IDAHO ELECTRICAL APPRENTICESHIP YEAR 1 PROGRAM STANDARDS

2016

CONTENT STANDARD 1.0: INTRODUCTION TO ELECTRICAL WORK SAFETY

Performance Standard 1.1: General Safety

1.1.1 Explain what a material safety data sheet (MSDS/SDS) is and its requirements.
1.1.2 Explain safety procedures for trenches.
1.1.3 Explain safety for confined space.
1.1.4 Explain lockout and tagout.
1.1.5 Explain protective clothing to include eye and hearing protection.
1.1.6 Explain the use of a safety harness.
1.1.7 Explain safety for ladders and scaffolds.
1.1.8 State the purpose of arc-fault and ground-fault circuit interrupters.
1.1.9 Identify safety handling and use of hand and power tools.

CONTENT STANDARD 2.0: ELECTRICAL THEORY

Performance Standard 2.1: Electrical Qualities and Ohm's Law

2.1.1 Explain the structure of the atom.
2.1.2 Explain electron flow.
2.1.3 State the difference between insulators and conductors.
2.1.4 Explain the basic methods of producing electricity.
2.1.5 Describe electrical effects such as magnetism, light, and heat.
2.1.6 Define a coulomb.
2.1.7 Define an ampere.
2.1.8 Define an ohm.
2.1.9 Define a watt.
2.1.10 Determine the resistance of a resistor using the color code or an ohmmeter.
2.1.11 Determine whether a resistor is operating within its power rating.
2.1.12 Calculate different electrical values using Ohm's law.
2.1.13 Select the proper Ohm's law formula from a chart.

Performance Standard 2.2: Static Electricity and Magnetism

2.2.1 Discuss the nature of static electricity.
2.2.2 Discuss lightning protection.
2.2.3 Give examples of both nuisance and useful static charges.
2.2.4 Discuss the properties of permanent magnets.
2.2.5 Discuss the operation of electromagnets.
2.2.6 Determine the polarity of an electromagnet when the direction of the current is known.

CONTENT STANDARD 3.0: ELECTRICAL CIRCUITS

Performance Standard 3.1: Series

3.1.1 Discuss the properties of series circuits.
3.1.2 List three rules for solving electrical values of series circuits.
3.1.3 Calculate values of voltage, current, resistance, and power for series circuits.

Performance Standard 3.2: Parallel

3.2.1 Discuss the characteristics of parallel circuits.
3.2.2 State three rules for solving electrical values of parallel circuits.
3.2.3 Solve the missing values in a parallel circuit using the three rules and Ohm's law.
3.2.4 Calculate current values using the current divider formula.

Performance Standard 3.3: Combination

3.3.1 Define a combination circuit.
3.3.2 List the rules for parallel circuits.
3.3.3 List the rules for series circuits.
3.3.4 Solve combination circuits using the rules for parallel circuits, rules for series circuits, and Ohm's law.

CONTENT STANDARD 4.0: TOOLS

Performance Standard 4.1: Electrical Testing Equipment

4.1.1 Identify the use of Category I through Category IV meters.
4.1.2 Use an ohmmeter and measure any resistance in electrical equipment or conductor.
4.1.3 Measure voltage between phases and phase to ground.
4.1.4 Take an ampere reading of any load.
4.1.5 Diagram the proper connection of a watt meter.
4.1.6 State the operation characteristics of analog and digital meters.
4.1.7 Recognize the wave form on an oscilloscope.

Performance Standard 4.2: Bending Conduit

4.2.1 Identify the parts of tools used for bending.
4.2.2 Identify the methods and tools used in bending raceways.
4.2.3 Define and identify saddle, offset, concentric, and 90-degree bends.

CONTENT STANDARD 5.0: INTRODUCTION TO THE NATIONAL ELECTRICAL CODE (NEC)

Performance Standard 5.1: NEC Articles 90, 100, and 110

5.1.1 Understand how the NEC began and its purpose.
5.1.2 Understand how changes to the code evolve.
5.1.3 Understand the terminology, and format of the NEC.
5.1.4 State the roles of nationally recognized testing laboratories, the National Electrical Manufactures Association, and the National Fire Protection Association.
5.1.5 Accurately evaluate a location as accessible, readily accessible, or not readily accessible.
5.1.6 Identify equipment classified as appliances.
5.1.7 State the four categories of branch circuits.
5.1.8 State the difference between a continuous load and a non-continuous load.
5.1.9 Determine minimum vertical clearances for each installation using the NEC.
5.1.10 Apply dedicated space requirements to electrical equipment to include the area that is to be clear of foreign systems unless protection is provided.

5.1.11 Determine the working clearances of any installation using the NEC.
5.1.12 State the difference between a branch circuit and a feeder.
5.1.13 State the difference between "grounded" and "grounding" as it applies to a conductor.
5.1.14 Define what "in sight" means in the NEC.
5.1.15 Give examples of damp, wet, and dry locations using the code book.
5.1.16 Determine which conductors are the neutral conductors.
5.1.17 Define a separately derived system using the NEC.

