Arkansas CTE

Mechanical Plumbing and Electrical: Grades 9, 10, 11, 12

Adopted 2015

Demonstrate an understanding of general and craft specific safety.

1.1 Demonstrate an understanding of general safety procedures.

1. Recognize safe working practices in the construction environment. 1.1.1
2. Explain safety issues concerning lockout/tagout procedures for energy sources, confined space entry, respiratory protection. 1.1.2
3. Describe how to handle unsafe acts and unsafe conditions. 1.1.3
4. Demonstrate the use and care of appropriate personal protective equipment. 1.1.4

1.2 Demonstrate an understanding of electrical and HVAC safety.

1. Explain the purpose of OSHA and how it promotes safety on the job. 1.2.1
2. Identify electrical hazards and how to avoid or minimize them in the workplace. 1.2.2
3. Develop a task plan and a hazard assessment for a given task and identify the benefits of a job safety analysis. 1.2.3
4. Describe the importance of LEED construction and energy management. 1.2.4
5. Present information regarding refrigerants and the environment. 1.2.5

1.3 Demonstrate an understanding of plumbing safety.

1. Describe the common unsafe acts and unsafe conditions that cause accidents and identify job-site hazardous work specific to plumbers. 1.3.1
2. Explain how to work safely in and around a trench and around confined spaces. 1.3.2
3. Explain how the cost of accidents and illnesses affects everyone on site. 1.3.3
4. Identify how green technology is incorporated into plumbing. 1.3.4
5. Identify the hazards and safety precautions associated with plastic pipe and copper tubing. 1.3.5

Identify various requirements and career opportunities.

2.1 Locate and research career opportunities as an electrician.

1. Describe the general aptitudes, values and behaviors necessary/expected in the electrical trades industry. 2.1.1
2. Describe the apprenticeship/training process for electricians. 2.1.2
3. Describe various career paths/opportunities one might follow in the electrical trade. 2.1.3
4. Define the various sectors of the electrical industry. 2.1.4
5. State the tasks typically performed by an electrician. 2.1.5
6. Design a career ladder for an electrician from coursework and apprenticeship to project manager 2.1.6

2.2 Locate and research career opportunities as a journeyman and master plumber.

1. Identify the responsibilities of a person working in the plumbing industry. 2.2.1
2. State the personal characteristics of a professional plumber. 2.2.2
3. Identify the stages of progress within the plumbing profession and its positive impact on society. 2.2.3

2.3 Demonstrate an understanding of a career as heating ventilation and air-conditioning technician.

1. Emphasize the important role of the HVAC technician in maintaining indoor air quality and energy efficiency. 2.3.1
2. Identify the responsibilities and characteristics needed to be a successful HVAC technician. 2.3.2
3. Identify career paths available in the HVAC trade career opportunities. 2.3.3

Demonstrate knowledge of specific craft tools and fundamentals.

3.1 Demonstrate the operations of and describe the pieces of electrical test equipment.

1. Identify and explain the test equipment tools. 3.1.1
2. Select the appropriate meter for a given work environment based on category ratings. 3.1.2
3. Identify the safety hazards associated with the various types of test equipment. 3.1.3

3.2 Demonstrate knowledge of specific craft tools and fundamentals in the plumbing craft.

1. Identify the basic hand and power tools used in the plumbing trade. 3.2.1
2. Demonstrate proper maintenance and storage for hand and power tools. 3.2.2
3. Describe the safety requirements for using power and hand tools common to the plumbing trade. 3.2.3

3.3 Demonstrate an understanding of the basic principles of heating, ventilation, and air conditioning.

1. Explain the principles of heating. 3.3.1
2. Explain the principles of ventilation. 3.3.2
3. Explain the principles of air conditioning. 3.3.3

Demonstrate knowledge of basic math principles.

4.1 Demonstrate an understanding of basic math principles.

1. Identify the functions of a construction trade calculator. 4.1.1
2. Add, subtract, multiply, and divide whole numbers, fractions and decimals. 4.1.2
3. Convert decimals to percentages and percentages to decimals. Convert fractions to decimals and decimals to fractions. 4.1.3
4. Identify units of measurement between the USA the metric measuring systems. 4.1.4
5. Convert, length, area, volume and weight values. 4.1.5
6. Convert pressure and temperature values. 4.1.6
7. Identify the parts of a fitting and use common pipe-measuring techniques. Calculate end-to-end measurements using fitting allowances and thread makeup. 4.1.7

4.2 Perform basic conduit and pipe bends.

1. Demonstrate the ability to precisely cut and bend electrical conduit for the appropriate length and angle. 4.2.1
2. Demonstrate the ability to precisely cut and bend copper and plastics plumbing pipe. 4.2.2

4.3 Calculate electrical measurements

1. Define voltage and identify the ways in which it can be produced. 4.3.1
2. Define the units of measurement that are used to measure the properties of electricity. 4.3.2
3. Identify the meters used to measure voltage, current, and resistance. 4.3.3

Demonstrate a knowledge of the basic principles of electrical and HVAC systems.

