

Heating, Ventilation and Air Conditioning (HVAC) I & II

Program Description: The Heating Ventilation and Air Conditioning (HVAC) course of study provides students with an opportunity to learn the theory and skills necessary to be successful in the world of work or post secondary training. Students will master a variety of HVAC skills as they relate to residential and commercial settings. Students participate in a variety of lab activities to reinforce the attainment of technical skills. Program standards are aligned with the National Center for Construction Education and Research (NCCER). Prior to performing any tasks in the lab setting, students are required to pass the NCCER safety examination. All students in the lab wear protective clothing and gear appropriate for work in the HVAC field.

Module 1: Introduction to HVAC

Unit Objective: Students will demonstrate a basic understanding of the HVAC profession.

Unit Competencies:

1. Understand and apply the basic principles of heating, ventilation and air conditioning.
2. Define the purpose and objectives of an apprentice training school.
3. Define the Clean Air Act and the purpose it serves in industry.
4. Describe the types of regulatory codes encountered in HVAC.

Module 2: HVAC Mathematics

Unit Objective: Students will demonstrate competency in mathematics required in the HVAC industry.

Unit Competencies:

1. Determine the powers and roots of numbers.
2. Solve basic algebraic equations.
3. Apply the Pythagorean Theorem to perform calculations involving right triangles.
4. Calculate perimeter, area and volume.
5. Convert temperature values between Celsius and Fahrenheit.

Module 3: Copper and Plastic Piping Practices

Unit Objective: Students will demonstrate competency in copper and piping practices.

Unit Competencies:

1. Identify precautions taken when installing refrigerant piping.
2. Identify the correct tubing.
3. Demonstrate cutting and bending copper tubing.
4. Demonstrate safe practices utilized to join tubing by using flare and compression fittings.
5. Identify the appropriate hangers and supports needed for refrigerant piping.
6. Describe basic safety requirements for pressure-testing a system once it has been installed.
7. Identify types of plastic pip and state their uses.
8. Demonstrate cutting and joining lengths of plastic pipe.

Module 4: Soldering and Brazing

Unit Objective: Students will demonstrate competency in soldering and brazing techniques.

Unit Competencies:

1. Demonstrate proper assembly and operation of the tools used for soldering and brazing.
2. Prepare tubing and fittings for soldering and brazing.
3. Identify the purposes and uses of solder, solder fluxes, filler metals and fluxes.
4. Demonstrate soldering and brazing of copper tubing and fittings.
5. Identify the inert gases that can be used safely to purge tubing when brazing.

Module 5: Ferrous Metal Piping Practices

Unit Objective: Students will demonstrate competency in working with ferrous metal piping.

Unit Competencies:

1. Identify and measure types and sizes of ferrous metal pipes.
2. Identify common malleable iron fittings.
3. Cut, ream and thread ferrous metal pipe.
4. Demonstrate joining lengths of threaded pipe together and installing fittings.
5. Describe the main points to consider when installing pipe runs.

Module 6: Basic Electricity

Unit Objective: Students will demonstrate an understanding of basic electricity as it relates to the HVAC industry.

Unit Competencies:

1. Describe how electrical power is distributed.
2. Describe how voltage, current, resistance and power are related.
3. Utilize Ohm's law to calculate current, voltage and resistance in a circuit.
4. Describe the difference between series and parallel circuits and calculate loads in each.
5. Describe the purpose and operation of electrical components used in HVAC equipment.
6. Measure voltage, current and resistance.
7. Read and interpret common electrical symbols.
8. Identify single-phase and three-phase wiring arrangements and induction motors.
9. Test AC components, including capacitors, transformers and motors.

Module 7: Introduction to Cooling

Unit Objective: Students will demonstrate competency in working with cooling systems.

Unit Competencies:

1. Explain how heat transfer occurs in a cooling system.
2. Demonstrate an understanding of terms and concepts used in the refrigeration cycle.
3. Safely use temperature and pressure measuring instruments to make readings during the refrigeration cycle.
4. Demonstrate proper identification and handling of refrigerants.
5. Identify the major components, accessories and control devices in cooling systems and how they work.

Module 8: Introduction to Heating

Unit Objective: Students will demonstrate competency in working with heating systems.

Unit Competencies:

1. Explain the three methods by which heat is transferred.
2. Describe how combustion occurs and identify the byproducts of combustion.
3. Identify types of fuels used in heating.
4. Explain the function of major components and accessories of an induced draft and condensing gas furnace.
5. Identify the factors that must be considered when installing a furnace.
6. Identify the major components of a gas, oil and electric furnace and describe their function.
7. Measure and adjust manifold pressure on a gas furnace with a manometer.
8. Perform basic furnace preventive maintenance procedures such as cleaning and filter replacement.

Module 9: Leak Detection, Evacuation, Recovery and Charging

Unit Objective: Students will develop an understanding of basic procedures for repairing a leak in a refrigerant system.

Unit Competencies:

1. Identify through lead detection, leaks in a refrigerant system.
2. Identify the service equipment used for recovering refrigerant from a system and for recycling the recovered refrigerant.
3. Identify service equipment for charging refrigerant into a system.

Module 10: Introduction to Troubleshooting Heating and Cooling Systems

Unit Objective: Students will demonstrate an understanding of the operations of heating and cooling systems and how to troubleshoot equipment failures.

Unit Competencies:

1. Explain the function of a thermostat in a temperature controlled environment.
2. Demonstrate the correct installation and adjustment of a thermostat.
3. Explain the basic principles applicable to all control systems.
4. Identify the various types of electromechanical, electronic and pneumatic HVAC controls and explain their function and operation.
5. Describe a systematic approach for troubleshooting HVAC equipment.
6. Identify the tools and instruments necessary to troubleshoot HVAC equipment.

Module 11: Sheet Metal Duct Systems

Unit Objective: Students will demonstrate an understanding of Sheet Metal Duct Systems.

Unit Competencies:

1. Identify the basic types of sheet metal.
2. Define properties of steel and aluminum alloys.
3. Describe a basic layout method and perform proper cutting.
4. Demonstrate joining of sheet metal duct sections using proper seams and connectors.
5. Demonstrate proper use of equipment (plasma cutter) in the fabrication of duct work and fittings.
6. Describe hanging and support methods for sheet metal duct.
7. Describe thermal and acoustic insulation principles.
8. Select, apply and seal insulation for sheet metal ductwork.

9. Describe guidelines for installing components such as registers, diffusers, grilles, dampers, access doors and zoning accessories.
10. Install takeoffs and attach flexible duct to a sheet metal duct.

Certifications:

NCCER Safety

OSHA-10 Safety

ESCO HVAC

Articulation Agreements:

Local 100-Sheetmetal Union, Local 201 Steamfitters Union