Pembroke Hopkins Park Construction Outreach Program
13355 E. 3000 S. Rd., Pembroke Township, IL 60958
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Competencies / Objectives

Level One

MODULE 26101-08 – ORIENTATION TO THE ELECTRICAL TRADE (2.5 Hours)

1. Describe the apprenticeship/training process for electricians.
2. Describe various career paths/opportunities one might follow in the electrical trade.
3. Define the various sectors of the electrical industry.
4. State the tasks typically performed by an electrician.
5. Explain the responsibilities and aptitudes of an electrician.

MODULE 26102-08– ELECTRICAL SAFETY (10 Hours)

1. Recognize safe working practices in the construction environment.
2. Explain the purpose of OSHA and how it promotes safety on the job.
3. Identify electrical hazards and how to avoid or minimize them in the workplace.
4. Explain safety issues concerning lockout/tagout procedures, confined space entry, respiratory protection, and fall protection systems.
5. Develop a task plan and a hazard assessment for a given task and select the appropriate PPE and work methods to safely perform the task.

MODULE 26103-08 – INTRODUCTION TO ELECTRICAL CIRCUITS (7.5 Hours)

1. Define voltage and identify the ways in which it can be produced.
2. Explain the difference between conductors and insulators.
3. Define the units of measurement that are used to measure the properties of electricity.
4. Identify the meters used to measure voltage, current, and resistance.
5. Explain the basic characteristics of series and parallel circuits.

MODULE 26104-08 – ELECTRICAL THEORY (7.5 Hours)

1. Explain the basic characteristics of combination circuits.
2. Calculate, using Kirchhoff's voltage law, the voltage drop in series, parallel, and series-parallel circuits.
3. Calculate, using Kirchhoff's current law, the total current in parallel and series-parallel circuits.

4. Using Ohm's law, find the unknown parameters in series, parallel, and series-parallel circuits.

MODULE 26105-08– INTRODUCTION TO THE NATIONAL ELECTRICAL CODE® (7.5 Hours)

1. Explain the purpose and history of the *NEC*®.
2. Describe the layout of the *NEC*®.
3. Demonstrate how to navigate the *NEC*®.
4. Describe the purpose of the National Electrical Manufacturers Association and the NFPA.
5. Explain the role of nationally recognized testing laboratories.

MODULE 26106-08 – DEVICE BOXES (10 Hours)

1. Describe the different types of nonmetallic and metallic boxes.
2. Calculate the *NEC*® fill requirements for boxes under 100 cubic inches.
3. Identify the appropriate box type and size for a given application.
4. Select and demonstrate the appropriate method for mounting a given box.

MODULE 26107-08 – HAND BENDING® (10 Hours)

1. Identify the methods for hand bending and installing conduit.
2. Determine conduit bends.
3. Make 90-degree bends, back-to-back bends, offsets, kicks, and saddle bends using a hand bender.
4. Cut, ream, and thread conduit.

MODULE 26108-08 – RACEWAYS AND FITTINGS (20 Hours)

1. Identify and select various types and sizes of raceways and fittings for a given application.
2. Identify various methods used to fabricate (join) and install raceway systems.
3. Identify uses permitted for selected raceways.
4. Demonstrate how to install a flexible raceway system.
5. Terminate a selected raceway system.
6. Identify the appropriate conduit body for a given application.

MODULE 26109-08 – CONDUCTORS AND CABLES (10 Hours)

1. From the cable markings, describe the insulation and jacket material, conductor size and type, number of conductors, temperature rating, voltage rating, and permitted uses.

2. Determine the allowable ampacity of a conductor for a given application.
3. Identify the *NEC*® requirements for color coding of conductors.
4. Install conductors in a raceway system.

MODULE 26110-08 – BASIC ELECTRICAL CONSTRUCTION DRAWINGS (7.5 Hours)

1. Explain the basic layout of a set of construction drawings.
2. Describe the information included in the title block of a construction drawing.
3. Identify the types of lines used on construction drawings.
4. Using an architect's scale, state the actual dimensions of a given drawing component.
5. Interpret electrical drawings, including site plans, floor plans, and detail drawings.
6. Interpret equipment schedules found on electrical drawings.
7. Describe the type of information included in electrical specifications.

MODULE 26111-08 – RESIDENTIAL ELECTRICAL SERVICES (15 Hours)

1. Explain the role of the National Electrical Code® in residential wiring and describe how to determine electric service requirements for dwellings.
2. Explain the grounding requirements of a residential electric service.
3. Calculate and select service-entrance equipment.
4. Select the proper wiring methods for various types of residences.
5. Compute branch circuit loads and explain their installation requirements.
6. Explain the types and purposes of equipment grounding conductors.
7. Explain the purpose of ground fault circuit interrupters and tell where they must be installed.
8. Size outlet boxes and select the proper type for different wiring methods.
9. Describe rules for installing electric space heating and HVAC equipment.
10. Describe the installation rules for electrical systems around swimming pools, spas, and hot tubs.
11. Explain how wiring devices are selected and installed.
12. Describe the installation and control of lighting fixtures.

MODULE 26112-08 – ELECTRICAL TEST EQUIPMENT (5 Hours)

1. Explain the operation of and describe the following pieces of test equipment:
• Voltmeter
• Ohmmeter
• Clamp-on ammeter
• Multimeter
• Megohmmeter

• Motor and phase rotation testers
2. Select the appropriate meter for a given work environment based on category ratings.
3. Identify the safety hazards associated with various types of test equipment.

Level Two

MODULE 26201-08 – ALTERNATING CURRENT (17.5 Hours)

1. Calculate the peak and effective voltage or current values for an AC waveform.
2. Calculate the phase relationship between two AC waveforms.
3. Describe the voltage and current phase relationship in a resistive AC circuit.
4. Describe the voltage and current transients that occur in an inductive circuit.
5. Define inductive reactance and state how it is affected by frequency.
6. Describe the voltage and current transients that occur in a capacitive circuit.
7. Define capacitive reactance and state how it is affected by frequency.
8. Explain the relationship between voltage and current in the following types of AC circuits:
• RL circuit
• RC circuit
• LC circuit
• RLC circuit
9. Explain the following terms as they relate to AC circuits:
• True power
• Apparent power
• Reactive power
• Power factor
10. Explain basic transformer action.

MODULE 26202-08 – MOTORS:THEORY AND APPLICATION (20 Hours)

1. Define the following terms:
• Controller
• Duty cycle
• Full-load amps
• Interrupting rating
• Thermal protection
• NEMAdesign letter
• Overcurrent
• Overload
• Power factor
• Rated full-load speed
• Rated horsepower

• Service factor
2. Describe the various types of motor enclosures.
3. Explain the relationships among speed, frequency, and the number of poles in a three-phase induction motor.
4. Define percent slip and speed regulation.
5. Explain how the direction of a three-phase motor is changed.
6. Describe the component parts and operating characteristics of a three-phase wound-rotor induction motor.
7. Describe the component parts and operating characteristics of a three-phase synchronous motor.
8. Describe the design and operating characteristics of various DC motors.
9. Describe the methods for determining various motor connections.
10. Describe general motor protection requirements as delineated in the National Electrical Code® (NEC®).
11. Define the braking requirements for AC and DC motors.
13. Explain how the direction of rotation of a DC motor is changed.
14. Describe the design and characteristics of a DC shunt, series, and compound motor.
15. Describe dual-voltage motors and their applications.
16. Describe the methods for determining various motor connections.
17. Describe general motor protection requirements as delineated in the NEC®.

