Appendix L

ARCHITECTURE AND CONSTRUCTION YOUTH APPRENTICESHIP

CONSTRUCTION PATHWAY ELECTRICAL FUNDAMENTALS (UNIT 5)

UNIT 5: Construction Pathway
Electrical Fundamentals Unit

Competency
1. Read blueprints, plans and specifications

Performance Standard Condition

Competence will be demonstrated

- At the worksite and classroom

Performance Standard Criteria

Performance will be successful when learners:

- Articulate the functionality of blueprints, plans and specifications
- Interpret technical drawings accurately as needed for job task
- Use appropriate terminology for electrical careers
- Interpret electrical drawings, including the site plans, floor plans, and detail drawings
- Identify basic elements of electrical drawings, including site plans, floor plans and detail drawings
- Identify lines, views, symbols, and representations on the drawings as applicable
- Interpret dimensions and scale on the drawings as applicable
- Utilize a metric scale to properly read a drawing

Learning Objectives:

- Articulate the basic design principles
- Explain where a design professional finds basic Architectural/Structural design codes
- Demonstrate basic drafting skills (AutoCAD)
- Demonstrate blueprint reading skills
- Explain why precision is interpretation is critical
- Demonstrate knowledge of fundamentals of statistics, trigonometry, and algebra and explain their relevance
- Define and explain the use of lines, views, symbols, dimensions, and scale on architectural technical drawings
- Identify different lines by name, type, order of usage, and application such as object, hidden, center, section, dimension, extension, cutting plane, short break, long break, phantom
- Describe standard view placement practices
- Compare pictorial format, orthographic projection, sectional views, and detail schedules
- Describe the standard usage of metric (SI) linear units in architectural drafting
- Using an architect's scale, state the actual dimensions of a given drawing component

Comments:

UNIT 5: Construction Pathway
Electrical Fundamentals Unit

Competency
2. Interpret symbols and procedures

Performance Standard Condition

Competence will be demonstrated

- At the worksite and classroom

Performance Standard Criteria

Performance will be successful when learners:

- Read and Identify drawings and symbols used on a construction drawing
- Demonstrate the ability to translate the symbols and procedures into the specifications of the work requirements to complete the building process
- Interpret and apply information from drawings to the scope of work
- Demonstrate the ability to interpret scales and measurements and convert them in terms of actual dimensions

Learning Objectives:

- Explain the role of drawings in relation to quantities, project specifications, and contract documentation
- Explain the role of specifications in relation to quantities, quality of work, contract documentation and payment to contractors
- State the difference between general and project specifications
- Identify drawings in terms of type and application for an electrical job task
- Identify the key users of the drawing in terms of work responsibility
- Interpret symbols and abbreviations in terms of their functions and meanings
- Interpret and explain the purpose of each view in terms of the result of the end product

Comments:

UNIT 5: Construction Pathway
Electrical Fundamentals Unit

Competency
3. Identify job prep needs and develop job task plan

Performance Standard Condition

Competence will be demonstrated

- At the worksite and classroom

Performance Standard Criteria

Performance will be successful when learners:

- Set up and prepare tool/equipment for safe operation
- Determine the scope of work:
    - Timetable
    - Work schedule
    - Cleanup process
    - Safety measures
- Demonstrate an understanding of contractual relationships between all parties involved in the building process
- Apply scheduling practices to ensure the successful completion of a construction project
- Develop a task plan and a hazard assessment for a given task and select the appropriate PPE and work methods to safely perform the task.

Learning Objectives:

- Explain the process to prepare the site
- Describe the process for collaboration with other construction professionals
- Strategize the scope of work for successful project completion
- Identify the importance of planning ahead to prevent problems on site before they occur
- Explain safety inspections to ensure regulations relating to health safety and the environment are adhered to.
- Prepare sample project schedule that incorporates sequencing of events
- Prepare a flow chart explaining shop drawing review process
- Describe the approval procedures required for successful completion of a construction project

Comments:

UNIT 5: Construction Pathway
Electrical Fundamentals Unit

Competency
4. Execute job prep needs as a coordinated effort

Performance Standard Condition

Competence will be demonstrated

- At the worksite and classroom

Performance Standard Criteria

Performance will be successful when learners:

- Review the scope and phases of the project with a worksite professional
- Illustrate how to control the main resources of a job:
    - Materials
    - Tools
    - Equipment
    - labor

Learning Objectives:

