

# 2022 Electrical

## Program Standards

### CONTENT STANDARD 1.0: Demonstrate Electrical Technician Career Basics

#### Performance Standard 1.1: Identify Electrical-Related Career Pathways and Regulations

- 1.1.1 Identify and maintain licensing and industry credentialing requirements.
- 1.1.2 Research postsecondary apprenticeship program opportunities and requirements.
- 1.1.3 Identify residential, commercial, and industrial career opportunities.
- 1.1.4 Identify elements of jobsite timeline coordination for an electrical project.
- 1.1.5 Identify the importance of job site timeline coordination with other trades.

### CONTENT STANDARD 2.0: Practice Jobsite and Tool Safety

#### Performance Standard 2.1: Practice Jobsite Safety

- 2.1.1 Explain the requirements for and information included on safety data sheets (SDS).
- 2.1.2 Don personal protective equipment (PPE) for any electrical hazard identified, in accordance with NFPA 70E (Standard for Electrical Safety).
- 2.1.3 Describe the effects of electrical shock on the human body.
- 2.1.4 Explain how to verify that circuits are de-energized.
- 2.1.5 Demonstrate proper material handling, storage, use, and disposal.
- 2.1.6 Demonstrate precautions for ladder safety.
- 2.1.7 Describe stairway and scaffold hazards and precautions.
- 2.1.8 Describe jobsite energy hazards and proper lockout/tagout procedures.
- 2.1.9 Identify the location and the types of fire extinguishers and other fire equipment.
- 2.1.10 Demonstrate procedures for using fire extinguishers and other fire safety equipment.
- 2.1.11 Earn the OSHA-10 card (Construction).

#### Performance Standard 2.2: Practice Tool Identification and Safety

- 2.2.1 Demonstrate safe use and maintenance of hand tools and power tools.
- 2.2.2 Match tools to their intended use and purpose.
- 2.2.3 Perform a safety check before using tools.
- 2.2.4 Identify the components of a conduit bender.
- 2.2.5 Identify the methods and tools used in bending metal conduit and tubing.
- 2.2.6 Identify saddle, offset, concentric, and 90-degree bends.
- 2.2.7 Perform conduit bends, using a conduit bender and a given set of parameters.

#### Performance Standard 2.3: Use Electrical Test Equipment and Meters

- 2.3.1 Describe meters and their applications to include ohmmeter, ammeter, multimeter, and voltmeter.
- 2.3.2 Select the multimeter setting to read the following: volts, ohms, amps, continuity, and temperature.
- 2.3.3 Identify electrical test equipment safety hazards.
- 2.3.4 Identify meters by their applications in Category I through Category IV.
- 2.3.5 Use an ohmmeter to measure resistance in electrical equipment or conductors.
- 2.3.6 Measure voltage between phases and phase-to-ground.
- 2.3.7 Measure voltage across open and closed switch contacts.
- 2.3.8 Measure amperage reading of various residential loads (e.g., microwave, toaster, curling iron, incandescent versus LED light, desktop computer) to identify branch circuit load calculations.
- 2.3.9 Diagram the proper connection of a watt meter.
- 2.3.10 Describe the operational characteristics of analog and digital meters.
- 2.3.11 Identify the wave form on an oscilloscope.

### CONTENT STANDARD 3.0: Interpret Blueprints, Drawings, and Diagrams

#### Performance Standard 3.1: Read Basic Electrical Construction Documents

- 3.1.1 Locate the information found in drawing blocks.
- 3.1.2 Identify the information found on different types of drawings.
- 3.1.3 Interpret common symbols on MEP (mechanical, electrical, plumbing) plans.
- 3.1.4 Interpret common symbols on electrical wiring diagrams.
- 3.1.5 Identify associated schematic symbols for relays.
- 3.1.6 Interpret a set of electrical drawings.
- 3.1.7 Interpret schedules, block diagrams, and schematic diagrams.
- 3.1.8 Interpret drafting lines.
- 3.1.9 Interpret plans, using an architect's scale.
- 3.1.10 Measure components of plans, using an engineer's scale.
- 3.1.11 Measure components of plans, using a metric scale.

