied fundamentals (2) levels. Once qualified to this point, they are ready for customized, site- and equipment-specific training (3) to service, maintain, troubleshoot, and repair critical assets.

We can also assess more experienced workers, identifying and analyzing any deficiencies, and close skill gaps—giving them renewed opportunities to develop their careers. When you build a culture of continual learning, workers recognize your investment in their success and employee engagement increases. That can lead to improved retention of your topperforming skilled workers.

Our Precision Maintenance Training Model provides the flexibility to address maintenance training needs from traditional program development and supplementation to plant launch and apprenticeship programs.

LEVEL



Foundational

This level focuses on equipment safety, basic math, print reading, hand tools, rigging, scaffolding, and basic technical knowledge to ensure learners are well prepared for Fundamentals training. This level can be tailored to include advanced placement exams for those workers who can demonstrate they already possess this level of knowledge.

LEVEL

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Fundamentals

This level introduces much of the theory associated with maintenance practices, such as Kirchhoff's Law and Pascal's Law. The curriculum includes skills and knowledge in mechanical systems, basic hydraulics, pneumatics, pumps, an introduction to programmable logic controllers (PLC), basic electricity, motors, drives, etc. This training is usually delivered in a classroom setting and reinforced with hands-on lab exercises.

LEVEL

2

Applied Fundamentals

This level applies the theory and knowledge elements to practical scenarios and skill building. It ensures that your maintenance technicians can perform required tasks and provides opportunities to practice these critical skills. Courses comprise advanced hydraulics, PLC programming, welding certification, HVAC certification, troubleshooting, and advanced maintenance techniques.

LEVEL

3

Site-Specific

This level establishes your team as fully capable in the use and maintenance practices of your specific equipment. By gathering and developing data onsite and working with your documentation, we tailor the courseware to include your site-specific assets. This can include structured on-the-job training (OJT), standard operations, predictive technologies, preventive maintenance and equipment servicing, emergency operations and shutdowns, and troubleshooting.



Courseware and **Training Options**

Customized Learning.

We can consult on and enhance your existing training program or design and develop a fully custom solution.

Intellectual Property (IP) License Agreement. Access our off-the-shelf training content through long-term licensing.

Off-the-Shelf Courses.

Select individual predeveloped courses if one-off or short-term standardized training suits your needs.

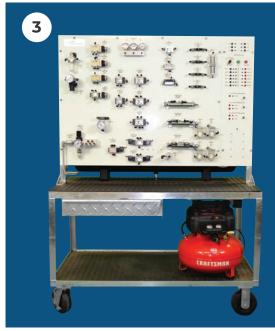
All our courseware includes student guides, instructor guides, instructor presentations, testing materials, and hands-on lab guides as appropriate.

Industrial Training Aids

In addition to consultation, program development, and courses, we are proud to offer a robust range of industrial-grade training equipment to support instructor-led, hands-on learning as part of a blended learning solution. We design and craft these training aids so learners can practice critical skills in realistic simulations using real-world hardware. Following are some of our most popular stations.

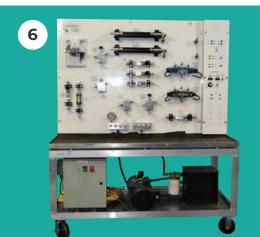


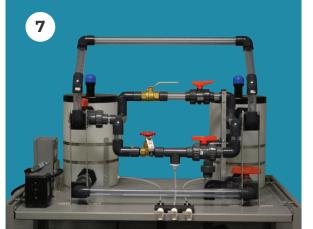












- **1** Electrical Troubleshooting Training Station
- 2 Process Control Training Station
- **3** Pneumatic Training Station
- **4** Pump/Mechanical Training Station
- **5** Valve Training Station
- **6** Hydraulic Training Station
- **7** Lockout/Tagout Training Station



Electrical Troubleshooting Training Station

We designed this station to introduce maintenance personnel to the fundamentals of relay-based motor control, PLC-based motor control, and troubleshooting. The hardware in this cabinet includes industry standard equipment that maintenance workers operate and repair daily. The system allows for the construction of motor control circuits of the same design found in working facilities.

Starting with relay-based motor control, learners explore the fundamentals of motor control circuit design, operation, and troubleshooting. All training station components can be faulted so instructors can present realistic scenarios in a lab environment.

At the same station, learners advance to PLCbased controls to expand their practical knowledge in building, programming, testing, maintaining, and troubleshooting.

The double-sided design of the station-all powered from a single 110-volt source-allows multiple learners to perform hands-on tasks at the same time.

Process Control Training Station

Designed to introduce personnel to the fundamentals of process instrumentation and process controls, this station features a process system that uses water to maintain either a tank level or a flow rate based on the instrumentation being employed. It's used to demonstrate fundamentals emphasizing proportional, integral, and derivative (PID) action using an industrialrated human-machine interface (HMI) and PLC.

Learners manipulate a pneumatic control valve via the controller to maintain the system's process variable within required control bands. The pump is controlled through a variable frequency drive which communicates with the HMI and PLC to offer PID control through frequency control—not pneumatic control-of the valve.

This training station features Highway Addressable Remote Transducer (HART)-compatible single modular auto-ranging remote transducer transmitters (SMART), ensuring industry standards are maintained.