- Identify the components of building systems needed to complete a construction project
- Define planning and describe what it involves
- Explain why it is important to plan
- Explain the importance of documenting one's work
- Explain the sequence of events for project completion
- Explain how schedules are developed and used
- Define the terms production and productivity and explain why they are important
- Describe how efficiency can affect costs associated with the project
- Explain the supervisors role in controlling costs
- Describe the estimating process and classification of costs (e.g., direct and indirect, fixed and variable, methods and standards)
- Identify the steps to overseeing the running of several projects
- Demonstrate a working knowledge of communicating with a range of people including the client, subcontractor, supplier, the public and the workforce

Comments:

UNIT 5: Construction Pathway
Electrical Fundamentals Unit

Competency
5. Select tools and materials

Performance Standard Condition

Competence will be demonstrated

- At the worksite and classroom

Performance Standard Criteria

Performance will be successful when learners:

- Choose the tools they are going to work with taking into consideration the usefulness and portability of the tool.
- Choose the appropriate tools and materials to minimize cost while meeting product performance goals.

Learning Objectives:

- Identify the hand tools commonly used by electricians and describe their uses
- Use hand tools in a safe and appropriate manner
- State the general rules for properly maintaining all power tools, regardless of type
- Explain importance of equipment and tool tracking
- Describe ways that a contractor can manage materials
- Compare the value of renting versus purchasing equipment

Comments:

UNIT 5: Construction Pathway
Electrical Fundamentals Unit

Competency
6. Use hand tools and light duty tools

Performance Standard Condition

Competence will be demonstrated

- At the worksite and classroom

Performance Standard Criteria

Performance will be successful when learners:

- Use correct hand tools in a safe and appropriate manner
- Demonstrate the general safety rules for operating all power tools, regardless of type
- Use portable power tools in a safe and appropriate manner
- Use stationary power tools in a safe and appropriate manner
- Demonstrate proper handling and storage of tools.

Learning Objectives:

- Identify the hand tools commonly used by electricians and describe their uses
- Identify the power tools commonly used by electricians and describe their uses
- Describe the proper handling and storage of hand and power tools.
- Identify trends in power tool use
- Identify battery time and voltage in various power tools.

Comments:

UNIT 5: Construction Pathway
Electrical Fundamentals Unit

Competency
7. Operate tools and equipment safely

Performance Standard Condition

Competence will be demonstrated

- At the worksite and classroom

Performance Standard Criteria

Performance will be successful when learners:

- Operate only equipment that he/she is trained on
- Choose correct tool(s) or equipment for the task
- Follow and complete any tool check list
- Verify tool/equipment is available for use and in working order
- Verify tool/equipment is current for preventative maintenance and/or calibration
- Verify safety equipment and any Personal Protective Equipment (PPE) needed for tool/equipment use
- Inspect tool/equipment and work area for safety considerations
- Wear the required Personal Protective Equipment (PPE) at all times as required for the operation of the tool/equipment
- Operate tool/equipment safely with guarding devices in the manner required for the job task
- Investigate and promptly report abnormal tool/equipment conditions
- Properly shut down and labels any tool/equipment that is not operating as expected
- Follow Lock Out/Tag Out procedures as applicable
- Document use and maintenance as required

Learning Objectives:

- Distinguish between common hand tools (e.g., hammers, wrenches, pliers, taps, wire strippers, voltage detector, level, allen wrenches, utility knife, screw drivers, and wire crimpers, etc.)
- Outline applications of each tool and equipment
- Describe and demonstrate the safety requirements for each tool and equipment
- Discuss start up and shut down procedures for each tool/equipment you will operate
- Explain the purpose of preventative maintenance
- Describe emergency shutdown procedures for the tool/equipment you will operate
- Explain how to recognize and address malfunctions for the tool/equipment you will operate
- Describe how to recognize wear and tear on equipment components
- Describe how to select lubricants and coolants as applicable
- List which tools and equipment require safety certification

Comments:

UNIT 5: Construction Pathway
Electrical Fundamentals Unit

Competency
8. Assist with the installation of materials per job specifications

Performance Standard Condition

Competence will be demonstrated

- At the worksite and classroom

Performance Standard Criteria

Performance will be successful when learners:

- Articulate the scope of work
- Retrieve the correct material(s) for the job
- Demonstrate the application of measuring knowledge
- Demonstrate the ability to identify labels and read labels on products
- Demonstrate the ability to read and follow directions
- Demonstrate the ability to listen and take direction well
- Assist with loading unloading of materials, tools, equipment and supplies
- Assist in lifting, position, and securing of materials and work pieces during installation
- Plan sequencing, tools, and equipment needed for the installation
- Identify set up needed
- Consult with worksite professional to verify production schedule, deadlines, and timeframes

Learning Objectives:

