

HVAC TECHNOLOGY 1, 2, 3, 4
COURSE CODE: 6003, 6004, 6005, 6006
STUDENT PROFILE

STUDENT'S NAME:	TEACHER'S NAME:
School Year/Semester:	Date Begin:
Grade:	Date Completed:

Directions: Document student's progress using the applicable rating scales below: Enter date of completion under the appropriate column.

0 - Has not received instruction in this area / **no experience or knowledge of this task (N/A)**

1 – Can apply and perform **independently (80-100)**

2 – Can perform the task completely with **limited supervision (70-79)**

3 – Requires additional instruction and or **close supervision (60-69)**

A. STUDENT ORGANIZATIONS		0	1	2	3
1	Identify the purpose and goals of a Career and Technology Student Organization (CTSO).				
2	Explain how CTSOs are integral parts of specific clusters, majors, and/or courses.				
3	Explain the benefits and responsibilities of being a member of a CTSO.				
4	List leadership opportunities that are available to students through participation in CTSO conferences, competitions, community service, philanthropy, and other activities.				
5	Explain how participation in CTSOs can promote lifelong benefits in other professional and civic organizations.				
B. TECHNOLOGY KNOWLEDGE		0	1	2	3
1	Demonstrate proficiency and skills associated with the use of technologies that are common to a specific occupation				
2	Identify proper netiquette when using e-mail, social media, and other technologies for communication purposes.				
3	Identify potential abuse and unethical uses of laptops, tablets, computers, and/or networks.				
4	Explain the consequences of social, illegal, and unethical uses of technology (e.g., cyber bullying; piracy; illegal downloading; cyberbullying; licensing infringement; inappropriate uses of software, hardware, and mobile devices in the work environment).				
5	Discuss legal issues and the terms of use related to copyright laws, fair use laws, and ethics pertaining to downloading of images, photographs, Creative Commons, documents, video, sounds, music, trademarks, and other elements for personal use.				

6	Describe ethical and legal practices of safeguarding the confidentiality of business-related information.				
7	Describe possible threats to a laptop, tablet, computer, and/or network and methods of avoiding attacks.				
C. PERSONAL QUALITIES AND EMPLOYABILITY SKILLS		0	1	2	3
1	Demonstrate punctuality.				
2	Demonstrate self-representation.				
3	Demonstrate work ethic.				
4	Demonstrate respect.				
5	Demonstrate time management.				
6	Demonstrate integrity.				
7	Demonstrate leadership.				
8	Demonstrate teamwork and collaboration.				
9	Demonstrate conflict resolution.				
10	Demonstrate perseverance.				
11	Demonstrate commitment.				
12	Demonstrate a healthy view of competition				
13	Demonstrate a global perspective.				
14	Demonstrate health and fitness.				
15	Demonstrate self-direction.				
16	Demonstrate lifelong learning.				
D. PROFESSIONAL KNOWLEDGE		0	1	2	3
1	Demonstrate effective speaking and listening skills.				
2	Demonstrate effective reading and writing skills.				
3	Demonstrate mathematical reasoning.				
4	Demonstrate job-specific mathematics skills.				
5	Demonstrate critical-thinking and problem-solving skills.				
6	Demonstrate creativity and resourcefulness.				
7	Demonstrate an understanding of business ethics.				
8	Demonstrate confidentiality.				
9	Demonstrate an understanding of workplace structures, organizations, systems, and climates.				

10	Demonstrate diversity awareness.				
11	Demonstrate job acquisition and advancement skills.				
12	Demonstrate task management skills.				
13	Demonstrate customer-service skills.				
E. NCCER® CORE MODULES		0	1	2	3
MODULE A: SAFETY					
1	Identify the responsibilities and personal characteristics of a professional craftsman.				
2	Describe the safe work requirements for elevated work.				
3	Identify and explain how to avoid struck-by and caught-in-between hazards.				
4	Explain the appropriate safety precautions around common job-site hazards.				
5	Demonstrate the use and care of appropriate personal protective equipment (PPE).				
6	Identify and describe other specific job-site safety hazards.				
7	Follow safe procedures for lifting heavy objects.				
8	Describe safe behavior on and around ladders and scaffolds.				
9	Explain the importance of the Hazard Communication Standard (HazCom) requirement and Safety Data Sheets (SDS)				
10	Describe fire prevention and firefighting techniques.				
11	Define safe work procedures around electrical hazards.				
12	Complete 10-hour OSHA course/assessment and receive card. (SDE Requirement)				
13	Complete Performance Tasks				
MODULE B: CONSTRUCTION MATH (OPTIONAL)		0	1	2	3
1	Add, subtract, multiply, and divide whole numbers, with and without a calculator.				
2	Use a standard ruler and a metric ruler to measure.				
3	Add, subtract, multiply, and divide fractions.				
4	Add, subtract, multiply, and divide decimals, with and without a calculator.				
5	Convert decimals to percent and percent to decimals.				
6	Convert fractions to decimals and decimals to fractions.				