Pneumatic Training Station

This station is a portable pneumatics training system on which learners can design, build, and troubleshoot basic and advanced pneumatic circuits in a safe environment. Various pneumatic components are integrated, including:

- Pneumatic push buttons
- Solenoid-controlled push buttons
- Various regulators
- Cylinders
- Switches
- Gauges

Using an optional built-in PLC, learners can maintain pneumatics that are monitored by computer systems.

Pump/Mechanical Training Station

This station provides hands-on training for mechanical skills using a functioning industry-standard pump, motor, and coupling system. With this station, learners gain practical experience with precision alignment of powertrains, pump rebuild and repair, pump mechanical seals, and more.

It's configurable for different alignment methods such as:

- Direct shaft coupling
- Belt drive coupling
- Chain drive coupling

A complete standalone training solution for power transmission and shaft alignment courses, the station integrates a functioning water flow system to demonstrate fluid flow basics for pump operations. It also includes all the tools, equipment, and drive components needed to perform precision alignments of power transmission systems.



Valve Training Station

This portable system gives learners the opportunity to safely disassemble, inspect, and reassemble basic valves and troubleshoot common problems. The station is composed of valves such as:

- Globe valve
- Gate valve
- Globe valve with Fisher pneumatic operator
- Safety valve
- Limitorque operator

Learners can make live adjustments on the pneumatic operator and Limitorque.

Hydraulic Training Station

This portable hydraulics training system allows learners to design, build, and troubleshoot, and maintain basic and advanced hydraulics circuits in a safe environment. The station is composed of various hydraulic components such as:

- Solenoid-controlled directional valve
- Proportional-controlled directional valve
- Various regulators
- Cylinders
- · Limit switches
- Gauges
- Hydraulic motor

Featuring an optional built-in PLC, the trainer enables learners to work with equipment controlled by automated systems.

Lockout/Tagout Training Station

Learners use this station to lockout/ tagout (LOTO) basic hydraulic and electrical circuits in a controlled setting. The station is composed with:

- Valves
- Hydraulic circuits
- Power panels
- Fuse box

Learners are able to isolate different circuits as directed and practice system isolation from sources both hydraulic and electric.





Foundational Series

Foundational

Introduction to Industrial Math
Advanced Industrial Math
Math Using the Metric System
Mechanical Print Reading
Mechanical Safety and Lockout/Tagout
Electrical Safety for Non-Qualified Personnel
Electrical Print Reading
Electrical Safety for Qualified Personnel
Hand and Power Tools
Electrical Series
Fundamentals
Basic Electrical Concepts
Motor Theory
Generator Theory
Electrical Test Equipment
National Electrical Code Overview
Conduit Bending and Wiring
Applied Fundamentals
Power Transformers
Low Voltage Switchgear
Medium Voltage Switchgear
High Voltage Switchgear
Protective Relays
Batteries and Uninterruptible Power Supplies
Motor Control and Troubleshooting

Site-Specific
Basic Programmable Logic Controllers (PLC-5)
Analog Input/Outputs (PLC-5)
DeviceNet For SLC-500
Introduction to Drives
Variable Frequency Drives
Instrumentation and Controls
Fundamentals
Industrial Electronics
Digital Circuits
Instrumentation Overview
Introduction to HART Communications
Combustion Basics
Introduction to Distributed Control Systems (DCS)
Applied Fundamentals
Process Controls Fundamentals
Introduction to Proportional-Integral-Derivative (PID) Systems
Introduction to Proportional-Integral-Derivative (PID) Tuning
Site-Specific
Differential Pressure Cells
Level Detection
Flow Detection





Mechanical Series

Fundamentals

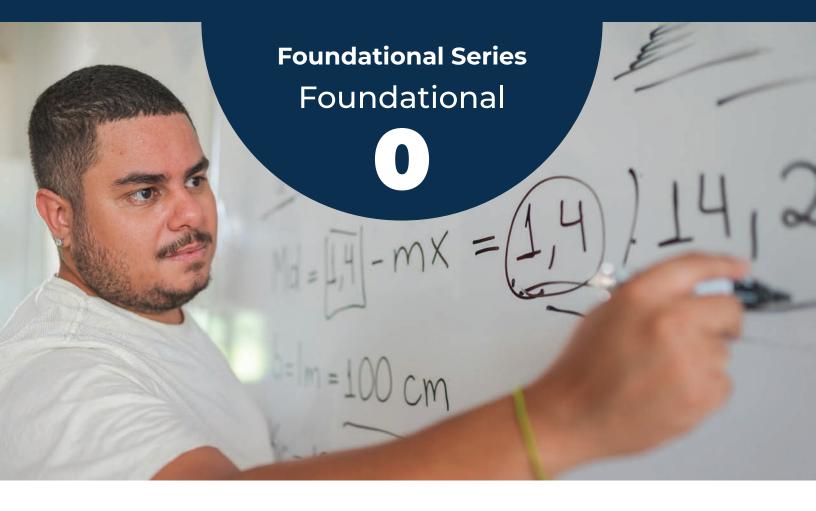
Heat Exchanger Fundamentals
Valve Fundamentals
Seals and Packing Fundamentals
Bearing Fundamentals
Boiler Fundamentals
Hydraulics and Pneumatics Fundamentals
Diesel Engines Fundamentals
Reciprocating Compressors Fundamentals
Axial Flow Compressors Fundamentals
Radial Flow Compressors Fundamentals
Applied Fundamentals
Centrifugal Pumps
Positive Displacement Pumps
Valve Repair
Clutches
Belt Drives
Chain Drives
Gears
Coupling
Shaft and Coupling Alignment
Pipefitting
Site-Specific
Hydraulics Applications
Pneumatics Applications

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Introduction to Industrial Math

FND-000 8 to 16 hours

- Calculate the sum, difference, product, and quotient of whole numbers.
- Solve problems using fractions.
- Solve problems using decimals.
- Calculate a percentage using fractions and decimals.
- Calculate measurements using fractions and decimals.
- Calculate the sum, difference, product, and quotient of signed numbers.
- Solve problems using powers and roots.
- Apply mathematical principles to evaluate algebraic expressions.