- Define the needed materials associated with the various jobs
- Determine effective and active listening skills
- Use acceptable language in the classroom
- Demonstrate writing legibly for all assignments
- Determine technical reading strategies
- Determine proper measuring techniques and explain how to use measuring tools.
- Demonstrate the ability to follow directions from the teacher/mentor in the classroom
- Explain the functions and collaborative nature of each department or unit within the larger organization

Comments:

UNIT 5: Construction Pathway
Electrical Fundamentals Unit

Competency
9. Demonstrate accuracy in measuring using various instruments

Performance Standard Condition

Competence will be demonstrated

- At the worksite and classroom

Performance Standard Criteria

Performance will be successful when learners:

- Accurately measure the frequency of the current voltage and resistance
- Verify instrument is accurate for calibration if applicable
- Read measuring instruments accurately (ammeter and voltmeter)
- Define the units of measurement that are used to measure the properties of electricity
- Confirm measurements to given specification
- Record measurements using proper symbols
- Calibrate, clean, and store measuring instruments properly as required

Learning Objectives:

- List measuring aids and devices commonly used by Electricians
- Add, subtract, multiply, and divide whole numbers, fractions, decimals and percent's
- Discuss how to convert standard English measures to metric and vice versa
- Explain architectural scale
- Explain the impact of error in measurement
- Use the proper instrument to measure voltage in an energized circuit
- Use the proper instrument to measure current in an energized circuit
- Use the proper instrument to measure resistance
- Compare accuracy and precision when using measuring equipment
- Measure and accurately report measurements of time, temperature, distance, length, width, height, width, perimeter, area, volume, weight, velocity and speed

Comments:

UNIT 5: Construction Pathway
Electrical Fundamentals Unit

Competency
10. Maintain clean and safe work environment

Performance Standard Condition

Competence will be demonstrated

- At the worksite and classroom

Performance Standard Criteria

Performance will be successful when learners:

- Inspect tools and work area for safety considerations
- Comply with posted safety warnings and symbols
- Identify unsafe conditions and/or work habits and reports them to the worksite professional immediately, if applicable
- Help maintain a clean and safe working environment free of debris and obstacles
- Clean, organize, put away items in the work area
- Safely identify, handle, store, and use hazardous materials according to company procedure, if applicable
- Report any indications of insects or pests

Learning Objectives:

- List the major components of a facility safety program
- List the different state and federal agencies that provide regulatory oversight at your facility for personal safety, environmental safety, and equipment safety
- Describe posted safety warnings and symbols and what they mean
- Describe safe and unsafe work habits and their implications
- Discuss the importance of keeping the work area and tools/equipment clean
- List mechanical, electrical, and equipment safety hazards at your facility
- Discuss how to identify and report unsafe conditions in your facility
- Discuss safety procedures to prevent accidents
- Describe the requirements at your facility for safety training and auditing
- Assess need for good housekeeping practices
- List accident and fire prevention techniques
- List hazards that contribute to injury due to slips, trips, or falls
- Outline compliance requirements of sanitation and health inspections

Comments:

UNIT 5: Construction Pathway
Electrical Fundamentals Unit

Competency
11. Clean up work area

Performance Standard Condition

Competence will be demonstrated

- At the worksite and classroom

Performance Standard Criteria

Performance will be successful when learners:

- Follow directions based on foreman scope of work plans
- Clean and maintain materials and tools as required
- Store materials and tools properly
- Follow facility procedures for clean-up and shut down after use

Learning Objectives:

- Explain the basic clean up procedures at the end of classroom or project build
- Explain the proper storage of tools and materials
- Articulate how a clean work environment supports safety
- Articulate how a clean work environment support efficiency

Comments:

UNIT 5: Construction Pathway
Electrical Fundamentals Unit

Competency
12. Practice quality craftsmanship

Performance Standard Condition

Competence will be demonstrated

- At the worksite and classroom

Performance Standard Criteria

Performance will be successful when learners:

- Inspect and/or test materials/pieces/products at all stages of production to determine quality or condition
- Monitor materials, processes, equipment, tools, and products throughout the production process for safety and quality specifications
- Inspect final product/piece to ensure it meets specifications
- Promptly identify and segregate materials and/or product that do not meet specification
- Communicate with worksite professional if materials and/or product do not meet requirements
- Document all quality checks

Learning Objectives:

- Explain and analyze the quality approval process used in the Electrical industry
- Describe the roles and responsibilities for quality in your facility
- List the major stages involved in producing products
- Explain the procedures for rejecting sub-standard products
- Define terms used in quality assurance
- Describe the impact of quality standards in construction
- Describe how materials are selected and tested for product requirements