### CONTENT STANDARD 4.0: Exploring Electrical Theory and Circuits

#### Performance Standard 4.1: Apply Basic Electrical Theory

- 4.1.1 Explain the structure of an atom.
- 4.1.2 Compare electron flow and conventional current flow.
- 4.1.3 Describe the difference between insulators and conductors.
- 4.1.4 Explain the basic methods of producing electricity.
- 4.1.5 Define *coulomb*.
- 4.1.6 Define *ampere*.
- 4.1.7 Define *ohm*.
- 4.1.8 Define *watt*.
- 4.1.9 Define *volt*.
- 4.1.10 Determine the resistance of a resistor, using the color code or an ohmmeter.
- 4.1.11 Determine the correct power rating of a resistor in a circuit.
- 4.1.12 Select the proper Ohm's law formula from a chart.
- 4.1.13 Select the proper Watt's law formula from a chart.
- 4.1.14 Calculate different electrical values using Ohm's law.
- 4.1.15 Calculate different electrical values using Watt's law.
- 4.1.16 Describe the nature of static electricity.
- 4.1.17 Describe the nature of magnetism and electromagnetism.
- 4.1.18 Describe the theory and operation of a solenoid.
- 4.1.19 Describe the theory and operation of a relay.

#### Performance Standard 4.2: Explore Circuits

- 4.2.1 Describe series, parallel, and combination circuit characteristics.
- 4.2.2 Calculate values of voltage, current, resistance, and wattage for series circuits.
- 4.2.3 Calculate values of voltage, current, resistance, and wattage for parallel circuits.
- 4.2.4 Calculate total resistance values in a parallel circuit, using the three resistance formulas (i.e., product over sum, reciprocal, identical resistance values).
- 4.2.5 Calculate voltage, amperage, resistance and wattage in combination circuits.
- 4.2.6 Diagram a series circuit.
- 4.2.7 Diagram a parallel circuit.
- 4.2.8 Diagram a combination circuit.

### CONTENT STANDARD 5.0: Navigate and Apply Regulations in the National Electrical Code (NEC)®

#### Performance Standard 5.1: Identify General Definitions and Requirements—NEC Articles 90, 100, and 110

- 5.1.1 Describe how the NEC began and its purpose.
- 5.1.2 Describe navigation of the NEC, including the terminology, and format (e.g., article, part, section, list, tables, informational notes, Fig. 90.3 Code Arrangement).

- 5.1.3 State the roles of nationally recognized testing laboratories, the National Electrical Manufacturers Association (NEMA), and the National Fire Protection Association (NFPA).
- 5.1.4 Evaluate a location as accessible, readily accessible, or not readily accessible.
- 5.1.5 Identify equipment classified as appliances.
- 5.1.6 Describe the four categories of branch circuits.
- 5.1.7 Compare continuous load and a non-continuous load.
- 5.1.8 Calculate voltage-drop.
- 5.1.9 Determine the enforceability of voltage drop, using informational notes in the NEC.
- 5.1.10 Describe the required distance that a cable should be installed from the edge of the wood-framing member, unless a steel plate is installed.
- 5.1.11 Identify the conductors in a cable and how certain conductors can be re-identified, using the NEC.
- 5.1.12 Determine underground installation provisions.
- 5.1.13 Determine the general provisions for any raceway installation.
- 5.1.14 Determine the type of raceways suited for individual installations.
- 5.1.15 Determine the support requirements for various raceways using the NEC.
- 5.1.16 Calculate the electrical trade size conduit required for any circuit or feeder.
- 5.1.17 Define *panelboard*, *enclosure*, and *cutout box*.
- 5.1.18 Determine the proper application and use of circuit breakers and fuses, using the NEC.
- 5.1.19 Describe *assembly occupancies*.

#### Performance Standard 5.2: Identify NEC General Requirements for Electrical Installations

- 5.2.1 Select the workspace clearance for electrical equipment.
- 5.2.2 Determine the cubic inch capacity of boxes when installing conductors # 6 AWG and smaller.
- 5.2.3 Determine the box size when the number of conductors is known.
- 5.2.4 State the mounting and supporting provisions for boxes and conduit bodies.
- 5.2.5 Determine the type of box needed for various applications.
- 5.2.6 Determine basic conductor properties.
- 5.2.7 Demonstrate the layout of general-purpose receptacles in a dwelling.
- 5.2.8 Determine the requirements for countertop receptacle placement.
- 5.2.9 Describe the minimum number of small appliance branch circuits required and their applications.
- 5.2.10 Describe the specific provisions for GFCI placement.
- 5.2.11 Identify the NEC accessibility requirements for tamper-proof receptacles.