Advanced Industrial Math

FND-005 8 to 16 hours

- Measure and calculate angles.
- · Identify the types of triangles.
- Calculate the side of a right triangle using Pythagorean Theorem.
- Identify and calculate the parameters of polygons.
- Calculate the parameters of a solid figure.
- Apply geometric principles to solve problems.
- Solve problems using basic trigonometric functions.

Math Using the Metric System

FND-010 8 hours

- Identify common metric units for mass, length, volume, temperature, force, and pressure.
- Identify the symbols used for common metric units.
- Identify metric unit prefixes and symbols.
- Complete metric-to-metric conversions.
- Complete English-to-metric and metric-to-English conversions.
- State the common rules for writing in metric.

Mechanical Print Reading

FND-015 16 hours

- List and explain the types of mechanical drawings.
- Explain and describe the purpose of the title block, legend, revisions, and material list in terms of location and content.
- · Describe and identify the meaning of each of the six types of lines used in drawings.
- Identify and define the types of views used in drawings.
- · Given a drawing, identify its construction, size, and location dimensions.
- · Locate and identify tolerances on machine drawings.
- Measure and identify screw threads.
- Identify and discuss the different types of dimensions found in drawings.
- Identify and discuss the different elements of a piping and instrumentation diagram (P&ID).
- Draw schematics of simple mechanical systems.

Mechanical Safety and Lockout/Tagout

FND-020 8 hours

- Identify and discuss electrical safety hazards.
- Discuss the hazards of stored energy in hydraulic and pneumatic systems.
- Given a scenario, discuss the proper use of personal protective equipment.
- Given a scenario, discuss the hazards particular to mechanical work and the precautions/ countermeasures for each hazard.
- Describe mechanical system lockout/tagout requirements.

Electrical Safety for Non-Qualified Personnel

FND-025 4 hours

- Review applicable OSHA 1910 regulations and NFPA 70E standards regarding arc flash protection.
- Review applicable OSHA 1910 regulations and NFPA 70E standards regarding lockout/tagout.
- Review applicable OSHA 1910 regulations and NFPA 70E standards regarding personal protective equipment.

Electrical Print Reading

FND-030 16 hours

- Describe the organization of an electrical print.
- Identify common electrical schematic symbols.
- Interpret an electrical block diagram and a oneline diagram.
- Interpret an electrical three-line diagram.
- Interpret a P&ID.
- Analyze a basic logic circuit.
- Interpret basic ladder logic.





Electrical Safety for Qualified Personnel

FND-035 8 hours

- · Describe general safety hazards and precautions associated with electrical systems.
- Describe electrical tool and equipment safety.
- Define voltage level conventions for electrical systems.
- Describe electrical lockout/tagout requirements.
- Identify the requirements for working on energized equipment.
- Given a scenario, describe the requirements associated with arc flash protection.
- Explain the requirements for protective grounding.
- Describe the electrical safety requirements associated with fuses.
- Describe the electrical safety requirements associated with switchgear and circuit breakers.
- · Describe the electrical safety requirements for batteries and DC systems.

Hand and Power Tools

FND-040 8 hours

- Describe the safe use and operation of measuring tools.
- · Describe the safe use and operation of hand tools.
- Describe the safe use and operation of power tools.



Basic Electrical Concepts

EM-100 40 hours

- Identify the types of electrical energy.
- Discuss the composition of the atom and its relation to electrical charge.
- Explain the characteristics of current, voltage, and resistance.
- Explain Kirchhoff's Current Law and Kirchhoff's Voltage Law
- Calculate equivalent resistance of series and parallel resistive circuits.
- Calculate DC circuit parameters using Ohm's Law, Kirchhoff's Current Law, and Kirchhoff's Voltage Law.
- Describe the characteristics of capacitors and capacitance.
- Describe the characteristics of inductors and inductance.

- Describe the construction and operation of a simple AC generator.
- Define inductive reactance.
- Calculate the inductive reactance of a simple AC circuit.
- Define capacitive reactance.
- Calculate the capacitive reactance of a simple AC circuit.
- Define impedance.
- Describe the relationship between apparent, true, and reactive power.
- Define power factor as it relates to true power and apparent power.

Motor Theory

24 hours EM-105

- Describe the general characteristics of electric motors.
- Describe the construction and operation of DC motors.
- Identify the types of DC motors.
- Describe how DC motors are controlled.
- Describe the construction and operation of AC motors.
- Identify the types of AC motors.
- Describe how AC motors are controlled.
- Identify the information on a motor nameplate.
- Describe DC and AC motor maintenance activities.
- Describe the InterNational Electrical Testing Association guidelines for testing motors.