Comments:

Unit 5: Construction Pathway
Electrical Fundamentals Unit

Competency
13. Assist with cutting wire, cable, conduit and raceway, cording and cutting chasses

Performance Standard Condition

Competence will be demonstrated

- at the worksite and classroom

Performance Standard Criteria

Performance will be successful when learners:

- Select the proper raceway of cable for the conditions
- Select the proper raceway size, depending on the conductors to be installed
- Properly size outlet(s), pull, and junction boxes

Learning Objectives:

- Identifies electrical hazards and how to avoid or minimize them in the workplace
- Identify the installation requirements for a raceway of cable
- Lists and describes electrical circuit overcurrent protective devices
- Explain how to use a wire stripper to strip insulation from a wire
- Use math formulas to determine conduit bends
- Identify the methods of hand bending conduit
- Identify the various methods used to install conduit
- Cut, ream, and thread conduit

Comments:

Unit 5: Construction Pathway
Electrical Fundamentals Unit

Competency
14. Assist with pulling wires and attaching wires

Performance Standard Condition

Competence will be demonstrated

- at the worksite and classroom

Performance Standard Criteria

Performance will be successful when learners:

- Demonstrate the knowledge and ability to assist with writing
- Demonstrate the ability to connect wires to circuit breakers, transformers, and/or other components

Learning Objectives:

- Explain the various sizes and gauges of wire in accordance with American Wire Gauge standards
- Describe voltage ratings of conductors and cables
- Describe the procedure for pulling wire through conduit
- Pull conductors in a conduit system
- Describe instrumentation control wiring
- Explain how wiring devices are selected and installed

Comments:

Unit 5: Construction Pathway
Electrical Fundamentals Unit

Competency
15. Assist with connecting conductors to switches, receptacles or appliances

Performance Standard Condition

Competence will be demonstrated

- at the worksite and classroom

Performance Standard Criteria

Performance will be successful when learners:

- Demonstrate the knowledge and ability to assist with connections
- Demonstrate two and three way switches
- Demonstrate normal and ground fault receptacles
- Demonstrate appliance reciprocals

Learning Objectives:

- Plan and install electrical components according to circuit layouts which include single-pole, three-way, four-way, and dimmer switches duplex and GFCI receptacles, boxes, covers, lamps, wire, solderless connectors, and conduit accurately
- Identify and state the functions and ratings of straight blade, twist lock, and pin and sleeve receptacles
- Identify and define receptacle terminals and disconnects
- Identify and define ground fault circuit interrupters
- Identify insulation and jacket types according to conditions and applications
- Explain the types and purposes of equipment grounding conductors

Comments:

Unit 5: Construction Pathway
Electrical Fundamentals Unit

Competency
16. Assist with installation of switches, outlet boxes and fixture boxes

Performance Standard Condition

Competence will be demonstrated

- at the worksite and classroom

Performance Standard Criteria

Performance will be successful when learners:

- Demonstrate the ability to identify and install the various types of electrical boxes
- Plan and install electrical components according to duplex and GFCI receptacles, boxes, covers, lamps, wire, solderless connectors, and conduit accurately
- Properly use color coding for electrical installations

Learning Objectives:

- Describe the purpose of conduit bodies.
- Identify and state the functions of limit switches, relays, and switchgear
- Explain the various types of outlet boxes and select the proper type for different wiring methods
- Calculate the required box size for any number and size of conductors.
- Properly locate, install, and support boxes of all types.
- Install the different types of fittings used in conjunction with boxes.

Comments:

Unit 5: Construction Pathway
Electrical Fundamentals Unit

Competency
17. Assist with installation of feeders and circuits

Performance Standard Condition

Competence will be demonstrated

- at the worksite and classroom

Performance Standard Criteria

Performance will be successful when learners:

- Select the correct feeder size, type and overcurrent protection for the application
- Layout electrical systems using materials and devices labeled and listed for project(s)
- Demonstrates the ability to rough-in and properly secure cables or conduits for branch circuits
- Connect circuits to circuit breaker panels
- Demonstrate the ability to compute the appropriate load calculations and power requirements for the job
- Follows all grounding and bonding requirements

Learning Objectives:

- Identify the feeder and branch circuits portion of a distribution system
- Describe the various types of branch circuits
- Define the functions of a feeder and the functions of branch-circuit connectors
- Calculate lighting and receptacle loads using code requirements
- Size branch circuits in accordance with the code
- Determine branch circuits over current protection required by code
- Use the code to size feeder conductors

Comments: