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Study Guide

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CHAPTER 1

A – Performs common occupational skills

1.1 Performs safety-related functions

Covers the safety responsibilities of construction electricians, including protecting themselves and others and following company, client and jurisdictional regulations.

- ✓ A-1.01 Uses personal protective equipment (PPE) and safety equipment
- ✓ A-1.02 Maintains safe work environment
- ✓ A-1.03 Performs lock-out and tag-out procedures

1.2 Uses tools and equipment

Covers the safe and effective selection, use and maintenance of tools and equipment relevant to the task being performed.

- ✓ A-2.01 Uses common and specialty tools and equipment
- ✓ A-2.02 Uses access equipment
- ✓ A-2.03 Uses rigging, hoisting and lifting equipment

1.3 Organizes work

Covers planning and organizing work activities including interpreting documentation, organizing materials, and preparing the worksite.

- ✓ A-3.01 Interprets plans, drawings and specifications
- ✓ A-3.02 Organizes materials and supplies
- ✓ A-3.03 Plans project tasks and procedures
- ✓ A-3.04 Prepares worksite
- ✓ A-3.05 Finalizes required documentation

1.4 Fabricates and installs support components

Covers fabricating and installing the structural support components used in electrical installations.

- ✓ A-4.01 Fabricates support structures
- ✓ A-4.02 Installs brackets, hangers and fasteners
- ✓ A-4.03 Installs seismic restraint systems

1.5 Commissions and decommissions electrical systems

Covers performing startup, shutdown, commissioning and decommissioning of electrical systems.

- ✓ A-5.01 Performs startup and shutdown procedures
- ✓ A-5.02 Performs commissioning and decommissioning of systems

1.6 Uses communication and mentoring techniques

Covers the communication and mentoring techniques used by construction electricians in the workplace.

- ✓ A-6.01 Uses communication techniques
- ✓ A-6.02 Uses mentoring techniques

CHAPTER 2

Task A-2 Uses tools and equipment (Hoisting, Lifting and Rigging)

2.1 Hoisting, lifting and rigging equipment and applications

Covers knowledge of hoisting, lifting and rigging equipment, their applications, limitations and procedures for use.

- ✓ identify types of rigging equipment and accessories, and describe their applications and procedures for use
- ✓ identify types of hoisting and lifting equipment and accessories, and describe their applications and procedures for use
- ✓ identify potential hazards, and describe safe work practices pertaining to hoisting, lifting and rigging
- ✓ describe procedures to inspect, maintain and store hoisting, lifting and rigging equipment

2.2 Regulatory requirements for hoisting, lifting and rigging equipment

Covers knowledge of regulatory requirements pertaining to hoisting, lifting and rigging equipment.

- ✓ identify and interpret codes and regulations pertaining to hoisting, lifting and rigging equipment

2.3 Hoisting and lifting operations for electrical installations

Covers knowledge of hoisting and lifting operations for electrical installations.

- ✓ identify types of knots, hitches, splices and bends, and describe their applications and procedures to tie them
- ✓ describe considerations when rigging material or equipment for lifting
- ✓ identify and describe procedures to communicate during hoisting, lifting and rigging operations

CHAPTER 3

B-10.02 Performs servicing and maintenance of power conditioning, UPS and surge suppression systems

3.1 Servicing and maintenance skills for power conditioning systems

Covers the practical steps to diagnose, repair and maintain power conditioning, UPS and surge suppression systems, from obtaining fault descriptions to updating maintenance logs.

- ✓ obtain detailed description of operation and malfunction
- ✓ determine source of malfunction
- ✓ select tools and equipment
- ✓ identify and remove defective components
- ✓ repair malfunctioning components and verify repair
- ✓ select replacement components
- ✓ install replacement components
- ✓ conduct tests after repair
- ✓ clean, lubricate and adjust components
- ✓ record tests in maintenance schedule
- ✓ compare and analyze maintenance test results
- ✓ update maintenance log

3.2 Knowledge of power conditioning systems and characteristics

Covers understanding power quality, power factor correction, harmonics reduction, surge suppression and UPS equipment types and their applications.

- ✓ interpret codes and regulations pertaining to power conditioning, UPS and surge suppression systems
- ✓ explain power quality and its impact on equipment operation
- ✓ explain single-phase and three-phase power factor correction and calculations
- ✓ identify types of power factor correction equipment
- ✓ identify equipment used to reduce harmonics
- ✓ identify surge suppression equipment
- ✓ identify types of UPS equipment

3.3 Procedures to service and maintain power conditioning systems

Covers the tools, equipment and procedures used to service and maintain power conditioning, UPS and surge suppression systems, including UPS hazards.

- ✓ identify tools and equipment used to service and maintain systems
- ✓ describe procedures to service and maintain systems
- ✓ identify hazards with UPS systems when working with batteries, multiple sources and capacitors

CHAPTER 4

B-15.04 Installs high-voltage transformers

4.1 Procedures to install high-voltage transformers and components

Covers the knowledge required to install high-voltage transformers and their components, including tools, equipment and installation procedures as framed in learning outcome B-15.04.02L.

- ✓ identify tools and equipment used to install high-voltage transformers and high-voltage transformer components, and describe their applications and procedures for use
- ✓ describe procedures to install high-voltage transformers and high-voltage transformer components
- ✓ describe procedures to install high-voltage transformers in parallel

4.2 Installing high-voltage transformers skills

Covers selecting transformer type and rating, calculating conductors, overcurrent protection, mounting, tap settings, connecting leads, grounding, testing and removal of high-voltage transformers.

- ✓ determine type and kVA rating of transformer required
- ✓ calculate conductor and cable requirements
- ✓ determine overcurrent devices
- ✓ select tools and equipment
- ✓ install overcurrent devices
- ✓ position and mount transformer
- ✓ select and change tap settings
- ✓ connect transformer leads
- ✓ ground and bond transformer
- ✓ conduct tests after installation and record results
- ✓ remove existing transformer when replacing and update documentation

4.3 Knowledge of high-voltage transformers

Covers high-voltage transformer types, winding configurations, components, nameplates, polarity, selection considerations and codes.

- ✓ identify types of high-voltage transformers
- ✓ identify winding configurations
- ✓ identify transformer components
- ✓ interpret information contained on nameplates
- ✓ explain transformer polarity and terminal markings
- ✓ identify considerations for selecting transformers
- ✓ interpret codes and regulations

CHAPTER 5

Task C-20 Installs, services and maintains exit and emergency lighting systems

5.1 Repair and replace exit and emergency lighting components

Covers repairing malfunctioning components, selecting and installing replacement components, and testing after repair according to manufacturers' specifications and AHJ.

- ✓ repair malfunctioning components and verify repair
- ✓ select replacement components (OEM when mandated)
- ✓ install replacement components
- ✓ conduct tests of exit and emergency lighting system after repair
- ✓ record tests in maintenance schedule
- ✓ identify, remove, dispose of or recycle defective components

5.2 Knowledge of exit and emergency lighting systems

Topic covers types, components, characteristics, applications and operation of exit and emergency lighting systems.

- ✓ identify types of exit and emergency lighting systems and describe characteristics, applications and operation
- ✓ identify exit and emergency lighting system components and describe applications and operation

5.3 Procedures to service exit and emergency lighting systems

Topic covers tools, equipment and procedures used to diagnose, repair and replace exit and emergency lighting systems.

- ✓ identify tools and equipment used to service and describe applications and procedures
- ✓ describe procedures to diagnose exit and emergency lighting systems and their components
- ✓ describe procedures to repair or replace systems and their components

5.4 Procedures to maintain exit and emergency lighting systems

Topic covers tools, equipment and procedures used to maintain exit and emergency lighting systems and their components.

- ✓ identify tools and equipment used to maintain and describe applications and procedures
- ✓ describe procedures to maintain systems and their components

CHAPTER 6

E-26.01 Installs fire alarm systems

6.1 Position, mount and assemble fire alarm components

Covers positioning, mounting and assembling fire alarm system components in locations according to electrical drawings and the authority having jurisdiction.

6.2 Terminate and interconnect fire alarm components and systems

Covers terminating and interconnecting fire alarm system components and associated system devices per drawings, specifications and job requirements.

6.3 Test fire alarm system components

Covers testing fire alarm system components so they function according to drawings, specifications and jurisdictional regulations.

6.4 Test conductors for opens and ground continuity

Covers verifying conductors have no opens and that all components are bonded to ground and clear of obstructions.

6.5 Conduct initial fire alarm system tests

Covers performing sensory and spot tests and initial fire alarm system tests per drawings and specifications.

6.6 Participate in startup, commissioning and verification

Covers conducting verification on fire alarm systems, components and associated systems per regulatory standards so devices function as intended.

6.7 Knowledge of fire alarm systems and components

Covers demonstrating knowledge of fire alarm systems, components, their characteristics, applications and operation.

- ✓ interpret codes and regulations pertaining to fire alarm systems
- ✓ interpret information pertaining to fire alarm systems found on drawings and specifications
- ✓ identify types of fire alarm systems, and describe their characteristics, applications and operation
- ✓ identify and describe types of associated systems that are interconnected with fire alarm systems
- ✓ identify fire alarm system components, and describe their characteristics and applications
- ✓ identify considerations and requirements for selecting fire alarm systems and components

6.8 Knowledge of procedures to install fire alarm systems

Covers demonstrating knowledge of procedures to install, upgrade and connect fire alarm systems and components.

- ✓ identify tools and equipment used to install, upgrade and connect fire alarm systems and components
- ✓ describe procedures to install, upgrade and connect fire alarm systems and components
- ✓ describe procedures for testing fire alarm systems and components
- ✓ describe procedures for commissioning and verification of fire alarm systems

CHAPTER 7

Glossary of Terms

7.1 Grounding

Defines grounding as a permanent, continuous conductive path to earth sized to carry any fault current and with low enough impedance to limit voltage rise and allow protective devices to operate.

- ✓ Permanent and continuous conductive path to earth
- ✓ Sufficient ampacity to carry fault current
- ✓ Sufficiently low impedance to limit voltage rise above ground
- ✓ Facilitates operation of protective devices in the circuit

7.2 High-voltage System

Defines a high-voltage system per the CEC by its voltage thresholds.

- ✓ Any voltage exceeding 1 000 V AC or 1 060 V DC as per CEC

7.3 Low-energy Power Circuit

Defines a low-energy power circuit based on limited power relative to open circuit voltage.

- ✓ Power limited to 100 VA where V is the open circuit voltage

7.4 Low-voltage System

Defines a low-voltage system per the CEC by its AC and DC voltage ranges.

- ✓ Exceeding 30 V AC but not exceeding 1 000 V AC
- ✓ Exceeding 42.4 V DC but not exceeding 1 060 V DC as per CEC

7.5 Luminaire

Defines a luminaire as a complete lighting unit that accommodates lamps and connects them to circuit conductors.

- ✓ Complete lighting unit designed to accommodate lamp(s)
- ✓ Connects lamp(s) to circuit conductors
- ✓ Examples: fluorescent, High Intensity Discharge (HID), incandescent

7.6 Raceway

Defines a raceway as any channel designed to hold wires, cables or busbars, including the range of conduit and enclosure types recognized by the CEC.

- ✓ Channel for holding wires, cables or busbars
- ✓ Includes conduit (rigid, flexible, metal, non-metallic)
- ✓ Electrical metallic and non-metallic tubing
- ✓ Underfloor raceway, cellular floors, surface raceways
- ✓ Wireways, cable trays, busways, and auxiliary gutters

7.7 Specifications

Defines specifications as an explicit set of requirements a material, product or service must satisfy, drawn from codes, drawings, and various authorities.

- ✓ Local and national building codes
- ✓ Documentation holding legal obligations
- ✓ Schematics and manufacturers' specifications
- ✓ Local code and provincial/federal authority
- ✓ Engineered drawings, diagrams and schematics
- ✓ Client requirements and warranty documents
- ✓ Site drawings, shop drawings, company requirements

CHAPTER 8

B – Installs, services and maintains generating, distribution and service systems

8.1 Installs, services and maintains consumer/supply services and metering equipment

Covers installation, servicing and maintenance of single-phase and three-phase consumer/supply services and metering equipment.

- ✓ B-7.01 Installs single-phase consumer/supply services and metering equipment
- ✓ B-7.02 Installs three-phase consumer/supply services and metering equipment
- ✓ B-7.03 Performs servicing and maintenance of single-phase consumer/supply services and metering equipment
- ✓ B-7.04 Performs servicing and maintenance of three-phase consumer/supply services and metering equipment

8.2 Installs, services and maintains protection devices

Covers installation, servicing and maintenance of overcurrent, ground fault, arc fault and surge protection devices.

- ✓ B-8.01 Installs overcurrent protection devices
- ✓ B-8.02 Installs ground fault, arc fault and surge protection devices
- ✓ B-8.03 Performs servicing and maintenance of protection devices

8.3 Installs, services and maintains power distribution equipment

Covers installation, servicing and maintenance of power distribution equipment.

- ✓ B-9.01 Installs power distribution equipment
- ✓ B-9.02 Performs servicing and maintenance of power distribution equipment

8.4 Installs, services and maintains bonding and grounding, and ground fault protection and detection systems

Covers installation, servicing and maintenance of bonding, grounding, ground fault protection and detection, and lightning protection systems.

- ✓ B-11.01 Installs bonding and grounding systems
- ✓ B-11.02 Installs ground fault protection and detection systems
- ✓ B-11.03 Installs lightning protection systems
- ✓ B-11.04 Performs servicing and maintenance of bonding and grounding systems

8.5 Installs, services and maintains transformers

Covers installation, servicing and maintenance of extra-low, low and high-voltage transformers.

- ✓ B-15.01 Installs extra-low-voltage transformers
- ✓ B-15.02 Installs low-voltage single-phase transformers
- ✓ B-15.03 Installs low-voltage three-phase transformers
- ✓ B-15.04 Installs high-voltage transformers
- ✓ B-15.05 Performs servicing and maintenance of transformers

8.6 Installs, services and maintains power conditioning, UPS and surge suppression systems

Covers installation, servicing and maintenance of power conditioning, uninterruptible power supply (UPS) and surge suppression systems.

- ✓ B-10.01 Installs power conditioning, UPS and surge suppression systems
- ✓ B-10.02 Performs servicing and maintenance of power conditioning, UPS and surge suppression systems

8.7 Installs, services and maintains power generation and conversion systems

Covers installation, servicing and maintenance of AC and DC generating and conversion systems.

- ✓ B-12.01 Installs alternating current (AC) generating systems
- ✓ B-12.02 Performs servicing and maintenance of AC generating systems
- ✓ B-12.03 Installs direct current (DC) generating and conversion systems
- ✓ B-12.04 Performs servicing and maintenance of DC generating and conversion systems

8.8 Installs, services and maintains renewable energy generating and storage systems

Covers installation, servicing and maintenance of renewable energy generating and storage systems.

- ✓ B-13.01 Installs renewable energy generating and storage systems
- ✓ B-13.02 Performs servicing and maintenance of renewable energy generating and storage systems

8.9 Installs, services and maintains high-voltage systems

Covers installation, servicing and maintenance of high-voltage equipment and cables.

- ✓ B-14.01 Installs high-voltage equipment
- ✓ B-14.02 Installs high-voltage cables
- ✓ B-14.03 Performs servicing and maintenance of high-voltage systems

CHAPTER 9

Task A-3 Organizes work

9.1 Interprets plans, drawings and specifications

Covers identifying symbols and scaling, locating equipment/devices, cross-referencing information and verifying currency of drawings.

- ✓ identify symbols and scaling
- ✓ determine location of equipment and devices
- ✓ locate and cross-reference information on plans, drawings, specifications and contract documents
- ✓ visualize finished product based on information in plans, drawings and specifications
- ✓ determine if plans, drawings, schematics and specifications are current

9.2 Drawings, schematics and specifications and their applications

Covers knowledge of drawings, schematics and specifications and their applications.

- ✓ identify types of drawings, schematics and specifications, and describe their applications
- ✓ identify documentation requirements for modifying drawings and specifications
- ✓ describe procedures to document changes made to equipment and wiring

9.3 Imperial and SI measurement systems

Covers knowledge of imperial and SI (système international) measurement systems used in trade documentation.

- ✓ identify imperial and SI units of measurement used in trade documentation

9.4 Interpreting and extracting information from drawings

Covers knowledge of interpreting and extracting information from drawings, schematics and specifications.

- ✓ interpret and extract information from drawings, schematics and specifications
- ✓ explain how scaling is performed to position devices

9.5 Organizes materials and supplies

Covers identifying, selecting, ordering, loading, storing, receiving, verifying and inventorying materials and supplies.

- ✓ identify and select materials and supplies
- ✓ locate, order and schedule delivery of materials and supplies
- ✓ load, unload and store materials and supplies
- ✓ identify required materials and supplies
- ✓ coordinate receiving of materials and supplies
- ✓ verify shipments for quality and quantity of materials and supplies
- ✓ perform inventory control

9.6 Procedures to plan and organize materials and supplies

Covers knowledge of procedures to plan and organize materials and supplies.

- ✓ identify sources of information relevant to organize materials and supplies
- ✓ describe considerations to organize materials and supplies

9.7 Plans project tasks and procedures

Covers determining job/material/labour/equipment requirements, scheduling, coordinating with trades and sketching layouts.

- ✓ determine job requirements
- ✓ determine material, labour and equipment requirements
- ✓ establish and maintain schedules
- ✓ coordinate work with other trades and end user
- ✓ draw and sketch layouts

9.8 Procedures to plan and organize job tasks

Covers knowledge of procedures to plan and organize job tasks.

- ✓ identify sources of information relevant to planning job tasks and procedures
- ✓ describe considerations to plan and organize job tasks and procedures
- ✓ describe functions of project schedule charts

9.9 Prepares worksite

Covers pre-job assessment, identifying hazards and hazardous locations, wiring/equipment/sealing in hazardous locations, containing work zones and obtaining permits.