Generator Theory

EM-110 16 hours

- · Identify the terminology associated with AC and DC generators.
- List and describe the major components of an AC generator.
- Describe AC power generation theory.
- Explain the operation of AC generators.
- List and describe the major components of a DC generator.
- Describe DC power generation theory.
- Explain the operation of DC generators.

Electrical Test Equipment

EM-115 16 hours

- Describe the operation of an analog meter.
- Describe the operation of a clamp-on ammeter.
- Describe the operation of a digital meter.
- Describe the operation of a voltage detector.
- Describe the operation of the basic oscilloscope.
- Calculate amplitude, frequency, period, phase difference, and duty cycle.
- Describe the operation of a megohmmeter (megger).
- Explain the purpose of thermography.

National Electrical Code Overview

EM-120 16 hours

- Identify the origin and purpose of the NEC.
- Describe the requirements of Article 90.
- Describe the general requirements for electrical installations (Chapter 1).
- Describe wiring and protection requirements (Chapter 2).
- Describe proper wiring methods and materials (Chapter 3).
- Describe the requirements for general use equipment (Chapter 4).
- Demonstrate the proper table usage (Chapter 9).
- Demonstrate proper methods to calculate ampacity.
- Demonstrate proper methods to calculate conduit fill and size.

Conduit Bending and Wiring

EM-125 40 hours

- Identify and describe the purpose for the various types of conduit used for electrical runs.
- Interpret rigid metal conduit data.
- Explain conduit fill and spacing requirements.
- Explain and demonstrate proper methods to cutting, reaming, bending, and installing conduit.
- Identify the difference between conductors, insulators, and semiconductors, and describe the key characteristics of each.
- Describe cable construction and characteristics of the different components used in construction of cables.
- Discuss the operating characteristics of electrical cables.
- Describe the different methods of cable installation and their advantages and disadvantages over other methods of installation.
- Demonstrate proper techniques to pull wire or cable.
- Describe the precautions that must be observed when splicing wires and demonstrate how wire and cable are spliced.
- Describe the precautions and tools used to terminate wiring and demonstrate proper wire termination methods.
- Demonstrate the proper techniques for connecting wiring to terminal boards.





Power Transformers

EM-200 24 hours

- Identify and discuss safety issues relating to transformers.
- Explain the theory of transformer operations.
- List and describe the types of transformers.
- Describe the construction and nameplate information of a transformer.
- Demonstrate different types of transformer tap connections.
- Demonstrate proper inspection techniques for transformers.
- Demonstrate proper maintenance techniques for transformers.

Low Voltage Switchgear

FM-205 40 hours

- List and explain the voltage level conventions used in electrical equipment.
- List and describe the components that make up electrical switchgear.
- · Identify and explain the four general classifications of circuit breakers.
- · List and explain the major ratings of circuit breakers.
- Discuss the major components associated with a power system.
- Demonstrate inspection methods of low voltage circuit breakers.

Medium Voltage Switchgear

EM-210 40 hours

• Demonstrate inspection methods of medium voltage circuit breakers.

High Voltage Switchgear

40 hours EM-215

• Demonstrate inspection methods of high voltage circuit breakers.

Protective Relays

EM-220 32 hours

- Identify the purpose and types of protective
- List and describe the components found in protective relays.
- Describe the functions of protective relays.
- Discuss methods for protective relay testing.
- List and demonstrate protective relay function tests.
- Identify and demonstrate common maintenance tasks associated with protective relays.

Batteries and Uninterruptible Power Supplies

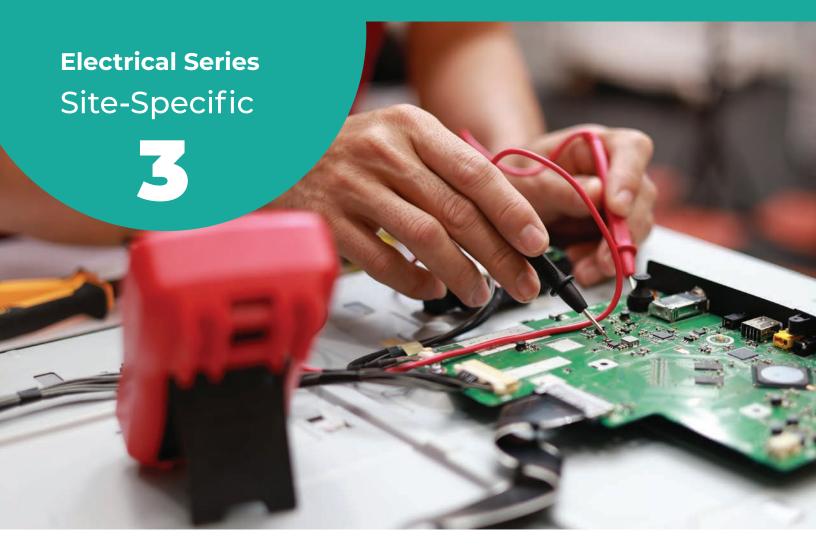
EM-225 8 hours

- Identify the types of batteries.
- Describe the construction and operation of various batteries.
- · Identify industry and government standards for maintenance, testing, replacement, sizing, and installation of lead-acid batteries.
- · Identify federal regulations governing lead-acid battery disposal.
- Describe the construction and operation of a UPS.
- Describe the function and operation of a transfer switch.
- Inspect a UPS system.
- Analyze battery charge and discharge rate to determine if replacement is needed.

Motor Control and Troubleshooting

EM-230 40 hours

- List and explain a systematic approach to troubleshooting electrical circuits.
- List and describe the purpose and application of various motor control components.
- Explain methods for inspecting electrical contacts.
- Describe three basic methods of starting a threephase AC motor using full or reduced voltage.
- Describe the basic operation of a three-phase AC motor.
- Describe methods for troubleshooting AC motors.
- Apply a systematic approach to troubleshooting motor control circuits.
- Design and construct motor control circuits.
- Implement proper motor control troubleshooting techniques.
- Analyze and evaluate faults to determine motor control components.



Basic Programmable Logic Controllers (PLC-5)

EM-300 40 hours

- Identify general PLC circuit and logic contact symbology.
- Describe the purpose of the address in memory.
- Identify contact symbols.
- Use the programming software to configure a PLC.
- Use the programming software to create and edit ladder logic programs.
- Create a ladder logic motor controller.
- Use the programming software to force bit state.
- Create a timer-based program.
- Create a counter-based program.

Analog Input/Outputs (PLC-5)

EM-310 24 hours

- List and describe the components of a PLC-5 and their function.
- Describe the function of an analog input and output card.
- Demonstrate proper setup of an analog input and output card.
- Demonstrate proper programming of analog cards.
- Demonstrate proper configuration of analog cards.
- Analyze system requirements and create a program using analog inputs and outputs.

DeviceNet For SLC-500

EM-315 40 hours

- Configure a DeviceNet network using RSNetWorx.
- Install and configure a variable frequency drive (VFD) to operate via DeviceNet from a SLC-500.

Introduction to Drives

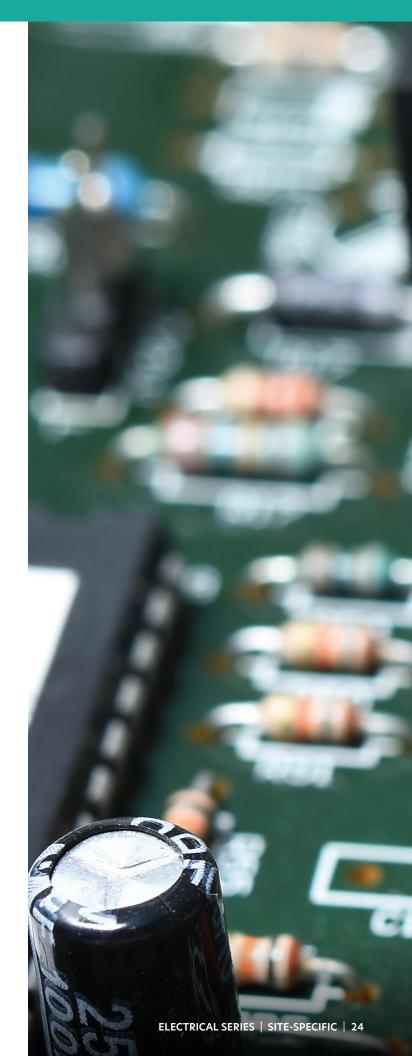
EM-320 24 hours

- Describe the operation of diodes, siliconcontrolled rectifiers (SCRs), and transistors.
- Match the proper motor, gearing drive, and electrical power to a load.
- Describe the basic functions of AC drive hardware.
- Identify the characteristics of shunt and series wound motors.
- Differentiate between field control and armature control of a DC motor.
- Describe the operation of various types of AC drives.
- Describe the operation of various types of DC drives.
- Use the parameters associated with a drive to control motor operation.

Variable Frequency Drives

EM-325 16 hours

- List and describe the operation of components found in a PowerFlex 70.
- List and explain the parameters found in a PowerFlex 70.
- Demonstrate proper installation and setup of a PowerFlex 70.
- Demonstrate proper troubleshooting techniques on a PowerFlex 70.





Industrial Electronics

I&C-100 24 hours

- Discuss the characteristics and uses of semiconductor devices.
- Discuss the characteristics and uses of bipolar transistors.
- Describe the operation of diodes.
- Describe the operation of transistors.
- Describe the operation of amplifiers.

Digital Circuits

I&C-105 24 hours

- Convert a number between binary and decimal.
- Describe the difference between analog and digital circuits.
- Describe the gates found in digital logic.
- Simplify expressions using Boolean algebra.
- Describe how to combine logic gates.
- Describe the circuit found in sequential logic.

Instrumentation Overview

I&C-110 8 hours

- Identify the different types of instruments used in an instrumentation loop.
- Describe and explain the function of components that are used for an instrumentation loop.
- Demonstrate how to build a basic instrumentation loop.

Introduction to HART Communications

I&C-115 8 hours

- Identify and discuss the components of a HART communicator.
- Demonstrate connection methods to field devices.
- Demonstrate how to properly set up and calibrate field devices.