Performance Standard 5.2: Boxes and Enclosures--NEC Articles 312, 314, and other Appropriate NEC Sections

5.2.1 Determine the cubic inch capacity of boxes when installing conductors # 6 AWG and smaller.
5.2.2 State which items use volume allowances of conductor fill when calculating box fill.
5.2.3 State how identical switches or receptacles can be mounted side by side, in a two gang box, can have different cubic inch volume allowances.
5.2.4 Determine the box size when the number of conductors is known.
5.2.5 Know the minimum conductor length to be left inside a box.
5.2.6 Explain what must be accessible after installation.
5.2.7 State the mounting and supporting provisions for boxes and conduit bodies using the NEC.
5.2.8 Determine the type of box needed for various applications using the NEC.
5.2.9 Calculate for junction box sizing containing #4 AWG and larger conductors using the NEC

Performance Standard 5.3: Cables--NEC Articles 320 through 340, and other appropriate NEC sections

5.3.1 State the distance from the edge of the wood framing member a cable can be installed unless a steel plate is installed.
5.3.2 State the requirements for protection of cable in metal framing using the NEC.
5.3.3 State the sealing requirements in fire-resistant-rated construction when electrical penetrations are made.
5.3.4 Identify what cables are permitted in spaces used for environmental air.
5.3.5 Determine the support requirements for MC, AC, and nonmetallic-sheathed cable using the NEC.
5.3.6 Identify the conductors in a cable and use the NEC to state how certain conductors can be re-identified.
5.3.7 Determine underground installation provisions per the NEC.
5.3.8 Identify special application cables using the NEC (This is not to be for installation requirements as this is for first year students).

Performance Standard 5.4: Raceways and Conductors--NEC Sections 11.14, 240.4, 300.19; NEC Articles 310, 342 through 378; Chapter 9 Tables; Annex C, and other appropriate NEC Sections

5.4.1 Determine the general provisions for any raceway installation using the NEC.
5.4.2 Determine the type of raceways suited for individual installations.
5.4.3 Determine the support requirements for various raceways using the NEC.
5.4.4 Determine the provisions for nonmetallic and metallic flexible conduit using the NEC.
5.4.5 Calculate the electrical trade size conduit required for any circuit or feeder.
5.4.6 Determine basic conductor properties using the NEC.
5.4.7 Show conductor temperature limitations.
5.4.8 Determine the provisions for conductors connected in parallel.
5.4.9 Apply conductor ampacity correction factors to include continuous loads.

Performance Standard 5.5: General Provisions for One-Family Dwellings--NEC Articles 210, 220, 240, 250, 315, 402, 404, 406, 410, 422, and other appropriate NEC Sections

5.5.1 Calculate the minimum number of 15 and 20 amp branch circuits in a one-family dwelling.
5.5.2 Determine the requirements for single receptacles on individual branch circuits.
5.5.3 Determine the branch-circuit ratings allowed for general-purpose receptacles.
5.5.4 Demonstrate the layout of general-purpose receptacles in a dwelling.
5.5.5 Determine the receptacle rating allowed on various size branch circuits using the NEC.
5.5.6 Determine the requirements for receptacles around sink areas using the NEC.
5.5.7 Determine the requirements for lighting and switching using the NEC.
5.5.8 Determine how and when to use the white conductor as an ungrounded conductor.
5.5.9 Determine any general requirement for boxes using the NEC.
5.5.10 Determine any illumination requirement for entrances and exits.
5.5.11 Determine the allowable use of vegetation such as trees for the mounting of outlets.

Performance Standard 5.6: Specific Provisions for One-Family Dwellings--NEC Articles 210, 410, 422, and other appropriate NEC sections

5.6.1 Determine the required ampere rating for any receptacle or branch circuit in kitchens, pantries, dining rooms, breakfast rooms, and similar locations.
5.6.2 Determine the requirements for countertop receptacle placement using the NEC.
5.6.3 State the minimum number of small appliance branch circuits required and their application.
5.6.4 Determine the requirements for appliances both cord and plug and permanently connected.
5.6.5 Calculate the load requirements for appliance branch circuits.
5.6.6 State the specific provisions for GFCI placement.
5.6.7 Identify luminaries permitted in closets and its placement.
5.6.8 Define a bathroom by the NEC and discuss the circuit requirements for receptacles, lights and fans.
5.6.9 Determine the requirements for receptacles and lighting in attached garages, detached

garages, and basements.

5.6.10 Determine the requirements for laundry rooms to include the clothes dryer.

5.6.11 Determine the lighting and receptacle requirements for attic, crawl space, and HVAC equipment.

Performance Standard 5.7: Load Calculations for One-Family Dwellings--NEC Articles, 210, 220, 230, 250, 310, and other appropriate NEC sections