5.1 Describe the fundamentals of electricity.

1. State how electrical power is created and distributed. 5.1.1
2. Demonstrate safe electrical wiring stripping and connecting to breakers, switches and receptacles. 5.1.2
3. Describe the difference between alternating current and direct current. 5.1.3

5.2 Understand and explain basic electrical theory and circuitry.

1. Define voltage, current, resistance, and power and describe how they are related. 5.2.1
2. Explain the basic characteristics of combination circuits. 5.2.2
3. Calculate, using Kirchhoff's voltage law, the voltage drop in series, parallel, and series-parallel circuits. And calculate, using Kirchhoff's current law, the total current in parallel and series-parallel circuits. 5.2.3
4. Use Ohm's law to calculate the current, voltage, and resistance in a circuit. And using Ohm's law, find the unknown parameters in series, parallel, and series-parallel circuits. 5.2.4
5. Describe the differences between series and parallel circuits and calculate circuit loads for each type. 5.2.5
6. Demonstrate and explain the usage of various gauges of wire and typical uses. 5.2.6

5.3 Demonstrate the ability to read and follow basic electrical schematic diagrams.

1. Read and interpret schematic circuit diagrams. 5.3.1
2. Design simple AC/DC diagrams to demonstrate current paths, switches resistance and breakers. 5.3.2

5.4 Identify the electrical instruments and describe their uses.

1. Identify HVAC measuring instruments 5.4.1
2. Identify electrical components used in HVAC systems and describe their functions. 5.4.2
3. Identify and describe various load devices and explain how they are represented on circuit diagrams. 5.4.3
4. Identify and describe various control devices and explain how they are represented on circuit diagrams. 5.4.4
5. Identify and describe the types of electrical diagrams used in HVAC work. 5.4.5

Demonstrate knowledge of the basic materials, equipment and supplies used in electrical, plumbing and HVAC systems.

6.1 Demonstrate knowledge of the basic materials used in electrical.

1. Explain the role of the National Electrical Code® in residential wiring and describe how to determine electric service requirements for dwellings. 6.1.1
2. Explain the grounding requirements of a residential electric service. 6.1.2
3. Calculate and select service-entrance equipment. 6.1.3
4. Select the proper wiring methods for various types of residences. 6.1.4
5. Compute branch circuit loads and explain their installation requirements. 6.1.5
6. Explain the types and purposes of equipment grounding conductors. 6.1.6
7. Explain the purpose of ground fault circuit interrupters and tell where they must be installed. 6.1.7
8. Size outlet boxes and select the proper type for different wiring methods. 6.1.8
9. Describe the installation rules for electrical systems around swimming pools, spas, and hot tubs. 6.1.9
10. Explain how wiring devices are selected and installed. 6.1.10
11. Describe the installation and control of lighting fixtures. 6.1.11

6.2 Demonstrate understanding of the basic materials used in fresh water plumbing.

1. Identify the various types of plastic pipe. 6.2.1
2. Identify the material properties, storage, and handling requirements of plastic pipe. 6.2.2
3. Identify the types of fittings and valves used with plastic pipe 6.2.3
4. Identify the techniques used in hanging and supporting plastic pipe. 6.2.4
5. Identify the various types of copper tube. 6.2.5
6. Identify the material properties, storage, and handling requirements of copper pipe. 6.2.6
7. Identify the types of fittings and valves used with copper tube. 6.2.7
8. Demonstrate the techniques used in hanging and supporting copper tubing. 6.2.8

6.3 Demonstrate a workable knowledge of drain, waste and sewage vent systems.

1. Explain how waste moves from a fixture through the drainage system to the environment. 6.3.1
2. Identify and explain the purpose of drainage traps and vent stacks. 6.3.2
3. Identify and explain health issues, code violations and consequences of improper sewage and waste systems. 6.3.3

6.4 Demonstrate a workable knowledge of home heating and air conditioning systems.

1. Demonstrate the ability and uses of solder and solder fluxes. 6.4.1
2. Identify the major components of a cooling system and explain how each type works. 6.4.2
3. Explain how heat transfer occurs in a cooling system, demonstrating an understanding of the concepts used in the refrigeration cycle. 6.4.3