Combustion Basics

I&C-120 16 hours

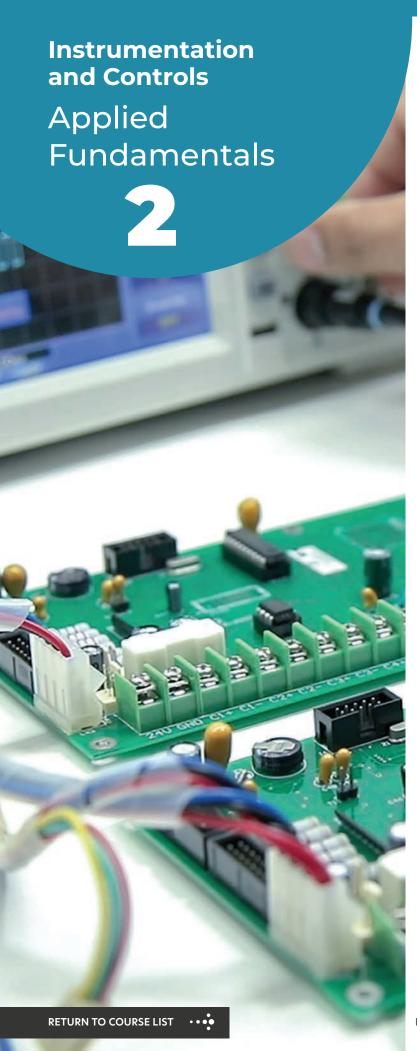
- Explain the flame triangle.
- Describe the relationship between heat, temperature, and specific heat.
- List and discuss the different methods of heat transfer.
- Identify and discuss the by-products of combustion.
- Identify and describe the importance of stoichiometric conditions.
- Describe the construction of basic combustion systems.
- Describe the safety equipment associated with a combustion system.
- Design a basic fuel train for a combustion system.

Introduction to Distributed Control Systems (DCS)

I&C-125 8 hours

- List and explain the concepts of computer networking and communications.
- Describe the components of a DCS and their functions.
- Describe communications in a DCS.





Process Controls Fundamentals

I&C-200 8 hours

- List and explain process control terms.
- Describe how a single or multiple capacity process responds to change.
- Demonstrate proper two-position control loop installation.
- Demonstrate basic proportional control loop installation.

Introduction to Proportional-Integral-Derivative (PID) Systems

I&C-205 24 hours

- Identify and explain the different control methods used in PID systems.
- Describe how changing control parameters affects system response.
- Demonstrate proper installation of PID systems.
- Demonstrate proper troubleshooting of PID systems.

Introduction to Proportional-**Integral-Derivative (PID) Tuning**

I&C-210 40 hours

- List and describe the factors that affect system stability.
- Demonstrate closed loop tuning methods.
- Demonstrate open loop tuning methods.



Instrumentation and Controls Site-Specific



Differential Pressure Cells

I&C-300 8 hours

- Identify and describe the components of a differential pressure cell.
- Describe how a differential pressure cell operates.
- Demonstrate different connection methods and uses of a differential pressure cell.
- Demonstrate proper setup and calibration of a differential pressure cell.

Level Detection

I&C-305 8 hours

- Identify and describe the components of different level detection devices.
- Describe how level detection devices operate.
- Demonstrate different connection methods and uses of level detection devices.
- Demonstrate proper setup and calibration of level detection devices

Flow Detection

I&C-310 8 hours

- Identify and describe the components of different flow measurement devices.
- Describe how flow measurement devices operate.
- Demonstrate different connection methods and uses of flow measurement devices.
- Demonstrate proper setup and calibration of flow measurement devices.

Temperature Detection

I&C-315 8 hours

- Identify and describe the components of different temperature measurement devices.
- · Describe how temperature measurement devices operate.
- Demonstrate different connection methods and uses of temperature measurement devices.
- Demonstrate proper setup and calibration of temperature measurement devices.

Final Control Elements

I&C-320 8 hours

- Identify and describe the components that are used in pneumatically controlled actuators.
- Demonstrate proper setup and calibration of a pneumatically controlled actuator.
- Identify and describe the types of electrically controlled final elements.
- Demonstrate proper setup and calibration of electrically controlled final elements.



Heat Exchanger Fundamentals

MM-100 8 hours

- Identify and explain heat transfer within heat exchangers.
- Discuss safety precautions associated with heat exchangers.
- List and identify different types of heat exchangers and their major components.
- Identify maintenance and inspection activities associated with heat exchangers.

Valve Fundamentals

MM-105 16 hours

- Identify the types of valves used in industrial applications.
- Describe the construction and operation of valves used in industrial applications.
- Identify the types of valve operators.
- List and explain valve markings.

Seals and Packing Fundamentals

MM-110 8 hours

- Identify the different types of compression packing and explain when each is used.
- Identify the different types of molded packing and explain when each is used.
- List the advantages and disadvantages of pump mechanical seals.

Bearing Fundamentals

MM-115 16 to 24 hours

- Identify and explain the purpose for bearings.
- Discuss the basic terms associated with bearing design and construction.
- Identify and recognize the major components of various bearings.
- Demonstrate proper bearing maintenance and lubrication techniques.
- Demonstrate the proper installation and removal of bearings.
- Examine a bearing and analyze it to determine cause of failure.

Boiler Fundamentals

MM-120 8 hours

- Explain the fundamentals of steam production.
- List and describe the major components in a boiler.
- Explain the basic operation of a boiler system.

Hydraulics and **Pneumatics Fundamentals**

MM-125 24 hours

- Describe the basic principles of fluid dynamics.
- State the relationship between force, pressure, and area.
- List and describe the major components of a hydraulic system.
- Identify the symbols used to identify hydraulic components in a schematic.
- List and describe the major components of a pneumatic system.
- Identify the symbols used to identify pneumatic components in a schematic.

Diesel Engines Fundamentals

MM-135 24 hours

- Describe the function of a diesel engine.
- List and describe the major components of a diesel engine.
- Describe the basic operation of a diesel engine.
- Discuss factors that affect engine operation.
- Discuss maintenance activities associated with a diesel engine.
- Troubleshoot common engine problems.

