

# Heating, Ventilation, and Air Conditioning

## Instructional Framework

An instructional framework provides educators with a list of benchmark statements aligned to Common Core and national content area standards for a given course or program. The Missouri HVAC Instructional Framework lists a sequence of content for heating, ventilation, and air conditioning, organized into distinct units of instruction with component evidence of mastery statements.

### HVAC Instructional Framework

Introductory Craft Skills	Common Core Standards
<b>Module 03102-07 - Trade Mathematics</b> This module explains how to solve problems involving the measurement of lines, area, volume, weights, angles, pressure, vacuum, and temperature. It also introduces scientific notation, powers, roots, and basic algebra and geometry.	
1. Identify similar units of measurement in both the inch-pound (English) and metric systems and state which units are larger.	A-CED 1, N-Q 1, N-Q 2, N-Q 3
2. Convert measured values in the inch-pound system to equivalent metric values and vice versa.	A-CED 2, A-CED 4, N-Q 1, N-Q 2, N-Q 3, F-LE 1b
3. Express numbers as powers of ten.	A-REI 1, N-Q 1, N-Q 2, N-Q 3
4. Determine the powers and roots of numbers.	A-REI 1, A-REI 2, A-REI 4, N-RN 2
5. Solve basic algebraic equations.	A-CED 1, A-REI 1, A-REI 2, A-REI 3
6. Identify various geometric figures.	G-CO 1, G-GMD 4
7. Use the Pythagorean theorem to make calculations involving right triangles.	G-SRT 8, G-SRT 9, A-CED 4, A-REI 2, A-REI 4
8. Convert decimal feet to feet and inches and vice versa.	N-Q 1
9. Calculate perimeter, area, and volume.	N-Q 1, N-Q 2, N-Q 3, G-C 2, G-GPE 7, G-GMD 3
10. Convert temperature values between Celsius and Fahrenheit.	N-Q 1, N-Q 3, A-CED 4

Introductory Craft Skills	Common Core Standards
<b>Module 03103-07 - Copper and Plastic Piping Practices</b> This module covers the selection, preparation, joining, and support of plastic and copper piping and fittings.	
1. State the precautions that must be taken when installing refrigerant piping.	S-IC 6
2. Select the right tubing for a job.	
3. Cut and bend copper tubing.	
4. Safely join tubing by using flare and compression fittings.	
5. Determine the kinds of hangers and supports needed for refrigerant piping.	
6. State the basic safety requirements for pressure-testing a system once it has been installed.	RST 11-12.3
7. Identify types of plastic pipe and state their uses.	
8. Cut and join lengths of plastic pipe.	
<b>Performance Tasks</b>	
1. Correctly measure the diameter of copper tubing.	N-Q 3
2. Cut and ream copper tubing using a tubing cutter.	
3. Correctly bend copper tubing using bending tools.	
4. Make a swage joint in a section of copper tubing.	
5. Make and join flare connections.	
6. Join two sections of tubing using a compression fitting.	
7. Cut and join two sections of plastic pipe using appropriate fittings.	
8. Identify correct types of copper pipe for given applications.	S-IC 6
9. Identify copper pipe sizes and wall thicknesses.	
<b>Module 03104-07 - Soldering and Brazing</b> This module covers the tools, materials, and safety precautions and depicts step-by-step procedures for soldering and brazing piping.	
1. Assemble and operate the tools used for soldering.	
2. Prepare tubing and fittings for soldering.	
3. Identify the purposes and uses of solder and solder fluxes.	S-ID 9, S-IC 6
4. Solder copper tubing and fittings.	
5. Assemble and operate the tools used for brazing.	
6. Preparing tubing and fittings for brazing.	
7. Identify the purposes and uses of filler metals and fluxes used for brazing.	S-ID 9, S-IC 6
8. Braze copper tubing and fittings.	
9. Identify the inert gases that can be used safely to purge tubing when brazing.	S-ID 9, S-IC 6, S-MD 7

Introductory Craft Skills	Common Core Standards
<b>Performance Tasks</b>	
1. For both soldering and brazing: <ul style="list-style-type: none"> <li>• Cut tubing to correct length.</li> <li>• Clean tubing and fittings.</li> <li>• Select and apply flux to tubing and fittings.</li> <li>• Assemble tubing and fittings.</li> </ul>	
2. For soldering: <ul style="list-style-type: none"> <li>• Assemble a propane torch.</li> <li>• Light and adjust a propane torch flame.</li> <li>• Select correct solder for the intended soldering job.</li> <li>• Heat joint to the right temperature and apply solder to fill a joint.</li> <li>• Clean and cool a soldered joint.</li> <li>—Solder a joint using butane.</li> <li>—Solder a joint using acetylene.</li> </ul>	
3. For brazing: <ul style="list-style-type: none"> <li>• Assemble an oxyacetylene torch, including selection of the proper size tip for the job.</li> <li>• Light and adjust an oxyacetylene torch flame.</li> <li>• Select correct filler metal rod for the intended brazing application.</li> <li>• After heating and brazing, clean and cool the brazed joint.</li> </ul>	
4. Assemble and operate a pressure regulator system used with an inert gas to purge tubing for brazing.	
5. Assemble a brass-to-copper joint.	
<b>Module 03106-07 - Basic Electricity</b> This module covers basic power generation and distribution, electrical components, DC circuits, and electrical safety.	
1. State how electrical power is distributed.	SL 11-12.1a
2. Describe how voltage, current, resistance, and power are related.	SL 11-12.1a, N-Q 1, N-Q 2, N-Q 3, A-CED 4
3. Use Ohm’s law to calculate the current, voltage, and resistance in a circuit.	A-CED 4
4. Use the power formula to calculate how much power is consumed by a circuit.	A-CED 4
5. Describe the difference between series and parallel circuits and calculate loads in each.	SL 11-12.1a, A-CED 1, A-CED 2, A-CED 3, A-CED 4
6. Describe the purpose and operation of the various electrical components used in HVAC equipment.	SL 11-12.1a
7. State and demonstrate the safety precautions that must be followed when working on electrical equipment.	SL 11-12.1a, S-ID 9, S-IC 6
8. Make voltage, current, and resistance measurements using electrical test equipment.	N-Q 1, N-Q 2, N-Q 3
9. Read and interpret common electrical symbols.	RST 11-12.1, G-GMD 4