- ✓ perform pre-job assessment
- ✓ identify traffic areas and potential hazards
- ✓ identify hazardous locations
- ✓ identify wiring procedures in hazardous locations
- ✓ identify equipment used in hazardous locations
- ✓ identify locations for where sealing is required
- ✓ contain work zone
- ✓ create openings and penetrations in structures and equipment
- ✓ ensure egress, lighting and ventilation in work area
- ✓ ensure required materials and equipment are on site
- ✓ control workplace and storage access
- ✓ ensure surveys are completed and locates are marked-out
- ✓ ensure hot work, building and safety permits are obtained

9.10 Procedures to prepare worksite

Covers knowledge of procedures to prepare the worksite.

- ✓ identify sources of information to prepare worksite
- ✓ identify potential hazards to prepare worksite
- ✓ describe considerations to prepare worksite

9.11 Locating elements encased in concrete and soil

Covers knowledge of procedures to locate elements encased in concrete and soil.

- ✓ identify types of surveying equipment used to locate elements in concrete walls and floors, concrete slab on grade and in soil
- ✓ describe safety requirements when using x-ray surveying equipment in occupied buildings

9.12 Hazardous locations classification

Covers knowledge of hazardous locations and the division system of classification.

- ✓ identify types of hazardous locations and describe safe work procedures
- ✓ identify types of potentially hazardous materials present and procedures to designate an area to be a hazardous location
- ✓ identify equipment and fittings designed for installation and operation in hazardous locations
- ✓ hazardous locations are identified according to division system of classification

9.13 Hazardous locations wiring methods

Covers knowledge of hazardous locations wiring methods.

- ✓ identify and describe wiring methods in hazardous locations

9.14 Finalizes required documentation

Covers documenting alterations, logging data, compiling maintenance manuals and submitting as-built drawings and O&M manuals.

- ✓ document alterations
- ✓ log data from various sources to assist with maintenance and replacement
- ✓ compile maintenance manuals from installed equipment manufacturers' specifications
- ✓ submit final documentation, including as-built drawings to client

9.15 Documentation, its purpose, application and use

Covers knowledge of documentation, its purpose, application and use.

- ✓ describe and identify types of documentation developed from different tasks
- ✓ describe procedures for finalizing documentation

CHAPTER 10

B-11.01 Installs grounding and bonding systems

10.1 Installing grounding and bonding systems skills

Covers determining grounding electrodes, conductor sizes, layout, installation, termination and testing of grounding and bonding system components.

- ✓ determine type of grounding electrodes
- ✓ determine ground conductor size
- ✓ determine layout and location of grounding system components
- ✓ select tools and equipment
- ✓ install grounding system components
- ✓ terminate and interconnect grounding system components
- ✓ terminate grounding conductor
- ✓ perform ground resistance test
- ✓ determine bonding method
- ✓ install bonding components
- ✓ terminate and interconnect bonding system components
- ✓ terminate bonding conductor

10.2 Knowledge of grounding and bonding systems

Covers grounding and bonding methods, conductors, equipment, selection considerations and the distinction between grounding and bonding.

- ✓ interpret codes and regulations pertaining to grounding and bonding
- ✓ interpret information found on drawings and specifications
- ✓ identify grounding methods
- ✓ identify bonding methods
- ✓ identify grounding conductors, equipment and components
- ✓ identify bonding conductors, equipment and components
- ✓ identify considerations for selecting grounding conductors and equipment
- ✓ identify considerations for selecting bonding conductors and equipment
- ✓ explain purpose and differences between grounding and bonding

10.3 Procedures to install grounding systems

Covers tools, equipment and procedures for installing grounding systems and calculating grounding conductor size.

- ✓ identify tools and equipment used to install grounding systems
- ✓ describe procedures to install grounding systems
- ✓ describe procedures used to calculate grounding conductor size

10.4 Procedures to install bonding systems

Covers tools, equipment and procedures for installing bonding systems and calculating bonding conductor size.

- ✓ identify tools and equipment used to install bonding systems
- ✓ describe procedures to install bonding systems
- ✓ describe procedures used to calculate bonding conductor size

CHAPTER 11

B-15.05 Performs servicing and maintenance of transformers

11.1 Servicing and maintaining transformers

Covers the skills to diagnose, remove, replace, test and maintain transformer components, restoring transformers to operating condition.

- ✓ obtain detailed description of operation and malfunction
- ✓ determine source of malfunction
- ✓ select tools and equipment
- ✓ identify and remove defective transformer components
- ✓ select replacement components
- ✓ install replacement components
- ✓ conduct tests of transformers after repair
- ✓ clean and adjust transformer components
- ✓ record tests in maintenance log
- ✓ compare and analyze maintenance test results

11.2 Knowledge of transformers and their components

Covers knowledge of transformer types, components, characteristics, applications, operation and related codes as framed in B-15.05.01L.

- ✓ identify types of transformers, and describe their characteristics, applications and operation
- ✓ identify transformer components and describe their characteristics and applications
- ✓ interpret codes and regulations pertaining to transformers
- ✓ interpret information pertaining to transformers found on drawings and specifications
- ✓ describe construction of transformers
- ✓ interpret information contained on transformer nameplates

11.3 Procedures to service and maintain transformers

Covers knowledge of the tools, equipment and procedures used to service and maintain transformers and their components.

- ✓ identify tools and equipment used to service and maintain transformers and transformer components, and describe their applications and procedures for use
- ✓ describe procedures to service transformers and transformer components
- ✓ describe procedures to maintain transformers and transformer components

CHAPTER 12

Task C-21 Installs, services and maintains cathodic protection systems

12.1 Install cathodic protection systems

Covers determining installation location, selecting and installing branch circuit wiring and systems, terminating conductors, testing operation, and removing existing systems.

- ✓ determine installation location for cathodic protection systems
- ✓ select branch circuit wiring
- ✓ select tools and equipment
- ✓ install branch circuit wiring
- ✓ install cathodic protection systems
- ✓ terminate conductors and cables
- ✓ test operation
- ✓ determine requirements for removal
- ✓ remove existing systems when replacing and update documentation

12.2 Knowledge of cathodic protection systems and components

Topic covers types, components, characteristics, applications and operation of cathodic protection systems, including drawings, specifications and codes.

- ✓ identify types of cathodic protection systems and describe characteristics, applications and operation
- ✓ identify cathodic protection system components and describe characteristics, applications and operation
- ✓ interpret information found on drawings and specifications
- ✓ interpret codes and regulations

12.3 Procedures to install, connect and test cathodic protection systems

Topic covers tools, equipment and procedures used to install, connect and test cathodic protection systems and components.

- ✓ identify tools and equipment used and describe applications and procedures
- ✓ describe procedures to install systems and components
- ✓ describe procedures to connect systems and components
- ✓ describe procedures to test systems and components

12.4 Perform servicing and maintenance of cathodic protection systems

Covers determining source of malfunction, removing, repairing and replacing components, testing after repair, and recording tests.

- ✓ determine source of malfunction
- ✓ select tools and equipment
- ✓ identify and remove defective components
- ✓ repair malfunctioning components and verify repair
- ✓ select replacement components (OEM when mandated)
- ✓ install replacement components
- ✓ conduct tests after repair
- ✓ record tests in maintenance schedule

12.5 Knowledge of procedures to service and maintain cathodic protection systems

Topic covers tools, equipment and procedures to diagnose, repair and maintain cathodic protection systems.

- ✓ identify types of systems and components and describe characteristics, applications and operation
- ✓ identify tools and equipment used to service and maintain
- ✓ describe procedures to diagnose and repair
- ✓ describe procedures to maintain

CHAPTER 13

E-26.02 Performs servicing and maintenance of fire alarm systems

13.1 Obtain description of operation and malfunction

Covers obtaining and documenting a detailed description of operation and malfunction issues from end user and CPU diagnostics.

13.2 Select tools and equipment

Covers selecting tools and equipment according to the task.

13.3 Determine source of malfunction

Covers determining source of malfunction using field assessments and diagnostic and test equipment results.

13.4 Identify existing fire alarm system and components

Covers identifying existing fire alarm system and components using as-built drawings, maintenance log and site visit.

13.5 Test fire alarm system

Covers performing tests per maintenance schedule with sensory and technical inspections using diagnostic and test equipment.

13.6 Analyze test results

Covers analyzing test results by comparing manufacturers' certification report and communication log per client requirements.

13.7 Participate in periodic inspections

Covers verifying system, component and associated systems function per manufacturers' specifications and inspecting per maintenance schedule.

13.8 Replace fire alarm system components

Covers replacing, testing and verifying fire alarm system components.

13.9 Update documentation for servicing and maintenance

Covers producing clear, detailed documentation of systems tested, results and changes per codes, standards and regulations.

13.10 Knowledge of fire alarm systems for servicing

Covers demonstrating knowledge of fire alarm systems, components, their characteristics, applications and operation for maintenance.

- ✓ interpret codes and regulations pertaining to fire alarm systems
- ✓ interpret information pertaining to fire alarm systems found on drawings and specifications
- ✓ identify types of fire alarm systems, and describe their characteristics, applications and operation
- ✓ identify fire alarm system components, and describe their characteristics and applications
- ✓ identify considerations and requirements for selecting fire alarm systems and components
- ✓ describe types of associated systems that interconnect with fire alarm systems
- ✓ describe possible effects of service and maintenance of fire alarm system on associated systems

13.11 Knowledge of procedures to service fire alarm systems

Covers demonstrating knowledge of procedures to service and maintain fire alarm systems and components.

- ✓ identify tools and equipment used to service and maintain fire alarm systems and components
- ✓ describe procedures to service and maintain fire alarm systems and components
- ✓ describe procedures for testing fire alarm systems and components

CHAPTER 14

C – Installs, services and maintains wiring systems

14.1 Installs, services and maintains raceways, conductors, cables and enclosures

Covers installation, servicing and maintenance of conductors, cables, conduit, raceways, boxes and enclosures.

- ✓ C-16.01 Installs conductors and cables
- ✓ C-16.02 Installs conduit and fittings
- ✓ C-16.03 Installs raceways
- ✓ C-16.04 Installs boxes and enclosures
- ✓ C-16.05 Performs servicing and maintenance of raceways, conductors, cables and enclosures

14.2 Installs, services and maintains branch circuitry and devices

Covers installation and servicing of luminaires, wiring devices, lighting controls and standards, and specialty branch circuit systems.

- ✓ C-17.01 Installs luminaires
- ✓ C-17.02 Installs wiring devices
- ✓ C-17.03 Installs lighting controls
- ✓ C-17.04 Installs lighting standards
- ✓ C-17.05 Performs servicing of branch circuitry
- ✓ C-17.06 Installs, services and maintains airport visual aid systems
- ✓ C-17.07 Installs, services and maintains traffic signal lights and controls

14.3 Installs, services and maintains HVAC systems

Covers connecting HVAC systems and associated equipment, installing HVAC controls, and servicing these systems.

- ✓ C-18.01 Connects HVAC systems and associated equipment
- ✓ C-18.02 Installs HVAC controls
- ✓ C-18.03 Performs servicing and maintenance of HVAC systems and controls

14.4 Installs, services and maintains electric heating systems

Covers installation, servicing and maintenance of electric heating systems and their controls.

- ✓ C-19.01 Installs electric heating systems
- ✓ C-19.02 Installs electric heating system controls
- ✓ C-19.03 Performs servicing and maintenance of electric heating systems and controls

14.5 Installs, services and maintains exit and emergency lighting systems

Covers installation, servicing and maintenance of exit and emergency lighting systems.

- ✓ C-20.01 Installs exit and emergency lighting
- ✓ C-20.02 Performs servicing and maintenance of exit and emergency lighting systems

14.6 Installs, services and maintains cathodic protection systems

Covers installation, servicing and maintenance of cathodic protection systems.

- ✓ C-21.01 Installs cathodic protection systems
- ✓ C-21.02 Performs servicing and maintenance of cathodic protection systems

CHAPTER 15

Task D-22 Installs, services and maintains motor starters and controls

15.1 Install motor starters

Covers determining type, function and size of motor starter, calculating conductors, mounting the assembly, setting overloads, interconnecting peripherals, testing and removing equipment.

- ✓ determine type and function of motor starter
- ✓ determine size of motor starter
- ✓ calculate conductor and cable requirements
- ✓ select tools and equipment
- ✓ position, mount and assemble starter assembly
- ✓ terminate conductors and cables
- ✓ set up and adjust motor overloads
- ✓ interconnect motor starter with peripheral devices
- ✓ conduct tests after installation and record results
- ✓ remove existing equipment when replacing

15.2 Knowledge of motor starters and installation procedures

Topic covers motor starters, their components, accessories, characteristics and procedures to install and connect them.

- ✓ interpret information on nameplate data, drawings and specifications
- ✓ identify motor starters, components and accessories
- ✓ interpret codes and regulations
- ✓ identify tools and equipment to install and connect
- ✓ describe procedures to install and connect
- ✓ identify enclosures and wiring methods based on application

15.3 Perform servicing and maintenance of motor starters

Covers obtaining malfunction descriptions, diagnosing, removing, repairing, replacing components, testing, cleaning, adjusting and analyzing maintenance results.

- ✓ obtain detailed description of operation and malfunction
- ✓ select tools and equipment
- ✓ determine source of malfunction
- ✓ identify and remove defective components
- ✓ repair malfunctioning components and verify repair
- ✓ select and install replacement components
- ✓ conduct tests after repair
- ✓ clean and adjust components
- ✓ record tests in maintenance schedule
- ✓ compare and analyze maintenance test results

15.4 Knowledge of procedures to service and maintain motor starters

Topic covers tools, equipment and procedures to service and maintain motor starters, their components and accessories.

- ✓ interpret information on drawings and specifications
- ✓ identify motor starters, components and accessories
- ✓ interpret codes and regulations
- ✓ identify tools and equipment to service and maintain
- ✓ describe procedures to service and maintain

15.5 Install motor control devices

Covers determining device type and circuit type, calculating conductors, mounting, adjusting, interconnecting with peripherals and overload protection, testing and removing equipment.

- ✓ determine type of motor control devices and function
- ✓ determine motor control circuit types
- ✓ calculate conductor and cable requirements
- ✓ select tools and equipment
- ✓ position, mount and assemble motor control device
- ✓ terminate conductors and cables
- ✓ set up and adjust motor control devices
- ✓ interconnect with peripheral devices
- ✓ interconnect with overload protection
- ✓ conduct tests after installation
- ✓ remove existing equipment when replacing

15.6 Knowledge of motor control devices and circuits

Topic covers motor control devices, motor control circuits, their characteristics, applications and installation procedures.

- ✓ interpret information on drawings and specifications
- ✓ identify motor control devices and describe characteristics
- ✓ interpret codes and regulations
- ✓ identify circuit types and describe characteristics
- ✓ describe circuit functional features
- ✓ identify methods to determine number of conductors
- ✓ identify motor protection devices
- ✓ identify tools and equipment to install
- ✓ describe procedures to install

15.7 Perform servicing and maintenance of motor controls

Covers obtaining malfunction descriptions, diagnosing, removing, replacing components, testing, cleaning, lubricating, adjusting and analyzing maintenance results.

- ✓ obtain detailed description of operation and malfunction
- ✓ select tools and equipment
- ✓ determine source of malfunction
- ✓ identify and remove defective components
- ✓ select replacement components
- ✓ install replacement components
- ✓ conduct tests after repair
- ✓ clean, lubricate and adjust components
- ✓ record tests in maintenance schedule
- ✓ compare and analyze maintenance test results

15.8 Knowledge of procedures to service and maintain motor control devices

Topic covers tools, equipment and procedures to service and maintain motor control devices and their components.

- ✓ interpret information on drawings and specifications
- ✓ identify types of motor control devices and components
- ✓ interpret codes and regulations
- ✓ identify tools and equipment to service and maintain
- ✓ describe procedures to service
- ✓ describe procedures to maintain

CHAPTER 16

Task A-4 Fabricates and installs support components

16.1 Fabricates support structures

Covers selecting tools, evaluating equipment, sketching, selecting materials/fasteners, preparing and assembling support structures.

- ✓ select tools and equipment
- ✓ evaluate equipment to determine support structure size, strength and weight
- ✓ draw basic sketch
- ✓ determine materials for support structure
- ✓ select and use fasteners
- ✓ prepare materials
- ✓ assemble materials to create structure

16.2 Interpreting, creating and extracting information from sketches

Covers knowledge of interpreting, creating and extracting information from sketches, drawings and specifications.

- ✓ create, interpret and extract information from sketches, drawings and specifications
- ✓ identify support materials, their characteristics and applications
- ✓ identify fasteners, their characteristics and applications

16.3 Procedures to fabricate support structures

Covers knowledge of procedures to fabricate support structures.

- ✓ identify tools and equipment used to fabricate support structures, and describe their applications and procedures for use
- ✓ describe procedures to fabricate support structures

16.4 Installs brackets, hangers and fasteners

Covers selecting, locating and securing brackets, hangers and fasteners while avoiding obstructions.

- ✓ select brackets, hangers and fasteners
- ✓ select tools and equipment
- ✓ determine installation location
- ✓ secure brackets, hangers and fasteners to structure

16.5 Brackets, hangers and fasteners characteristics and applications

Covers knowledge of brackets, hangers and fasteners, their characteristics and applications.

- ✓ identify types of brackets, hangers and fasteners, and describe their characteristics and applications
- ✓ identify building materials, their characteristics and applications

16.6 Procedures to install brackets, hangers and fasteners

Covers knowledge of procedures to install brackets, hangers and fasteners.

- ✓ identify tools and equipment used to install brackets, hangers and fasteners, and describe their applications and procedures for use
- ✓ describe measurement and layout techniques to ensure brackets, hangers and fasteners are positioned and mounted
- ✓ describe procedures for securing brackets, hangers and fasteners to structure

16.7 Installs seismic restraint systems

Covers selecting/fabricating seismic restraint systems, tools, locating and securing them to structure.

- ✓ select and fabricate seismic restraint systems
- ✓ select tools and equipment
- ✓ determine installation location
- ✓ position, mount and secure seismic restraint systems to structure

16.8 Seismic restraint systems characteristics and applications

Covers knowledge of seismic restraint systems, their characteristics and applications.

- ✓ identify types of seismic restraint systems, their characteristics, applications and requirements
- ✓ identify materials to be installed

16.9 Procedures for mounting and securing seismic restraint systems

Covers knowledge of procedures for mounting and securing seismic restraint systems to structure.

- ✓ identify tools and equipment used to mount and secure seismic restraint systems to structure, and describe their applications and procedures for use
- ✓ describe procedures for mounting and securing seismic restraint systems to structure

CHAPTER 17

B-11.02 Installs ground fault protection and detection systems

17.1 Installing ground fault protection and detection systems skills

Covers determining, mounting, terminating, setting parameters and testing of ground fault protection and detection systems.

- ✓ determine type of ground fault system required
- ✓ select tools and equipment
- ✓ position and mount ground fault system components
- ✓ terminate and interconnect ground fault system components
- ✓ set parameters for ground fault systems
- ✓ test operation of ground fault system

17.2 Knowledge of ground fault systems and operation

Covers ground fault system types, purpose, codes, drawings and component selection considerations.

- ✓ identify types of ground fault systems
- ✓ explain purpose of ground fault systems
- ✓ interpret codes and regulations pertaining to ground fault systems
- ✓ interpret information found on drawings and specifications
- ✓ identify considerations for selecting ground fault system components

17.3 Procedures to install ground fault systems

Covers tools, equipment and procedures for installing ground fault systems and components.

- ✓ identify tools and equipment used to install ground fault system
- ✓ describe procedures to install ground fault systems and components

CHAPTER 18

C-16.01 Installs conductors and cables

18.1 Installing conductors and cables

Covers the skills to select, install, terminate and remove conductors, cables and their components according to codes and specifications.

- ✓ determine installation requirements, and select conductors, cables and conductor and cable components
- ✓ select tools and equipment
- ✓ mount, support and install conductors, cables, and conductor and cable components
- ✓ measure and cut conductors and cables
- ✓ prepare conductors and cables for termination
- ✓ terminate conductors and cables
- ✓ complete documentation to reflect changes
- ✓ determine requirements for removal of existing conductors, cables, connectors and supports
- ✓ remove conductors, cables, connectors and supports when replacing, and update documentation

18.2 Knowledge of conductors, cables and components

Covers knowledge of conductor and cable types, characteristics, applications, codes and selection/removal considerations.

- ✓ identify types of conductors, cables, and conductor and cable components, and describe their characteristics and applications
- ✓ interpret codes, regulations and standards pertaining to conductors and cables
- ✓ interpret information pertaining to conductors and cables found on drawings and specifications
- ✓ identify considerations and requirements for removal of conductors, cables, and conductor and cable components
- ✓ identify considerations and requirements for selecting conductors, cables, and conductor and cable components

18.3 Procedures to remove or install conductors and cables

Covers knowledge of tools, equipment and procedures to remove, prepare, install and terminate conductors, cables and components.

- ✓ identify tools and equipment used to remove or install conductors, cables and conductor and cable components, and describe their applications and procedures for use
- ✓ describe procedures to remove conductors, cables and conductor and cable components
- ✓ describe procedures to prepare and install conductors, cables and conductor and cable components
- ✓ describe procedures to terminate conductors and cables

CHAPTER 19

E-26.03 Installs security and surveillance systems

19.1 Determine type of security and surveillance system required

Covers determining the type of security and surveillance system per drawings, specifications and job requirements.

19.2 Select tools and equipment

Covers selecting tools and equipment according to the task.

19.3 Remove and dispose of existing components

Covers removing and disposing of existing components in an environmentally conscious manner and updating documentation.

19.4 Determine security and surveillance system layout

Covers determining system layout per architectural and client requirements.

19.5 Select security and surveillance system components

Covers selecting components per drawings, specifications, and job and client requirements.

19.6 Position, mount and assemble components

Covers positioning, mounting and assembling components in locations per drawings, specifications, and job and client requirements.

19.7 Terminate and interconnect components and associated systems

Covers terminating and interconnecting components and associated system devices per drawings, specifications and job requirements.

19.8 Program and configure security and surveillance system

Covers programming and configuring the system per job and client requirements and manufacturers' specifications.

19.9 Test components to ensure functionality

Covers testing continuity and polarity of video data wiring using diagnostic equipment to confirm components function.

19.10 Test conductors for opens and ground continuity

Covers verifying conductors have no opens and all components are bonded to ground and clear of obstructions.

19.11 Conduct initial security and surveillance system tests

Covers performing sensory, spot and system tests per drawings and specifications.

19.12 Participate in startup and commissioning inspections

Covers activating devices to trigger events and associated systems' responses.

19.13 Knowledge of security and surveillance systems and components

Covers demonstrating knowledge of security and surveillance systems, components, associated systems, characteristics, applications and operation.

- ✓ interpret codes and regulations pertaining to security and surveillance systems
- ✓ interpret information pertaining to security and surveillance systems found on drawings and specifications
- ✓ identify types of security and surveillance systems, and describe their characteristics, applications and operation
- ✓ identify and describe types of associated systems that are interconnected with security and surveillance systems
- ✓ identify security and surveillance system components, and describe their characteristics and applications
- ✓ identify considerations and requirements for selecting security and surveillance systems and components

19.14 Knowledge of procedures to install security systems

Covers demonstrating knowledge of procedures to install, upgrade and connect security and surveillance systems and components.

- ✓ identify tools and equipment used to install, upgrade and connect security and surveillance systems and components
- ✓ describe procedures to install, upgrade and connect security and surveillance systems and components
- ✓ describe procedures for testing security and surveillance systems and components
- ✓ describe procedures for commissioning and verification of security and surveillance systems

CHAPTER 20

D – Installs, services and maintains motors and control systems

20.1 Installs, services and maintains motor starters and controls

Covers installation, servicing and maintenance of motor starters and motor control devices.

- ✓ D-22.01 Installs motor starters
- ✓ D-22.02 Performs servicing and maintenance of motor starters
- ✓ D-22.03 Installs motor control devices
- ✓ D-22.04 Performs servicing and maintenance of motor controls

20.2 Installs, services and maintains motors

Covers installation, servicing and maintenance of single-phase, three-phase and DC motors.

- ✓ D-24.01 Installs single-phase motors
- ✓ D-24.02 Performs servicing and maintenance of single-phase motors
- ✓ D-24.03 Installs three-phase motors
- ✓ D-24.04 Performs servicing and maintenance of three-phase motors
- ✓ D-24.05 Installs DC motors
- ✓ D-24.06 Performs servicing and maintenance of DC motors

20.3 Installs, services and maintains drives

Covers installation, servicing and maintenance of AC and DC drives.

- ✓ D-23.01 Installs AC drives
- ✓ D-23.02 Performs servicing and maintenance of AC drives
- ✓ D-23.03 Installs DC drives
- ✓ D-23.04 Performs servicing and maintenance of DC drives

20.4 Installs, programs, services and maintains automated control systems

Covers installation, servicing, maintenance, programming and configuration of automated control systems.

- ✓ D-25.01 Installs automated control systems
- ✓ D-25.02 Performs servicing and maintenance of automated control systems
- ✓ D-25.03 Programs and configures automated control systems

CHAPTER 21

Task D-23 Installs, services and maintains drives

21.1 Install AC drives

Covers determining type, size and function of AC drive, calculating conductors, mounting, calibrating and programming, interconnecting peripherals, testing and removing existing drives.

- ✓ determine type of AC drive
- ✓ determine size and function of AC drive
- ✓ calculate conductor and cable requirements
- ✓ select tools and equipment
- ✓ position, mount and assemble AC drives
- ✓ terminate conductors and cables
- ✓ calibrate and program AC drives
- ✓ interconnect AC drives with peripheral devices
- ✓ conduct tests after installation and record results
- ✓ remove existing AC drives when replacing

21.2 Knowledge of AC drives and installation procedures

Topic covers AC drives, their components, accessories, operating principles and procedures to install, connect and adjust them.

- ✓ identify types of AC drives
- ✓ identify AC drive components and accessories
- ✓ interpret information on drawings and specifications
- ✓ interpret codes and regulations
- ✓ explain operating principles and impact on motor performance
- ✓ identify considerations for selecting AC drives
- ✓ identify tools and equipment to install and connect
- ✓ describe procedures to install, connect and adjust

21.3 Perform servicing and maintenance of AC drives

Covers diagnosing, removing, repairing, replacing components, adjusting programming, testing, cleaning and analyzing maintenance results.

- ✓ obtain detailed description of operation and malfunction
- ✓ select tools and equipment
- ✓ determine source of malfunction
- ✓ identify and remove defective components
- ✓ repair malfunctioning components and verify repair
- ✓ select and install replacement components
- ✓ adjust programming after repair
- ✓ conduct tests after repair
- ✓ clean and adjust components
- ✓ record tests in maintenance schedule
- ✓ compare and analyze maintenance test results

21.4 Knowledge of procedures to service and maintain AC drives

Topic covers tools, equipment and procedures to service and maintain AC drives, components and accessories.

- ✓ identify types of AC drives
- ✓ identify AC drive components and accessories
- ✓ interpret information on drawings and specifications
- ✓ interpret codes and regulations
- ✓ explain operating principles
- ✓ identify tools and equipment to service and maintain
- ✓ describe procedures to service and maintain

21.5 Install DC drives

Covers determining type, size and function of DC drive, calculating conductors, mounting, calibrating and programming, interconnecting peripherals, testing and removing existing drives.

- ✓ determine type of DC drive
- ✓ determine size and function of DC drive
- ✓ calculate conductor and cable requirements
- ✓ select tools and equipment
- ✓ position, mount and assemble DC drives
- ✓ terminate conductors and cables
- ✓ calibrate and program DC drives
- ✓ interconnect DC drives with peripheral devices
- ✓ conduct tests after installation and record results
- ✓ remove existing DC drives when replacing

21.6 Knowledge of DC drives and installation procedures

Topic covers DC drives, their components, accessories, operating principles and procedures to install, connect and adjust them.

- ✓ identify types of DC drives
- ✓ identify DC drive components and accessories
- ✓ interpret information on drawings and specifications
- ✓ interpret codes and regulations
- ✓ explain operating principles and impact on motor performance
- ✓ identify considerations for selecting DC drives
- ✓ identify tools and equipment to install and connect
- ✓ describe procedures to install, connect and adjust

21.7 Perform servicing and maintenance of DC drives

Covers diagnosing, removing, repairing, replacing DC drive components, testing, cleaning and analyzing maintenance results.

- ✓ obtain detailed description of operation and malfunction
- ✓ select tools and equipment
- ✓ determine source of malfunction
- ✓ identify and remove defective DC drive components
- ✓ repair malfunctioning DC drive components and verify repair
- ✓ select and install replacement DC drive components
- ✓ conduct tests after repair
- ✓ clean and adjust DC drive components
- ✓ record tests in maintenance schedule
- ✓ compare and analyze maintenance test results

21.8 Knowledge of procedures to service and maintain DC drives

Topic covers tools, equipment and procedures to service and maintain DC drives, components and accessories.

- ✓ identify types of DC drives
- ✓ identify DC drive components and accessories
- ✓ interpret information on drawings and specifications
- ✓ interpret codes and regulations
- ✓ explain operating principles
- ✓ identify tools and equipment to service and maintain
- ✓ describe procedures to service and maintain

CHAPTER 22

Task A-5 Commissions and decommissions electrical systems

22.1 Performs startup and shutdown procedures

Covers identifying equipment to energize/de-energize, testing conductors, verifying drawings, following startup/shutdown sequences and installing temporary grounds.

- ✓ identify equipment that needs to be energized
- ✓ identify equipment that needs to be de-energized
- ✓ select tools and equipment
- ✓ test cables and conductors
- ✓ verify drawings match field wiring
- ✓ verify connected components operate
- ✓ follow specifications sequence for startup
- ✓ follow specifications sequence for shutdown
- ✓ check system peripherals for specified operation
- ✓ install temporary protective ground equipment on shutdown and remove on startup
- ✓ verify connections and terminations and torquing of bolts
- ✓ inspect and remove shipping materials, tools, jumpers, debris, gravity pins, blocking and latching devices
- ✓ notify required personnel of startup and shutdown procedures

22.2 Purpose of startup and shutdown procedures

Covers knowledge of the purpose of startup and shutdown procedures.

- ✓ identify hazards, and describe safe work practices pertaining to starting up and shutting down systems or equipment
- ✓ describe purpose of starting up and shutting down, and types of systems and equipment requiring it
- ✓ identify and interpret information sources and documentation pertaining to starting up and shutting down of systems or equipment

22.3 Procedures to start up and shut down systems

Covers knowledge of procedures to start up and shut down systems or equipment.

- ✓ identify tools and equipment used to start up and shut down systems or equipment, and describe their applications and procedures for use
- ✓ describe startup and shutdown procedures for various types of systems and equipment

22.4 Performs commissioning and decommissioning of systems

Covers setting operational parameters, confirming peripherals, operational checks, adjusting components and de-energizing/isolating equipment to zero energy state.

- ✓ select tools and equipment
- ✓ check documentation and nameplate data for operational parameters
- ✓ confirm system peripherals are functional
- ✓ perform operational checks
- ✓ visually inspect system for problems
- ✓ adjust components to achieve desired operation
- ✓ isolate potential energy from equipment
- ✓ identify and remove equipment feed from distribution source
- ✓ collaborate with other trades to ensure all services are disconnected
- ✓ confirm system is de-energized

22.5 Commissioning and decommissioning and their purpose

Covers knowledge of commissioning and decommissioning and their purpose.

- ✓ identify hazards and describe safe work practices pertaining to commissioning and decommissioning systems or equipment
- ✓ identify purpose of commissioning and decommissioning, and types of systems and equipment requiring them
- ✓ identify and interpret information sources and documentation pertaining to commissioning and decommissioning of systems or equipment
- ✓ identify diagnostic and test equipment for purpose of commissioning and decommissioning systems

22.6 Commissioning and decommissioning procedures

Covers knowledge of commissioning and decommissioning procedures.

- ✓ describe commissioning and decommissioning procedures

CHAPTER 23

B-11.03 Installs lightning protection systems

23.1 Installing lightning protection systems skills

Covers determining, laying out, mounting, terminating and removing lightning protection system components.

- ✓ determine type of lightning protection system required
- ✓ select and lay out lightning protection components
- ✓ select tools and equipment
- ✓ position and mount lightning protection components
- ✓ terminate and interconnect lightning protection components
- ✓ remove and dispose of existing components when replacing and update documentation

23.2 Knowledge of lightning protection systems

Covers purpose, types, codes, drawings and selection considerations for lightning protection systems.

- ✓ explain purpose of lightning protection systems
- ✓ identify lightning protection systems and describe their characteristics
- ✓ interpret codes and regulations pertaining to lightning protection systems
- ✓ interpret information found on drawings and specifications
- ✓ identify considerations for selecting type of lightning protection systems

23.3 Procedures to install lightning protection systems

Covers tools, equipment and procedures to install lightning protection systems and components.

- ✓ identify tools and equipment used to install lightning protection system
- ✓ identify and describe procedures to install lightning protection systems and components

CHAPTER 24

C-16.02 Installs conduit and fittings

24.1 Installing conduit and fittings

Covers the skills to select, route, measure, cut, bend, mount, support and remove conduit, tubing and fittings.

- ✓ determine installation requirements and select conduit, tubing and fittings
- ✓ select tools and equipment
- ✓ determine routing of conduit and tubing
- ✓ measure, cut, thread and bend conduit
- ✓ measure, cut and bend tubing
- ✓ assemble, position, mount and support conduit, tubing and fittings
- ✓ determine requirements for removal of existing conduit, tubing and fittings
- ✓ remove conduit, tubing and fittings when replacing, and update documentation

24.2 Knowledge of conduit, tubing and fittings

Covers knowledge of conduit, tubing and fitting types, components, characteristics, applications, codes and selection/removal considerations.

- ✓ identify types of conduit, tubing and fittings, and describe their characteristics, applications and limitations
- ✓ identify conduit, tubing and fitting components, and describe their characteristics and applications
- ✓ identify tools and equipment related to conduit, tubing and fittings, and describe their applications and procedures for use
- ✓ interpret information pertaining to conduit, tubing and fittings found on drawings and specifications
- ✓ interpret codes and regulations pertaining to conduit, tubing and fittings
- ✓ identify considerations and requirements for removal of conduit, tubing and fittings, and their components
- ✓ identify considerations and requirements for selecting conduit, tubing and fittings, and their components

24.3 Procedures to remove or install conduit and tubing

Covers knowledge of tools, equipment and procedures to remove, cut, thread, bend, install and support conduit and tubing systems.

- ✓ identify tools and equipment used to remove or install conduit, tubing and fittings, and their components, and describe their applications and procedures for use
- ✓ describe procedures used for removal of conduit and tubing
- ✓ describe procedures to cut, thread (if applicable) and bend conduit and tubing
- ✓ describe procedures to install and support conduit and tubing systems
- ✓ describe procedures to select and install conduit and tubing related components

CHAPTER 25

E-26.04 Performs servicing and maintenance of security and surveillance systems

25.1 Obtain detailed description of malfunction

Covers obtaining and documenting a detailed description of operation and malfunction issues from end user.

25.2 Select tools and equipment

Covers selecting tools and equipment according to the task.

25.3 Identify existing security system and components

Covers referencing as-built drawings and maintenance log and conducting a walkthrough to identify existing systems.

25.4 Program and configure security and surveillance system

Covers programming and configuring the system per job and client requirements.

25.5 Conduct security and surveillance system tests

Covers performing sensory and technical inspections using diagnostic equipment and software.

25.6 Analyze test results

Covers comparing test results to the security and surveillance log and client requirements.

25.7 Replace defective components

Covers testing and verifying replacement security and surveillance system components.

25.8 Clean and adjust components

Covers restoring component functionality so sensors and recording devices cover required area to optimal condition.

25.9 Update documentation for servicing

Covers producing clear, detailed documentation of systems and components tested and changed plus test and certification results.

25.10 Notify and explain system changes to monitor

Covers explaining system changes to the system monitor.