Reciprocating Compressors Fundamentals

MM-140 24 hours

- Describe the function of a reciprocating compressor.
- List and describe the major components of a reciprocating compressor.
- Describe the basic operation of a reciprocating compressor.
- Discuss factors that affect compressor operation.
- Discuss maintenance activities associated with a reciprocating compressor.
- Troubleshoot common compressor problems.

Axial Flow Compressors Fundamentals

MM-145 24 hours

- Describe the function of an axial flow compressor.
- List and describe the major components of an axial flow compressor.
- Describe the basic operation of an axial flow compressor.
- Discuss maintenance activities associated with an axial flow compressor.

Radial Flow Compressors Fundamentals

MM-150 24 hours

- Describe the function of a centrifugal compressor.
- List and describe the major components of a centrifugal compressor.
- Describe the basic operation of a centrifugal compressor.
- Discuss factors that affect compressor operation.
- Discuss maintenance activities associated with a centrifugal compressor.





Centrifugal Pumps

MM-200 24 hours

- Discuss centrifugal pump laws.
- List and describe terminology associated with centrifugal pumps.
- · Identify the major components of a centrifugal pump and describe its function.
- Discuss factors affecting pump performance.
- Demonstrate proper techniques for disassembly, maintenance, and assembly of a centrifugal pump.

Positive Displacement Pumps

MM-205 16 hours

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- Discuss positive displacement pump laws.
- List and describe terminology associated with positive displacement pumps.
- Identify the major components of a positive displacement pump and describe its function.
- · Demonstrate proper techniques for disassembly, maintenance, and assembly of a positive displacement pump.

Valve Repair

MM-210 40 hours

- Demonstrate proper valve disassembly and inspection.
- Demonstrate how to properly repair a valve seat.
- Identify and replace worn valve components.
- Demonstrate how to properly repack a valve.

Clutches

MM-220 8 hours

- Identify the various methods of clutch engagement.
- Identify the various types of clutches.
- Describe how to properly install a clutch and perform maintenance.

Belt Drives

MM-225 8 hours

- List and describe the principles of operation of belt drives.
- Identify the types of belts and their uses.
- Demonstrate proper installation, alignment, and tensioning of belt drives.
- Discuss common drive failures.

Chain Drives

MM-230 8 hours

- List and describe the principles of operation of chain drives.
- Identify the types of chains and their uses.
- Demonstrate the proper installation, alignment, and tensioning of chain drives.

Gears

MM-235 8 hours

- State the purpose of gears.
- Define the terminology associated with gears.
- Identify the following types of gear arrangements: spur gear, helical gear, herringbone gear, bevel gear, worm gear, and planetary gear.
- Demonstrate how to measure backlash in a gearing arrangement.

Coupling

MM-240 8 hours

- Explain the purpose of a coupling.
- Explain the difference between a rigid and flexible coupling.
- Explain the following terms as they relate to a coupling: hub, shaft, key, match marks, bore, and gap.

Shaft and Coupling Alignment

MM-245 40 hours

- Identify the fundamental principles of shaft alignment.
- List and identify the tools used in the alignment process.
- Identify the phases of the alignment process.
- Demonstrate proper alignment methods.
- Discuss the factors that may affect alignment.
- Discuss the importance of alignment tolerances.
- Discuss the importance of using a pre-alignment checklist.
- Identify soft foot and discuss methods to correct it.
- Discuss methods used for non-standard alignments.
- Identify the coupling used to connect shafts.

Pipefitting

MM-250 40 hours

- List and discuss codes and standards associated with pipe and tubing.
- Identify and discuss types of metal piping and their uses.
- Identify and discuss types of non-metallic piping and their uses.
- Identify and discuss types of tubing, including their installation and use.
- Describe the methods used for connecting pipes.
- Describe the components found in a piping system.
- Identify and discuss the types of pipe hangers and their applications.





Hydraulics Applications

MM-300 16 hours

- Describe hydraulic power and the components used in the design of hydraulic systems.
- Identify and explain common hydraulic components.
- Describe basic hydraulic theory.
- Replace hoses, seals, and fittings according to the guidelines identified in this training course.
- Explain common circuit applications.
- Describe preventive maintenance actions such as removing, replacing, and cleaning common hydraulic components.
- Interpret ANSI symbols and drawings to explain the functions of specific hydraulic systems.
- Troubleshoot common hydraulic components.

Pneumatics Applications

MM-305 16 hours

- Describe pneumatic power and the components used in the design of pneumatic systems.
- Identify and explain common pneumatic components.
- Describe basic pneumatic theory.
- Replace hoses, seals, and fittings according to the guidelines identified in this training course.
- Describe preventive maintenance actions such as removing, replacing, and cleaning common pneumatic components.
- Interpret ANSI symbols and drawings to explain the functions of specific pneumatic systems.
- Troubleshoot common pneumatic components.



Bolts and Fasteners

MUL-100 8 hours

- Identify the standards associated with bolts and fasteners.
- Describe the different types of basic fasteners and their applications.
- Discuss the appropriate specification and selection criteria for fasteners.
- Describe the various types of locking devices in common use.
- Select the proper fastener for a given application.
- Demonstrate the proper torquing techniques for various mechanical fasteners.