Introductory Craft Skills	Common Core Standards
<b>Performance Tasks</b>	
1. Use a multimeter to measure voltage.	N-Q 1, N-Q 2, N-Q 3
2. Use a multimeter to measure current.	N-Q 1, N-Q 2, N-Q 3
3. Use a multimeter to measure resistance.	N-Q 1, N-Q 2, N-Q 3
4. Use a multimeter to check circuit continuity.	N-Q 1, N-Q 2, N-Q 3
5. Assemble and test series and parallel circuits using a battery, wires, and selected load devices.	G-GPE 6, G-GMD 4, G-MG 2, G-MG 3
<b>Module 03107-07 - Introduction To Cooling</b> This module covers the basic principles of heat transfer, refrigeration, and pressure-temperature relationships and describes the components and accessories used in air conditioned systems.	
1. Explain how heat transfer occurs in a cooling system, demonstrating an understanding of the terms and concepts used in the refrigeration cycle.	A-CED 1, A-CED 2, SL 11-12.1a
2. Calculate the temperature and pressure relationships at key points in the refrigeration cycle.	A-CED 1, A-CED 2, F-IF 4, F-IF 5, F-IF 6, N-Q 1
3. Under supervision, use temperature- and pressure-measuring instruments to make readings at key points in the refrigeration cycle.	A-CED 1, A-CED 2, N-Q 1, N-Q 2, N-Q 3
4. Identify commonly used refrigerants and demonstrate the proper procedures for handling these refrigerants.	S-ID 9, S-IC 6
5. Identify the major components of a cooling system and explain how each type works.	S-ID 9, S-IC 6
6. Identify the major accessories available for cooling systems and explain how each works.	S-ID 9, S-IC 6
7. Identify the control devices used in cooling systems and explain how each works.	S-ID 9, S-IC 6
8. State the correct methods to be used when piping a refrigeration system.	SL 11-12.1b
<b>Performance Tasks</b>	
1. Measure temperatures in an operating air conditioning system.	N-Q 3
2. Use cylinder color codes to identify refrigerants.	
3. Identify compressors, condensers, evaporators, metering devices, controls, and accessories.	
4. Use service valves to gain access to an air conditioning system in order to measure pressures using a gauge manifold set.	N-Q 3

Introductory Craft Skills	Common Core Standards
<b>Module 03108-07 - Introduction To Heating</b> This module covers heating fundamentals, types and designs of furnaces and their components, and basic procedures for installing and servicing furnaces.	
1. Explain the three methods by which heat is transferred and give an example of each.	SL 11-12.1c
2. Describe how combustion occurs and identify the byproducts of combustion.	SL 11-12.1c
3. Identify various types of fuels used in heating.	
4. Identify the major components and accessories of an induced draft and condensing gas furnace and explain the function of each component.	S-ID 9, S-IC 6
5. State the factors that must be considered when installing a furnace.	SL 11-12.1c, S-ID 9, S-IC 6
6. Identify the major components of a gas furnace and describe how each works.	SL 11-12.1c
7. With supervision, use a manometer to measure and adjust manifold pressure on a gas furnace.	N-Q 1, N-Q 2, N-Q 3
8. Describe how an electric furnace works.	RST 11-12.3
9. With supervision, perform basic furnace preventive maintenance procedures such as cleaning and filter replacement.	
<b>Performance Tasks</b>	
1. Identify the components of an induced draft and condensing gas furnace and state their purpose.	S-ID 9, S-IC 6
2. With supervision, turn on and check a gas furnace.	S-MD 7
3. Identify symptoms of combustion problems in a gas furnace and adjust the manifold pressure.	S-ID 9, S-IC 6, S-MD 7
4. With supervision, perform preventive maintenance procedures on a gas furnace, including filter replacement, cleaning of components, and temperature measurements.	N-Q 2, N-Q 3, S-ID 9, S-IC 6, S-MD 7

Introductory Craft Skills	Common Core Standards
<b>Module 03202-07 - Chimneys, Vents, and Flues</b> This module covers proper venting of fossil-fuel furnaces and the procedures for selecting and installing vents in all types of gas furnaces.	
1. Describe the principles of combustion and explain complete and incomplete combustion.	RST 11-12.1, S-ID 9, S-IC 6, S-MD 7
2. Describe the content of flue gas and explain how it is vented.	RST 11-12.1
3. Identify the components of a furnace vent system.	
4. Describe how to select and install a vent system.	RST 11-12.7, S-ID 9, S-IC 6, S-MD 7
5. Perform the adjustments necessary to achieve proper combustion in a gas furnace.	S-ID 9, S-IC 6, S-MD 7, N-Q 1, N-Q 2, N-Q 3
6. Describe the techniques for venting different types of furnaces.	RST 11-12.7
7. Explain the various draft control devices used with natural-draft furnaces.	RST 11-12.7
8. Calculate the size of a vent required for a given application.	S-ID 9, S-IC 6, S-MD 7, G-GPE 7, G-GMD 3, G-GMD 4, G-MG 1, G-MG 2, G-MG 3, A-CED 3, A-CED 4, A-REI 1
9. Adjust a thermostat heat anticipator.	
<b>Performance Tasks</b>	
1. Measure supply and return temperature and determine the temperature rise of a furnace.	A-CED.1, N-Q 1, N-Q 2, N-Q 3
2. Adjust a thermostat heat anticipator.	
3. Calculate the correct size and type of PVC pipe using manufacturer's instructions or <i>National Fuel Gas Code</i> or American Gas Association specifications.	S-ID 9, S-IC 6, S-MD 7, G-GPE 7, G-GMD 3, G-GMD 4, G-MG 1, G-MG 2, G-MG 3, A-CED 3, A-CED 4, A-REI 1
4. Calculate the correct size and type of furnace vent connector and metal vent using manufacturer's instructions or <i>National Fuel Gas Code</i> or American Gas Association specifications.	S-ID 9, S-IC 6, S-MD 7, G-GPE 7, G-GMD 3, G-GMD 4, G-MG 1, G-MG 2, G-MG 3, A-CED 3, A-CED 4, A-REI 1