25.11 Knowledge of security systems for servicing

Covers demonstrating knowledge of security and surveillance systems, components, associated systems, characteristics, applications and operation.

- ✓ interpret codes and regulations pertaining to security and surveillance systems
- ✓ interpret information pertaining to security and surveillance systems found on drawings and specifications
- ✓ identify types of security and surveillance systems, and describe their characteristics, applications and operation
- ✓ identify security and surveillance system components, and describe their characteristics and applications
- ✓ identify considerations and requirements for selecting security and surveillance systems and components
- ✓ describe types of associated systems that often interconnect with security and surveillance systems

25.12 Knowledge of procedures to service security systems

Covers demonstrating knowledge of procedures to service and maintain security and surveillance systems and components.

- ✓ identify tools and equipment used to service and maintain security and surveillance systems and components
- ✓ describe possible effects of service and maintenance of security and surveillance system on associated systems
- ✓ describe procedures to service and maintain security and surveillance systems and components
- ✓ describe procedures for testing security and surveillance systems, components and conductors
- ✓ describe procedures for commissioning and verification of security and surveillance systems

CHAPTER 26

Task D-24 Installs, services and maintains motors

26.1 Install single-phase motors

Covers determining motor type, calculating conductors, installing protection devices, mounting, terminating leads, testing and removing existing motors.

- ✓ determine type of single-phase motor required
- ✓ calculate conductor and cable requirements
- ✓ determine and install overload and overcurrent devices
- ✓ select tools and equipment
- ✓ position and mount single-phase motor
- ✓ terminate motor leads
- ✓ conduct tests after installation and document results
- ✓ remove existing single-phase motor when replacing

26.2 Knowledge of single-phase motors and installation procedures

Topic covers single-phase motors, their components, operating principles and procedures to install and connect them.

- ✓ identify types of single-phase motors
- ✓ identify single-phase motor components
- ✓ interpret codes and regulations
- ✓ interpret information on drawings and specifications
- ✓ explain construction and operating principles
- ✓ interpret nameplate information
- ✓ identify tools and equipment to install and connect
- ✓ describe procedures to install and connect
- ✓ identify coupling methods
- ✓ identify considerations for selecting motors

26.3 Perform servicing and maintenance of single-phase motors

Covers diagnosing, removing, replacing components, testing, cleaning, lubricating, adjusting and analyzing maintenance results.

- ✓ obtain detailed description of operation and malfunction
- ✓ select tools and equipment
- ✓ determine source of malfunction
- ✓ identify and remove defective components
- ✓ select and install replacement components
- ✓ conduct tests after repair
- ✓ clean, lubricate and adjust components
- ✓ record tests in maintenance schedule
- ✓ compare and analyze maintenance test results

26.4 Knowledge of procedures to service and maintain single-phase motors

Topic covers tools, equipment and procedures to service and maintain single-phase motors and components.

- ✓ identify types of single-phase motors
- ✓ identify single-phase motor components and accessories
- ✓ interpret codes and regulations
- ✓ interpret information on drawings and specifications
- ✓ explain construction and operating principles
- ✓ interpret nameplate information
- ✓ identify tools and equipment to service and maintain
- ✓ describe procedures to service and maintain

26.5 Install three-phase motors

Covers determining motor type, calculating conductors, installing protection devices, mounting, terminating leads, testing and removing existing motors.

- ✓ determine type of three-phase motor required
- ✓ select tools and equipment
- ✓ calculate conductor and cable requirements
- ✓ determine and install overload and overcurrent devices
- ✓ determine and install motor protection devices
- ✓ position and mount three-phase motor
- ✓ terminate motor leads
- ✓ conduct tests after installation and record results
- ✓ remove existing three-phase motors when replacing

26.6 Knowledge of three-phase motors and installation procedures

Topic covers three-phase motors, their components, operating principles and procedures to install and connect them.

- ✓ identify types of three-phase motors
- ✓ identify three-phase motor components
- ✓ interpret codes and regulations
- ✓ interpret information on drawings and specifications
- ✓ explain construction and operating principles
- ✓ interpret nameplate information
- ✓ identify considerations for selecting motors
- ✓ identify tools and equipment to install and connect
- ✓ describe procedures to install and connect
- ✓ identify coupling methods

26.7 Perform servicing and maintenance of three-phase motors

Covers diagnosing, removing, replacing components, testing, cleaning, lubricating, adjusting and analyzing maintenance results.

- ✓ obtain detailed description of operation and malfunction
- ✓ select tools and equipment
- ✓ determine source of malfunction
- ✓ identify and remove defective components
- ✓ select and install replacement components
- ✓ conduct tests after repair
- ✓ clean, lubricate and adjust components
- ✓ record tests in maintenance schedule
- ✓ compare and analyze maintenance test results

26.8 Knowledge of procedures to service and maintain three-phase motors

Topic covers tools, equipment and procedures to service, maintain, repair and test three-phase motors and components.

- ✓ identify types of three-phase motors
- ✓ identify three-phase motor components
- ✓ interpret codes and regulations
- ✓ interpret information on drawings and specifications
- ✓ explain construction and operating principles
- ✓ interpret nameplate information
- ✓ identify tools and equipment to service and maintain
- ✓ describe procedures to service
- ✓ describe procedures to maintain, repair and test

26.9 Install DC motors

Covers determining motor type, calculating conductors, installing protection devices, mounting, terminating leads, testing and removing existing motors.

- ✓ determine type of DC motor required
- ✓ select tools and equipment
- ✓ calculate conductor and cable requirements
- ✓ determine and install overload and overcurrent devices
- ✓ position and mount DC motor
- ✓ terminate motor leads
- ✓ conduct tests after installation and record results
- ✓ remove existing DC motors when replacing

26.10 Knowledge of DC motors and installation procedures

Topic covers DC motors, their components, operating principles and procedures to install and connect them.

- ✓ identify types of DC motors
- ✓ identify DC motor components
- ✓ interpret codes and regulations
- ✓ interpret information on drawings and specifications
- ✓ explain construction and operating principles
- ✓ interpret nameplate information
- ✓ identify considerations for selecting DC motors and controls
- ✓ identify tools and equipment to install and connect
- ✓ describe procedures to install
- ✓ describe procedures to connect

26.11 Perform servicing and maintenance of DC motors

Covers diagnosing, removing, replacing DC motor components, testing, cleaning, lubricating, adjusting and analyzing maintenance results.

- ✓ obtain detailed description of operation and malfunction
- ✓ select tools and equipment
- ✓ determine source of malfunction
- ✓ identify and remove defective DC motor components
- ✓ select and install replacement DC motor components
- ✓ conduct tests after repair
- ✓ clean, lubricate and adjust DC motor components
- ✓ record tests in maintenance schedule
- ✓ compare and analyze maintenance test results

26.12 Knowledge of procedures to service and maintain DC motors

Topic covers tools, equipment and procedures to service and maintain DC motors and components.

- ✓ identify types of DC motors
- ✓ identify DC motor components
- ✓ interpret codes and regulations
- ✓ interpret information on drawings and specifications
- ✓ explain construction and operating principles
- ✓ interpret nameplate information
- ✓ identify tools and equipment to service and maintain
- ✓ describe procedures to service
- ✓ describe procedures to maintain

CHAPTER 27

E – Installs, services and maintains signalling and communication systems

27.1 Installs, services and maintains signalling systems

Covers installation, servicing and maintenance of fire alarm systems and security and surveillance systems.

- ✓ E-26.01 Installs fire alarm systems
- ✓ E-26.02 Performs servicing and maintenance of fire alarm systems
- ✓ E-26.03 Installs security and surveillance systems
- ✓ E-26.04 Performs servicing and maintenance of security and surveillance systems

27.2 Installs, services and maintains communication systems

Covers installation, servicing and maintenance of voice/data/video, CATV, public address, intercom and nurse call systems.

- ✓ E-27.01 Installs voice/data/video (VDV) and community antenna television (CATV) systems
- ✓ E-27.02 Installs public address (PA) and intercom systems
- ✓ E-27.03 Installs nurse call systems
- ✓ E-27.04 Performs servicing and maintenance of communication systems

27.3 Installs, services and maintains integrated control systems

Covers installation, servicing and maintenance of building automation and building control systems.

- ✓ E-28.01 Installs building automation systems
- ✓ E-28.02 Installs building control systems
- ✓ E-28.03 Performs servicing and maintenance of integrated control systems

CHAPTER 28

Task A-6 Uses communication and mentoring techniques

28.1 Uses communication techniques

Covers communication practices, active listening, feedback, questioning and participating in safety and information meetings.

- ✓ demonstrate communication practices with individuals or in a group
- ✓ listen using active listening practices
- ✓ receive and respond to feedback on work
- ✓ explain and provide feedback
- ✓ use questioning to improve communication
- ✓ participate in safety and information meetings

28.2 Trade terminology

Covers knowledge of trade terminology.

- ✓ define terminology used in trade

28.3 Effective communication practices

Covers knowledge of effective communication practices including verbal and non-verbal communication, learning styles and workplace responsibilities.

- ✓ describe importance of using effective verbal and non-verbal communication with people in the workplace
- ✓ identify sources of information to effectively communicate
- ✓ identify communication and learning styles
- ✓ describe effective listening and speaking skills
- ✓ identify personal responsibilities and attitudes that contribute to on-the-job success
- ✓ identify communication that constitutes harassment and discrimination

28.4 Uses mentoring techniques

Covers communicating learning objectives, demonstrating skills, setting up practice, assessing learners, giving feedback and supporting anti-harassment.

- ✓ identify and communicate learning objective and point of lesson
- ✓ link lesson to other lessons and job
- ✓ demonstrates performance of skill to apprentice or learner
- ✓ set up conditions required for apprentice or learner to practice skill
- ✓ assess apprentice or learner's ability to perform tasks with increasing independence and productivity
- ✓ give supportive and corrective feedback
- ✓ support apprentices or learners in pursuing technical training opportunities
- ✓ support anti-harassment in workplace
- ✓ assess apprentice or learner suitability to trade during probationary period

28.5 Strategies for learning skills in workplace

Covers knowledge of strategies for learning skills in the workplace.

- ✓ describe importance of individual experience
- ✓ describe shared responsibilities for workplace learning
- ✓ determine one's own learning preferences and explain how these relate to learning new skills
- ✓ describe importance of different types of skills in workplace
- ✓ describe importance of essential skills in workplace
- ✓ identify different learning styles
- ✓ identify different learning needs and strategies to meet them
- ✓ identify strategies to assist in learning a skill

28.6 Strategies for teaching skills

Covers knowledge of strategies for teaching skills.

- ✓ identify different roles played by a workplace mentor
- ✓ describe teaching skills
- ✓ explain importance of identifying point of a lesson
- ✓ identify how to choose a good time to present a lesson
- ✓ explain importance of linking lessons
- ✓ identify components of skill (the context)
- ✓ describe considerations in setting up opportunities for skill practice
- ✓ explain importance of providing feedback
- ✓ identify techniques for giving effective feedback
- ✓ describe a skills assessment
- ✓ identify methods of assessing progress
- ✓ explain how to adjust a lesson to different situations

CHAPTER 29

B-11.04 Performs servicing and maintenance of bonding and grounding systems

29.1 Servicing and maintenance of bonding and grounding skills

Covers diagnosing malfunctions, repairing, replacing components, creating maintenance schedules, testing and documenting for bonding and grounding systems.

- ✓ obtain detailed description of malfunction
- ✓ determine source of malfunction
- ✓ determine course of action
- ✓ select tools and equipment
- ✓ repair malfunctioning components and verify repair
- ✓ select equivalent replacement components
- ✓ install equivalent replacement components
- ✓ determine maintenance requirements
- ✓ create maintenance schedule
- ✓ follow maintenance schedule
- ✓ conduct tests
- ✓ update maintenance log

29.2 Procedures to service and maintain bonding and grounding

Covers tools, equipment and procedures to service and maintain bonding and grounding systems and their protection systems.

- ✓ identify tools and equipment used to service and maintain systems
- ✓ describe procedures to service bonding and grounding systems and components
- ✓ describe procedures to maintain bonding and grounding systems and components

CHAPTER 30

C-16.03 Installs raceways

30.1 Installing raceways

Covers the skills to select, route, form, mount, support and remove raceways such as cable tray, wireways and busways.

- ✓ determine installation requirements and select raceways
- ✓ determine routing of raceway
- ✓ select tools and equipment
- ✓ measure, cut and form raceways
- ✓ assemble, position, mount and support raceways
- ✓ determine requirements for removal of existing raceways
- ✓ remove raceways and raceway components, and update documentation

30.2 Knowledge of raceways and raceway components

Covers knowledge of raceway types, components, characteristics, applications, codes and selection/removal considerations.

- ✓ identify types of raceways, and describe their characteristics and applications
- ✓ identify raceway components, and describe their characteristics and applications
- ✓ interpret codes, regulations and standards pertaining to raceways
- ✓ interpret information pertaining to raceways found on drawings and specifications
- ✓ identify considerations and requirements for removal of raceways and their components
- ✓ identify considerations and requirements for selecting raceways and their components

30.3 Procedures to remove, install and support raceways

Covers knowledge of tools, equipment and procedures to remove, install and support raceways and raceway components.

- ✓ identify tools and equipment used to remove, install and support raceways and raceway components, and describe their applications and procedures for use
- ✓ describe procedures to remove raceways and raceway components
- ✓ describe procedures to install and support raceways and raceway components

CHAPTER 31

E-27.01 Installs voice/data/video (VDV) and community antenna television (CATV) systems

31.1 Determine VDV and CATV system required

Covers determining the type of VDV and CATV system per electrical and communication drawings, specifications, job and client requirements, and codes and standards.

31.2 Select tools and equipment

Covers selecting tools and equipment according to the task.

31.3 Remove and dispose of existing components

Covers removing and disposing of existing VDV and CATV components per local codes and waste disposal requirements and updating documentation.

31.4 Determine VDV and CATV system layout

Covers determining system layout per drawings, specifications, client requirements and site visit.

31.5 Select VDV and CATV system components

Covers selecting components per drawings, specifications, building material finishes, and job and client requirements.

31.6 Position, mount and assemble communication cabling raceway

Covers positioning, mounting and assembling communication cabling raceway per manufacturers' specifications, industry standards and CEC requirements.

31.7 Temporarily label and install cabling

Covers labeling and installing cabling per manufacturers' specifications and CEC requirements.

31.8 Position, mount and assemble system components

Covers positioning, mounting, assembling, bonding and making functional VDV and CATV components per drawings, CEC, job and client requirements, and codes and standards.

31.9 Terminate and interconnect components and associated systems

Covers terminating and interconnecting VDV and CATV components and associated system devices per standards, drawings, specifications and job requirements.

31.10 Test and label VDV and CATV system components

Covers verifying cable performance within acceptable parameters using diagnostic and test equipment.

31.11 Update documentation for manufacturer certification

Covers updating as-builts and completing documentation to support certification.

31.12 Knowledge of VDV and CATV systems and components

Covers demonstrating knowledge of VDV and CATV systems, components, associated systems, characteristics, applications and operation.

- ✓ interpret codes and standards pertaining to VDV and CATV systems
- ✓ identify types of VDV and CATV systems, and describe their characteristics, applications, and operation
- ✓ identify VDV and CATV system components, and describe their characteristics and applications
- ✓ describe types of associated systems that often interconnect with VDV and CATV systems
- ✓ identify considerations and requirements for selecting VDV and CATV systems and components

31.13 Knowledge of procedures to install VDV and CATV systems

Covers demonstrating knowledge of procedures to install VDV and CATV systems.

- ✓ identify tools and equipment used to install VDV and CATV systems
- ✓ describe procedures to install VDV and CATV systems and components
- ✓ describe procedures for testing VDV and CATV systems and components
- ✓ describe procedures for verification and certification of VDV and CATV systems

CHAPTER 32

Task B-7 Installs, services and maintains consumer/ supply services and metering equipment

32.1 Installs single-phase consumer/supply services and metering equipment

Covers determining service size/type, layout, trench and overhead clearances, protecting/mounting components, installing and terminating conductors, testing, bonding and grounding for single-phase services.

- ✓ determine services, and size and type of service components and service conductors
- ✓ determine layout and location of service components
- ✓ determine trench size and minimum cover requirements
- ✓ determine overhead clearance
- ✓ select tools and equipment
- ✓ protect service components for single-phase service
- ✓ mount and secure service components
- ✓ install service conductors
- ✓ terminate service conductors
- ✓ conduct tests of service components, service conductors and metering equipment
- ✓ identify service information on panels and metering equipment
- ✓ bond non-current carrying metallic service components
- ✓ ground neutral conductor
- ✓ bond non-electrical metallic piping and structures
- ✓ remove and dispose of unserviceable service components and service conductors, and update documentation

32.2 Single-phase services and service components characteristics

Covers knowledge of single-phase services, service components, and their characteristics and applications.

- ✓ interpret codes and regulations pertaining to single-phase services
- ✓ interpret information pertaining to single-phase services found on drawings and specifications
- ✓ identify types of single-phase services, and describe their characteristics and applications
- ✓ identify service components, service conductors and fasteners, and describe their purpose and applications
- ✓ identify considerations and requirements for selecting type of single-phase services, service components

and service conductors

32.3 Procedures to install single-phase service

Covers knowledge of procedures to install single-phase service.

- ✓ identify tools and equipment used to install single-phase service, and describe their applications and procedures for use
- ✓ identify sources of information and documentation required for installation of single-phase services
- ✓ identify and describe procedures to install single-phase services, service components and service conductors
- ✓ identify and describe procedures to connect service conductors
- ✓ identify procedures to ground and bond single-phase services

32.4 Load calculations for single-phase service

Covers knowledge of load calculations for single-phase service.

- ✓ describe procedures to calculate load
- ✓ calculate load for single-phase service

32.5 Single-phase systems theory

Covers knowledge of single-phase systems.

- ✓ describe theory of single-phase Edison three-wire system
- ✓ describe single-phase circuit fundamentals and interpret AHJ requirements

32.6 Installs three-phase consumer/supply services and metering equipment

Covers determining service size/type, layout, trench and overhead clearances, protecting/mounting components, installing and color-coding conductors, testing, bonding and grounding for three-phase services.