Precision Measuring Instruments

MUL-105 16 hours

- Explain the purpose of precision measurement.
- · List and discuss the terminology as it applies to precision measurement.
- Discuss the factors that affect measurement.
- Identify and demonstrate the proper use and application of precision measuring instruments.
- Apply and measure torque to fasteners.

Lubrication Fundamentals

MUL-110 8 hours

- Identify and explain lubrication maintenance strategies.
- Discuss the fundamentals and theory of lubrication.
- Describe the selection criteria for lubrication.

Lubricant Application and Analysis

MUL-115 16 hours

- · Discuss proper lubricant application and maintenance on lubricating systems.
- Explain the requirements for proper lubricant storage and management.
- Describe lubrication system filtering methods.
- List and explain lube oil sampling requirements.
- Identify and explain the factors affecting lubrication health.
- Describe common wear mechanisms associated with machines.

Piping Corrosion Protection

MUL-120 8 hours

- · Identify the different types of piping coating and their purpose.
- Describe galvanic corrosion and how to reduce or prevent deterioration of the pipe.
- · Describe the application, inspection, and repair process for piping coatings.
- Describe the tape coating and heat shrink coating systems.

Introduction to Steam Turbines

MUL-125 24 hours

- Describe the function of a steam turbine.
- · List and describe the major components of a steam turbine.
- Describe the basic operation of a steam turbine.
- Discuss factors that affect turbine operation.
- Discuss maintenance activities associated with a steam turbine.
- Troubleshoot common turbine problems.

Introduction to Gas Turbines

MUI-130 24 hours

- Describe the function of a gas turbine.
- List and describe the major components of a gas turbine.
- Describe the basic operation of a gas turbine.
- Discuss maintenance associated with a aas turbine.



Scaffolding

MUL-200 16 to 24 hours

- Explain the requirements set forth by OSHA part 1910 and part 1926 regulations.
- · Identify safety hazards associated with scaffolding.
- Identify the types and uses of scaffolding.
- Discuss procedures, precautions, limitations, and practices surrounding the aspects of erecting, using, and dismantling fabricated frame scaffolding.
- Discuss case reports from OSHA files.
- Safely erect and dismantle a two-tier scaffold following OSHA regulations.

Rigging

MUL-205 16 hours

- · Identify the safety hazards associated with rigging.
- Identify and describe rigging gear.
- Discuss the fundamentals of rigging.
- Discuss methods used to determine the weight of a load.
- Demonstrate methods used for moving and manipulating loads.



Electric Overhead Traveling (EOT) Crane Inspection

MUL-300 16 hours

- Identify and discuss the major assemblies of EOT cranes.
- List the inspection points on an EOT crane.
- Locate the inspection points on an EOT crane.
- Discuss the criteria for the inspection points.

Direct Current (DC) Crane Controls

MUL-305 24 hours

- Identify and explain component layout of a crane.
- Describe the function and operation of electrical components associated with DC cranes.
- List and describe the purpose of components located in a DC power control system.
- Describe the operation of DC motors.
- Analyze a DC schematic to determine failed component.
- Demonstrate proper troubleshooting techniques.
- Demonstrate proper maintenance associated with cranes.

Crane Brakes

MUL-310 16 to 24 hours

- Explain the operation of overhead crane brakes.
- Describe maintenance activities associated with overhead crane brakes.
- Implement proper troubleshooting techniques associated with overhead crane brakes.



Articulated Dump Truck Operation

HEO-100 40 hours

- Describe the safety rules associated with articulated dump truck operation.
- Identify the controls and functions on the articulated dump truck control panels.
- Perform a vehicle inspection.
- Describe basic techniques for using the articulated dump truck.

Tractor Dozer Operation and Techniques

HEO-105 40 hours

- · Locate and identify the safety warning labels on the dozer.
- Describe the safety rules associated with the dozer operation.
- Perform a visual walk-around using the Dozer Inspection sheet.
- Complete the Mobile Equipment Pre-Shift Inspection sheet.
- Identify all console equipment.
- Identify all control equipment.
- Perform a pre-start check of the dozer.
- Perform an engine start-up.
- Perform an engine and machine warm-up.
- Drive the dozer.
- Operate the blade in all directions.
- Plow with a straight blade.
- Plow with a tilt right blade.
- Plow with a tilt left blade.
- Stop and park the machine.
- Stop the engine.
- Leave the machine.
- Perform operator maintenance tasks.

Flatbed Truck Operation

HEO-110 40 hours

- Describe the safety rules associated with flatbed truck operation.
- Identify the controls and functions on the flatbed truck control panels.
- Perform a vehicle inspection.
- Describe basic techniques for using the flatbed truck.
- Perform basic operations with the flatbed truck.

Payloader Operation

HEO-115 40 hours

- Describe the safety rules associated with payloader operation.
- Identify the controls and functions on the payloader control panels.
- Perform a vehicle inspection.
- Describe basic techniques for using the payloader.

Tractor Trailer Operation

HEO-120 40 hours

- Describe the safety rules associated with tractor trailer operation.
- Identify the controls and functions on the tractor trailer control panels.
- Perform a vehicle inspection.
- Describe basic techniques for using the tractor trailer.

Tractor/Loader/Backhoe Operation

HEO-125 40 hours

- Describe the safety rules associated with the Tractor/Loader/Backhoe (TLB) operation.
- Identify the controls and functions on the TLB control panels.
- Perform a vehicle inspection.
- Describe basic techniques for using the TLB.



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