Introductory Craft Skills	Common Core Standards
<b>Module 03205-07 - Leak Detection, Evacuation, Recovery, and Charging</b> This module introduces the trainee to the leak detection, evacuation, recovery, and charging service procedures used to troubleshoot, repair, and/or maintain proper operation of the mechanical refrigeration systems.	
1. Identify the common types of leak detectors and explain how each is used.	S-ID 9, S-IC 6, S-MD 7
2. Perform leak detection tests using selected methods.	S-ID 9, S-IC 6, S-MD 7
3. Identify the service equipment used for evacuating a system and explain why each item of equipment is used.	S-ID 9, S-IC 6, S-MD 7
4. Perform system evacuation and dehydration.	
5. Identify the service equipment used for recovering refrigerant from a system and for recycling the recovered refrigerant, and explain why each item of equipment is used.	
6. Perform a refrigerant recovery.	
7. Evacuate a system to a deep vacuum.	
8. Identify the service equipment used for charging refrigerant into a system, and explain why each item of equipment is used.	RST 11-12.7
9. Use nitrogen to purge a system.	
10. Charge refrigerant into a system by the following methods: <ul style="list-style-type: none"> <li>• Weight</li> <li>• Subcooling</li> <li>• Superheat</li> <li>• Charging pressure chart</li> </ul>	F-LE 1b N-Q 1, N-Q 2, N-Q 3  F-IF 4, F-IF 5, F-IF 6
<b>Performance Tasks</b>	
1. Identify the common types of leak detectors and explain the advantages and disadvantages associated with each type.	RST 11-12.3
2. Use selected electronic, ultrasonic, liquid (bubble), and ultraviolet/fluorescent leak detectors to leak test a pressurized operational system.	
3. Under supervision, use a recovery and/or recovery/recycle unit to recover the refrigerant from a system.	
4. Under supervision, use a mixture of nitrogen and a trace amount of HCFC-22 refrigerant to pressurize a refrigerant system in preparation for leak testing.	
5. Under supervision, demonstrate and/or describe how to evacuate a system using the deep vacuum method.	RI 11-12.7
6. Perform a vacuum leak test on an evacuated system.	
7. Under supervision, demonstrate how to evacuate a system using the triple evacuation method.	
8. Under supervision, demonstrate how to use dry nitrogen as the moisture-absorbing gas when triple evacuating a system.	
9. Under supervision, demonstrate how to charge a system by weight.	

Introductory Craft Skills	Common Core Standards
10. Under supervision, demonstrate how to charge a system using the superheat method.	
11. Under supervision, demonstrate how to charge a system using the subcooling method.	
12. Under supervision, demonstrate how to charge a system using the charging pressure charts method.	
<b>Module 03206-07 - Alternating Current</b> This module introduces the trainee to the production, transmission, and uses of alternating current in the HVAC field.	
1. Describe the operation of various types of transformers.	RST 11-12.3
2. Explain how alternating current is developed and draw a sine wave.	RST 11-12.3, F-TF 5
3. Identify single-phase and three-phase wiring arrangements.	G-MG 1
4. Explain how phase shift occurs in inductors and capacitors.	RST 11-12.3
5. Describe the types of capacitors and their applications.	RST 11-12.3
6. Explain the operation of single-phase and three-phase induction motors.	RST 11-12.3
7. Identify the various types of single-phase motors and their applications.	
8. State and demonstrate the safety precautions that must be followed when working with electrical equipment.	RST 11-12.3, S-ID 9, S-IC 6, S-MD 7
9. Test AC components, including capacitors, transformers, and motors.	
<b>Performance Tasks</b>	
1. Identify the components used in a given AC circuit and explain their functions.	RST 11-12.3
2. Identify types of single-phase and three-phase power distribution systems from electrical circuit diagrams.	G-GMD 4, G-MG 1
3. Following applicable safety practices, test AC components, including transformers, capacitors, and motor windings.	S-ID 9, S-IC 6, S-MD 7
4. Identify various types of AC motors from schematic diagrams.	G-GMD 4, G-MG 1
<b>Module 03208-07 - Introduction To Control Circuit Troubleshooting</b> This module covers the various types of thermostats used in HVAC systems. It also covers hydronic, pneumatic, and digital controls and introduces the trainee to control circuit analysis and troubleshooting.	
1. Explain the function of a thermostat in an HVAC system.	SL 11-12.1c
2. Describe different types of thermostats and explain how they are used.	SL 11-12.1c
3. Demonstrate the correct installation and adjustment of a thermostat.	
4. Explain the basic principles applicable to all control systems.	SL 11-12.1c
5. Identify the various types of electromechanical, electronic, and pneumatic HVAC controls, and explain their function and operation.	



Introductory Craft Skills	Common Core Standards
6. Describe a systematic approach for electrical troubleshooting of HVAC equipment and components.	RST11-12.3, S-ID 9, S-IC 6, S-MD 7
7. Recognize and use equipment manufacturer's troubleshooting aids to troubleshoot HVAC equipment.	S-ID 9, S-IC 6, S-MD 7
8. Demonstrate how to isolate electrical problems to faulty power distribution, load, or control circuits.	S-ID 9, S-IC 6, S-MD 7
9. Identify the service instruments needed to troubleshoot HVAC electrical equipment.	
10. Make electrical troubleshooting checks and measurements on circuits and components common to all HVAC equipment.	N-Q 1, N-Q2, N-Q 3
11. Isolate and correct malfunctions in a cooling system control circuit.	S-ID 9, S-IC 6, S-MD 7
<b>Performance Tasks</b>	
1. Identify various types of thermostats and explain their operation and uses.	SL 11-12.1c
2. Install a conventional 24V bimetal thermostat and hook it up using the standard coding system for thermostat wiring.	
3. Check and adjust a thermostat, including heat anticipator setting and indicator adjustment.	
4. Program an electronic programmable thermostat.	
5. Identify electrical, electronic, and pneumatic components and circuits, recognize their diagram symbols, and explain their functions.	G-GMD 4, G-MG 1
6. Interpret control circuit diagrams.	G-GMD 4, G-MG 1
7. Perform electrical tests and troubleshooting as follows: <ul style="list-style-type: none"> <li>• Single- and three-phase input voltage measurements</li> <li>• Fuse and circuit breaker checks</li> <li>• Resistive and inductive load checks</li> <li>• Switch and contactor/relay checks</li> <li>• Control transformer checks</li> </ul>	N-Q 1, N-Q 2, N-Q 3, S-ID 9, S-IC 6, S-MD 7
8. Perform electrical tests and troubleshooting of compressor and fan motors as follows: <ul style="list-style-type: none"> <li>• Start and run capacitor checks</li> <li>• Start relay and start thermistor checks</li> <li>• Open, shorted, and grounded winding check</li> </ul>	S-ID 9, S-IC 6, S-MD 7
<b>Module 03209-07 - Troubleshooting Gas Heating</b> This module introduces the trainee to the procedures for recognizing, analyzing, and repairing malfunctions in gas heating equipment.	
1. Describe the basic operating sequence for gas heating equipment.	RST 11-12.3
2. Interpret control circuit diagrams for gas heating systems.	G-GMD 4, G-MG 1
3. Describe the operation of various types of burner ignition methods.	RST 11-12.3
4. Identify the tools and instruments used when troubleshooting gas heating systems.	
5. Demonstrate using the tools and instruments required for troubleshooting gas heating systems.	
6. Isolate and correct malfunctions in gas heating systems.	S-ID 9, S-IC 6, S-MD 7