- ✓ determine services, and size and type of service components and service conductors
- ✓ determine layout and location of service components
- ✓ determine trench size and minimum cover requirements
- ✓ determine overhead clearance
- ✓ select tools and equipment
- ✓ protect service components for three-phase service
- ✓ mount and secure service components
- ✓ install service conductors
- ✓ terminate service conductors
- ✓ conduct tests of service components, service conductors and metering equipment
- ✓ identify service information on metering equipment and main disconnect
- ✓ bond non-current carrying metallic service components
- ✓ ground neutral conductor
- ✓ bond non-electrical metallic piping and structures
- ✓ remove and dispose of unserviceable service components and service conductors when replacing, and update documentation

32.7 Three-phase services characteristics and applications

Covers knowledge of three-phase services, their characteristics and applications.

- ✓ interpret codes and regulations pertaining to three-phase services
- ✓ interpret information pertaining to three-phase services found on drawings and specifications
- ✓ identify types of three-phase services, and describe their characteristics and applications
- ✓ identify service components, service conductors and fasteners, and describe their purpose and applications
- ✓ identify considerations and requirements for selecting three-phase services, service components and service conductors
- ✓ identify ground fault and ground detection type protection systems, and describe their characteristics and applications

32.8 Procedures to install three-phase services

Covers knowledge of procedures to install three-phase services, service components and service conductors.

- ✓ identify tools and equipment used to install three-phase services, service components and service conductors, and describe their applications and procedures for use
- ✓ identify sources of information and documentation required for installation of three-phase services
- ✓ identify and describe procedures to install three-phase services, service components and service conductors
- ✓ identify and describe procedures to connect service conductors
- ✓ identify procedures used to ground and bond three-phase services

32.9 Load calculations for three-phase services

Covers knowledge of load calculations for three-phase services.

- ✓ describe procedures to calculate load
- ✓ calculate load for three-phase services

32.10 Servicing and maintenance of single-phase services

Covers troubleshooting, diagnosing, repairing/replacing components, and creating and following maintenance schedules for single-phase services and metering equipment.

- ✓ obtain detailed description of malfunction
- ✓ select tools and equipment
- ✓ determine source of malfunction
- ✓ determine course of action
- ✓ repair malfunctioning components and verify repair
- ✓ select replacement components
- ✓ install replacement components
- ✓ determine maintenance requirements
- ✓ create maintenance schedule
- ✓ follow maintenance schedule
- ✓ conduct tests
- ✓ update maintenance log

32.11 Procedures to service and maintain single-phase services

Covers knowledge of single-phase systems and procedures to service and maintain single-phase services and their components.

- ✓ describe theory of single-phase Edison three-wire system
- ✓ describe single-phase circuit fundamentals and interpret AHJ requirements
- ✓ identify tools and equipment used to service and maintain single-phase services and their components, and describe their applications and procedures for use
- ✓ describe procedures to service single-phase services and their components
- ✓ describe procedures used to maintain single-phase services and their components

32.12 Servicing and maintenance of three-phase services

Covers troubleshooting, diagnosing, repairing/replacing components, and creating and following maintenance schedules for three-phase services and metering equipment.

- ✓ obtain detailed description of malfunction
- ✓ select tools and equipment
- ✓ determine source of malfunction
- ✓ determine course of action
- ✓ repair malfunctioning components and verify repair
- ✓ select replacement components
- ✓ install replacement components
- ✓ determine maintenance requirements
- ✓ create maintenance schedule
- ✓ follow maintenance schedule
- ✓ conduct tests
- ✓ update maintenance log

32.13 Procedures to service and maintain three-phase services

Covers knowledge of three-phase systems and procedures to service and maintain three-phase services and their components.

- ✓ describe three-phase circuit fundamentals
- ✓ identify tools and equipment used to service and maintain three-phase services and their components, and describe their applications and procedures for use
- ✓ describe procedures to service three-phase services and their components
- ✓ describe procedures to maintain three-phase services and their components

CHAPTER 33

Task D-25 Installs, programs, services and maintains automated control systems

33.1 Install automated control systems

Covers determining system type, calculating conductors, mounting, bonding to ground, adjusting, interconnecting peripherals, testing and removing existing equipment.

- ✓ determine type of automated control system required
- ✓ select tools and equipment
- ✓ calculate conductor and cable requirements
- ✓ position, mount and assemble automated control system
- ✓ terminate conductors and cables
- ✓ bond automated control system to ground
- ✓ set up and adjust automated control system
- ✓ interconnect with peripheral devices
- ✓ conduct tests after installation and record results
- ✓ remove existing equipment when replacing

33.2 Knowledge of automated control systems and components

Topic covers automated control systems, components, number and code systems, control circuit logic, and data highway systems.

- ✓ identify types of automated control systems
- ✓ identify automated control system components
- ✓ interpret information on drawings and specifications
- ✓ interpret codes and regulations
- ✓ identify sources of information for service, maintenance, configuration and programming
- ✓ identify number and code systems
- ✓ perform conversions between number systems
- ✓ explain and interpret control circuit logic

33.3 Knowledge of automated control system data highway systems

Topic covers types, components and communication methods for automated control system data highway systems and ladder logic instruction sets.

- ✓ identify types of data highway systems
- ✓ identify data highway system components
- ✓ identify methods used to communicate with automated control systems
- ✓ identify basic instruction sets for ladder logic

33.4 Procedures to install and connect automated control systems

Topic covers tools, equipment and procedures to install and connect automated control systems and components.

- ✓ identify tools and equipment to install and connect
- ✓ describe procedures to install
- ✓ describe procedures to connect

33.5 Perform servicing and maintenance of automated control systems

Covers diagnosing, removing, repairing, replacing components, testing, cleaning, backups and analyzing maintenance results.

- ✓ obtain detailed description of operation and malfunction
- ✓ select tools and equipment
- ✓ determine source of malfunction
- ✓ identify and remove defective components
- ✓ repair malfunctioning components and verify repair
- ✓ select and install replacement components
- ✓ conduct tests after repair
- ✓ clean and adjust components
- ✓ complete backups and record tests
- ✓ compare and analyze maintenance test results

33.6 Knowledge of procedures to service and maintain automated control systems

Topic covers systems, components, data highway systems and procedures to service and maintain automated control systems.

- ✓ identify types of automated control systems and components
- ✓ interpret information on drawings and specifications
- ✓ interpret codes and regulations
- ✓ identify sources of service and programming information
- ✓ identify number and code systems and conversions
- ✓ explain and interpret control circuit logic
- ✓ identify data highway systems and components
- ✓ identify communication methods and ladder logic instruction sets
- ✓ identify tools and equipment to service and maintain
- ✓ describe procedures to service and maintain

33.7 Programs and configures automated control systems

Covers setting inputs/outputs and I/O tables, naming variables, writing and verifying programs, setting parameters, testing and adjusting programs.

- ✓ set inputs and outputs and create I/O tables
- ✓ set names for variables
- ✓ write and verify automated control program
- ✓ set parameters for automated control program
- ✓ test and adjust automated control program

33.8 Knowledge of programming and configuring automated control systems

Topic covers programming languages, PLC/DCS differences, data highway systems, and procedures for programming and configuration.

- ✓ identify programming languages and describe applications
- ✓ explain difference between PLC and DCS systems
- ✓ identify types of data highway systems
- ✓ describe procedures to perform programming, editing and configuration (online and offline)
- ✓ interpret codes and regulations
- ✓ identify basic instruction sets for ladder logic
- ✓ identify number and code systems and conversions
- ✓ explain and interpret control circuit logic

CHAPTER 34

B-12.01 Installs alternating current (AC) generating systems

34.1 Installing AC generating systems skills

Covers determining power requirements, positioning, terminating, grounding, programming, testing and disconnecting AC generating systems and components.

- ✓ determine power requirements for application
- ✓ determine type and capacity of AC generating system and components
- ✓ select tools and equipment
- ✓ position and mount AC generating system and components
- ✓ terminate and interconnect AC generating system and components
- ✓ ground and bond AC generating system and components
- ✓ program AC generating system and controls for startup and shutdown
- ✓ conduct tests after installation and document results
- ✓ disconnect existing system, ensure safety and update documentation

34.2 Knowledge of AC generating systems

Covers AC generating system types, components, selection considerations, drawings and codes.

- ✓ identify types of AC generating systems
- ✓ identify AC generating system components
- ✓ identify considerations for selecting AC generating systems and components
- ✓ interpret information found on drawings and specifications
- ✓ interpret codes, standards and regulations pertaining to AC generating systems

34.3 Procedures to install and connect AC generating systems

Covers tools, equipment and procedures to install, connect and control the output of AC generating systems.

- ✓ identify tools and equipment used to install and connect AC generating systems
- ✓ describe procedures to install AC generating systems and components
- ✓ describe procedures to connect AC generating systems and components
- ✓ describe procedures to control output voltage, phase sequencing and frequency

CHAPTER 35

C-16.04 Installs boxes and enclosures

35.1 Installing boxes and enclosures

Covers the skills to select, locate, mount, support and remove boxes and enclosures according to codes and specifications.

- ✓ determine installation requirements and select boxes and enclosures
- ✓ determine installation location for boxes and enclosures
- ✓ select tools and equipment
- ✓ assemble, position, mount and support boxes and enclosures
- ✓ determine requirements for removal of existing boxes and enclosures
- ✓ remove boxes and enclosures when replacing
- ✓ update documentation

35.2 Knowledge of boxes and enclosures

Covers knowledge of box and enclosure types, characteristics, applications, codes and selection/removal considerations.

- ✓ identify types of boxes and enclosures, and describe their characteristics and applications
- ✓ interpret codes, regulations and standards pertaining to boxes and enclosures
- ✓ interpret information pertaining to boxes and enclosures found on drawings and specifications
- ✓ identify considerations and requirements for removal of boxes and enclosures
- ✓ identify considerations and requirements for selecting boxes and enclosures

35.3 Procedures to remove, install and support boxes and enclosures

Covers knowledge of tools, equipment and procedures to remove, install and support boxes and enclosures.

- ✓ identify tools and equipment used to remove, install and support boxes and enclosures, and describe their applications and procedures for use
- ✓ describe procedures to remove boxes and enclosures
- ✓ describe procedures to install and support boxes and enclosures

CHAPTER 36

E-27.02 Installs public address (PA) and intercom systems

36.1 Determine type of PA and intercom system required

Covers determining the type of PA and intercom system per drawings, specifications, and job and client requirements.

36.2 Select tools and equipment

Covers selecting tools and equipment according to the task.

36.3 Remove and dispose of existing components

Covers removing and disposing of existing PA and intercom components per local codes and waste disposal requirements and updating documentation.

36.4 Determine PA and intercom system layout

Covers determining system layout per drawings, job and client requirements, and site visit.

36.5 Select PA and intercom system components

Covers selecting components per drawings, specifications, and job and client requirements.

36.6 Position, mount and assemble components

Covers positioning, mounting and assembling components in locations per drawings, specifications, and job and client requirements.

36.7 Terminate and interconnect components and associated systems

Covers terminating and interconnecting components and associated system devices per drawings, specifications and job requirements.

36.8 Test conductors and components to ensure functionality

Covers performing continuity and speaker wiring tests using diagnostic and test equipment to confirm components function.

36.9 Test conductors for opens and ground continuity

Covers testing conductors for opens and confirming all components are bonded to ground and clear of obstructions.

36.10 Conduct initial PA and intercom system tests

Covers performing system tests per drawings and specifications and sensory and spot tests.

36.11 Participate in startup, commissioning, inspections and verifications

Covers activating devices to trigger events and associated systems response.

36.12 Knowledge of PA and intercom systems and components

Covers demonstrating knowledge of PA and intercom systems, components, associated systems, characteristics, applications and operation.

- ✓ interpret codes and regulations pertaining to PA and intercom systems
- ✓ interpret information pertaining to PA and intercom systems found on drawings and specifications
- ✓ identify types of PA and intercom systems, and describe their characteristics, applications and operation
- ✓ describe types of associated systems that interconnect with PA and intercom systems
- ✓ identify PA and intercom system components, and describe their characteristics and applications
- ✓ identify considerations and requirements for selecting PA and intercom systems and components

36.13 Knowledge of procedures to install PA and intercom systems

Covers demonstrating knowledge of procedures to install, upgrade and connect PA and intercom systems and components.

- ✓ identify tools and equipment used to install, upgrade and connect PA and intercom systems and components
- ✓ describe procedures to install, upgrade and connect PA and intercom systems and components
- ✓ describe procedures for testing PA and intercom systems, components and conductors

CHAPTER 37

Task B-8 Installs, services and maintains protection devices

37.1 Installs overcurrent protection devices

Covers determining enclosure and overcurrent device type/rating, securing, terminating and setting trip settings, and updating documentation.

- ✓ determine type and size of enclosures
- ✓ determine type and rating of overcurrent protection devices
- ✓ select tools and equipment
- ✓ secure overcurrent protection devices
- ✓ terminate overcurrent protection devices
- ✓ set trip settings and ensure protection is coordinated
- ✓ update documentation and labels
- ✓ remove and dispose of unserviceable enclosures, overcurrent protection devices and hardware, and update documentation

37.2 Overcurrent protection devices characteristics and operation

Covers knowledge of overcurrent protection devices, their characteristics, applications and operation.

- ✓ interpret codes and regulations pertaining to overcurrent protection devices
- ✓ interpret information pertaining to overcurrent protection devices found on drawings and specifications
- ✓ explain effects of short-circuit current and describe associated damage to circuit
- ✓ identify types of overcurrent protection devices, and describe their characteristics, applications, purpose and operation
- ✓ identify considerations and requirements for selecting overcurrent protection devices
- ✓ explain purpose of coordination studies
- ✓ explain value of updating required documentation

37.3 Procedures to install overcurrent protection devices

Covers knowledge of procedures to install overcurrent protection devices.

- ✓ identify tools and equipment used to install overcurrent protection devices, and describe their applications and procedures for use
- ✓ describe procedures to install overcurrent protection devices
- ✓ explain procedures to adjust trip settings

37.4 Installs ground fault, arc fault and surge protection devices

Covers determining branch/feeder protection requirements and device types, mounting, terminating and updating documentation for GFCI, AFCI and surge protection devices.

- ✓ determine branch circuit and feeder circuits protection requirements
- ✓ determine type of ground fault protection devices to use
- ✓ determine type of arc fault protection devices to use
- ✓ determine type of surge protection devices to use
- ✓ select tools and equipment
- ✓ mount and secure protection devices
- ✓ terminate protection devices
- ✓ update documentation and labels
- ✓ remove and dispose of unserviceable protection devices when replacing, and update documentation

37.5 Ground fault, arc fault and surge protection devices characteristics

Covers knowledge of ground fault, arc fault and surge protection devices, their characteristics, applications and operation.

- ✓ interpret codes and regulations pertaining to ground fault, arc fault and surge protection devices
- ✓ interpret information pertaining to ground fault, arc fault and surge protection devices found on drawings and specifications
- ✓ explain purpose and operation of ground fault, arc fault and surge protection devices
- ✓ identify types of ground fault, arc fault and surge protection devices, and describe their characteristics, applications and operation
- ✓ identify considerations and requirements for selecting ground fault, arc fault and surge protection devices
- ✓ explain value of updating documentation

37.6 Procedures to install ground fault, arc fault and surge protection devices

Covers knowledge of procedures to install ground fault, arc fault and surge protection devices.

- ✓ identify tools and equipment used to install ground fault, arc fault and surge protection devices, and describe their applications and procedures for use
- ✓ describe procedures to install ground fault, arc fault and surge protection devices

37.7 Servicing and maintenance of protection devices

Covers troubleshooting, diagnosing, replacing components, and creating and following maintenance schedules for ground fault, arc fault and surge protection devices.

- ✓ obtain detailed description of malfunction
- ✓ select tools and equipment
- ✓ determine source of malfunction
- ✓ determine course of action
- ✓ select replacement components
- ✓ install replacement components
- ✓ determine maintenance requirements
- ✓ create maintenance schedule
- ✓ follow maintenance schedule
- ✓ conduct tests
- ✓ update maintenance log

37.8 Theory and procedures to service and maintain protection devices

Covers knowledge of theory and procedures used to service and maintain protection devices.

- ✓ describe theory used to service protection devices
- ✓ describe theory used to maintain protection devices
- ✓ identify tools and equipment used to service and maintain protection devices, and describe their applications and procedures for use
- ✓ describe procedures to service and maintain protection devices

CHAPTER 38

B-12.02 Performs servicing and maintenance of AC generating systems

38.1 Servicing and maintenance of AC generating systems skills

Covers diagnosing, repairing, replacing, testing, servicing and documenting for AC generating systems and components.

- ✓ obtain detailed description of operation and malfunction
- ✓ determine source of malfunction
- ✓ select tools and equipment
- ✓ identify and remove defective components
- ✓ repair malfunctioning components and verify repair
- ✓ select replacement components
- ✓ install replacement components
- ✓ conduct tests after repair
- ✓ perform service procedures to components
- ✓ record tests in maintenance log
- ✓ compare and analyze maintenance test results

38.2 Knowledge of AC generating systems for servicing

Covers AC generating system types, components, codes, drawings and nameplate interpretation.

- ✓ identify types of AC generating systems
- ✓ identify AC generating system components
- ✓ interpret codes and regulations pertaining to AC generating systems
- ✓ interpret information found on drawings and specifications
- ✓ interpret information contained on AC generator nameplates

38.3 Procedures to service and maintain AC generating systems

Covers tools, equipment and procedures to service and maintain AC generating systems and components.

- ✓ identify tools and equipment used to service and maintain systems
- ✓ describe procedures to service AC generating systems and components
- ✓ describe procedures to maintain AC generating systems and components

CHAPTER 39

C-16.05 Performs servicing and maintenance of raceways, conductors, cables and enclosures

39.1 Servicing and maintaining raceways, conductors, cables and enclosures

Covers the skills to diagnose faults, repair or replace components, test conductors and re-terminate for excessive heating.