MODULE 26203-08 – ELECTRIC LIGHTING (15 Hours)

1. Describe the characteristics of light.
2. Recognize the different kinds of lamps and explain the advantages and disadvantages of each type:
• Incandescent
• Halogen
• Fluorescent
• High-intensity discharge (HID)
3. Properly select and install various lamps in lighting fixtures.
4. Recognize and describe the installation requirements for various types of lighting fixtures:
• Surface-mounted
• Recessed
• Suspended
• Track-mounted
5. Recognize ballasts and describe their use in fluorescent and HID lighting fixtures.
6. Explain the relationship of Kelvin temperature to the color of light produced by a lamp.

7. Recognize basic occupancy sensors, photoelectric sensors, and timers used to control lighting circuits and describe how each device operates.

MODULE 26204-08 – CONDUIT BENDING (15 Hours)

1. Describe the process of conduit bending using power tools.
2. Identify all parts of electric and hydraulic benders.
3. Bend offsets, kicks, saddles, segmented, and parallel bends.
4. Explain the requirements of the National Electrical Code® (NEC®) for bending conduit.
5. Compute the radius, degrees in bend, developed length, and gain for conduit up to six inches.

MODULE 26205-08 – PULL AND JUNCTION BOXES (12.5 Hours)

1. Describe the different types of nonmetallic and metallic pull and junction boxes.
2. Properly select, install, and support pull and junction boxes and their associated fittings.
3. Describe the National Electrical Code® (NEC®) regulations governing pull and junction boxes.
4. Size pull and junction boxes for various applications.
5. Understand the NEMA and IP classifications for pull and junction boxes.
6. Describe the purpose of conduit bodies and Type FS boxes.

MODULE 26206-08 – CONDUCTOR INSTALLATIONS (10 Hours)

1. Explain the importance of communication during a cable-pulling operation.
2. Plan and set up for a cable pull.
3. Set up reel stands and spindles for a wire-pulling installation.
4. Explain how mandrels, swabs, and brushes are used to prepare conduit for conductors.
5. Properly install a pull line for a cable-pulling operation.
6. Explain how and when to support conductors in vertical conduit runs.
7. Describe the installation of cables in cable trays.
8. Calculate the probable stress or tension in cable pulls.

MODULE 26207-08 – CABLE TRAY (7.5 Hours)

1. Describe the components that make up a cable tray assembly.
2. Explain the methods used to hang and secure cable tray.
3. Describe how cable enters and exits cable tray.
4. Select the proper cable tray fitting for the situation.

5. Explain the *National Electrical Code*® (*NEC*®) requirements for cable tray installations.
6. Select the required fittings to ensure equipment grounding continuity in cable tray systems.
7. Interpret electrical working drawings showing cable tray fittings.
8. Size cable tray for the number and type of conductors contained in the system.

MODULE 26208-08 – CONDUCTOR TERMINATIONS AND SPLICES (7.5 Hours)

1. Describe how to make a good conductor termination.
2. Prepare cable ends for terminations and splices and connect using lugs or connectors.
3. Train cable at termination points.
4. Understand the *National Electrical Code*® (*NEC*®) requirements for making cable terminations and splices.
5. Demonstrate crimping techniques.
6. Select the proper lug or connector for the job.

MODULE 26209-08 – GROUNDING AND BONDING (15 Hours)

1. Explain the purpose of grounding and bonding and the scope of ***NEC Article 250***.
2. Distinguish between a short circuit and a ground fault.
3. Define the *National Electrical Code*® requirements related to bonding and grounding.
4. Distinguish between grounded systems and equipment grounding.
5. Use ***NEC Table 250.66*** to size the grounding electrode conductor for various AC systems.
6. Explain the function of the grounding electrode system and determine the grounding electrodes to be used.
7. Define electrodes and explain the resistance requirements for electrodes using ***NEC Section 250.56***.
8. Use ***NEC Table 250.122*** to size the equipment grounding conductor for raceways and equipment.
9. Explain the function of the main and system bonding jumpers in the grounding system and size the main and system bonding jumpers for various applications.
10. Size the main bonding jumper for a service utilizing multiple service disconnecting means.
11. Explain the importance of bonding equipment in clearing ground faults in a system.
12. Explain the purposes of the grounded conductor (neutral) in the operation of overcurrent devices.

MODULE 26210-08 – CIRCUIT BREAKERS AND FUSES (12.5 Hours)

1. Explain the necessity of overcurrent protection devices in electrical circuits.
2. Define the terms associated with fuses and circuit breakers.
3. Describe the operation of a circuit breaker.
4. Apply the *National Electrical Code*® (*NEC*®) requirements for overcurrent devices.
5. Describe the operation of single-element and time-delay fuses.

MODULE 26211-08 – CONTROL SYSTEMS AND FUNDAMENTAL CONCEPTS (12.5)

1. Describe the operating principles of contactors and relays.
2. Select contactors and relays for use in specific electrical systems.
3. Explain how mechanical contactors operate.
4. Explain how solid-state contactors operate.
5. Install contactors and relays according to the *NEC*® requirements.
6. Select and install contactors and relays for lighting control.
7. Read wiring diagrams involving contactors and relays.
8. Describe how overload relays operate.
9. Connect a simple control circuit.
10. Test control circuits.

Level Three

MODULE 26301-08 – LOAD CALCULATIONS– BRANCH AND FEEDER CIRCUITS (17.5 Hours)

1. Calculate loads for single-phase and three-phase branch circuits.
2. Size branch circuit overcurrent protection devices (circuit breakers and fuses) for noncontinuous duty and continuous duty circuits.
3. Apply derating factors to size branch circuits.
4. Calculate ampacity for single-phase and three-phase loads.
5. Use load calculations to determine branch circuit conductor sizes.
6. Use *NEC Table 220.55* to calculate residential cooking equipment loads.
7. Select branch circuit conductors and overcurrent protection devices for electric heat, air conditioning equipment, motors, and welders.

MODULE 26302-08 – CONDUCTOR SELECTION AND CALCULATIONS (15 Hours)

1. Select electrical conductors for specific applications.
2. Calculate voltage drop in both single-phase and three-phase applications.

3. Apply *National Electrical Code*® (*NEC*®) regulations governing conductors to a specific application.
4. Calculate and apply *NEC*® tap rules to a specific application.
5. Size conductors for the load.
6. Derate conductors for fill, temperature, and voltage drop.
7. Select conductors for various temperature ranges and atmospheres.

MODULE 26303-08 – PRACTICAL APPLICATIONS OF LIGHTING (12.5 Hours)

1. Explain how the lighting terms lumen, candlepower, and footcandle relate to one another.
2. Classify lighting fixtures by type and application.
3. Identify the general lighting pattern produced by each type of fixture.
4. Identify the lighting requirements associated with lighting systems used in selected applications such as office buildings, schools, theaters, hazardous areas, etc.
5. Identify various dimming systems and their components.
6. Use manufacturers' lighting fixture catalogs to select the appropriate lighting fixtures for specific lighting applications.