Introductory Craft Skills	Common Core Standards
<b>Performance Tasks</b>	
1. Develop a checklist for troubleshooting a gas heating appliance.	F-IF 1, F-IF 3, F-IF 4
2. Select the tools and instruments needed to troubleshoot a gas heating appliance in a given situation.	S-ID 9, S-IC 6, S-MD 7
3. Analyze control circuit diagram(s) for a selected gas heating appliance.	G-GMD 4, G-MG 1
4. Isolate and correct malfunctions in a gas heating appliance. <ul style="list-style-type: none"> <li>• Control circuits</li> <li>• Combustion system</li> <li>• Safety controls</li> <li>• Air system</li> </ul>	S-ID 9, S-IC 6, S-MD 7
<b>Module 03210-07 - Troubleshooting Cooling</b> This module covers the troubleshooting methods used with cooling systems.	
1. Describe a systematic approach for troubleshooting cooling systems and components.	RST 11-12.3
2. Isolate problems to electrical and/or mechanical functions in cooling systems.	S-ID 9, S-IC 6, S-MD 7
3. Recognize and use equipment manufacturer's troubleshooting aids to troubleshoot cooling systems.	S-ID 9, S-IC 6, S-MD 7
4. Identify and use the service instruments needed to troubleshoot cooling systems.	
5. Successfully troubleshoot selected problems in cooling equipment.	S-ID 9, S-IC 6, S-MD 7
6. State the safety precautions associated with cooling troubleshooting.	RST 11-12.8
<b>Performance Tasks</b>	
1. Develop a checklist for troubleshooting cooling systems.	F-IF 1, F-IF 3, F-IF 4
2. Select the tools and instruments needed to troubleshoot a cooling system in a given situation.	
3. Analyze control circuit diagram(s) for a selected cooling system.	G-GMD 4, G-MG 1
4. Isolate and correct malfunctions in a cooling appliance: <ul style="list-style-type: none"> <li>• Electrical problems</li> <li>• Compressor electrical failures</li> <li>• System-related compressor problems</li> <li>• Refrigerant overcharge and undercharge</li> <li>• Evaporator and condenser problems</li> <li>• Metering device problems</li> <li>• Refrigerant lines and accessories</li> <li>• Noncondensibles and contamination</li> </ul>	S-ID 9, S-IC 6, S-MD 7, N-Q 1, N-Q 2, N-Q 3

Introductory Craft Skills	Common Core Standards
<b>Module 03211-07 - Heat Pumps</b> This module introduces covers operation, installation, and control circuit analysis for heat pumps.	
1. Describe the principles of reverse-cycle heating.	RST 11-12.3
2. Identify heat pumps by type and general classification.	
3. Describe various types of geothermal water loops and their application.	RST 11-12.3
4. List the components of heat pump systems.	
5. Describe the role and basic operation of electric heat in common heat pump systems.	RST 11-12.3
6. Describe common heat pump ratings, such as Coefficient of Performance (COP), Heating Season Performance Factor (HSPF), and Seasonal Energy Efficiency Ratio (SEER).	RST 11-12.3, A-SSE 1, F-IF 5, F-BF 1c, F-LE 5
7. Demonstrate heat pump installation and service procedures.	
8. Identify and install refrigerant circuit accessories commonly associated with heat pumps.	
9. Analyze a heat pump control circuit.	G-GMD 4, G-MG 1
10. Isolate and correct malfunctions in a heat pump.	S-ID 9, S-IC 6, S-MD 7
<b>Performance Tasks</b>	
1. Identify components that are unique to heat pumps and explain the function of each.	
2. Calculate the balance point of a heat pump.	A-CED 1, A-CED 2, A-CED 3, A-CED 4, A-REI 1, A-REI 2, A-REI 3
3. Simulate the installation procedures for a heat pump.	
4. Perform heat pump servicing procedures.	
5. Analyze a heat pump circuit diagram and perform simulated troubleshooting exercises.	G-GMD 4, G-MG 1, S-ID 9, S-IC 6, S-MD 7
<b>Module 03212-07 - Basic Installation And Maintenance Practices</b> This module introduces the trainee to the basic mechanical procedures commonly performed in HVAC servicing work. Basic maintenance procedures, documentation, and customer relations are also covered.	
1. Identify, explain, and install threaded and non-threaded fasteners.	
2. Identify, explain, remove, and install types of gaskets, packings, and seals.	
3. Identify types of lubricants, and explain their uses.	
4. Use lubrication equipment to lubricate motor bearings.	
5. Identify the types of belt drives, explain their uses, and demonstrate procedures used to install or adjust them.	
6. Identify and explain types of couplings.	
7. Demonstrate procedures used to remove, install, and align couplings.	
8. Identify types of bearings, and explain their uses.	

Introductory Craft Skills	Common Core Standards
9. Explain causes of bearing failures.	S-ID 9, S-IC 6, S-MD 7
10. Demonstrate procedures used to remove and install bearings.	
11. Perform basic preventive maintenance inspection and cleaning procedures.	
12. List ways to develop and maintain good customer relations.	
<b>Performance Tasks</b>	
1. Identify different types of threaded fasteners.	
2. Identify non-threaded fasteners.	
3. Identify different types of gaskets.	
4. Identify mechanical seal parts.	
5. Install an oil seal.	
6. Align and properly adjust V-belts.	G-MG 3
7. Identify different types of drive couplings.	
8. Tighten a four-bolt flange.	
9. Install an expandable anchor bolt.	
10. Identify different types of bearings.	
11. Recognize and use a manual bearing puller to remove a bearing.	
12. Recognize and use a feeler gauge to measure bearing clearances.	
13. Lubricate a bearing using a lever-type grease gun.	
14. Fill out typical forms used for installation and service calls.	
<b>Module 03213-07 - Sheet Metal Duct Systems</b>	
This module introduces sheet metal duct systems and explains how to lay out and install sheet metal and flexible ducts.	
1. Identify and describe the basic types of sheet metal.	
2. Define properties of steel and aluminum alloys.	
3. Describe a basic layout method and perform proper cutting.	G-CO 12, G-GMD 4, RST 11-12.3
4. Join sheet metal duct sections using proper seams and connectors.	G-MG 3, G-GMD 4
5. Describe proper hanging and support methods for sheet metal duct.	RST 11-12.3
6. Describe thermal and acoustic insulation principles.	RST 11-12.3
7. Select, apply, and seal the proper insulation for sheet metal ductwork.	
8. Describe guidelines for installing components such as registers, diffusers, grilles, dampers, access doors, and zoning accessories.	RST 11-12.3
9. Install takeoffs and attach flexible duct to a sheet metal duct.	
<b>Performance Tasks</b>	
1. Join duct sections and fittings.	
2. Install takeoffs and attach flexible duct.	

Introductory Craft Skills	Common Core Standards
<b>Module 03301-08 - Refrigerants and Oils</b> This module covers the refrigerants and oils commonly used in HVAC/R systems. It includes identification and classification of refrigerants, differences between pure and blended refrigerants, types and properties of oils, use and testing of oils, and refrigerant retrofits.	
1. Identify the refrigerants in common use and state the types of applications in which each is used.	
2. Explain the effects of releasing refrigerants into the atmosphere.	S-ID 9, S-IC 6
3. Explain how refrigerants are classified by their chemical composition.	
4. Describe the color-coding scheme used to identify refrigerant cylinders.	RI 11-12.7, F-IF 1
5. Describe how azeotropes and near-azeotropes differ from each other and from so-called pure refrigerants.	RST 11-12.3
6. Interpret a P-T chart for an azeotrope refrigerant.	F-IF 4
7. Calculate superheat and subcooling.	A-REI 1
8. Demonstrate refrigerant leak detecting methods.	
9. Identify the different types of oils used in refrigeration systems and explain their relationships to the various refrigerants.	
10. Explain how to add and remove oil from a system.	
11. Describe how to test oil for contamination.	RST 11-12.3
12. Perform a refrigerant retrofit.	
<b>Performance Tasks</b>	
1. Interpret a P-T chart for an azeotrope refrigerant.	
2. Calculate superheat and subcooling.	
3. Perform a refrigerant leak detection procedure.	
4. Perform a refrigerant retrofit.	
<b>Module 03302-08 - Compressors</b>	
This module explains the operating principles of the different types of compressors used in comfort air conditioning systems and the basic installation service and repair procedures for these compressors.	
1. Identify the different types of compressors.	
2. Demonstrate or describe the mechanical operation for each type of compressor.	
3. Demonstrate or explain compressor lubrication methods.	
4. Demonstrate or explain methods used to control compressor capacity.	
5. Demonstrate or describe how compressor protection devices operate.	
6. Perform the common procedures used when field servicing open and semi-hermetic compressors, including: <ul style="list-style-type: none"> <li>• Shaft seal removal and installation</li> <li>• Valve plate removal and installation</li> <li>• Unloader adjustment</li> </ul>	
7. Demonstrate the procedures used to identify system problems that cause compressor failures.	S-ID 9, S-IC 6, S-MD 7

Introductory Craft Skills	Common Core Standards
8. Demonstrate the system checkout procedure performed following a compressor failure.	
9. Demonstrate or describe the procedures used to remove and install a compressor.	
10. Demonstrate or describe the procedures used to clean up a system after a compressor burnout.	
<b>Performance Tasks</b>	
1. Identify different types of compressor capacity controls.	
2. Identify protection devices commonly used with compressors.	
3. Under supervision, make electrical troubleshooting checks on single-phase and three-phase compressor motors.	S-ID 9, S-IC 6, S-MD 7
4. Under supervision, use a sealed tube acid/moisture test kit to test a system for the presence of acid and/or moisture.	S-ID 9, S-IC 6, S-MD 7
5. Under supervision, remove and install a hermetic compressor.	
6. Remove and install a valve plate assembly and head on a semi-hermetic compressor.	
7. Adjust the cylinder unloader on a semi-hermetic compressor.	
<b>Module 03303-08 - Metering Devices</b> This module covers operation and servicing of the various types of fixed-orifice and expansion valve metering devices used in refrigerant systems.	
1. Explain the function of metering devices.	RST 11-12.3
2. Describe the operation of selected fixed-orifice and expansion valves.	RST 11-12.3
3. Identify types of expansion valves.	
4. Describe problems associated with replacement of expansion valves.	RST 11-12.3, S-ID 9, S-IC 6, S-MD 7
5. Describe the procedure for installing and adjusting selected expansion valves.	RST 11-12.3, S-ID 9, S-IC 6, S-MD 7
<b>Performance Tasks</b>	
1. Identify various types of metering devices.	
2. Replace the orifice piston in a piston-type metering device.	
3. Use catalog data to select a replacement metering device.	
4. Install an externally equalized expansion valve, correctly placing the sensing bulb and equalizer tube.	
5. Calculate superheat and adjust an expansion valve to obtain the correct superheat.	A-REI 1

Introductory Craft Skills	Common Core Standards
<b>Module 03311-08 - Troubleshooting Heat Pumps</b> This module introduces the trainee to the procedures for recognizing, analyzing, and repairing malfunctions in heat pumps.	
1. Describe the basic operating sequence for an air-to-air heat pump.	RST 11-12.3
2. Interpret control circuit diagrams for heat pumps.	RH 11-12.7, G-GMD 4, G-MG 1
3. Develop a checklist for troubleshooting a heat pump.	F-IF 1, F-IF 3, F-IF 4
4. Identify the tools and instruments used in troubleshooting heat pumps.	
5. Correctly use the tools and instruments required for troubleshooting heat pumps.	
6. Isolate and correct malfunctions in heat pumps.	S-ID 9, S-IC 6, S-MD 7
7. Describe the safety precautions associated with servicing heat pumps.	RST 11-12.3
<b>Performance Tasks</b>	
1. Develop a checklist for troubleshooting a heat pump.	F-IF 1, F-IF 3, F-IF 4
2. Analyze control circuit diagram(s) for a selected heat pump.	G-GMD 4, G-MG 1
3. Isolate and correct malfunctions in a heat pump using the correct tools and instruments: <ul style="list-style-type: none"> <li>• Cooling function</li> <li>• Reverse cycle heating function</li> <li>• Defrost cycle</li> <li>• Auxiliary electric heat</li> </ul>	S-ID 9, S-IC 6, S-MD 7
<b>Module 03407-09 - Heating And Cooling System Design</b> This module identifies the factors that affect the heating and cooling loads of a building. It describes the process by which heating and cooling loads are calculated, and shows how load information is used to select heating and cooling equipment, including duct systems.	
1. Identify and describe the steps in the system design process.	G-MG 2, RST 11-12.3
2. From construction drawings or an actual job site, obtain information needed to complete heating and cooling load estimates.	G-MG 2, S-IC 1, S-IC 4, S-MD 1, S-MD 2, S-MD 4, S-MD 5b, S-MD 7, G-GPE 7, G-GMD 3, G-GMD 4, G-MG 1, G-MG 2, G-MG 3, N-Q 1, N-Q 2, N-Q 3
3. Identify the factors that affect heat gains and losses to a building and describe how these factors influence the design process.	G-MG 2, RST 11-12.3, S-ID 9
4. With instructor supervision, complete a load estimate to determine the heating and/or cooling load of a building.	G-MG 2, G-GPE 7, G-GMD 3, G-GMD 4, G-MG 1, G-MG 2, G-MG 3, A-CED 1, A-CED 2, A-CED 3, A-CED 4, A-REI 1, A-REI 2, A-REI 3, F-IF 1, F-IF 4, F-IF 5, F-IF 6, N-Q 1, N-Q 2, N-Q 3

Introductory Craft Skills	Common Core Standards
5. State the principles that affect the selection of equipment to satisfy the calculated heating and/or cooling load.	G-MG.2, RST 11-12.8, S-IC 6
6. With instructor supervision, select heating and/or cooling equipment using manufacturers' product data.	G-MG 2, S-IC 6
7. Identify the various types of duct systems and explain why and where each type is used.	G-MG 2, RST 11-12.7
8. Demonstrate the effect of fittings and transitions on duct system design.	G-MG 2
9. Use a friction loss chart and duct sizing table to size duct.	G-MG 2, F-IF 4, G-GMD 4, G-MG 1, G-MG 2, G-MG 3, N-Q 1, N-Q 2, N-Q 3
10. Install insulation and vapor barriers used in duct systems.	
11. Following proper design principles, select and install refrigerant and condensate piping.	G-MG 2
12. Estimate the electrical load for a building and calculate the effect of the comfort system on the electrical load.	G.MG.2, G-GPE 7, G-GMD 3, G-GMD 4, G-MG 1, G-MG 3, A-CED 1, A-CED 2, A-CED 3, A-CED 4, A-REI 1, A-REI 2, A-REI 3, F-IF 1, F-IF 4, F-IF 5, F-IF 6, N-Q 1, N-Q 2, N-Q 3
Performance Tasks	
1. Develop a list of factors that affect heating and cooling loads.	F-IF 1, F-IF 3
2. Develop a floor plan that contains all the information needed to perform a load estimate.	
3. Perform a load estimate using a standardized method.	
4. Use manufacturer's product data to select the appropriate heating and cooling equipment based on a load estimate and airflow requirements.	
5. Determine the number, location, and sizes of supply outlets and return inlets needed in a building.	
6. Use a friction chart and/or standard duct sizing tables to size the trunk and branch ducts for a selected low-volume air distribution system.	
7. Use a duct design calculator to size the trunk and branch ducts for a selected low-volume air distribution system.	
8. Calculate the total system friction loss (external static pressure) for a selected air distribution system.	



Introductory Craft Skills	Common Core Standards
<b>Module 03105-07 - Ferrous Metal Piping Practices</b> This module covers various types of iron and steel pipe and fittings, and provides step-by-step instructions for cutting, threading, and joining ferrous piping.	
1. Identify the types of ferrous metal pipes.	
2. Measure the sizes of ferrous metal pipes.	N-Q 1, N-Q 2, N-Q 3
3. Identify the common malleable iron fittings.	
4. Cut, ream, and thread ferrous metal pipe.	
5. Join lengths of threaded pipe together and install fittings.	
6. Describe the main points to consider when installing pipe runs.	RST 11-12.7
7. Describe the methods used to join grooved piping.	RST 11-12.7
<b>Performance Tasks</b>	
1. Identify types of carbon steel pipe.	
2. Identify pipe sizes and weights.	F-IF 4, F-IF 5, F-IF 6, F-BF 1, F-LE 1.b, F-LE 2, F-LE 5
3. Identify various pipe fittings.	
4. Use five methods for measuring pipe.	N-Q 1, N-Q 2, N-Q 3
5. Cut, ream, thread, and assemble steel pipe.	
<b>Module 03109-07 - Air Distribution Systems</b> This module describes air distribution systems and their components, air flow measurement, duct work installation principles, and the use of instruments for measuring temperature, humidity, pressure, and velocity.	
1. Describe the airflow and pressures in a basic forced-air distribution system.	RST 11-12.3
2. Explain the differences between propeller and centrifugal fans and blowers.	WHST 11-12.2e
3. Identify the various types of duct systems and explain why and where each type is used.	RST 11-12.3
4. Demonstrate or explain the installation of metal, fiberboard, and flexible duct.	RST 11-12.3
5. Demonstrate or explain the installation of fittings and transitions used in duct systems.	RST 11-12.3
6. Demonstrate or explain the use and installation of diffusers, registers, and grilles used in duct systems.	RST 11-12.3
7. Demonstrate or explain the use and installation of dampers used in duct systems.	RST 11-12.3
8. Demonstrate or explain the use and installation of insulation and vapor barriers used in duct systems.	RST 11-12.3
9. Identify instruments used to make measurements in air systems and explain the use of each instrument.	
10. Make basic temperature, air pressure, and velocity measurements in an air distribution system.	N-Q 1, N-Q 2, N-Q 3

Introductory Craft Skills	Common Core Standards
<b>Performance Tasks</b>	
1. Use a tachometer to measure blower motor rpm.	N-Q 1, N-Q 2, N-Q 3
2. Read and interpret equivalent length charts and required air volume/duct size charts.	N-Q 1, N-Q 2, N-Q 3, F-IF 4
3. Assemble duct and fittings.	
4. Assemble flexible duct.	
5. Install insulation and vapor barriers on metal ducts.	
6. Use a manometer to measure static pressure in a duct system.	N-Q 1, N-Q 2, N-Q 3
7. Use a velometer to measure the velocity of airflow at the output of air system supply diffusers and registers.	N-Q 1, N-Q 2, N-Q 3
<b>Module 03204-07 - Air Quality Equipment</b> This module covers common accessories used to control air quality, including dehumidifiers, humidifiers, and filters. It also covers energy conservation equipment.	
1. Explain why it is important to control humidity in a building.	RST 11-12.7, S-ID 9, S-IC 6
2. Recognize the various kinds of humidifiers used with HVAC systems and explain why each is used.	RST 11-12.7, S-ID 9, S-IC 6, S-MD 7
3. Demonstrate how to install and service the humidifiers used in HVAC systems.	
4. Recognize the kinds of air filters used with HVAC systems and explain why each is used.	RST 11-12.7, S-ID 9, S-IC 6, S-MD 7
5. Demonstrate how to install and service the filters used in HVAC systems.	
6. Use a manometer or differential pressure gauge to measure the friction loss of an air filter.	N-Q 1, N-Q 2, N-Q 3
7. Identify accessories commonly used with air conditioning systems to improve indoor air quality and reduce energy cost, and explain the function of each, including: <ul style="list-style-type: none"> <li>• Humidity control devices</li> <li>• Air filtration devices</li> <li>• Energy conservation devices</li> </ul>	
8. Demonstrate or describe how to clean an electronic air cleaner.	RST 11-12.3
<b>Performance Tasks</b>	
1. Demonstrate how to inspect, clean, and replace humidifiers.	
2. Inspect disposable/permanent air filters for mechanical damage and cleanliness.	
3. Clean permanent-type air filters.	
4. Measure the differential pressure drop across an air filter with a manometer.	

Introductory Craft Skills	Common Core Standards
<b>Module 03214-07 - Fiberglass And Flexible Duct Systems</b> This module introduces fiberglass and flexible duct systems and explains how to lay out and install them.	
1. Identify types of fiberglass duct, including flexible duct.	
2. Describe fiberglass duct layout and some basic fabrication methods.	N-Q 1, N-Q 2, N-Q 3, G-CO 5, G-CO 12, G-GMD 4, G-MG 2, G-MG 3, RST 11-12.3
3. Describe the various closure methods for sealing fiberglass duct.	RST 11-12.3
4. Fabricate selected duct modules and fittings using the appropriate tools.	N-Q 1, N-Q 2, N-Q 3, G-CO 5, G-CO 12, G-GMD 4, G-MG 3
5. Describe hanging and support methods for fiberglass duct.	RST 11-12.7
6. Describe how to repair major and minor damage to fiberglass duct.	RST 11-12.3
7. Install takeoffs and attach flexible duct to a fiberglass duct.	
<b>Performance Tasks</b>	
1. Fabricate and assemble fiberglass duct fittings and sections.	
2. Install takeoffs and attach flexible duct.	
<b>Module 03304-08 - Retail Refrigeration Systems</b> This module covers the mechanical refrigeration systems normally found in retail establishments. This equipment includes reach-in and walk-in coolers and freezers, ice machines, and other appliances used in stores, restaurants, and hotels. This module includes a discussion of the refrigeration process and defrost techniques, as well as troubleshooting and maintenance procedures.	
1. Describe the mechanical refrigeration cycle as it applies to retail refrigeration systems.	RST 11-12.3
2. Explain the differences in refrigerants and applications in low-, medium-, and high-temperature refrigeration systems.	WHST 11-12.2e
3. Identify and describe the primary refrigeration cycle components used in retail refrigeration systems.	L 11-12.6
4. Identify and describe the supporting components and accessories used in retail refrigeration systems.	L 11-12.6
5. Describe the various methods of defrost used in retail refrigeration systems.	L 11-12.6
6. Identify and describe the applications for the various types of retail refrigeration systems.	L 11-12.6
7. Describe the control system components used in retail refrigeration systems.	L 11-12.6
8. Explain the operating sequence of a retail refrigeration system.	RST 11-12.3
9. Interpret wiring diagrams and troubleshooting charts to isolate malfunctions in retail refrigeration systems.	RH 11-12.7, G-GMD 4, G-MG 1, S-ID 9, S-IC 6, S-MD 7, N-Q 1, N-Q 2, N-Q 3

Introductory Craft Skills	Common Core Standards
<b>Performance Tasks</b>	
1. Clean an ice machine.	
2. Isolate faults in refrigeration and ice machines.	
3. Set up an electric defrost schedule for a refrigeration appliance.	
<b>Module 03401-09 - Construction Drawings and Specifications</b> This module covers the techniques for reading and understanding various types of construction drawings, specifications, and other related documents. Emphasis is placed on the types of drawings and specifications that are commonly used by those in the HVAC trade and other closely-related trades. The procedures and documents involved in an HVAC equipment and material takeoff are also covered.	
1. Read HVAC drawings and architect's plans and explain their relationships.	RH 11-12.7, G-GMD 4, G-MG1, G-MG 2, G-MG 3, N-Q 1, N-Q 2, N-Q 3
2. Compare mechanical plans with the actual installation of duct and pipe runs, fittings, and sections.	G-GMD 4, G-MG1, G-MG 2, G-MG 3
3. Interpret specification documents and apply them to the plans.	RH 11-12.7, N-Q 1, N-Q 2, N-Q 3, S-IC 6
4. Interpret shop drawings and apply them to the plans and specifications.	RH 11-12.7, G-GMD 4, G-MG 1, G-MG 2, G-MG 3, N-Q 1, N-Q 2, N-Q 3
5. Describe a submittal, its derivation, routing, and makeup.	RST 11-12.8
6. Develop a field set of as-built drawings.	G-CO 5, G-CO 12, G-SRT 3, G-GMD 4, G-MG1, G-MG 2, G-MG 3, N-Q 1, N-Q 2, N-Q 3
7. Identify the steps required for transferring design information to component production.	RST 11-12.3, G-CO 5, G-CO 12, G-SRT 3, G-GMD 4, G-MG1, G-MG 2, G-MG 3, N-Q 1, N-Q 2, N-Q 3
8. Identify, develop, and complete takeoff sheets.	A-CED 1, A-CED 2, A-CED 3, A-CED 4, F-LE 5
9. List and classify materials most commonly used in HVAC systems.	
10. Complete takeoff procedures for HVAC systems.	
<b>Performance Tasks</b>	
1. Identify and interpret a site plan drawing.	RH 11-12.7
2. Identify and interpret the following on an architectural drawing: <ul style="list-style-type: none"> <li>• Floor plans and details</li> <li>• Elevations</li> <li>• Foundation plan</li> <li>• Reflected ceiling plan</li> </ul>	RH 11-12.7, G-GMD 4

Introductory Craft Skills	Common Core Standards
3. Identify and interpret the following on a plumbing plan drawing: <ul style="list-style-type: none"> <li>• Sanitary plumbing plans</li> <li>• Domestic water plumbing plans</li> <li>• Isometric views</li> <li>• Riser diagrams</li> <li>• Schedules</li> <li>• Specification references</li> <li>• Legends</li> </ul>	RH 11-12.7, G-GMD 4
4. Identify and interpret the following on a mechanical plan drawing: <ul style="list-style-type: none"> <li>• Hot- and chilled-water coil piping</li> <li>• HVAC piping</li> <li>• Chiller piping/installation</li> <li>• Refrigeration piping schematics</li> <li>• Air handling unit installation/connecting ductwork</li> <li>• Hot- and chilled-water flow diagrams</li> <li>• Schedules</li> <li>• Specification references</li> <li>• Legends</li> </ul>	RH 11-12.7, G-GMD 4
5. Identify and interpret the following on an electrical plan drawing: <ul style="list-style-type: none"> <li>• Riser diagrams</li> <li>• Schedules</li> <li>• Specification references</li> <li>• Legends</li> </ul>	RH 11-12.7, G-GMD 4
6. Prepare a request for information (RFI) form.	
7. Identify and interpret the information given in the specifications pertaining to a construction project.	RH 11-12.7
8. Interpret all types of HVAC-related shop drawings.	RH 11-12.7, G-GMD 4
9. Mark up HVAC mechanical plans to show as-built modifications.	G-GMD 4, G-MG 1
10. Perform an HVAC equipment and material takeoff and prepare the takeoff forms.	N-Q 1, N-Q 2, N-Q 3, N-VM 7, A-REI 1, A-REI 3, F-IF 4, A-SSE 1, A-SSE 3, F-BF 1, F-LE 1b
11. Prepare building coordination drawings that show the composite installation of HVAC equipment relative to the equipment installed by other trades, such as the electrical and plumbing trades.	G-GMD 4, G-MG 1
<b>Module 03403-09 - Indoor Air Quality</b> This module covers indoor air quality and its effect on the health and comfort of building occupants. It provides guidelines for performing a building IAQ survey and identifies the equipment and methods used to test and control indoor air quality.	
1. Explain the need for good indoor air quality.	RST 11-12.7
2. List the symptoms of poor indoor air quality.	
3. Perform an inspection/evaluation of a building's structure and equipment for potential causes of poor indoor air quality.	
4. Identify the causes and corrective actions used to remedy common indoor air problems.	S-ID 9, S-IC 6, S-MD 7