- ✓ select tools and equipment
- ✓ determine source of malfunction
- ✓ repair or replace malfunctioning component
- ✓ conducts tests of conductors and cables, and record results
- ✓ re-terminate and test conductors for excessive heating
- ✓ update documentation

39.2 Procedures to service raceways, cables and enclosures

Covers knowledge of tools, equipment, procedures and considerations when servicing raceways, cables and enclosures.

- ✓ identify tools and equipment used to service raceways, cables and enclosures, and describe their applications and procedures for use
- ✓ describe procedures to service raceways, cables and enclosures
- ✓ identify considerations when servicing raceways, cables and enclosures

39.3 Procedures to maintain raceways, cables and enclosures

Covers knowledge of tools, equipment, procedures and considerations when maintaining raceways, cables and enclosures.

- ✓ identify tools and equipment used to maintain raceways, cables and enclosures, and describe their applications and procedures for use
- ✓ describe procedures to maintain raceways, cables and enclosures
- ✓ identify considerations when maintaining raceways, cables and enclosures

CHAPTER 40

Task E-26 Installs, services and maintains signalling systems

40.1 Install fire alarm systems

Covers determining system type, removing existing components, determining layout, and selecting fire alarm system components according to drawings, specifications and AHJ.

- ✓ determine type of fire alarm system required
- ✓ select tools and equipment
- ✓ remove and dispose of existing fire alarm system components when replacing
- ✓ determine fire alarm system layout
- ✓ select fire alarm system components

CHAPTER 41

E-27.03 Installs nurse call systems

41.1 Determine type of nurse call system required

Covers determining the type of nurse call system per drawings, specifications, and job and client requirements.

41.2 Select tools and equipment

Covers selecting tools and equipment according to the task.

41.3 Remove and dispose of existing components

Covers removing and disposing of existing nurse call components per local codes and waste disposal requirements and updating documentation.

41.4 Determine nurse call system layout

Covers determining system layout per drawings, client requirements and site visit.

41.5 Select nurse call system components

Covers selecting components per drawings, specifications, and job and client requirements.

41.6 Position, mount and assemble components

Covers positioning, mounting and assembling components in locations per drawings, job and client requirements, and manufacturers' specifications.

41.7 Terminate and interconnect components and associated systems

Covers terminating and interconnecting components and associated system devices per drawings, specifications and job requirements.

41.8 Test components to ensure functionality

Covers confirming nurse call system components function according to job specifications.

41.9 Test conductors for opens and ground continuity

Covers testing conductors using diagnostic and test equipment to confirm no opens and all components grounded and clear of obstructions.

41.10 Conduct initial nurse call system tests

Covers performing system tests per drawings and specifications and testing all devices.

41.11 Label annunciation panels and devices

Covers labelling initiating and annunciating devices for identification and servicing.

41.12 Participate in startup and commissioning inspections

Covers activating devices to trigger events and associated system responses.

41.13 Knowledge of nurse call systems and components

Covers demonstrating knowledge of nurse call systems, components, associated systems, characteristics, applications and operation.

- ✓ interpret codes and regulations pertaining to nurse call systems
- ✓ interpret information pertaining to nurse call systems found on drawings and specifications
- ✓ identify types of nurse call systems, and describe their characteristics, applications and operation
- ✓ describe types of associated systems that often interconnect with nurse call systems
- ✓ identify nurse call system components, and describe their characteristics and applications
- ✓ identify considerations and requirements for selecting nurse call systems and components

41.14 Knowledge of procedures to install nurse call systems

Covers demonstrating knowledge of procedures to install nurse call systems and components.

- ✓ identify tools and equipment used to install nurse call systems and components
- ✓ describe procedures to install nurse call systems and components
- ✓ describe procedures for testing nurse call systems, components and conductors
- ✓ describe procedures for commissioning and verification of nurse call systems

CHAPTER 42

Task B-9 Installs, services and maintains power distribution equipment

42.1 Installs power distribution equipment

Covers determining equipment size/type and enclosure, layout, mounting, installing and terminating feeder conductors, testing, labelling and updating documentation.

- ✓ determine size and type of power distribution equipment, and type of enclosure
- ✓ determine layout and location of power distribution equipment
- ✓ select tools and equipment
- ✓ install and secure power distribution equipment
- ✓ install feeder conductors
- ✓ terminate feeder conductor
- ✓ conduct tests of power distribution equipment and feeder conductors
- ✓ identify information on power distribution equipment
- ✓ remove and dispose of existing power distribution equipment
- ✓ update documentation

42.2 Power distribution equipment characteristics and operation

Covers knowledge of power distribution equipment, their characteristics, applications and operation.

- ✓ interpret codes and regulations pertaining to power distribution equipment
- ✓ interpret information pertaining to power distribution equipment found on drawings and specifications
- ✓ identify types of power distribution equipment, and describe their characteristics, applications and operation
- ✓ identify considerations and requirements for selecting power distribution equipment and enclosures

42.3 Procedures to install and connect power distribution equipment

Covers knowledge of procedures to install and connect power distribution equipment.

- ✓ identify tools and equipment used to install power distribution equipment and their components, and describe their applications and procedures for use
- ✓ describe procedures to install power distribution equipment
- ✓ describe procedures to connect power distribution equipment
- ✓ describe procedures for transporting and moving electrical equipment

42.4 Servicing and maintenance of power distribution equipment

Covers troubleshooting, diagnosing, repairing/replacing components, and creating and following maintenance schedules for power distribution equipment.

- ✓ obtain detailed description of malfunction
- ✓ determine source of malfunction
- ✓ determine course of action
- ✓ select tools and equipment
- ✓ repair malfunctioning components and verify repair
- ✓ select replacement components
- ✓ install replacement components
- ✓ determine maintenance requirements
- ✓ create maintenance schedule
- ✓ follow maintenance schedule
- ✓ conduct tests
- ✓ update maintenance log

42.5 Theory and procedures to service and maintain power distribution equipment

Covers knowledge of theory and procedures used to service and maintain power distribution equipment and their components.

- ✓ describe theory to service power distribution equipment and their components
- ✓ describe theory used to maintain power distribution equipment and their components
- ✓ identify tools and equipment used to service and maintain power distribution equipment and their components, and describe their applications and procedures for use
- ✓ describe procedures to service and maintain power distribution equipment and their components

CHAPTER 43

B-12.03 Installs direct current (DC) generating and conversion systems

43.1 Installing DC generating and conversion systems skills

Covers determining requirements, positioning, terminating, grounding, programming, testing and disconnecting DC generating and conversion systems.

- ✓ determine power requirements
- ✓ determine type and capacity of DC generating and conversion system and components
- ✓ select tools and equipment
- ✓ position and mount system and components
- ✓ terminate and interconnect system and components
- ✓ ground and/or bond system and components
- ✓ program system and controls for startup and shutdown
- ✓ conduct tests after installation and record results
- ✓ disconnect existing system, ensure safety and update documentation

43.2 Knowledge of DC generating and conversion systems

Covers DC generating and conversion system types, components, generators, selection considerations, drawings and codes.

- ✓ identify DC generating and conversion systems
- ✓ identify types of DC generating and conversion system components
- ✓ identify DC generators
- ✓ identify considerations for selecting systems and components
- ✓ interpret information found on drawings and specifications
- ✓ interpret codes, standards and regulations

43.3 Procedures to install and connect DC systems

Covers tools, equipment and procedures to install, connect and control the output of DC generating and conversion systems.

- ✓ identify tools and equipment used to install and connect systems
- ✓ describe procedures to install systems and components
- ✓ describe procedures to connect systems and components
- ✓ describe procedures to control output voltage of DC generators

CHAPTER 44

C-17.01 Installs luminaires

44.1 Installing luminaires and lamps

Covers the skills to select, locate, wire, install, support, test, remove and dispose of luminaires and lamps.

- ✓ determine type of luminaire and type of lamps required, and their installation requirements
- ✓ calculate branch circuit requirements
- ✓ determine installation location for luminaire and lamps
- ✓ select branch circuit wiring
- ✓ select tools and equipment
- ✓ install branch circuit wiring
- ✓ install and support luminaire
- ✓ terminate conductors and cables
- ✓ install lamps
- ✓ test for required operation
- ✓ determine requirements for removal of luminaires
- ✓ remove existing luminaires and update documentation
- ✓ dispose of lamps and ballasts

44.2 Knowledge of luminaires and lamps

Covers knowledge of luminaire and lamp types, components, characteristics, applications, operation, codes and selection/removal considerations.

- ✓ identify types of luminaires and lamps, and describe their characteristics, applications and operation
- ✓ identify luminaire components and lamp components, and describe their characteristics and applications
- ✓ interpret codes, regulations and standards pertaining to luminaires and lamps
- ✓ interpret information pertaining to luminaires and lamps found on drawings and specifications
- ✓ identify considerations and requirements for removal of luminaires, lamps and their components
- ✓ identify considerations and requirements for selecting luminaires, lamps and their components

44.3 Procedures to remove, install and support luminaires and lamps

Covers knowledge of tools, equipment and procedures to remove, install, support and test luminaires, lamps and their components.

- ✓ identify tools and equipment used to remove, install and support luminaires and their components, and to install lamps and their components, and describe their applications and procedures for use
- ✓ describe procedures to remove luminaires, lamps and their components
- ✓ describe procedures to install and support luminaires and their components, and install lamps and their components
- ✓ describe procedures to perform tests related to luminaires and lamps

44.4 Procedures to troubleshoot luminaires and lamps

Covers knowledge of the tools, equipment and procedures used to troubleshoot luminaires and lamps.

- ✓ identify tools and equipment used to troubleshoot luminaires and lamps, and describe their applications and procedures for use
- ✓ describe procedures to troubleshoot luminaires and lamps

CHAPTER 45

E-27.04 Performs servicing and maintenance of communication systems

45.1 Obtain detailed description of malfunction

Covers obtaining and documenting a detailed description of operation and malfunction issues from end user.

45.2 Select tools and equipment

Covers selecting tools and equipment according to the task.

45.3 Identify existing communication system and components

Covers identifying existing systems using as-built drawings, maintenance log and certification report and performing a walkthrough.

45.4 Test communication system

Covers performing tests per field assessments using diagnostic and test equipment.

45.5 Analyze test results

Covers comparing test results to relevant documents and client requirements.

45.6 Replace communication system components

Covers scheduling replacement timing with client, avoiding disruption, and testing and verifying replacement components.

45.7 Update documentation for servicing

Covers producing clear, detailed documentation of systems and components tested and changed plus certification results.

45.8 Notify and explain system changes to client

Covers informing the client of system changes.

45.9 Knowledge of communication systems and components

Covers demonstrating knowledge of communication systems, components, associated systems, characteristics, applications and operation.

- ✓ interpret codes, standards and regulations pertaining to communication systems
- ✓ interpret information pertaining to communication systems found on drawings and specifications
- ✓ identify types of communication systems, and describe their characteristics, applications and operation
- ✓ identify communication system components, and describe their characteristics and applications
- ✓ describe types of associated systems that interconnect with communication systems

45.10 Knowledge of procedures to service communication systems

Covers demonstrating knowledge of procedures to service and maintain communication systems and components.

- ✓ identify tools and equipment used to service and maintain communication systems and components
- ✓ describe possible effects of service and maintenance of communication system on associated systems
- ✓ describe procedures to service and maintain communication systems and components
- ✓ describe procedures for testing communication systems, components and conductors
- ✓ describe procedures for verification of communication systems

CHAPTER 46

Task B-10 Installs, services and maintains power conditioning, UPS and surge suppression systems

46.1 Installs power conditioning, UPS and surge suppression systems

Covers analyzing existing systems, identifying and sizing power conditioning/UPS/surge suppression, installing, terminating, testing and analyzing system output.

- ✓ select tools and equipment
- ✓ analyze existing system to assess conditions that require power conditioning
- ✓ identify type of power conditioning required
- ✓ perform calculations to size power conditioning and UPS systems, and surge suppression components
- ✓ install components
- ✓ terminate and interconnect components
- ✓ analyze system output
- ✓ conduct tests of power conditioning, UPS and surge suppression after installation and record results
- ✓ remove existing power conditioning and UPS components when replacing
- ✓ update documentation

46.2 Power conditioning, UPS and surge suppression systems characteristics

Covers knowledge of power conditioning, UPS and surge suppression systems, their characteristics and applications.

- ✓ interpret codes and regulations pertaining to power conditioning, UPS and surge suppression systems
- ✓ explain power quality and its impact on equipment operation
- ✓ explain single-phase and three-phase power factor correction, and its associated calculations
- ✓ identify types of power factor correction equipment, and describe their characteristics, applications and operation
- ✓ identify equipment used to reduce harmonics in power distribution systems, and describe their characteristics, applications and operation
- ✓ identify surge suppression equipment used in power distribution system conditioning, and describe their characteristics, applications and operation
- ✓ identify types of UPS equipment used in power distribution system conditioning, and describe their characteristics, applications and operation

CHAPTER 47

B-12.04 Performs servicing and maintenance of DC generating and conversion systems

47.1 Servicing and maintenance of DC systems skills

Covers diagnosing, repairing, replacing, testing, servicing and documenting for DC generating and conversion systems.

- ✓ obtain detailed description of operation and malfunction
- ✓ determine source of malfunction
- ✓ select tools and equipment
- ✓ identify and remove defective components
- ✓ repair malfunctioning components and verify repair
- ✓ select replacement components
- ✓ install replacement components
- ✓ conduct tests after repair
- ✓ perform service procedures to components
- ✓ record tests in maintenance log
- ✓ compare and analyze maintenance test results

47.2 Knowledge of DC systems for servicing

Covers DC generating and conversion system types, components, codes, drawings and nameplate interpretation.

- ✓ identify DC generating and conversion systems
- ✓ identify types of components
- ✓ interpret codes and regulations
- ✓ interpret information found on drawings and specifications
- ✓ interpret information contained on DC generator nameplates

47.3 Procedures to service and maintain DC systems

Covers tools, equipment and procedures to service and maintain DC generating and conversion systems and components.

- ✓ identify tools and equipment used to service and maintain systems
- ✓ describe procedures to service systems and components
- ✓ describe procedures to maintain systems and components

CHAPTER 48

C-17.02 Installs wiring devices

48.1 Installing wiring devices

Covers the skills to select, locate, wire, install, terminate, test and remove wiring devices such as switches, receptacles and sensors.

- ✓ determine type of wiring devices required and installation requirements
- ✓ determine installation location for wiring devices
- ✓ select branch circuit wiring
- ✓ select tools and equipment
- ✓ install branch circuit wiring
- ✓ install wiring devices
- ✓ terminate conductors and cables
- ✓ test for required operation
- ✓ select and install faceplate
- ✓ determine requirements for removal of wiring devices
- ✓ remove existing wiring devices when replacing and update documentation

48.2 Knowledge of wiring devices

Covers knowledge of wiring device types, characteristics, applications, operation, codes and selection/removal considerations.

- ✓ identify types of wiring devices, and describe their characteristics, applications and operation
- ✓ interpret codes, regulations and standards pertaining to wiring devices
- ✓ interpret information pertaining to wiring devices found on drawings and specifications
- ✓ identify considerations and requirements for removal of wiring devices
- ✓ identify considerations and requirements for selecting wiring devices

48.3 Procedures to remove and install wiring devices

Covers knowledge of tools, equipment and procedures to remove and install wiring devices.

- ✓ identify tools and equipment used to remove and install wiring devices, and describe their applications and procedures for use
- ✓ describe procedures to remove wiring devices
- ✓ describe procedures to install wiring devices

CHAPTER 49

E-28.01 Installs building automation systems

49.1 Determine type of building automation system required

Covers determining the type of building automation system per drawings, specifications, and job and client specifications.

49.2 Select tools and equipment

Covers selecting tools and equipment according to the task.

49.3 Remove and dispose of existing components

Covers removing and disposing of existing building automation components per local codes and waste disposal requirements and updating documentation.

49.4 Determine building automation system layout

Covers determining system layout per architectural, electrical, communication and mechanical drawings, job and client requirements, and site visit.

49.5 Select building automation system components

Covers selecting components per electrical, communication and mechanical drawings and client requirements.

49.6 Position, mount and assemble components

Covers positioning, mounting and assembling components in locations per architectural, electrical, communication and mechanical drawings and job and client requirements.

49.7 Terminate and interconnect components and associated systems

Covers terminating and interconnecting components and associated system devices per electrical, communication and mechanical drawings and job requirements.

49.8 Test building automation system components

Covers testing components to confirm they function as required.

49.9 Test conductors for opens and ground continuity

Covers verifying conductors have no opens and all components are bonded to ground and clear of obstructions.

49.10 Test building automation system

Covers performing system tests per the specific system being tested.

49.11 Participate in startup and commissioning inspections

Covers activating devices to trigger functionality of building automation and associated systems.

49.12 Knowledge of building automation systems and components

Covers demonstrating knowledge of building automation systems, components, associated systems, characteristics, applications, operation and interconnection.

- ✓ interpret standards pertaining to building automation systems
- ✓ interpret information pertaining to building automation systems found on drawings and specifications
- ✓ identify types of building automation systems, and describe their characteristics, applications, operation and interconnection
- ✓ identify building automation system components, and describe their characteristics and applications
- ✓ describe types of associated systems that interconnect with building automation systems
- ✓ identify considerations and requirements for selecting building automation systems and components

49.13 Knowledge of procedures to install building automation systems

Covers demonstrating knowledge of procedures to install building automation systems and components.

- ✓ identify tools and equipment used to install building automation systems and components
- ✓ describe procedures to install building automation systems and components
- ✓ describe procedures for testing building automation systems and components
- ✓ describe procedures for commissioning and verification of building automation systems

CHAPTER 50

B-13.01 Installs renewable energy generating and storage systems

50.1 Installing renewable energy and storage systems skills

Covers determining energy requirements, capacity, connection types, mounting, terminating, testing, grounding and bonding of renewable energy and storage systems.