MODULE 26304-08 – HAZARDOUS LOCATIONS (15 Hours)

1. Define the various classifications of hazardous locations.
2. Describe the wiring methods permitted for branch circuits and feeders in specific hazardous locations.
3. Select seals and drains for specific hazardous locations.
4. Select wiring methods for Class I, Class II, and Class III hazardous locations.
5. Follow *National Electrical Code*® (*NEC*®) requirements for installing explosionproof fittings in specific hazardous locations.

MODULE 26305-08 – OVERCURRENT PROTECTION (25 Hours)

1. Apply the key *National Electrical Code*® (*NEC*®) requirements regarding overcurrent protection.
2. Check specific applications for conformance to *NEC*® sections that cover short circuit current, fault currents, interrupting ratings, and other sections relating to overcurrent protection.
3. Determine let-through current values (peak and rms) when current-limiting overcurrent devices are used.
4. Select and size overcurrent protection for specific applications.

PHPCOP

MODULE 26306-08 – DISTRIBUTION EQUIPMENT (12.5 Hours)

1. Describe the purpose of switchgear.
2. Describe the four general classifications of circuit breakers and list the major circuit breaker ratings.
3. Describe switchgear construction, metering layouts, wiring requirements, and maintenance.
4. List *National Electrical Code*® (*NEC*®) requirements pertaining to switchgear.
5. Describe the visual and mechanical inspections and electrical tests associated with low-voltage and medium-voltage cables, metal-enclosed busways, and metering and instrumentation.
6. Describe a ground fault relay system and explain how to test it.

MODULE 26307-08 – TRANSFORMERS (12.5 Hours)

1. Describe transformer operation.
2. Explain the principle of mutual induction.
3. Describe the operating characteristics of various types of transformers.
4. Connect a multi-tap transformer for the required secondary voltage.
5. Explain *National Electrical Code*® (*NEC*®) requirements governing the installation of transformers.
6. Compute transformer sizes for various applications.
7. Connect a control transformer for a given application.
8. Describe how current transformers are used in conjunction with watt-hour meters.

MODULE 26308-08 – COMMERCIAL ELECTRICAL SERVICES (10 Hours)

1. Describe various types of electric services for commercial and industrial installations.
2. Read electrical diagrams describing service installations.
3. Select service-entrance equipment for various applications.
4. Explain the role of the *National Electrical Code*® in service installations.
5. Install main disconnect switches, panelboards, and overcurrent protection devices.
6. Identify the *National Electrical Code*® requirements and purposes of service grounding.
7. Describe single-phase and three-phase service connections.
8. Describe both wye- and delta-connected three-phase services.

MODULE 26309-08 – MOTOR CALCULATIONS (12.5 Hours)

1. Size branch circuits and feeders for electric motors.
2. Size and select overcurrent protective devices for motors.
3. Size and select overload relays for electric motors.

4. Size and select devices to improve the power factor at motor locations.
5. Size motor short circuit protectors.
6. Size multi-motor branch circuits.
7. Size motor disconnects.

MODULE 26310-08 – VOICE, DATA, AND VIDEO (10 Hours)

1. Define the different categories for voice-data-video (VDV) cabling systems.
2. Install raceways, boxes, and enclosures for VDV systems.
3. Interpret and apply *NEC*® requirements for installing and grounding VDV systems.
4. Explain the requirements for firestopping.

MODULE 26311-08 – MOTOR CONTROLS (12.5 Hours)

1. Identify contactors and relays both physically and schematically and describe their operating principles.
2. Identify pilot devices both physically and schematically and describe their operating principles.
3. Interpret motor control wiring, connection, and ladder diagrams.
4. Select and size contactors and relays for use in specific electrical motor control systems.
5. Select and size pilot devices for use in specific electrical motor control systems.
6. Connect motor controllers for specific applications according to *National Electrical Code*® (*NEC*®) requirements.

Level Four

MODULE 26401-08 – LOAD CALCULATIONS – FEEDERS AND SERVICES (20 Hours)

1. Size feeders and services in accordance with *National Electrical Code*® (*NEC*®) requirements.
2. Calculate loads and ampacities for single-phase and three-phase feeders.
3. Apply derating factors to size feeders.
4. Size feeder overcurrent protection devices (circuit breakers and fuses) for noncontinuous duty and continuous duty loads.
5. Apply tap rules.
6. Calculate loads for various residential and commercial applications.
7. Calculate loads for schools and other institutional projects.
8. Perform feeder and service calculations for farms.
9. Calculate the power and supply feeders for marinas and boatyards.
10. Calculate electric motor loads on feeders.

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MODULE 26402-08 – HEALTH CARE FACILITIES (10 Hours)

1. List the types of electrical distribution systems used in the medical industry.
2. Describe the categories and branch portions of the distribution circuits.
3. List the items allowed in the life safety branch and critical branch.
4. Describe the ground fault protection required to ensure a safe environment.
5. List the required wiring methods in a health care facility.
6. Explain the application of special wiring devices in critical care locations.
7. Describe the requirements for the installation of specialty equipment.
8. Describe the applications of isolated power systems.

MODULE 26403-08 – STANDBY AND EMERGENCY SYSTEMS (10 Hours)

1. Explain the basic differences between emergency systems, legally required standby systems, and optional standby systems.
2. Describe the operating principles of an engine-driven standby AC generator.
3. Describe the different types and characteristics of standby and emergency generators.
4. Recognize and describe the operating principles of both automatic and manual transfer switches.
5. Recognize the different types of storage batteries used in emergency and standby systems and explain how batteries charge and discharge.
6. For selected types of batteries, describe their characteristics, applications, maintenance, and testing.
7. Recognize double-conversion and single-conversion types of uninterruptible power supplies (UPSs) and describe how they operate.
8. Describe the *National Electrical Code*® (*NEC*®) requirements that pertain to the installation of standby and emergency power systems.

MODULE 26404-08 – BASIC ELECTRONIC THEORY (10 Hours)

1. Identify electronic system components.
2. Describe the electrical characteristics of solid-state devices.
3. Describe the basic materials that make up solid-state devices.
4. Describe and identify the various types of transistors and explain how they operate.
5. Interpret electronic schematic diagrams.
6. Describe and connect diodes.
7. Describe and connect light-emitting diodes (LEDs).
8. Describe how to connect silicon-controlled rectifiers (SCRs).
9. Identify the leads of various solid-state devices.

MODULE 26405-08 – FIRE ALARM SYSTEMS (15 Hours)

1. Define the unique terminology associated with fire alarm systems.
2. Describe the relationship between fire alarm systems and life safety.
3. Explain the role that various codes and standards play in both commercial and residential fire alarm applications.
4. Describe the characteristics and functions of various fire alarm system components.
5. Identify the different types of circuitry that connect fire alarm system components.
6. Describe the theory behind conventional, addressable, and analog fire alarm systems and explain how these systems function.

MODULE 26406-08 – SPECIALTY TRANSFORMERS (10 Hours)

1. Identify three-phase transformer connections.
2. Identify specialty transformer applications.
3. Size and select buck-and-boost transformers.
4. Calculate and install overcurrent protection for specialty transformers.
5. Ground specialty transformers in accordance with *National Electrical Code*® (*NEC*®) requirements.
6. Calculate transformer derating to account for the effects of harmonics.