Introductory Craft Skills	Common Core Standards
5. Identify the HVAC equipment and accessories that are used to sense, control, and/or enhance indoor air quality.	
6. Use selected test instruments to measure or monitor the quality of indoor air.	N-Q 1, N-Q 2, N-Q 3
7. Clean HVAC air system ductwork and components.	
<b>Performance Tasks</b>	
1. Use selected radon monitors and/or test kits.	N-Q 2, N-Q 3
2. Perform a building indoor air quality (IAQ) inspection/evaluation.	
3. Make air measurements using each of the following: <ul style="list-style-type: none"> <li>• Carbon dioxide (CO<sub>2</sub>) detector/sensor</li> <li>• Carbon monoxide (CO) detector/sensor</li> <li>• Volatile organic compound (VOC) detector/sensor</li> <li>• Combustion analyzer</li> </ul>	N-Q 2, N-Q 3
4. Use a manufacturer’s humidifier capacity chart to find the humidifier capacity needed for various building types and sizes.	F-IF 4
5. Use a manufacturer’s portable dehumidifier capacity chart to find the dehumidifier capacity needed for various building types and sizes.	F-IF 4
6. Clean and inspect ductwork using one or more approved methods: <ul style="list-style-type: none"> <li>• Contact vacuum</li> <li>• Air washing</li> <li>• Power brushing</li> </ul>	
<b>Module 03404-09 - Energy Conservation Equipment</b> This module covers various heat recovery/reclaim devices and other energy conservation equipment. It includes information on their operation as well as maintenance procedures.	
1. Identify selected air-to-air heat exchangers and describe how they operate.	
2. Identify selected condenser heat recovery systems and explain how they operate.	
3. Identify a coil energy recovery loop and explain how it operates.	
4. Identify a heat pipe heat exchanger and explain how it operates.	
5. Identify a thermosiphon heat exchanger and explain how it operates.	
6. Identify a twin tower enthalpy recovery loop system and explain how it operates.	
7. Identify air-side and water-side economizers and explain how each type operates.	
8. Identify selected steam system heat recovery systems and explain how they operate.	
9. Identify an ice bank-type off-peak hours energy reduction system.	
10. Operate selected energy conversion equipment.	
<b>Performance Tasks</b>	
1. Adjust an economizer for the proper setting in a local area.	

Introductory Craft Skills	Common Core Standards
<p><b>Module 03408-09 - Commercial And Industrial Refrigeration Systems</b></p> <p>This module expands on the refrigeration system coverage provided in the <i>HVAC Level Three</i> module <i>Retail Refrigeration Systems</i>. It covers large-scale refrigeration systems such as those found in supermarkets, cold storage facilities, packing houses, and food processing plants.</p>	
1. Identify different types of refrigerated coolers and display cases and describe each one's common application.	
2. Compare the basic components used in commercial/industrial refrigeration systems with those used in retail refrigeration systems.	
3. Identify single, multiple, and satellite compressor systems. Describe the applications, installation considerations, and advantages and disadvantages of each type.	
4. Identify packaged condensing units and unit coolers. Describe their applications, operation, and installation considerations.	
5. Identify two-stage compressors and explain their operation and applications.	
6. Identify the various accessories used in commercial refrigeration systems. Explain why each is used and where it should be installed in the system.	
7. Identify the various refrigeration control devices. Explain the purpose of each type and how it works.	
8. Compare the components used in ammonia systems with those used in halocarbon-based refrigerant systems.	
<b>Performance Tasks</b>	
1. Install a packaged condensing unit and/or individual air-cooled condenser in a refrigeration system.	
2. Install a packaged unit cooler and/or individual evaporator in a refrigeration system.	
3. Install two to three selected refrigeration system accessories.	
<p>4. From a selection provided by the instructor, identify the following control devices commonly used in refrigeration systems:</p> <ul style="list-style-type: none"> <li>• Crankcase pressure regulator</li> <li>• Evaporator pressure regulator</li> <li>• Condenser head pressure regulator</li> <li>• Hot gas bypass regulator</li> <li>• Compressor cylinder unloader</li> <li>• Solenoid-controlled unloader</li> </ul>	

Codes for Common Core English Language Arts and Literacy are:

L = Language

RH = Reading for Literacy in  
History/Social Studies

RI = Reading for Informational  
Text

RST = Reading for Literacy in  
Science and Technical  
Subjects

SL = Speaking and Listening

W = Writing

WHST = Writing for Literacy in  
History/Social Studies,  
Science, and Technical  
Subjects

Codes for Common Core Mathematics are:

A-CED = Algebra: Creating  
Equations

A-REI = Algebra: Reasoning with  
Equations and Inequalities

F-IF = Functions: Interpreting  
Functions

F-BF = Functions: Building  
Functions

F-LE = Functions: Linear,  
Quadratic, and Exponential  
Models

G-CO = Geometry: Congruence

G-SRT = Similarity, right  
Triangles, and  
Trigonometry

G-C = Geometry: Circles

G-GPE = Geometry: Expressing  
Geometric Properties with  
Equations

G-GMD = Geometry: Geometric  
Measurement and  
Dimension

G-MG = Geometry: Modeling with  
Geometry

N-RN = Number and Quantity:  
The Real Number System

N-Q = Number and Quantity:  
Quantities

S-ID = Statistics and Probability:  
Interpreting Categorical and  
Quantitative Data

S-IC = Statistics and Probability:  
Making Inferences and  
Justifying Conclusions

S-MD = Statistics and Probability:  
Using Probability to Make  
Decisions