- ✓ determine energy requirements for application
- ✓ determine capacity of renewable energy system and components
- ✓ determine type of renewable energy system connection
- ✓ select tools and equipment
- ✓ determine type of energy storage system
- ✓ determine capacity of energy storage system
- ✓ position and mount systems and components
- ✓ terminate and interconnect renewable energy and control systems
- ✓ terminate and interconnect energy storage system and components
- ✓ conduct tests of renewable energy system after installation
- ✓ conduct tests of energy storage system
- ✓ document test results
- ✓ remove existing equipment when replacing and update documentation
- ✓ determine grounding and bonding requirements

50.2 Knowledge of renewable energy generating systems

Covers renewable energy generating system types, control components, connections, codes and terminology.

- ✓ identify types of renewable energy generating systems and components
- ✓ identify control system components
- ✓ identify types of renewable energy generating connections
- ✓ interpret codes and regulations
- ✓ define terminology associated with renewable energy generating systems

50.3 Knowledge of energy storage systems

Covers energy storage system types, components, connections, codes and terminology.

- ✓ identify types of energy storage systems and components
- ✓ identify types of energy storage system component connections
- ✓ interpret codes and regulations
- ✓ define terminology associated with energy storage systems

50.4 Procedures to install renewable energy systems

Covers tools, equipment and procedures to install and connect renewable energy generating and control systems.

- ✓ identify tools and equipment used to install and connect systems
- ✓ describe procedures to install renewable energy generating systems and control components
- ✓ describe procedures to connect renewable energy generating systems and control components

50.5 Procedures to install energy storage systems

Covers tools, equipment and procedures to install and connect energy storage systems and components.

- ✓ identify tools and equipment used to install and connect systems
- ✓ describe procedures to install energy storage systems and components
- ✓ describe procedures to connect energy storage systems and components

CHAPTER 51

C-17.03 Installs lighting controls

51.1 Installing lighting controls

Covers the skills to determine control requirements, select, assemble, install, program, test and remove lighting control components.

- ✓ determine control requirements and select lighting control components
- ✓ determine circuitry and load requirements
- ✓ select tools and equipment
- ✓ assemble and install lighting control components
- ✓ label and terminate conductors and cables
- ✓ program and test lighting controls
- ✓ determine requirements for removal of existing lighting controls
- ✓ install and upgrade lighting controls

51.2 Knowledge of lighting control components

Covers knowledge of lighting control component types, characteristics, applications, operation, codes, energy management and selection/removal considerations.

- ✓ identify types of lighting control components, and describe their characteristics, applications and operation
- ✓ interpret information pertaining to lighting control components found on drawings and specifications
- ✓ interpret codes and regulations pertaining to lighting control components
- ✓ identify considerations and requirements for removal of lighting control components
- ✓ identify considerations and requirements for selecting lighting control components
- ✓ identify requirements related to energy management

51.3 Procedures to remove, install, connect and test lighting controls

Covers knowledge of tools, equipment and procedures to remove, install, connect and test lighting control components.

- ✓ identify tools and equipment used to remove or install, connect and test lighting control components, and describe their applications and procedures for use
- ✓ describe procedures to remove lighting control components
- ✓ describe procedures to install lighting control components
- ✓ describe procedures to connect lighting control components
- ✓ describe procedures to test lighting control components

CHAPTER 52

E-28.02 Installs building control systems

52.1 Determine type of building control system required

Covers determining the type of building control system per electrical and mechanical drawings, and job and client specifications.

52.2 Select tools and equipment

Covers selecting tools and equipment according to the task.

52.3 Remove and dispose of existing components

Covers removing and disposing of existing building control components per local codes and waste disposal requirements and updating documentation.

52.4 Determine building control system layout

Covers determining system layout per electrical and communication drawings, client requirements and site visit.

52.5 Select building control system components

Covers selecting components per electrical and mechanical drawings and job and client requirements.

52.6 Position, mount and assemble components

Covers positioning, mounting and assembling components in locations per drawings, specifications, and job and client requirements.

52.7 Terminate and interconnect components and associated systems

Covers terminating and interconnecting components and associated system devices per drawings, specifications, and job requirements.

52.8 Test building control system components

Covers testing components to ensure functionality.

52.9 Test conductors for opens and ground continuity

Covers testing conductors with diagnostic and test equipment to confirm no opens and all components bonded to ground and clear of obstructions.

52.10 Test building control system

Covers performing system tests per drawings, specifications and functionality tests.

52.11 Participate in startup and commissioning inspections

Covers activating devices to trigger functionality of building control and associated systems.

52.12 Knowledge of building control systems and components

Covers demonstrating knowledge of building control systems, components, associated systems, characteristics, applications and operation.

- ✓ interpret standards pertaining to building control systems
- ✓ interpret information pertaining to building control systems found on drawings and specifications
- ✓ identify types of building control systems, and describe their characteristics, applications and operation
- ✓ identify building control system components, and describe their characteristics and applications
- ✓ describe types of associated systems that interconnect with building control systems
- ✓ identify considerations and requirements for selecting building control systems and components

52.13 Knowledge of procedures to install building control systems

Covers demonstrating knowledge of procedures to install building control systems and components.

- ✓ identify tools and equipment used to install building control systems and components
- ✓ describe procedures to install building control systems and components
- ✓ describe procedures for testing building control systems, components and conductors
- ✓ describe procedures for commissioning and verification of building control systems

CHAPTER 53

B-13.02 Performs servicing and maintenance of renewable energy generating and storage systems

53.1 Servicing and maintenance of renewable energy systems skills

Covers diagnosing, repairing, replacing control components, testing, lubricating and documenting for renewable energy and storage systems.

- ✓ obtain detailed description of operation and malfunction
- ✓ determine source of malfunction
- ✓ select tools and equipment
- ✓ identify and remove defective control system components
- ✓ repair malfunctioning control system components and verify repair
- ✓ select replacement control system components
- ✓ install replacement control system components
- ✓ conduct tests of renewable energy systems after repair
- ✓ conduct tests on energy storage systems and components
- ✓ lubricate, clean and adjust components
- ✓ record tests in maintenance log
- ✓ compare and analyze maintenance test results

53.2 Knowledge of renewable energy systems for servicing

Covers renewable energy generating system types, control components, codes and terminology.

- ✓ identify types of renewable energy generating systems and components
- ✓ identify control system components
- ✓ interpret codes and regulations
- ✓ define terminology associated with renewable energy generating systems

53.3 Knowledge of energy storage systems for servicing

Covers energy storage system types, components, connections, codes and terminology.

- ✓ identify types of energy storage systems and components
- ✓ identify types of energy storage system component connections
- ✓ interpret codes and regulations
- ✓ define terminology associated with energy storage systems

53.4 Procedures to service renewable energy systems

Covers tools, equipment and procedures to service and maintain renewable energy generating and control systems.

- ✓ identify tools and equipment used to service and maintain systems
- ✓ describe procedures to service systems and components
- ✓ describe procedures to maintain systems and components

53.5 Procedures to service energy storage systems

Covers tools, equipment and procedures to service and maintain energy storage systems and components.

- ✓ identify tools and equipment used to service and maintain systems
- ✓ describe procedures to service systems and components
- ✓ describe procedures to maintain systems and components

CHAPTER 54

C-17.04 Installs lighting standards

54.1 Installing lighting standards

Covers the skills to select, locate, assemble, erect, secure and remove lighting standards such as roadway and parking lot lighting.

- ✓ determine type of lighting standards required and associated installation requirements for application
- ✓ determine installation location for lighting standards
- ✓ select tools and equipment
- ✓ assemble, erect and secure lighting standards
- ✓ determine requirements for removal of lighting standards
- ✓ remove existing lighting standards when replacing and update documentation

54.2 Knowledge of lighting standards

Covers knowledge of lighting standard types, components, applications, regulations and selection/removal considerations.

- ✓ identify types of lighting standards and describe their applications
- ✓ identify lighting standard components, and describe their characteristics and applications
- ✓ interpret regulations pertaining to lighting standards
- ✓ interpret information pertaining to lighting standards found on drawings and specifications
- ✓ identify considerations and requirements for removal of lighting standards and their components
- ✓ identify considerations and requirements for selecting lighting standards and their components

54.3 Procedures to remove and install lighting standards

Covers knowledge of tools, equipment, rigging/hoisting and procedures to remove, assemble, erect and secure lighting standards.

- ✓ identify tools and equipment used to remove and install lighting standards, and describe their applications and procedures for use
- ✓ describe procedures used for rigging and hoisting lighting standards for erection and dismantling
- ✓ describe procedures to remove lighting standards and their components
- ✓ describe procedures to assemble, erect and secure lighting standards, and their components

54.4 Procedures to maintain and troubleshoot lighting standards

Covers knowledge of tools, equipment and procedures to maintain and troubleshoot lighting standards.

- ✓ identify tools and equipment used to maintain and troubleshoot lighting standards, and describe their applications and procedures for use
- ✓ describe procedures to maintain lighting standards
- ✓ describe procedures to troubleshoot lighting standards

CHAPTER 55

E-28.03 Performs servicing and maintenance of integrated control systems

55.1 Obtain detailed description of malfunction

Covers obtaining and documenting a detailed description of operation and malfunction issues from end user.

55.2 Select tools and equipment

Covers selecting tools and equipment according to the task.

55.3 Identify integrated control system and components

Covers identifying the integrated control system and components using as-built drawings, maintenance log and site visit.

55.4 Test integrated control system

Covers testing the integrated control system and performing system activation.

55.5 Analyze test results

Covers comparing test results to manufacturers' certification report, communication log and client requirements.

55.6 Adjust integrated control system components

Covers adjusting integrated control system components.

55.7 Replace integrated control system components

Covers scheduling replacement with client and local monitoring station and testing and verifying replacement components.

55.8 Update documentation for servicing

Covers producing clear, detailed documentation of systems and components tested and changed plus test and certification results.

55.9 Notify and explain system changes to operator

Covers explaining system changes to the system operator.

55.10 Knowledge of integrated control systems and components

Covers demonstrating knowledge of integrated control systems, components, associated systems, characteristics, applications and operation.

- ✓ interpret standards pertaining to integrated control systems
- ✓ interpret information pertaining to integrated control systems found on drawings and specifications
- ✓ identify types of integrated control systems, and describe their characteristics, applications and operation
- ✓ identify integrated control system components, and describe their characteristics and applications
- ✓ identify considerations and requirements for selecting integrated control systems and components
- ✓ describe types of associated systems that interconnect with integrated control systems

55.11 Knowledge of procedures to service integrated control systems

Covers demonstrating knowledge of procedures to service and maintain integrated control systems and components.

- ✓ identify tools and equipment used to service and maintain integrated control systems and components
- ✓ describe possible effects of service and maintenance of integrated control systems on associated systems
- ✓ describe procedures to service and maintain integrated control systems and components
- ✓ describe procedures for testing integrated control systems, components and conductors
- ✓ describe procedures for commissioning and verification of integrated control systems

CHAPTER 56

B-14.01 Installs high-voltage equipment

56.1 Installing high-voltage equipment skills

Covers determining requirements, layout, assembling, terminating, bonding, grounding, testing, labelling and disposing of high-voltage equipment.

- ✓ determine installation requirements for high-voltage equipment
- ✓ determine layout of high-voltage equipment
- ✓ select tools and equipment
- ✓ assemble high-voltage equipment
- ✓ terminate conductors and cables and interconnect equipment
- ✓ bond non-current carrying metallic components
- ✓ install station ground grid
- ✓ perform ground resistance test
- ✓ perform acceptance tests
- ✓ install labelling and signage
- ✓ update documentation required by AHJ
- ✓ remove and dispose of unserviceable equipment and components

56.2 Knowledge of high-voltage equipment

Covers high-voltage equipment types, codes, drawings, grounding/bonding, grounding grids and function.

- ✓ identify high-voltage equipment and components
- ✓ interpret codes and regulations
- ✓ interpret information found on drawings and specifications
- ✓ identify grounding conductors, equipment and components
- ✓ identify bonding conductors, equipment and components
- ✓ explain purpose of grounding grids in relation to step and touch voltages
- ✓ explain function of high-voltage equipment

56.3 Procedures to install high-voltage equipment

Covers tools, equipment and procedures to install high-voltage equipment, ground grids and required documentation.

- ✓ identify tools and equipment used to install high-voltage equipment
- ✓ describe procedures to install high-voltage equipment
- ✓ describe procedures to install ground grid
- ✓ identify sources of information and documentation required by AHJ

56.4 Knowledge of high-voltage testing procedures

Covers tools and procedures for ground resistance and acceptance testing of high-voltage equipment.

- ✓ identify tools and equipment used for testing
- ✓ identify and describe testing procedures
- ✓ describe procedures to perform ground resistance and acceptance testing

CHAPTER 57

C-17.05 Performs servicing of branch circuitry

57.1 Servicing branch circuitry

Covers the skills to diagnose, remove, replace, install and test branch circuitry components after repair.

- ✓ select tools and equipment
- ✓ determine source of malfunction
- ✓ identify and remove defective components
- ✓ select replacement components
- ✓ install replacement components
- ✓ conduct tests of branch circuitry after repair

57.2 Knowledge of branch circuitry and components

Covers knowledge of branch circuitry types and components, their characteristics, applications and operation.

- ✓ identify types of branch circuitry and components, and describe their characteristics, applications and operation

57.3 Procedures to service branch circuitry

Covers knowledge of tools, equipment and procedures to diagnose and repair or replace branch circuitry components.

- ✓ identify tools and equipment used to service branch circuitry and branch circuitry components, and describe their applications and procedures for use
- ✓ describe procedures to diagnose branch circuitry components
- ✓ describe procedures to repair/replace branch circuitry components

CHAPTER 58

B-14.02 Installs high-voltage cables

58.1 Installing high-voltage cables skills

Covers verifying cable type, layout, trenching, mounting, installing cables and terminations, testing, labelling, bonding and disposal.

- ✓ verify size and type of high-voltage cable
- ✓ determine layout and location of cable installation
- ✓ determine trench size and minimum cover requirements
- ✓ install flagging and warning tape
- ✓ determine overhead clearance
- ✓ select tools and equipment
- ✓ mount and secure high-voltage cable components
- ✓ install high-voltage cables
- ✓ install terminations on high-voltage cables
- ✓ conduct high pot test of high-voltage cables
- ✓ identify cable information on each conductor
- ✓ bond cable shield
- ✓ remove and dispose of cables and components when replacing

58.2 Knowledge of high-voltage cables

Covers high-voltage cable types, components and selection considerations.

- ✓ identify types of high-voltage cables
- ✓ identify high-voltage cable components
- ✓ identify considerations for selecting cables and components

58.3 Procedures to install and terminate high-voltage cables

Covers tools, equipment and procedures to install and terminate high-voltage cables and components.

- ✓ identify tools and equipment used to install and terminate cables
- ✓ describe procedures to install and terminate high-voltage cables and components

58.4 Knowledge of high-voltage cable testing procedures

Covers tools and procedures for high pot testing of high-voltage cables.

- ✓ identify tools and equipment used for testing
- ✓ identify and describe testing procedures
- ✓ describe procedures to perform high pot tests

CHAPTER 59

C-17.06 Installs, services and maintains airport visual aid systems

59.1 Installing and maintaining airport runway lighting systems

Covers the skills to select, install, terminate, test, service, maintain and remove airport runway lighting systems and control components.

- ✓ determine installation requirements and select airport runway lighting system components and control components
- ✓ select tools and equipment
- ✓ determine circuitry and load requirements
- ✓ assemble and install airport runway lighting system components
- ✓ label and terminate conductors and cables
- ✓ test lighting and controls
- ✓ service and maintain airport runway lighting systems and control components
- ✓ determine requirements for removal of existing airport runway lighting systems and components
- ✓ remove existing airport runway lighting systems and components when replacing, and update documentation

59.2 Knowledge of airport runway lighting systems

Covers knowledge of airport runway lighting system types and components, characteristics, applications, operation, codes and selection/removal considerations.

- ✓ identify types of airport runway lighting systems, and describe their characteristics, applications and operation
- ✓ identify airport runway lighting system components, and describe their characteristics and applications
- ✓ interpret codes, regulations and standards pertaining to airport runway lighting systems
- ✓ interpret information pertaining to airport runway lighting systems found on drawings and specifications
- ✓ identify considerations and requirements for removal of airport runway lighting systems and components
- ✓ identify considerations and requirements for selecting airport runway lighting systems and components

59.3 Procedures to remove or install airport runway lighting systems

Covers knowledge of tools, equipment and procedures to remove, install and test airport runway lighting systems and components.

- ✓ identify tools and equipment used to remove or install airport runway lighting systems and components, and describe their applications and procedures for use
- ✓ describe procedures to remove airport runway lighting systems and components
- ✓ describe procedures to install airport runway lighting systems and components
- ✓ describe procedures to perform tests related to airport runway lighting systems

CHAPTER 60

B-14.03 Performs servicing and maintenance of high-voltage systems

60.1 Servicing and maintenance of high-voltage systems skills

Covers diagnosing, replacing, repairing, scheduling maintenance, isolating components, testing and documenting for high-voltage systems.

- ✓ obtain detailed description of malfunction
- ✓ determine source of malfunction
- ✓ determine course of action
- ✓ select tools and equipment
- ✓ select replacement components
- ✓ install replacement components
- ✓ repair malfunctioning components and verify repair
- ✓ determine maintenance requirements
- ✓ create maintenance schedule
- ✓ follow maintenance schedule
- ✓ isolate components
- ✓ conduct tests
- ✓ update maintenance log and required documentation

60.2 Knowledge of high-voltage equipment for servicing

Covers high-voltage equipment types, codes, drawings, grounding/bonding, grounding grids and function.

- ✓ identify high-voltage equipment and components
- ✓ interpret codes and regulations
- ✓ interpret information found on drawings and specifications
- ✓ identify grounding conductors, equipment and components
- ✓ identify bonding conductors, equipment and components
- ✓ explain purpose of grounding grids in relation to step and touch voltages
- ✓ explain function of high-voltage equipment

60.3 Procedures to service high-voltage equipment

Covers tools, equipment and procedures to service and maintain high-voltage equipment and components.