MODULE 26407-08 – ADVANCED CONTROLS (20 Hours)

1. Select and install solid-state relays for specific applications in motor control circuits.
2. Install non-programmable/programmable motor circuit protectors (solid-state overload relays) in accordance with the manufacturer's instructions.
3. Select and install electromechanical and solid-state timing relays for specific applications in motor circuits.
4. Recognize the different types of reduced-voltage starting motor controllers and describe their operating principles.
5. Connect and program adjustable frequency drives to control a motor in accordance with the manufacturer's instructions.
6. Demonstrate and/or describe the special precautions used when handling and working with solid-state motor controls.
7. Recognize common types of motor braking and explain the operating principles of motor brakes.
8. Perform preventive maintenance and troubleshooting tasks in motor control circuits.

MODULE 26408-08 – HVAC CONTROLS (15 Hours)

1. Identify the major mechanical components common to all HVAC systems.
2. Explain the function of a thermostat in an HVAC system.
3. Describe different types of thermostats and explain how they are used.

4. Demonstrate the correct installation and adjustment of a thermostat using proper siting and wiring techniques.
5. Explain the basic principles applicable to all control systems.
6. Identify the various types of electromechanical and electronic HVAC controls, and explain their function and operation.
7. State the *National Electrical Code*® (*NEC*®) requirements applicable to HVAC controls.

MODULE 26409-08 – HEAT TRACING AND FREEZE PROTECTION (10 Hours)

1. Identify and describe the purpose of electric heat tracing equipment used with pipelines and vessels.
2. Select, size, and install electric heat tracing equipment on selected pipelines and vessels in accordance with the manufacturer's instructions and *National Electrical Code*® (*NEC*®) requirements.
3. Identify and describe the purpose of electric heating equipment used with roof, gutter, and downspout de-icing systems.
4. Select, size, and install selected roof, gutter, and downspout de-icing systems in accordance with the manufacturer's instructions and *NEC*® requirements.
5. Identify and describe the purpose of electric heating equipment used with snow-melting and anti-icing systems.
6. Select, size, and install selected snow-melting and anti-icing systems in accordance with the manufacturer's instructions and *NEC*® requirements.
7. Identify and describe the purpose of electric heat tracing equipment used with domestic hot-water temperature maintenance systems.
8. Select, size, and install selected electric heat traced domestic hot-water systems in accordance with the manufacturer's instructions and *NEC*® requirements.
9. Identify and describe the purpose of electric floor heating/warming systems.
10. Select, size, and install selected electric floor heating/warming systems in accordance with the manufacturer's instructions and *NEC*® requirements.

MODULE 26410-08 – MOTOR OPERATION AND MAINTENANCE (10 Hours)

1. Recognize the factors related to motor reliability and life span.
2. Measure motor winding insulation resistance and compensate for temperature.
3. Identify motors needing replacement.

MODULE 26411-08 – MEDIUM-VOLTAGE TERMINATIONS/SPLICES (10 Hours)

1. Select the proper materials and tools for medium-voltage terminations and splices.
2. Prepare medium-voltage cable for terminations and splices.
3. Complete cable assemblies using terminations and splices.

4. Inspect and test medium-voltage terminations and splices.

MODULE 26412-08 – SPECIAL LOCATIONS (20 Hours)

1. Identify and select equipment, enclosures, devices, and wiring methods approved by the current *NEC*® for the following special occupancies or installations:
• Places of assembly
• Theaters
• Carnivals, circuses, and fairs
• Agricultural buildings
• Marinas and boatyards
• Temporary wiring
• Office partitions
• Swimming pools, fountains, hot tubs, and similar installations
• Natural and manmade bodies of water
2. Comply with *NEC*® requirements regarding equipotential planes as they refer to bonding and grounding in water-related installations.
3. Determine electrical datum planes in water-related installations.

MODULE 26413-08 – INTRODUCTORY SKILLS FOR THE CREWLEADER (16 Hours)

Chapter One

1. Discuss the growth and economic conditions of the construction industry.
2. Describe how workers' values have changed over the years.
3. Explain the importance of training for construction industry personnel.
4. List the new technologies available, and discuss how they are helpful to the construction industry.
5. Identify the gender and minority issues associated with a changing workforce.
6. Describe what employers can do to prevent workplace discrimination.
7. Differentiate between formal and informal organizations.
8. Describe the difference between authority and responsibility.
9. Explain the purpose of job descriptions and what they should include.
10. Distinguish between company policies and procedures.

Chapter Two

1. Explain the role of a crew leader.
2. List the characteristics of effective leaders.
3. Be able to discuss the importance of ethics in a supervisor's role.
4. Identify the three styles of leadership.

5. Describe the forms of communication.
6. Explain the four parts of verbal communication.
7. Demonstrate the importance of active listening.
8. Illustrate how to overcome the barriers to communication.
9. List some ways that supervisors can motivate their employees.
10. Explain the importance of delegating and implementing policies and procedures.
11. Differentiate between problem solving and decision making.

Chapter Three

1. Demonstrate an understanding of the importance of safety.
2. Give examples of direct and indirect costs of workplace accidents.
3. Identify safety hazards of the construction industry.
4. Explain the purpose of the Occupational Safety and Health Act (OSHA).
5. Discuss OSHA inspection programs.
6. Identify the key points of a safety program.
7. List the steps to train employees on how to perform new tasks safely.
8. Identify a supervisor's safety responsibilities.
9. Explain the importance of having employees trained in first aid and Cardio-Pulmonary Resuscitation (CPR) on the job site.
10. Describe the signals of substance abuse.
11. List the essential parts of an accident investigation.
12. Describe the ways to maintain employee interest in safety.

Chapter Four

1. Describe the three phases of a construction project.
2. Define the three types of project delivery systems.
3. Define planning and describe what it involves.
4. Explain why it is important to plan.
5. Describe the two major stages of planning.
6. Explain the importance of documenting one's work.
7. Describe the estimating process.
8. Explain how schedules are developed and used.
9. Identify the two most common schedules.
10. Explain short-interval production scheduling (SIPS).
11. Describe the different costs associated with building a job.
12. Explain the supervisor's role in controlling costs.
13. Illustrate how to control the main resources of a job: materials, tools, equipment, and labor.
14. Define the terms production and productivity and explain why they are important.

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Materials and Equipment

Level One

MODULE 26101-08 – ORIENTATION TO THE ELECTRICAL TRADE

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Appropriate personal protective equipment
Exploring Careers in Construction
Help-wanted section from an electrical trade publication
Samples of PHPCOP Apprentice Training Recognition
Employee manual
OSHA Safety and Health Standards for the Construction Industry
Personal protective equipment
TV/VCR/DVD player
Copies of the Trade Terms Quiz
Module Examinations

MODULE 26102-08 – ELECTRICAL SAFETY

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Copy of the latest edition of the *National Electrical Code®*
OSHA Electrical Safety Guidelines (pocket guide)
NFPA 70E
Various types of personal protective and safety equipment, including:
Rubber gloves
Insulating blankets
Hot sticks

Fuse pullers
Shorting probes
Safety glasses
Face shields
Company safety manual
GFCI device
Company lockout/tagout procedures
Step ladders
Straight ladders
Solvent MSDS
Fall arrest system
Safety harnesses
Lockout/tagout devices and labels
Access to eye wash station
TV/DVD/VCR player (optional)
Safety videos (optional)
Module Examinations
Performance Profile Sheet

MODULE 26103-08 – INTRODUCTION TO ELECTRICAL CIRCUITS

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Basic electrical circuit, including:
Battery/power source
Wiring
Loads
Switches
Copy of the latest edition of the *National Electrical Code*®
Examples of conductors, insulators, and resistors
Magnets
Simple electromagnet
Metal sheet
Iron filings
Battery
Sample schematics
Color-coded resistors
Various types of meters, including:
Multimeter

Voltmeter
Clamp-on ammeter
Ohmmeter
Continuity tester
Voltage tester
Module Examination

MODULE 26104-08 – ELECTRICAL THEORY

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Copy of the latest edition of the *National Electrical Code*®
Module examination

MODULE 26105-08 – INTRODUCTION TO THE NATIONAL ELECTRICAL CODE®

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Copy of the latest edition of the *National Electrical Code*®
Module Examination
Performance Profile Sheets

MODULE 26106-08 – DEVICE BOXES

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Conduit caps
Copy of the latest edition of the *National Electrical Code*®

Examples of different types of metallic and nonmetallic boxes, device covers, and extension rings
Examples of pull and junction boxes
Examples of device boxes
Wire nuts
Stripping tools
Wire
Module Examination
Performance Profile Sheets

MODULE 26107-08 – HAND BENDING

Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Appropriate personal protective equipment
Copy of the latest edition of the *National Electrical Code*®
OSHA Electrical Safety Guidelines (pocket edition)
Hand bender and manufacturer's instructions
Various pieces of conduit
Hickey bar
Manufacturers' gain tables
No. 10 or No. 12 solid wire
Tape measure
Calculator
Hacksaw
Pipe vise
Pipe cutter
Reamer
Cutting oil
Shop towels
Hand-operated threader
Sandbox or drip pan
Torpedo level
PVC pieces
PVC cements
Module Examination
Performance Profile Sheets

MODULE 26108-08 – RACEWAYS AND FITTINGS

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Appropriate personal protective equipment
Copy of the latest edition of the *National Electrical Code*®
OSHA Electrical Safety Guidelines (pocket edition)
Sections of EMT
EMT compression fittings
EMT setscrew fittings
Rigid metal conduit and fittings
Plastic-coated RMC and fittings
Aluminum conduit and fittings
Rigid black conduit and fittings
IMC and fittings
EB and DB RNC conduit and fittings
LFNC and connectors
Flexible metal conduit and fittings
Combination couplings
Various conduit couplings
Type C, Type L, Type T, and Type X conduit bodies
Various types of bushings
Threaded waterproof hubs
Insulated bushings
Offset nipples
Concrete, masonry, and wood for fastener application
Assorted hand tools (wrenches, screwdrivers)
Drills/drivers and assorted drill bits
Sample loads
Assorted threaded fasteners, including:
Bolts
Cap screws
Studs
Machine screws
Nuts
Washers
Tie wraps
Assorted special threaded fasteners

Assorted screws, including:
Wood screws
Lag screws and shields
Concrete/masonry screws
Thread-forming (sheet metal) and threadcutting screws
Deck screws
Drywall screws
Hammer-driven tools and related pin and stud fasteners
Powder-actuated tool, powder charges, and related pin and stud fasteners
Assorted mechanical anchors and assorted anchor fastening tools, including:
Wedge
Stud
Sleeve
One-piece
Hammer-driven
Drop-in
Expansion shields
Lead (caulk-in)
Screw (fiber, lead, plastic)
Self-drilling
Toggle bolts
Sleeve-type
Wallboard
Metal drive-in
Metal boxes
Nonmetallic boxes
Bushings and locknuts
Seal fittings and packing material
Liquid sealing compound
Various straps
Standoff support
Hammer
Screwdriver
Access to job site where trainees can observe a variety of wireway components, including:
Connectors
End plates
Closing plates
Tee fittings
Crosses
Elbows
Nipples
Slip fittings

Access to job site where trainees can observe a variety of cable tray support systems, including:
Direct rod
Trapeze mounting
Center hung support
Wall mounting
Pipe rack mounting
Module Examination
Performance Profile Sheets

MODULE 26109-08 – CONDUCTORS AND CABLES

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Appropriate personal protective equipment
Copy of the latest edition of the *National Electrical Code*®
Variety of solid wire conductors
Samples of stranded conductors
Samples of cable, including:
Type NM
Type NMC
Type SE
Type UF
Type NMS
Type MV
High-voltage shielded
Type FC
Type FCC
Type TC
Type USE
Instrument control wiring
Power fishing system
Basket grip
Wire grip
Manual wire puller
Power puller
Pull lines
Reel cart
Electrician’s hand tools

Access to a conduit run
Module Examination
Performance Profile Sheet

MODULE 26110-08 – BASIC ELECTRICAL CONSTRUCTION DRAWINGS

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Appropriate personal protective equipment
Copy of the latest edition of the *National Electrical Code*®
Set of electrical drawings
Architect's scales (both flat and triangular)
Engineer's scale
Module Examination
Performance Profile Sheet

MODULE 26111-08 – RESIDENTIAL ELECTRICAL SERVICES

Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Appropriate personal protective equipment
Copy of the latest edition of the *National Electrical Code*®
Calculator
Residential floor plan
Blank worksheet
Various types of GFCIs
Panelboard
Examples of cable, including:
Type NM
Type AC
Type UF
Type SE/USE
Examples of raceways, including:
Rigid
IMC

EMT
Flexible
PVC
Various grounding devices
Examples of made-type grounding electrodes
Assortment of metallic and plastic outlet boxes
Assorted types of electrical receptacles
Assortment of switches, including:
Single-pole
Three-way
Four-way
Photoelectric switches
Dimmer
Relays
Module Examination
Performance Profile Sheet

MODULE 26112-08 – ELECTRICAL TEST EQUIPMENT

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Appropriate personal protective equipment
Analog meter
Voltmeter and operator's manual
Voltage tester and operator's manual
Ohmmeter and operator's manual
Continuity tester
Clamp-on ammeter and operator's manual
Multimeter and operator's manual
Megohmmeter and operator's manual
Motor and phase rotation testers and operator's manuals
Resistors
Copy of the latest edition of the *National Electrical Code*®
Safety video/DVD (optional)
TV/Video/DVD player (optional)
Module Examination
Performance Profile Sheet

Level Two

MODULE 26201-08 – ALTERNATING CURRENT

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Quiz
Markers/chalk
Pencils and scratch paper
Appropriate personal protective equipment
Scientific calculator or trigonometric tables
Examples of capacitors
Module Examination

MODULE 26202-08 – MOTORS:THEORY AND APPLICATION

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Copy of the latest edition of the *National Electrical Code*®
Multimeters
Megger
Various types of motors, including:
Three-phase wye/star and delta
Two-phase double-voltage
Low-voltage and high-voltage
Scientific calculator or trigonometric tables
Module Examinations
Performance Profile Sheet