7	Explain what the metric system is and how it is important in the construction trade.				
8	Recognize and use metric units of length, weight, volume, and temperature.				
9	Recognize some of the basic shapes used in the construction industry and apply basic geometry to measure them.				
MODULE C: INTRODUCTION TO HAND TOOLS (OPTIONAL)		0	1	2	3
1	Recognize and identify various types of basic hand tools used in the construction trade.				
2	Identify and describe how to use various types of measurement and layout tools.				
3	Identify and explain how to use various types of cutting and shaping tools.				
4	Use these tools safely.				
5	Describe the basic procedures for taking care of these tools.				
6	Complete Performance Tasks				
MODULE D: INTRODUCTION TO POWER TOOLS (OPTIONAL)		0	1	2	3
1	Identify and explain how to use various types of power drills and impact wrenches used in the construction trade.				
2	Identify and explain how to use various types of power saws.				
3	Identify and explain how to use various grinders and grinder attachments.				
4	Identify and explain how to use miscellaneous power tools.				
5	Use power tools safely.				
6	Explain how to maintain power tools properly.				
7	Complete Performance Tasks				
MODULE E: INTRODUCTION TO CONSTRUCTION DRAWINGS/RECOMMEND BLUEPRINT READING (OPTIONAL)		0	1	2	3
1	Identify and describe various types of construction drawings, including their fundamental components and features.				
2	Recognize and identify basic blueprint terms, components, and symbols.				
3	Relate information on blueprints to actual locations on the print.				
4	Recognize different classifications of drawings.				
5	Interpret and use drawing dimensions.				

6	Complete Performance Tasks				
MODULE F: BASIC RIGGING (OPTIONAL)		0	1	2	3
1	Explain how ropes, chains, hoists, loaders, and cranes are used to move material and equipment from one location to another on a job site.				
2	Describe inspection techniques and load-handling safety practices.				
3	Explain the American National Standards Institute (ANSI) hand signals.				
4	Complete Performance Tasks				
MODULE G. BASIC COMMUNICATION SKILLS (SDE Requirement)		0	1	2	3
1	Describe the communication, listening and speaking processes and their relationship to job performance.				
2	Describe good reading and writing skills and their relationship to job performance				
3	Demonstrate telephone and e-communication skills necessary in the workplace.				
4	Complete Performance Tasks				
MODULE H: BASIC EMPLOYABILITY SKILLS (SDE Requirement)		0	1	2	3
1	Describe the opportunities in the construction business and how an individual enters the construction workforce.				
2	Explain the importance of critical thinking and how to solve problems in the workplace.				
3	Explain the importance of social skills and identify ways good social skills are applied in the construction trade.				
4	Describe computer systems and their industry applications.				
5	Explain interpersonal relationship skills, self-presentation, and key workplace issues such as sexual harassment, stress, and substance abuse.				
MODULE I: MATERIALS HANDLING (OPTIONAL)		0	1	2	3
1	Describe the hazards associated with handling materials and provides techniques to avoid both injury and property damage.				
HVACR TECHNOLOGY 1 – 4 LEVEL 1 (240 HOURS)					
F. INTRODUCTION TO HVACR		0	1	2	3
1	Explain the basic principles of heating, ventilation, and air conditioning.				
2	Identify career opportunities available to people in the HVACR trade.				
3	Explain the purpose and objectives of an apprentice training program.				

4	Describe how certified apprentice training can start in high school.				
5	Describe what the Clean Air Act means to the HVACR trade.				
G. TRADE MATHEMATICS (OPTIONAL)		0	1	2	3
1	Identify similar units of measurement in both the inch-pound (English) and metric systems and know which units are larger.				
2	Convert measured values in the inch-pound system to equivalent metric values and vice versa.				
3	Express numbers as powers of ten.				
4	Determine the powers and roots of numbers.				
5	Solve basic algebraic equations.				
6	Recognize various geometric figures.				
7	Use the Pythagorean Theorem to make calculations involving right triangles.				
8	Convert decimal feet to feet and inches and vice versa.				
H. BASIC ELECTRICITY		0	1	2	3
1	State how electrical power is generated and distributed.				
2	Describe how the voltage, current, resistance, and power are related.				
3	Use Ohm's law to calculate the current, voltage, and resistance in a circuit.				
4	Use the power formula to calculate how much power is consumed by a circuit.				
5	Describe the differences between series and parallel.				
6	Recognize and describe the purpose and operation of the various electrical components used in HVACR equipment.				
7	State and demonstrate the safety precautions that must be followed when working on electrical equipment.				
8	Make voltage, current, and resistance measurements using electrical test equipment.				
9	Wire a relay.				
10	Wire a contactor and/or starter.				
11	Demonstrate performance tasks.				
I. INTRODUCTION TO HEATING		0	1	2	3
1	Explain the three methods by which heat is transferred and give an example of each.				
2	Describe how combustion occurs and identify the byproducts of combustion.				

3	Identify the various types of fuels used in heating.				
4	Identify the major components and accessories of a forced-air furnace and explain the function of each component.				
5	State the factors that must be considered when installing a furnace.				
6	Identify the major components of a gas furnace and describe how each works.				
7	With supervision, use a monometer to measure and adjust manifold pressure on a gas furnace.				
8	Identify the major components of an oil furnace and describe how each works.				
9	Describe how an electric furnace works.				
10	With supervision, perform basic furnace preventative maintenance procedures such as cleaning and filter replacement.				
11	Demonstrate performance tasks.				
J. INTRODUCTION TO COOLING		0	1	2	3
1	Explain how heat transfer occurs in a cooling system, demonstrating an understanding of the terms and concepts used in the refrigeration cycle.				
2	Calculate the temperature and pressure relationships at key points in the refrigeration cycle.				
3	Under supervision, use temperature- and pressure-measuring instruments to make readings at key points in the refrigeration cycle.				
4	Identify commonly used refrigerants and demonstrate the procedures for handling these refrigerants.				
5	Identify and draw the major components of a cooling system and explain how each type works.				
6	Identify the major accessories available for cooling systems and explain how each type works.				
7	Identify the control devices used in cooling systems and explain how each type works.				
8	State the correct methods to be used when piping a refrigeration or cooling systems.				
9	Front Seat, mid position, and back service valve.				
10	Install filter dryer.				
11	Install capillary tube.				
12	Install liquid line indicator.				
13	Install an access core types services valve.				
14	Demonstrate performance tasks.				

K. INTRODUCTION TO AIR DISTRIBUTION SYSTEMS		0	1	2	3
1	Describe the airflow and pressures in a basic forced-air distribution systems.				
2	Explain the differences between propeller and centrifugal fans and blowers.				
3	Identify the various types of duct systems and explain why and where each type is used.				
4	Demonstrate or explain the installation of metal, fiberboard, and flexible duct.				
5	Demonstrate or explain the installation of fittings and transitions used in duct systems.				
6	Demonstrate or explain the use and installation of diffusers, registers, and grilles used in duct systems.				
7	Demonstrate or explain the use and installation of dampers used in duct systems.				
8	Demonstrate or explain the use and installation of insulation and vapor barriers used in duct systems.				
9	Identify the 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 systems.				
11	Demonstrate performance tasks.				
L. BASIC COPPER AND PLASTIC PIPING PRACTICES		0	1	2	3
1	State the precautions that must be taken when installing refrigerant piping.				
2	Select the right tubing for the job.				
3	Cut and bend 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 requirements for pressure-testing a system once it has been installed.				
7	Demonstrate performance tasks.				
M. SOLDERING AND BRAZING		0	1	2	3
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.				
4	Solder copper/brass/steel tubing and fittings.				
5	Assemble and operate the tools used for brazing.				