5.7.1 Calculate the general lighting for a one-family dwelling.

5.7.2 Specify the volt-amp requirements for small appliance and laundry branch circuits.

5.7.3 Apply demand factors to the general lighting load.

5.7.4 Apply demand factors to fastened-in-place appliances.

5.7.5 Calculate feeder demand loads for household clothes dryers.

5.7.6 Calculate feeder demand loads for household cooking equipment.

5.7.7 Calculate feeder demand loads for HVAC equipment.

5.7.8 Calculate a one-family dwelling or feeder using the standard method.

5.7.9 Calculate a one-family dwelling or feeder using the optional method.

5.7.10 Calculate service and feeder conductors.

5.7.11 Calculate the minimum size neutral conductor.

5.7.12 Select the proper grounding electrode conductor.

Performance Standard 5.8: Services and Electrical Equipment for One-Family Dwellings--NEC Articles 110, 225, 230, 240, 250, 300, 310, and other appropriate NEC sections

5.8.1 Determine adequate strength for a mast supporting service-drop conductors.

5.8.2 Explain the use of service-entrance cable.

5.8.3 Define a service lateral and underground service conductors, and explain their provisions.

5.8.4 Determine clearances for service and outside overhead wiring.

5.8.5 Determine work space required for electrical equipment, services, and panels.

5.8.6 Define a panelboard, an enclosure, and a cutout box.

5.8.7 Determine the proper application and use of circuit breakers and fuses using the NEC.

5.8.8 Determine the appropriate conductor sizing using 310.15(B)(7) or Table 310.15 (B)(16).

5.8.9 Size the grounding electrode conductor, equipment grounding conductor, main bonding jumper, bonding jumpers on the supply side or load side of the main breaker or fuse on any one-family dwelling service.

5.8.10 Properly install grounded and grounding conductors in subpanels.

5.8.11 Prevent objectionable current flow in grounding conductors and equipment.

5.8.12 Properly install a panelboard in a separate building or structure.

Performance Standard 5.9: Comprehensive Provisions for Multi-Family Dwellings--NEC Articles 210, 230, 240, 250, 310, Chapter 9, Tables 8 and 9, and other appropriate NEC sections

5.9.1 Determine when more than one service can be installed on a multifamily building.
5.9.2 Determine the proper number of disconnects allowed on a service.
5.9.3 Determine proper access to a unit's disconnecting means by any occupant.
5.9.4 Properly install the grounding electrode conductors to the grounding electrode.
5.9.5 Determine the appropriate service or feeder conductor sizing using 310.15(B)(7) or Table 310.15 (B)(16) Determine outdoor receptacle placement.
5.9.6 Calculate voltage-drop.

Performance Standard 5.10: General Provisions for Commercial Locations--NEC Articles 210, 220, 310, 410, 430, 440, 600, and other appropriate NEC sections

5.10.1 Compare receptacle placement with that of one-family dwellings to show the difference.
5.10.2 Determine the receptacle requirements in a commercial bathroom.
5.10.3 Determine the sign outlet requirements in a commercial installation.
5.10.4 Determine the branch circuit requirements for motors and HVAC equipment.
5.10.5 Determine the volt-amp ratings for receptacles (single, duplex, quad, etc.).
5.10.6 Determine the maximum number of receptacles permitted on a 15 amp or 20 amp circuit.
5.10.7 Identify the NEC accessibility requirements for receptacles in guest rooms of hotels and motels.
5.10.8 Determine NEC requirements for showcase and show window.
5.10.9 Calculate general lighting load based on square-foot area.
5.10.10 Determine the provisions for fluorescent, HID, recessed, LED, and track lighting provisions.
5.10.11 Determine the proper use and restrictions when using luminaires as raceways.
5.10.12 Determine handhole access requirements.

Performance Standard 5.11: Provisions for Services, Feeders, and Provisions for Commercial Locations--NEC Articles 110, 215, 230, 250, 368, 408, and other appropriate NEC sections

5.11.1 Properly install both grounding and grounded conductors on the line side and load side of the service supply conductors.
5.11.2 Determine the conditions that require ground-fault protection of equipment.
5.11.3 Recognize separately derived systems.
5.11.4 Explain how to properly ground and bond separately derived systems.
5.11.5 Recognize and explain the use of busways.

CONTENT STANDARD 6.0: SPECIAL OCCUPANCIES

Performance Standards 6.1: Hazardous Locations--NEC Articles 500 through 516

6.1.1 Explain what a hazardous location is.
6.1.2 Determine if a classified location is Class I, II or III and if it is Division 1 or 2 using the NEC.
6.1.3 Identify the NEC requirements pertaining to commercial garages and repair and storage facilities.

6.1.4 Identify the NEC requirements for buildings in which aircraft are stored and repaired.
6.1.5 Identify the NEC requirements for a motor fuel dispensing facility.

Performance Standards 6.2: Health Care--NEC Articles 500 through 517

6.2.1 Identify basic health care terminology used in NEC.
6.2.2 Determine the grounding and bonding requirements of any health care facility.
6.2.3 Identify patient care areas as general care or critical care and their branch circuit requirements.
6.2.4 Determine the tamper-resistant requirements of pediatric facilities.
6.2.5 Define the types of essential systems.

Performance Standard 6.3: Other Special Occupancies--NEC Articles 518 through 551

6.3.1 Define “places of assembly” according to the NEC.
6.3.2 Determine manufactured building requirements.
6.3.3 Determine agricultural building requirements.
6.3.4 Determine requirements for mobile home parks and recreational vehicle parks.