MODULE 26203-08 – GROUNDING

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard

Markers/chalk
Pencils and scratch paper
Prism
Copy of the latest edition of the *National Electrical Code*®
Examples of manufacturers' lighting and fixture catalogs
Examples of manufacturers' lighting fixture installation instructions
Examples of typical lighting plans and lighting fixtures schedule
Assortment of wire nuts
Electrical tape
Assortment of electric lamps, including:
Incandescent
Halogen
Fluorescent
High-intensity discharge (HID)
Electrician's toolbox
Assortment of lighting fixtures, including:
Surface-mounted
Recessed
Suspended
Track-mounted
Ceiling fans/fixtures
Assortment of electrical boxes, mounting hardware, and support hardware used to install different types of lighting fixtures
Assortment of track lighting components and accessories
Hangers and supports used with suspended lighting fixtures
Occupancy sensors and photosensors
Timers
Quick Quiz
Module Examinations
Performance Profile Sheet

MODULE 26204-08 – CONDUIT BENDING

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Prism
Copy of the latest edition of the *National Electrical Code*®
Hand bender and manufacturer's instructions
Lengths of 3⁄4" rigid, EMT, and IMC conduit

Lengths of 1" rigid, EMT, and IMC conduit
Lengths of 2" rigid, EMT, and IMC conduit
Lengths of PVC conduit
Lengths of 8" pipe
10" sample obstructions
Bending charts to match mechanical, electrical, and hydraulic benders
PVC solvent cements
End plugs for PVC conduit
Pipe reamer
Shop towels
Brushes
Felt-tip markers
Portable mechanical conduit benders
Magnetic torpedo level
EMT bending tools
Conduit bending protractor
Hickey bar
Tape measure
Straightedge
Conduit leveling tools
PVC heater
Scientific calculator
Hacksaw
Pipe vise
Pipe cutter
Cutting oil
Quick Quizzes
Module Examinations
Performance Profile Sheet

MODULE 26205-08 – BOXES AND FITTINGS

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Prism
Copy of the latest edition of the *National Electrical Code*®
Index cards
Examples of pull and junction boxes

Examples of different types of metallic and nonmetallic boxes, device covers, and extension rings
Quick Quiz
Examples of FS and FD boxes
Examples of different types of conduit bodies, pulling elbows, and entrance ells
Examples of different types of boxes used in hazardous locations
Seal fittings
Examples of fittings, including:
EMT
Rigid
Aluminum
IMC
Locknuts and bushings
Module Examinations
Performance Profile Sheet

MODULE 26206-08 – CONDUCTOR INSTALLATIONS

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Prism
Copy of the latest edition of the *National Electrical Code*®
Several lengths of cable from No. 12 through 4/0 AWG
Lubricant
Several types of pulling ropes
Several different types and lengths of conductors
Measuring tape
Setscrew cable grips
Swivel rope clevis
Basket-type pulling grips
Cable cutters/stripping tools
Self-contained hand-crank wire puller
Fish tape
Power blower/vacuum fish tape system
Electrical cable puller
Cable grips
Clamps for supporting conductors
Insulating supports
Manufacturers' catalogs for cable supports

Cable manufacturers' literature
Quick Quiz
Module Examinations
Performance Profile Sheet

MODULE 26207-08 – CABLE TRAY

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Prism
Copy of the latest edition of the *National Electrical Code*®
Cable tray samples:
Metal ladder tray
Metal trough tray
Solid bottom tray
Tray covers
Nonmetallic tray
Examples of cable tray failures
Cable tray covers
Splice plates
Alignment strips
Drop out plates
H-bar
Eight vertical adjustment splice plates
Cable tray supports, including:
Beam clamps
Anchor clips
All-thread rods
Nuts, bolts, washers, and other hangers
Cable tray sections for cutting and offset
Felt-tip markers
Hacksaw and blades
Protractor
Conventional square
Quick Quiz
Module Examinations
Performance Profile Sheet

MODULE 26208-08 – CONDUCTOR TERMINATIONS AND SPLICES

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Prism
Copy of the latest edition of the *National Electrical Code*®
Wire strippers
Power cable strippers
Assorted sizes of wire/cables and connectors
Assorted sizes and types of crimp connectors
Assorted sizes and types of mechanical compression connectors
Heat-shrink insulators
Heat gun for shrink insulators
Assorted sizes and types of wire nuts
Hand crimping tools and dies
Hydraulic crimping tools and dies
Metal-clad cable
Type MC cable connectors
Ratchet cable bender
Heat-shrink and roll-on insulating tapes
Propane torch
Torque wrenches
Multimeter
Test circuit
Quick Quiz
Module Examinations
Performance Profile Sheet

MODULE 26209-08 – INSTALLATION OF ELECTRIC SERVICES

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Prism
Copy of the latest edition of the *National Electrical Code*®
OSHA Electrical Safety Guidelines (pocket guide)

No. 4 AWG bare copper grounding wire
Small main panelboard
Switch boxes
Grounding clips, screws, and clamps
Galvanized water pipe
Various lengths of Type NM cable
Wire strippers
Earth ground resistance tester
Quick Quiz
Module Examinations
Performance Profile Sheet

MODULE 26210-08 – CIRCUIT BREAKERS AND FUSES

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Prism
Copy of the latest edition of the *National Electrical Code*®
OSHA Electrical Safety Guidelines (pocket guide)
Samples of circuit breakers, including:
Single-pole
Two-pole
Three-pole
Various types of GFCIs
Samples of various types of fuses, including:
Edison-base fuses
Type S fuses and adapters
Nonrenewable cartridge fuses
Renewable cartridge fuses
Several blown renewable cartridge fuses with renewable links
Quick Quiz
Module Examinations
Performance Profile Sheet

MODULE 26211-08 – CONTACTORS AND RELAYS

Overhead projector and screen
Transparencies
Blank acetate sheets

Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Prism
Copy of the latest edition of the *National Electrical Code*®
120V lighting contactors
Pushbutton stations
Lampholders and lamps
Cable for connecting contactors
Electrician's tool set
Quick Quiz
Module Examinations
Performance Profile Sheet

Level Three

MODULE 26301-08 – LOAD CALCULATIONS—BRANCH AND FEEDER CIRCUITS

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Appropriate personal protective equipment
Copy of the latest edition of the *National Electrical Code*®
Calculator
Module Examinations

MODULE 26302-08 – CONDUCTOR SELECTION AND CALCULATIONS

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Appropriate personal protective equipment
Copy of the latest edition of the *National Electrical Code*®
One length each of various solid and stranded conductors
Module Examinations

PHPCOP

MODULE 26303-08 – PRACTICAL APPLICATIONS OF LIGHTING

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Appropriate personal protective equipment
Copy of the latest edition of the National Electrical Code®
Light meter
Examples of lighting fixture manufacturers' catalogs
Assortment of incandescent, halogen, fluorescent, and HID lighting fixtures, including:
• Surface-mounted
• Recessed
• Suspended
• Track-mounted
Assortment of incandescent, fluorescent, and HID dimming controls and ballasts
Module Examinations
Performance Profile Sheets

MODULE 26304-08 – HAZARDOUS LOCATIONS

Overhead projector and screen
Transparencies
Markers/chalk
Blank acetate sheets
Transparency pens
Pencils and scratch paper
Overhead projector and screen
Whiteboard/chalkboard
Appropriate personal protective equipment
Copy of the latest edition of the *National Electrical Code*®
Sealoff fittings, packing fiber, and sealing compound
Short conduit nipples
No. 12 THHN conductors
Various types of explosionproof fittings
Various types of sealing fittings used in hazardous locations, including those with drains
Portable conduit threader
Module Examinations
Performance Profile Sheets

PHPCOP

MODULE 26305-08 – OVERCURRENT PROTECTION

Overhead projector and screen
Transparencies
Markers/chalk
Blank acetate sheets
Transparency pens
Pencils and scratch paper
Overhead projector and screen
Whiteboard/chalkboard
Appropriate personal protective equipment
Copy of the latest edition of the *National Electrical Code*®
Various types of circuit breakers
Various types of fuses, including electronic fuses
Sample fuse blocks and holders with nonrejection bases
Sample fuse blocks and holders with rejection clips that accept only Class R fuses
Module Examinations

MODULE 26306-08 – DISTRIBUTION EQUIPMENT

Transparencies
Markers/chalk
Blank acetate sheets
Transparency pens
Pencils and scratch paper
Overhead projector and screen
Whiteboard/chalkboard
Appropriate personal protective equipment
Copy of the latest edition of the *National Electrical Code*®
Manufacturer's literature for various types of distribution equipment
Module Examinations

MODULE 26307-08 – TRANSFORMERS

Transparencies
Markers/chalk
Blank acetate sheets
Transparency pens
Pencils and scratch paper
Overhead projector and screen
Whiteboard/chalkboard
Appropriate personal protective equipment
Copy of the latest edition of the *National Electrical Code*®
Samples of various types of transformers

Samples of transformer cores, including:
Mitered
Butt
Wound
Iron filings
Multi-tap control transformers
Control cable
Volt-ohm-milliammeter (VOM)
Tools necessary for making transformer wiring connections
Module Examinations

MODULE 26308-08 – COMMERCIAL ELECTRICAL SERVICES

Overhead projector and screen
Transparencies
Markers/chalk
Blank acetate sheets
Transparency pens
Pencils and scratch paper
Overhead projector and screen
Whiteboard/chalkboard
Appropriate personal protective equipment
Copy of the latest edition of the *National Electrical Code*®
Samples of common service components, including:
Service disconnect
Meter
Transformers
Wireways
Gutters
Weatherhead and service mast
Panelboards
Module Examinations

MODULE 26309-08 – MOTOR CALCULATIONS

Transparencies
Markers/chalk
Blank acetate sheets
Transparency pens
Pencils and scratch paper
Overhead projector and screen
Whiteboard/chalkboard
Appropriate personal protective equipment
Copy of the latest edition of the *National Electrical Code*®

Various types of fuses, including:
Nontime-delay
Dual-element, time-delay fuses
Various types of disassembled motors, including:
Squirrel cage
Wound-rotor
Synchronous
Various types of circuit breakers
Motor short circuit protector
Devices used to provide motor overload protection, including:
Overload relays
Fuses
Circuit breakers
Module Examinations

MODULE 26310-08 – VOICE, DATA, AND VIDEO

Overhead projector and screen
Transparencies
Markers/chalk
Blank acetate sheets
Transparency pens
Pencils and scratch paper
Overhead projector and screen
Whiteboard/chalkboard
Appropriate personal protective equipment
Copy of the latest edition of the *National Electrical Code*®
Samples of:
Fiber-optic cable
Coaxial cable
UTP cable
Coax F-type connector terminations
Innerduct
Various types of coax stripping tools
Module Examinations

MODULE 26311-08 – MOTOR CONTROLS

Overhead projector and screen
Transparencies
Markers/chalk
Blank acetate sheets
Transparency pens
Pencils and scratch paper

Overhead projector and screen
Whiteboard/chalkboard
Appropriate personal protective equipment
Copy of the latest edition of the *National Electrical Code*®
Assorted wire and connectors necessary for making control circuit wiring connections
Assorted manufacturer's motor control device catalogs/data sheets
Examples of wiring diagrams
Examples of circuit schedules/wire lists
Examples of control ladder diagrams
Examples of logic diagrams
Open-frame electromechanical power relays
Miniature electromechanical plug-in relays
Assorted NEMA and IEC magnetic and manual contactors and motor starters
Melting-alloy thermal overload relays
Bimetallic overload relays
Magnetic overload relays
Contactor/motor starter accessories including:
Power-pole adder kit
Timer attachment
Fuse kit
Transient suppression module
Internal auxiliary contacts
Control transformers
Pushbutton switches
Push-pull pushbutton switches
Selector switches
Pilot lights
Assorted pushbutton stations
Temperature switches
Pressure switches
Mechanical limit switches
Flow switches
Float switches
Foot switches
Jogging and plugging switches
Inductive and capacitive proximity sensors
Photoelectric switches/sensors
Drum switches
Assorted NEMA enclosures
240V motor
Tools necessary for making wiring connections
Module Examinations
Performance Profile Sheets*

Level Four

MODULE 26401-08 -LOAD CALCULATIONS – FEEDERS AND SERVICES

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Trade Terms Quiz
Module Examinations

MODULE 26402-08 – HEALTH CARE FACILITIES

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Module Examinations

MODULE 26401308 – STANDBY AND EMERGENCY SYSTEMS

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Appropriate personal protective equipment
Engine-driven AC generator
Transfer switches
Storage batteries
Tools to perform resistance and capacity checks on batteries
Module Examinations

MODULE 26404-08 – BASIC ELECTRONIC THEORY

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Appropriate personal protective equipment
Various diodes
Light-emitting diodes (LEDs)
Transistors
Silicon-controlled rectifiers (SCRs)
Schematic drawings
Trade Terms Quiz
Module Examinations

MODULE 26405-08 – FIRE ALARM SYSTEMS

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Appropriate personal protective equipment
If possible, provide samples of:
Automatic detectors
Fixed-temperature heat detectors
Combination heat detectors
Photoelectric smoke detectors
Ionization smoke detectors
Projected beam smoke detectors
Duct detectors
Cloud chamber smoke detectors
Semiconductor heat detectors
Fusible line-type heat detectors
Ultraviolet and infrared flame detectors
Water flow detectors
UV and IR flame detectors
Photoelectric beam smoke detectors

Spot detectors
Tools used to connect fire alarm systems
Trade Terms Quiz
Module Examinations
Performance Profile Sheets

MODULE 26406-08 – SPECIALTY TRANSFORMERS

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Appropriate personal protective equipment
Potential (voltage) and current transformers
Various specialty transformers
Trade Terms Quiz
Module Examinations
Performance Profile Sheets

MODULE 26407-08 – ADVANCED CONTROLS

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Appropriate personal protective equipment
Heat sinks
Non-programmable solid-state overload relays (SSOLRs)
Programmable solid-state overload relays (SSOLRs)
Programmable overload relays
Timing relays
Pneumatic timing relay
Dashpot timing relay
Solid-state plug-in timing relays
Good and faulty contacts
Trade Terms Quiz
Module Examinations
Performance Profile Sheets