6	Prepare tubing and fittings for brazing.				
7	Identify the purposes and uses of filler metals and fluxes used for brazing.				
8	Brace copper tubing and fittings.				
9	Identify the inert gases that can safely be used to purge tubing when brazing.				
10	Construct a swage joint.				
11	Braze saddle valve on suction line.				
12	Demonstrate performance tasks.				
N. BASIC CARBON STEEL PIPING PRACTICES		0	1	2	3
1	Identify the types of ferrous metal pipes.				
2	Measure the sizes of ferrous metal pipes.				
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.				
7	Describe the method used to join grooved piping.				
8	Demonstrate performance tasks.				
LEVEL 2 (240 HOURS)					
F. ALTERNATING CURRENT		0	1	2	3
1	Describe the operation of various types of transformers.				
2	Explain how alternating current is developed and draw a sine wave.				
3	Identify shingle-phase and three-phase wiring arrangements.				
4	Explain how phase shift occurs in inductors and capacitors.				
5	Describe the types of capacitors and their applications.				
6	Explain the operation of single-phase and three-phase induction motors.				
7	Identify the various types of single-phase motors and their applications.				
8	Use a wattmeter, megger, capacitor analyzer, and chart recorder.				
9	Test inductors and capacitors using an ohmmeter.				

10	State and demonstrate the safety precautions that must be followed when working with electrical equipment.				
11	Demonstrate performance tasks.				
G. COMPRESSORS		0	1	2	3
1	Identify the different kinds 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 describe how compressor protection devices operate.				
6	Perform the common procedures used when field servicing open and semi-hermetic compressors, i.e., valve plat removal and installation, and unloader adjustment.				
7	Demonstrate the procedures used to identify system problems that cause compressor failures.				
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.				
11	Install a start capacitor with different types of relays.				
12	Demonstrate performance tasks.				
H. REFRIGERANTS AND OILS		0	1	2	3
1	Describe the desirable characteristics of refrigerants and the various applications that require these characteristics.				
2	Identify the primary chemical classifications of common refrigerants.				
3	Describe the environmental concerns associated with refrigerants.				
4	Identify and describe compounded and blended azeotrope, near-azeotropic, and zeotropic refrigerants.				
5	Identify various refrigerant classifications and cylinder colors.				
6	Explain how to use pressure-temperature (PT) charts to calculate superheat and subcooling for compounds, azeotropic, and near-azeotropic, and zeotropic refrigerants.				
7	Identify important characteristics of refrigerant oils.				

8	Compare mineral-based and synthetic oils.				
9	Describe the movement of oil through the refrigerant circuit.				
10	Describe oil contamination and its sources.				
11	Describe common practices associated with handling, charging, and removing oils.				
12	Identify and describe issues of concern and common practices related to refrigerant conversions.				
13	Demonstrate performance tasks.				
I. LEAK DETECTION, EVACUATION, RECOVERY, AND CHARGING		0	1	2	3
1	Identify the common types of leak detectors and explain how each is used.				
2	Demonstrate skill in performing leak detection tests.				
3	Identify the service equipment used for evacuating a system and explain why each item of equipment is used.				
4	Demonstrate skill in performing 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	Demonstrate skill in performing refrigerant recovery.				
7	Demonstrate or explain how to use a recycle unit.				
8	Identify the service equipment used for charging.				
9	Demonstrate performance tasks.				
J. METERING DEVICES		0	1	2	3
1	Explain the function of metering devices.				
2	Describe the operation of selected metering devices and expansion valves.				
3	Identify types of thermal expansion valves (TXVs).				
4	Describe the procedure for installing and adjusting selected TXVs.				
5	Demonstrate performance tasks.				
K. HEAT PUMPS		0	1	2	3
1	Describe the principles of reverse-cycle heating.				
2	Identify heat pumps by type and general classification.				
3	List the components of heat pump systems.				

4	Demonstrate heat pump installation and service procedures.				
5	Identify and install refrigerant circuit accessories commonly associated with heat pumps.				
6	Analyze a heat pump control circuit.				
7	Demonstrate performance tasks.				
L. BASIC MAINTENANCE		0	1	2	3
1	Identify the types of gaskets, pickings, and seals and explain their use.				
2	Remove and install gaskets, packings, and seals.				
3	Identify the types of lubricants and explain their use.				
4	Use lubrication equipment to lubricate motor bearings.				
5	Identify the types of belt drives and explain their use.				
6	Demonstrate and/or explain procedures used to install or adjust a belt drive.				
7	Identify the types of couplings and explain their use.				
8	Demonstrate and/or explain procedures used to remove, install, and align couplings.				
9	Identify the types of bearings and explain their use.				
10	Explain causes of bearing failures.				
11	Demonstrate and/or explain procedures used to remove and install bearings.				
12	Perform basic preventive maintenance inspection and cleaning procedures.				
13	Identify common environmental health hazards associated with HVACR maintenance activities.				
14	Describe common inspection and maintenance procedures for gas heating equipment.				
15	Describe common inspection and maintenance procedures for DX cooling and heat pump systems.				
16	Describe common inspection and maintenance procedures for various system accessories.				
17	Describe how to complete common HVACR service reports.				
18	Demonstrate performance tasks.				
M. CHIMNEYS, VENTS, AND FLUES		0	1	2	3
1	Describe the principles of combustion and explain complete and incomplete combustion.				
2	Describe the content of flue gas and explain how it is vented.				

