

2022 HEATING, VENTILATION, AND AIR CONDITIONING

Program Standards

CONTENT STANDARD 1.0: DEMONSTRATE HVAC CAREER BASICS

Performance Standard 1.1: Identify HVAC-Related Career Pathways and Regulations

- 1.1.1 Identify and maintain licensing (refrigeration), registration, certification, and industry credentialing requirements (e.g., IDAPA rules, EPA regulations, OSHA, L&I).
- 1.1.2 Research postsecondary apprenticeship program opportunities and requirements.
- 1.1.3 Identify residential, commercial, and industrial career opportunities.
- 1.1.4 Identify the roles of other trades represented on the jobsite.
- 1.1.5 Describe opportunities provided by equipment manufacturers.

CONTENT STANDARD 2.0: PRACTICE JOBSITE AND TOOL SAFETY

Performance Standard 2.1: Practice Jobsite Safety

- 2.1.1 Identify personal protective equipment (PPE) requirements.
- 2.1.2 Demonstrate proper material handling (e.g., sheet metal), storage, use, and disposal.
- 2.1.3 Demonstrate precautions for ladder safety.
- 2.1.4 Describe stairway and scaffold hazards and precautions.
- 2.1.5 Describe jobsite energy hazards and proper lockout/tagout procedures.
- 2.1.6 Describe refrigerant and pressure vessel storage.
- 2.1.7 Describe the importance of safety procedures for brazing and soldering.
- 2.1.8 Identify the location and the types of fire extinguishers and other fire equipment.
- 2.1.9 Demonstrate procedures for using fire extinguishers and other fire safety equipment.
- 2.1.10 Describe the effects of electrical shock on the human body.
- 2.1.11 Explain how to verify that circuits are de-energized.
- 2.1.12 Earn the OSHA-10 card (Construction).
- 2.1.13 Earn the basic EPA 608 certificate.

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 Demonstrate use of refrigerant handling equipment.
- 2.2.5 Demonstrate use and storage of oxy-acetylene torches and tanks.

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 Use an ohmmeter to measure resistance in electrical equipment or conductors.
- 2.3.5 Measure voltage between phases and phase-to-ground.
- 2.3.6 Measure voltage across open and closed switch contacts.
- 2.3.7 Measure amperage reading of various residential loads (e.g., microwave, toaster, curling iron, incandescent versus LED light, desktop computer).

Performance Standard 2.4: Braze and Solder Tubing and Piping

- 2.4.1 Identify the purpose of the piping, tubing, and fittings used in the heating, air-conditioning, and refrigeration industry.

- 2.4.2 Identify appropriate brazing and soldering alloys and materials.
- 2.4.3 Explain the purposes and procedures for protecting piping materials and fabrication products, such as valves and fittings, from heat.
- 2.4.4 Perform brazing operations.
- 2.4.5 Perform soldering operations.
- 2.4.6 Describe proper use of piping and tubing fabrication tools (e.g., swaging, flaring).

CONTENT STANDARD 3.0: APPLY ACADEMIC FOUNDATIONS

Performance Standard 3.1: Apply Trade Mathematics

- 3.1.1 Identify industry standard units of measure.
- 3.1.2 Convert units of measure.
- 3.1.3 Measure and calculate size, area, volume, temperature, and pressure.
- 3.1.4 Convert between fractions and decimals.
- 3.1.5 Identify measuring tools (i.e., tape measure) and how to use and read them.
- 3.1.6 Perform ratio, percentage, and proportion calculations.
- 3.1.7 Demonstrate the use of order of operations.

Performance Standard 3.2: Use Applied Science

- 3.2.1 Perform energy conversion calculations.
- 3.2.2 Perform sensible, latent, and total heat calculations.
- 3.2.3 Differentiate between saturated, superheated, and subcooled refrigerant.
- 3.2.4 Explain atmospheric, absolute, and gauge-pressure relationship.
- 3.2.5 Convert gauge pressure, absolute pressure, and vacuum.
- 3.2.6 Diagram a basic refrigeration cycle, identifying pressure, temperature, and state of refrigerant.
- 3.2.7 List the type and function of the four major refrigeration components.
- 3.2.8 Describe the methods of heat transfer.
- 3.2.9 Describe the three components of the combustion cycle (i.e., heat, fuel, oxygen).

Performance Standard 3.3: Apply Basic Electricity Fundamentals

- 3.3.1 Describe basic electrical theory.
- 3.3.2 Describe series, parallel, and combination circuit characteristics.
- 3.3.3 Apply Ohm's Law to basic electrical measurements.
- 3.3.4 Interpret basic HVAC electrical circuit diagrams.
- 3.3.5 Describe basic motor operations.

CONTENT STANDARD 4.0: INTERPRET BLUEPRINTS, DRAWING, AND DIAGRAMS

Performance Standard 4.1: Read Blueprints

- 4.1.1 Locate the information found in drawing blocks.
- 4.1.2 Identify the information found on different types of drawings.
- 4.1.3 Interpret common MEP (mechanical, electrical, plumbing) symbols.
- 4.1.4 Interpret schedules, block diagrams, and schematic diagrams.
- 4.1.5 Interpret drafting lines.
- 4.1.6 Measure components of plans, using an architect's scale.
- 4.1.7 Measure components of plans, using a metric scale.

CONTENT STANDARD 5.0: EXPLORE HVAC SYSTEMS

Performance Standard 5.1: Describe Basic Systems

- 5.1.1 Describe fossil-fuel and electrical furnace operations.
- 5.1.2 Describe the typical configuration of residential split air conditioning systems.
- 5.1.3 List various types of commercial air conditioning systems and their applications.
- 5.1.4 Describe the configuration of common duct systems.
- 5.1.5 Describe basic control strategies.

Performance Standard 5.2: Explore Energy Sources

- 5.2.1 Explain natural, liquefied petroleum (LP) gas, and fuel oil characteristics.
- 5.2.2 Describe the application of geothermal systems.

- 5.2.3 Describe the application of renewable energy systems.
- 5.2.4 Describe the application of electrical production and transmission systems.

Performance Standard 5.3: Explore Airflow Distribution

- 5.3.1 Describe basic air flow characteristics.
- 5.3.2 Explain duct-system pressures.
- 5.3.3 Lay out basic fittings (e.g., rectangular duct, transition, furnace base).
- 5.3.4 Fabricate basic fittings (e.g., rectangular duct, transition, furnace base).

Performance Standard 5.4: Practice Installation Techniques

- 5.4.1 Describe split and packaged air conditioning system installation, start-up, and checkout procedures.
- 5.4.2 Explain heat pump heating and cooling cycles.
- 5.4.3 Wire a low-voltage circuit (e.g., thermostat).
- 5.4.4 Wire a high-voltage circuit (e.g., supply power source to load).

IDCTE Document Control Information

Program Standard Revision:

Date	Standard #	Original	Summary of Change	Revised By	Approved By