- ✓ identify tools and equipment used to service and maintain equipment
- ✓ describe procedures to service high-voltage equipment and components
- ✓ describe procedures to maintain high-voltage equipment and components

60.4 Procedures to service high-voltage cables

Covers tools, equipment and procedures to service and maintain high-voltage cables and components.

- ✓ identify tools and equipment used to service and maintain cables
- ✓ describe procedures to service high-voltage cables and components
- ✓ describe procedures to maintain high-voltage cables and components

CHAPTER 61

C-17.07 Installs, services and maintains traffic signal lights and controls

61.1 Installing and maintaining traffic signal lights and controls

Covers the skills to select, install, terminate, program, test, service, maintain and remove traffic signal light systems and control components.

- ✓ determine installation requirements and select traffic signal light system and control components
- ✓ select tools and equipment
- ✓ determine circuitry and load requirements
- ✓ assemble and install system components and control components
- ✓ label and terminate conductors and cables
- ✓ program and test traffic signal lights and controls
- ✓ service and maintain traffic signal lights and controls
- ✓ determine requirements for removal of existing traffic signal light systems and control components
- ✓ remove existing traffic signal lights and control components when replacing and update documentation

61.2 Knowledge of traffic signal light systems and controls

Covers knowledge of traffic signal light system and control component types, characteristics, applications, operation, codes and selection/removal considerations.

- ✓ identify types of traffic signal light systems and control components, and describe their characteristics and applications
- ✓ interpret information pertaining to traffic signal light systems and controls found on drawings and specifications
- ✓ interpret codes and regulations pertaining to traffic signal light systems and control components
- ✓ identify considerations and requirements for removal of traffic signal light systems and control components
- ✓ identify considerations and requirements for selecting traffic signal light systems and control components

61.3 Procedures to remove, install, connect and test traffic signal systems

Covers knowledge of tools, equipment and procedures to remove, install, connect, service, maintain and test traffic signal light systems and controls.

- ✓ identify tools and equipment used to remove or install, connect and test traffic signal light systems and control components, and describe their applications and procedures for use
- ✓ describe procedures to remove traffic signal lights and control components
- ✓ describe procedures to install traffic signal light systems and control components
- ✓ describe procedures to connect traffic signal light systems and control components
- ✓ describe procedures to service and maintain traffic signal light systems and control components
- ✓ describe procedures to test traffic signal light systems and control components, and document results

CHAPTER 62

B-15.01 Installs extra-low-voltage transformers

62.1 Installing extra-low-voltage transformers skills

Covers selecting transformer type and rating, calculating conductors, installing overcurrent devices, mounting, connecting, testing and removing extra-low-voltage transformers.

- ✓ select tools and equipment
- ✓ determine type of extra-low-voltage transformer required and its VA rating
- ✓ calculate conductor and cable requirements
- ✓ determine overcurrent devices
- ✓ install overcurrent devices
- ✓ position and mount extra-low-voltage transformer
- ✓ connect transformer leads
- ✓ conduct tests after installation and record results
- ✓ remove existing transformer when replacing and update documentation

62.2 Knowledge of extra-low-voltage transformers

Covers extra-low-voltage transformer types, nameplates, components and selection considerations.

- ✓ identify types of extra-low-voltage transformers
- ✓ interpret information contained on nameplates
- ✓ identify transformer components
- ✓ identify considerations for selecting transformers

62.3 Procedures to install extra-low-voltage transformers

Covers tools, equipment and procedures to install extra-low-voltage transformers and components.

- ✓ identify tools and equipment used to install transformers and components
- ✓ describe procedures to install transformers and components

CHAPTER 63

C-18.01 Connects HVAC systems and associated equipment

63.1 Connecting HVAC systems and associated equipment

Covers the skills to determine loads, select and install branch circuit wiring, disconnects and overcurrent protection, terminate, test and disconnect HVAC systems.

- ✓ determine connected load requirements
- ✓ select branch circuit wiring including disconnect means and overcurrent protection devices
- ✓ select tools and equipment
- ✓ install branch circuit wiring including disconnect means and overcurrent protection devices
- ✓ terminate and label conductors and cables
- ✓ test operation
- ✓ determine requirements for disconnection of power source of HVAC systems
- ✓ disconnect existing HVAC systems when replacing and update documentation

63.2 Knowledge of HVAC systems

Covers knowledge of HVAC system types, characteristics, applications, operation, codes and connection/disconnection considerations.

- ✓ identify types of HVAC systems, and describe their characteristics, applications and operation
- ✓ interpret information pertaining to HVAC systems found on drawings, specifications and nameplates
- ✓ interpret codes, standards and regulations pertaining to HVAC systems
- ✓ identify considerations and requirements for disconnecting HVAC systems and their components
- ✓ identify considerations and requirements for connecting HVAC systems and their components

63.3 Procedures to disconnect or connect HVAC systems

Covers knowledge of tools, equipment and procedures to connect and disconnect HVAC systems and their components.

- ✓ identify tools and equipment used to disconnect or connect HVAC systems and their components, and describe their applications and procedures for use
- ✓ describe procedures to connect HVAC systems and their components
- ✓ describe procedures to disconnect HVAC systems and their components

CHAPTER 64

B-15.02 Installs low-voltage single-phase transformers

64.1 Installing low-voltage single-phase transformers skills

Covers selecting transformer type and rating, calculating conductors, overcurrent protection, mounting, connecting leads, tap settings, grounding, testing and removal.

- ✓ determine type of transformer required and its kVA rating
- ✓ calculate conductor and cable requirements
- ✓ determine overcurrent devices
- ✓ select tools and equipment
- ✓ install overcurrent devices
- ✓ position and mount transformer
- ✓ connect transformer leads
- ✓ select and change tap settings
- ✓ ground and bond transformer
- ✓ conduct tests after installation and record results
- ✓ remove existing transformer when replacing and update documentation

64.2 Knowledge of low-voltage single-phase transformers

Covers single-phase transformer types, components, nameplates, polarity, selection considerations and codes.

- ✓ identify low-voltage single-phase transformers
- ✓ identify transformer components
- ✓ interpret information found on nameplates
- ✓ explain transformer polarity and terminal markings
- ✓ describe considerations for selecting transformers
- ✓ interpret codes and regulations

64.3 Procedures to install low-voltage single-phase transformers

Covers tools, equipment and procedures to install single-phase transformers, including parallel installation.

- ✓ identify tools and equipment used to install transformers and components
- ✓ describe procedures to install transformers and components
- ✓ describe procedures to install transformers in parallel

CHAPTER 65

C-18.02 Installs HVAC controls

65.1 Installing HVAC controls

Covers the skills to determine control requirements, select, assemble, install, program, test and remove HVAC control components.

- ✓ determine HVAC control requirements and select HVAC control components
- ✓ select tools and equipment
- ✓ calculate circuitry and load requirements
- ✓ assemble and install HVAC control components
- ✓ label and terminate conductors and cables
- ✓ program and test HVAC control components
- ✓ determine requirements for removal of existing HVAC control components
- ✓ remove existing HVAC control components when replacing and update documentation

65.2 Knowledge of HVAC control components

Covers knowledge of HVAC control component types, characteristics, applications, operation, codes and selection/removal considerations.

- ✓ identify types of HVAC control components, and describe their characteristics, applications and operation
- ✓ interpret information pertaining to HVAC control components found on drawings and specifications
- ✓ interpret codes and regulations pertaining to HVAC control components
- ✓ identify considerations and requirements for removal of HVAC control components
- ✓ identify considerations and requirements for selecting HVAC control components

65.3 Procedures to remove, install, connect and test HVAC controls

Covers knowledge of tools, equipment and procedures to remove, install, connect and test HVAC control components.

- ✓ identify tools and equipment used to remove or install, connect and test HVAC control components, and describe their applications and procedures for use
- ✓ describe procedures to remove HVAC control components
- ✓ describe procedures to install HVAC control components
- ✓ describe procedures to connect HVAC control components
- ✓ describe procedures to test HVAC control components

CHAPTER 66

B-15.03 Installs low-voltage three-phase transformers

66.1 Installing low-voltage three-phase transformers skills

Covers selecting transformer type and rating, calculating conductors, overcurrent protection, mounting, tap settings, connecting leads, grounding, testing and removal.

- ✓ determine type and kVA rating of transformer required
- ✓ calculate conductor and cable requirements
- ✓ determine overcurrent devices
- ✓ select tools and equipment
- ✓ install overcurrent devices
- ✓ position and mount transformer
- ✓ select and change tap settings
- ✓ connect transformer leads
- ✓ ground and bond transformer
- ✓ conduct tests after installation and record results
- ✓ remove existing transformer when replacing and update documentation

66.2 Knowledge of low-voltage three-phase transformers

Covers three-phase transformer types, winding configurations, components, nameplates, polarity, selection considerations and codes.

- ✓ identify types of low-voltage three-phase transformers
- ✓ identify winding configurations
- ✓ identify transformer components
- ✓ interpret information contained on nameplates
- ✓ explain transformer polarity and terminal markings
- ✓ identify considerations for selecting transformers
- ✓ interpret codes and regulations

66.3 Procedures to install low-voltage three-phase transformers

Covers tools, equipment and procedures to install three-phase transformers, including parallel installation.

- ✓ identify tools and equipment used to install transformers and components
- ✓ describe procedures to install transformers and components
- ✓ describe procedures to install transformers in parallel

CHAPTER 67

C-18.03 Performs servicing and maintenance of HVAC systems and controls

67.1 Servicing and maintaining HVAC systems and controls

Covers the skills to diagnose, remove, repair, replace, reprogram, test and record servicing of HVAC systems, controls and equipment.

- ✓ select tools and equipment
- ✓ determine source of malfunction
- ✓ identify and remove defective electrical components and equipment of HVAC systems and controls
- ✓ repair malfunctioning electrical components and equipment
- ✓ select replacement electrical components and equipment
- ✓ install replacement electrical components and equipment and reprogram
- ✓ conduct tests of HVAC systems and controls after repair
- ✓ record tests in maintenance schedule

67.2 Knowledge of HVAC systems and controls

Covers knowledge of HVAC system and control types and components, their characteristics, applications and operation.

- ✓ identify types of HVAC systems and controls, and describe their characteristics, applications and operation
- ✓ identify HVAC system and control components, and describe their characteristics and applications

67.3 Procedures to service HVAC systems and controls

Covers knowledge of tools, equipment and procedures to diagnose and repair HVAC systems, controls and components.

- ✓ identify tools and equipment used to service HVAC systems and controls, and their components, and describe their applications and procedures for use
- ✓ describe procedures to diagnose HVAC systems and controls, and their components
- ✓ describe procedures to repair HVAC systems and controls, and their components

67.4 Procedures to maintain HVAC systems and controls

Covers knowledge of tools, equipment and procedures to maintain HVAC systems, controls and their components.

- ✓ identify tools and equipment used to maintain HVAC systems and controls, and their components, and describe their applications and procedures for use
- ✓ describe procedures to maintain HVAC systems and controls, and their components

CHAPTER 68

C-19.01 Installs electric heating systems

68.1 Installing electric heating systems

Covers the skills to determine requirements, calculate loads and heat loss, select and install wiring and heating devices, terminate, test and remove electric heating systems.

- ✓ determine type of electric heating system required and installation requirements
- ✓ calculate demand load, determine branch circuit requirements and reference heat loss calculations
- ✓ determine installation location for heating device
- ✓ select branch circuit wiring
- ✓ select tools and equipment
- ✓ install branch circuit wiring
- ✓ install heating device
- ✓ terminate conductors and cables
- ✓ test operation
- ✓ determine requirements for removal of electric heating systems
- ✓ remove existing electric heating systems and update documentation

68.2 Knowledge of electric heating systems

Covers knowledge of electric heating system types and components, characteristics, applications, operation, codes and selection/removal considerations.

- ✓ identify types of electric heating systems, and describe their characteristics, applications and operation
- ✓ identify electric heating system components, and describe their characteristics and applications
- ✓ interpret codes, regulations and standards pertaining to electric heating systems
- ✓ interpret information pertaining to electric heating systems found on drawings and specifications
- ✓ identify considerations and requirements for removal of electric heating systems and their components
- ✓ identify considerations and requirements for selecting electric heating systems and their components

68.3 Procedures to remove and install electric heating systems

Covers knowledge of tools, equipment and procedures to calculate heat loss, remove and install electric heating systems and components.

- ✓ identify tools and equipment used to remove and install electric heating systems and their components, and describe their applications and procedures for use
- ✓ describe procedures to calculate heat loss
- ✓ describe procedures to remove electric heating systems and their components
- ✓ describe procedures to install electric heating systems and their components

CHAPTER 69

C-19.02 Installs electric heating system controls

69.1 Installing electric heating system controls

Covers the skills to determine, select, assemble, install, program, test and remove electric heating system control components.

- ✓ determine electric heating system control components required
- ✓ select tools and equipment
- ✓ calculate circuitry and load requirements
- ✓ assemble and install electric heating system control components
- ✓ label and terminate conductors and cables
- ✓ program and test electric heating system control components
- ✓ determine requirements for removal of existing electric heating system controls
- ✓ remove existing electric heating system control components when replacing and update documentation

69.2 Knowledge of electric heating system control components

Covers knowledge of electric heating control component types, characteristics, applications, codes and selection/removal considerations.

- ✓ identify types of electric heating system control components, and describe their characteristics and applications
- ✓ interpret information pertaining to electric heating system control components found on drawings and specifications
- ✓ interpret codes and regulations pertaining to electric heating system control components
- ✓ identify considerations and requirements for removal of electric heating system control components
- ✓ identify considerations and requirements for selecting electric heating system control components

69.3 Procedures to remove, install, connect and test heating controls

Covers knowledge of tools, equipment and procedures to remove, install, connect and test electric heating system control components.

- ✓ identify tools and equipment used to remove, install, connect and test electric heating system control components, and describe their applications and procedures for use
- ✓ describe procedures to remove electric heating system control components
- ✓ describe procedures to install electric heating system control components
- ✓ describe procedures to connect electric heating system control components
- ✓ describe procedures to test electric heating system control components

CHAPTER 70

C-19.03 Performs servicing and maintenance of electric heating systems and controls

70.1 Servicing and maintaining electric heating systems and controls

Covers the skills to diagnose, remove, replace, install, test, clean, adjust and record servicing of electric heating system controls.

- ✓ select tools and equipment
- ✓ determine source of malfunction
- ✓ identify and remove defective electric heating system control components and controls
- ✓ select replacement electric heating system control components
- ✓ install replacement electric heating system control components
- ✓ conduct tests of electric heating system control components after repair
- ✓ clean and adjust electric heating system control components
- ✓ record tests in maintenance schedule

70.2 Knowledge of electric heating systems and control components

Covers knowledge of electric heating system and control component types, characteristics, applications and operation.

- ✓ identify types of electric heating systems and electric heating system control components, and describe their characteristics, applications and operation
- ✓ identify electric heating systems and electric heating system control components, and describe their characteristics and applications

70.3 Procedures to service electric heating systems and controls

Covers knowledge of tools, equipment and procedures to diagnose and repair electric heating systems and control components.

- ✓ identify tools and equipment used to service electric heating systems and electric heating system control components, and describe their applications and procedures for use
- ✓ describe procedures to diagnose electric heating systems and electric heating system control components
- ✓ describe procedures to repair electric heating systems and electric heating system control components

70.4 Procedures to maintain electric heating systems and controls

Covers knowledge of tools, equipment and procedures to maintain electric heating systems and control components.

- ✓ identify tools and equipment used to maintain electric heating systems and electric heating system control components, and describe their applications and procedures for use
- ✓ describe procedures to maintain electric heating systems and electric heating system control components

CHAPTER 71

C-20.01 Installs exit and emergency lighting

71.1 Installing exit and emergency lighting

Covers the skills to determine requirements, calculate loads, select and install wiring and systems, terminate, test, remove and dispose of exit and emergency lighting.

- ✓ determine type and installation requirements of exit and emergency lighting system required
- ✓ calculate connected load
- ✓ determine branch circuit requirements and standby energy source
- ✓ determine installation location for exit and emergency lighting system
- ✓ select branch circuit wiring
- ✓ select tools and equipment
- ✓ install branch circuit wiring
- ✓ install exit and emergency lighting system
- ✓ terminate conductors and cables
- ✓ test operation and complete documentation
- ✓ determine requirements for removal of exit and emergency lighting system
- ✓ remove and dispose of existing exit and emergency lighting system when replacing and update documentation

71.2 Knowledge of exit and emergency lighting systems

Covers knowledge of exit and emergency lighting system types and components, characteristics, applications, operation, codes and selection/removal considerations.

- ✓ identify types of exit and emergency lighting systems, and describe their characteristics, applications and operation
- ✓ identify exit and emergency lighting system components, and describe their characteristics and applications
- ✓ interpret codes, regulations and standards pertaining to exit and emergency lighting systems
- ✓ interpret information pertaining to exit and emergency lighting systems found on drawings and specifications
- ✓ identify considerations and requirements for removal and disposal of exit and emergency lighting systems, and their components
- ✓ identify considerations and requirements for selecting exit and emergency lighting systems, and their components

71.3 Procedures to remove and install exit and emergency lighting

Covers knowledge of tools, equipment and procedures to remove, install and test exit and emergency lighting systems and components.

- ✓ identify tools and equipment used to remove and install exit and emergency lighting systems, and their components, and describe their applications and procedures for use
- ✓ describe procedures to remove exit and emergency lighting systems, and their components
- ✓ describe procedures to install exit and emergency lighting systems, and their components
- ✓ describe procedures to test exit and emergency lighting systems, and their components, and identify required documentation to be completed

CHAPTER 72

C-20.02 Performs servicing and maintenance of exit and emergency lighting systems

72.1 Servicing and maintaining exit and emergency lighting systems

Covers the skills to select tools, determine sources of malfunction and remove/dispose of defective components in exit and emergency lighting systems.

- ✓ select tools and equipment
- ✓ determine source of malfunction
- ✓ identify, remove and dispose of defective components