3	Identify the components of a furnace vent system.				
4	Describe how to select and install a vent system.				
5	Perform the adjustments necessary to achieve proper combustion in a gas furnace.				
6	Describe the techniques for venting different types of furnaces.				
7	Explain the various draft control devices used with natural-draft furnaces.				
8	Demonstrate performance tasks.				
N. SHEET METAL DUCT SYSTEMS		0	1	2	3
1	Identify various types of steel sheet metals.				
2	Identify various types of alloy sheet metals.				
3	Identify various types of duct seams.				
4	Identify various methods of duct component connection.				
5	Describe methods used to suspend sheet metal duct.				
6	Describe methods used to support sheet metal duct.				
7	Describe the selection and installation of duct lining products.				
8	Describe the selection and installation of external duct wraps.				
9	Identify and describe the installation of various types of dampers.				
10	Identify and describe the installation of duct takeoffs and access doors.				
11	Identify different types of flexible duct.				
12	Explain how flexible duct is connected and supported.				
13	Demonstrate performance tasks.				
O. FIBERGLASS AND FLEXIBLE DUCT SYSTEMS		0	1	2	3
1	Identify the standards related to fiberglass duct.				
2	Identify application considerations related to fiberglass duct.				
3	Describe how to close and join fiberglass duct using various methods.				
4	Describe how to repair both minor and major fiberglass duct damage.				
5	Describe methods used to suspend and support fiberglass duct.				

6	Describe methods used to suspend and support fiberglass duct fittings and risers.				
7	Identify various types and designs of fabric-based air distribution products.				
8	Describe the various methods of installing and suspending fabric-based air Distribution products.				
9	Demonstrate performance tasks.				
P. COMMERCIAL AIRSIDE SYSTEMS		0	1	2	3
1	Describe the typical operating characteristics of a commercial airside system.				
2	Describe the purpose and function of ventilation and exhaust systems.				
3	Describe single-zone constant volume system operation.				
4	Describe multi-zone constant volume system operation.				
5	Describe variable volume, variable temperature (VVT) system operation.				
6	Describe variable air volume (VAV) system operation.				
7	Explain the basic operation of VVT and single-duct VAV terminal devices.				
8	Explain the basic operation of fan-powered VAV terminals.				
9	Identify various styles of commercial grilles and registers.				
10	Describe the various forms and components of packaged systems.				
11	Describe the various forms and components of air handling units.				
12	Describe common accessories used with commercial airside systems.				
13	Demonstrate performance tasks.				
Q. AIR QUALITY EQUIPMENT		0	1	2	3
1	Identify the factors related to the quality of indoor air.				
2	Describe the elements of human comfort and their relationship to air properties.				
3	Explain the relationship between air and moisture content.				
4	Describe the processes and equipment used to humidify and dehumidify air.				
5	Identify the various types of media-based air filters.				
6	Describe the operation of non-media based air filtration and purification equipment.				
7	Explain how dampers and economizers are used to control the introduction of fresh air.				

8	Describe the function and operation of energy and heat recovery ventilation systems.				
9	Demonstrate performance tasks.				
R. INTRODUCTION TO HYDRONIC SYSTEM (OPTIONAL)		0	1	2	3
1	Describe the basic properties of water and the significance of its contents.				
2	Describe the relationship between water flow and system pressures.				
3	Identify gravity and forced hydronic systems.				
4	Describe the different types of boilers used.				
5	Identify primary boiler components.				
6	Identify common components related air and water control.				
7	Describe the characteristics of one- and two-pipe systems.				
8	Describe the function of hot-water zoning systems.				
9	Identify various hot-water heating system terminal devices.				
10	Identify the devices used to measure and control water flow in hydronic systems.				
11	Describe how circulating pumps are selected based on required flow rates.				
12	Explain how to measure pump pressures and system flow rates in operating system.				
13	Demonstrate performance tasks.				