PHPCOP

MODULE 26408-08 – HVAC CONTROLS

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Appropriate personal protective equipment
Thermostats used in residential, commercial, and industrial applications
Trade Terms Quiz
Module Examinations
Performance Profile Sheets

MODULE 26409-08 – HEAT TRACING AND FREEZE PROTECTION

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Appropriate personal protective equipment
Self-regulating cables
Power-limiting cables
Mineral-insulated cables
Manufacturer's application/design guides
Components used in pipeline heat tracing systems
Components used in roof, gutter, and downspout de-icing systems
Components used in snow-melting and anti-icing systems
Electric heating mats and cables
TV with DVD or VHS player (optional)
Trade Terms Quiz
Module Examinations
Performance Profile Sheets

MODULE 26410-08 – MOTOR OPERATION AND MAINTENANCE

Overhead projector and screen
Transparencies

Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Appropriate personal protective equipment
Various couplings
Motors and megohmmeters for insulation resistance testing
Module Examinations*

MODULE 26411-08 – MEDIUM-VOLTAGE TERMINATIONS/SPLICES

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Appropriate personal protective equipment
Common types of medium-voltage cable
Inline tape splicing kits
Various types of tape applied for primary insulation
Manufactured termination and splice kits
Quick inline splicing kit
Photos of terminations/cables that have been damaged by flashover and/or tracking
Insulators used with medium-voltage terminations
Trade Terms Quiz
Module Examinations
Performance Profile Sheets

MODULE 26412-08 – MEDIUM-VOLTAGE TERMINATIONS/SPLICES

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Appropriate personal protective equipment
Trade Terms Quiz
Module Examinations

MODULE 26413-08 – INTRODUCTORY SKILLS FOR THE CREWLEADER

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Appropriate personal protective equipment
OSHA log books
Sample MSDSs
Module Examinations
Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
NFPA 70E®, Standard for Electrical Safety in the Workplace
Various types of protective equipment, including rubber gloves, leathers, rubber blankets, face shields, and
arc flash suits
Various insulated/insulating and live-line tools
Temporary grounding jumpers
Insulated rescue hook
Blank energized electrical work request forms
Example job drawings
Time-current curves for various molded-case and low-voltage power circuit breakers (both thermal-magnetic operators and electronic trip units)
Molded-case and low-voltage circuit breakers
Insulation tester
Proximity detectors
Module Examinations
Performance Profile Sheets

Module #	Electrical Level 1	Credit Hours	Registry Equivalent Module	Comments
	Core Modules	72.5		
26101-08	Orientation to the Electrical Trade	2.5	No	
26102-08	Electrical Safety	10	No	Add code-driven reqs on eye protection; include NFPA 70E references/compare to Safety Orientation from Safety series
26103-08	Introduction to Electrical Circuits	7.5	No	Add introduction to circuits including basic test eq. (voltage & continuity), DC theory, basic circuit testing & sensing. Includes material from old Electrical Theory I.
26104-08	Electrical Theory	7.5	No	
26105-08	Introduction to the National Electrical Code	7.5	26107-05	
26106-08	Device Boxes	10	No	Pull material from 26103, "Fasteners & Anchors", and 26205, "Boxes & Fittings", and rename "Device Boxes". Pad info on installation (boxes under 100 cu. in.)
26107-08	Hand Bending	10	No	
26108-08	Raceways & Fittings	20	No	Rename "Raceways and Fittings" (from old "Raceways, Boxes & Fittings") and pull material from 26103
26109-08	Conductors and Cables	10	No	Rename "Conductors and Cables" (from old "Conductors" module) Add information on cables
26110-08	Basic Electrical Construction Drawings	7.5	No	Add layout of locations; pull material from 112 and 111; update per new CSI specs
26111-08	Residential Electrical Services	15	No	incorporate wiring of devices
26112-08	Electrical Test Equipment	5	No	
	Total Hours:	**185**		
	Electrical Level 2, 2008 Revision	**New Hours**	**Registry Equivalent Module**	**Comments**
26201-08	Alternating Current	17.5	No	Delete 9.4.2 and 9.4.4 (keep 9.4.3); Add note in AIG to review DC first
26202-08	Motors: Theory and Application	20	No	
26203-08	Electric Lighting	15	No	Incorporates Lamps, Ballasts, and Components module
26204-08	Conduit Bending	15	No	
26205-08	Pull and Junction Boxes	12.5	No	Leave box sizing and box fill and add info on hand holes; Rename "Pull and Junction Boxes" (from old "Boxes & Fittings" module)
26206-08	Conductor Installations	10	No	
26207-08	Cable Tray	7.5	No	
26208-08	Conductor Terminations and Splices	7.5	No	Move info applying to wiring devices up to Level 1
26209-08	Grounding and Bonding	15	No	
26210-08	Circuit Breakers and Fuses	12.5	No	Move section 9.0.0 to the end of the mod over to 26303
26211-08	Control Systems and Fundamental Concepts	12.5	26211-05	Add new technologies for low voltage (e.g. programmable panel boards); Rename "Control Systems and Fundamental Concepts" (Old "Contactors & Relays" module)
	Total Hours:	**145**		
	Electrical Level 3, 2008 Revision	**New Hours**	**Registry Equiv.**	**Comments**
26301-08	Load Calculations - Branch Circuits	17.5	26301-05	
26302-08	Conductor Selection and Calculations	15	26302-05	
26303-08	Practical Applications of Lighting	12.5	No	
26304-08	Hazardous Locations	15	26312-05	
26305-08	Overcurrent Protection	25	26303-05	Move 26210, section 9.0.0, over to this module
26306-08	Distribution Equipment	12.5	26306-05	Add feature on electrical system maintenance (see NFPA 70B & NEMA disaster recovery & installation guidelines), add high-resistance grounding
26307-08	Transformers	12.5	No	Add material on how to phase two separate systems
26308-08	Commercial Electrical Services	10	No	Module requires update
26309-08	Motor Calculations	12.5	26309-05	Revise calculations section to create worksheet-type approach
26310-08	Voice, Data, & Video	10	No	This is a new module on video architecture and integration to be based on info created by Encompass
26311-08	Motor Controls	12.5	26311-05	
	Total Hours:	**155**		

	Electrical Level 4, 2008 Revision	New Hours	Registry Equiv.	Comments
26401-08	Load Calculations Feeders & Services	20	No	
26402-08	Health Care Facilities	10	No	This is a new module.
26403-08	Standby and Emergency Systems	10	26403-05	
26404-08	Basic Electronic Theory	10	26404-05	
26405-08	Fire Alarm Systems	15	26405-05	
26406-08	Specialty Transformers	10	No	
26407-08	Advanced Controls	20	26407-05	
26408-08	HVAC Controls	15	26408-05	
26409-08	Heat Tracing and Freeze Protection	10	26409-05	
26410-08	Motor Operation and Maintenance	10	No	Combine and condense with 26410
26411-08	Medium-Voltage Terminations/Splices	10	No	
26412-08	Special Locations	20	No	
26413-08	Introductory Skills for the Crew Leader	16	MT101	
	Total Hours:	**176**		