

# HEATING, VENTILATION, AIR CONDITIONING AND REFRIGERATION

## Associate of Applied Science Degree

### Certificates of Completion

- HVAC/R

The climate in New Mexico creates a demand for skilled technicians in both heating and cooling because people prefer to live and work in comfort. Every new home, hospital, university building, shopping mall, or office complex requires installation mechanics, service technicians, operating engineers, maintenance foremen, and trained crews to keep complex environmental systems operating efficiently.

The heating, air conditioning, and refrigeration industry is one of the country's most stable. The supply of qualified, trained people has not kept pace with the demand, and new opportunities are constantly developing. The demand for trained HVAC/R graduates is also increasing due to Environmental Protection Agency requirements that refrigerants be handled by a certified technician.

Technicians knowledgeable in heating, air conditioning, and refrigeration are also needed in defense, space exploration, and manufacturing. Because climate control is important wherever microprocessors are used in manufacturing or scientific research, skilled technicians are in demand in these fields. Many experienced technicians own and manage their own businesses.

The Heating, Ventilation, Air Conditioning and Refrigeration program at DACC uses training facilities equipped with the most modern test equipment and tools available. As a student, you will learn to—

- service, repair, and maintain heating, air conditioning, and refrigeration systems;
- read and interpret technical drawings, schematics, and symbols to diagnose and troubleshoot problems in a system;
- evaluate, diagnose, and service various mechanical and electrical controls;
- apply the mathematics related to the heating, air conditioning, and refrigeration trade;
- handle customer relations, shop management procedures, and record keeping relative to the trade;
- properly use special tools and testing equipment; and
- become certified in Section 608, EPA Certification.

Students will complete a one-credit Job Shadowing course during their first semester that will allow the student the opportunity to see firsthand the daily activities of a HVAC technician. A unique practicum training program is offered during the final semester to provide students with field experiences. Working side by side with journeymen technicians, students are offered an opportunity to practice and refine their new skills.

After the first semester, full-time heating, air conditioning, and refrigeration students must purchase a personal set of technician's tools (approximate cost, which may vary, \$1300). The tool set includes the basic tools that most employers require on the job. Part-time students will purchase only those tools required by the specific course(s) in

which they are enrolled. Students must also purchase an iPad at the approximate cost of \$400 that will be used to access course materials and document completion of course competencies.

Students will also provide their own medical/accident insurance. They need to be in good physical condition and possess the ability and desire to work with their minds and hands.

The curriculum is competency and performance based and uses multimedia classroom instruction and hands-on laboratory exercises. Classroom and laboratory hours are listed in the Schedule of Classes.

All heating, air conditioning, and refrigeration students are eligible to join SkillsUSA. Membership provides students an opportunity to develop their leadership skills and to become proficient in public speaking and parliamentary procedure. SkillsUSA also offers students a chance to demonstrate their occupational skills. Skill competitions are conducted each year in New Mexico for all post-secondary students.

Whether taking classes or working on a job site, students enrolled in this program will be required to perform the same job duties and be able to meet the same physical requirements that they will as a graduate in the field. Depending where they find employment, graduates may be required to

- work in inclement weather,
- lift up to 50 pounds from the ground,
- have good eye-hand coordination,
- work safely around electrical hazards using the appropriate safety equipment,
- work safely using hand and power tools,
- ascend and descend stairs and ladders, and
- stand, squat, stoop, or kneel for long periods of time.

Licensure for journeyman gas fitters, journeyman refrigeration workers, and journeyman sheet metal workers require both a written and practical exam. Not all licensing agencies provide special testing accommodations.

**NOTE:** Students must earn a final grade of C- or better in all required HVAC courses/Technical Requirements and achieve a cumulative grade-point average of at least 2.0. A grade of C- or better is required in ENGL 1110G Composition I and designated Mathematics courses.

Heating, Ventilation, Air Conditioning and Refrigeration - Associate of Applied Science (<https://catalogs.nmsu.edu/dona-ana/academic-career-programs/hvac-refrigeration/heating-ventilation-air-conditioning-refrigeration-associate-applied-science/>)

HVAC/R - Certificate of Completion (<https://catalogs.nmsu.edu/dona-ana/academic-career-programs/hvac-refrigeration/hvacr-certificate-completion/>)

Residential HVAC - Certificate of Completion (<https://catalogs.nmsu.edu/dona-ana/academic-career-programs/hvac-refrigeration/residential-hvac-certificate-completion/>)

### **HVAC 1105. Introduction to Fundamentals of Refrigeration 4 Credits (3+2P)**

Demonstrate the ability to perform HVAC/R Technician duties in a safe manner. Accurately perform HVAC/R related calculations and interpret results for the purpose of diagnosis, repair, or installation of HVAC/R equipment and systems. Professionally communicate in oral and written forms. Demonstrate the use of current industry techniques including

tools, testing equipment, manufacturers' apps. Determine the appropriate ethical action that should occur in a given circumstance. Work effectively in a team-based environment. Possess a mastery of the refrigeration cycle and its components.

**Learning Outcomes**

1. Demonstrate working knowledge of heat theory, safety, and temperature/pressure/volume gas laws as they relate to the refrigeration cycle.
2. Identify and demonstrate heat transfer by conduction, convection, and radiation and describe their effects on temperature change using latent and sensible heat transfer.
3. Safely demonstrate the refrigeration process using system components such as compressors, condensers, evaporators, metering (expansion) devices and accessories.
4. Demonstrate a knowledge of industry standards for system installation of equipment and tubing and safely demonstrate tubing operations including cutting, reaming, flaring, swaging, and brazing.

**HVAC 1110. Introduction to Fundamentals of Electricity**

**4 Credits (3+2P)**

Introduces the student to electrical theory, generation and distribution, OHM's Law, series and parallel circuits, A/C / D/C, practical applications and electrical safety.

**Learning Outcomes**

1. Demonstrate the use of industry practices: safety, use of lockout/tagout, diagnosing, repairing, and installing electrical components in HVAC/R equipment and systems; use of test instruments both digital and analog, comprehension of wiring diagrams, proper use of tools specific to the industry, mastery of electrical theory and circuits, single-phase and three-phase applications; use of symbols and terminology, and the ability to communicate professionally in oral and written forms.

**HVAC 1111. EPA Clean Air Act: Section 608**

**1 Credit (1)**

Refrigerant certification preparation to include basics of refrigerant bearing equipment, ozone depletion and the new legislation, technician categories covered and the certification examination.

**Learning Outcomes**

1. Use oral communication effectively, use written communication effectively.
2. Accurately perform calculations related to refrigeration.
3. Accurately perform calculations related to refrigeration.
4. Accurately perform calculations related to air conditioning.
5. Accurately perform conversions between various units.

**HVAC 1125. Electrical and Mechanical Controls I**

**4 Credits (3+2P)**

Applications of basic electrical and mechanical controls. Reading and drawing diagrams of simple refrigerating equipment. Safe use of testing equipment.

**Prerequisite:** HVAC 1105 and HVAC 1110, or consent of instructor.

**Learning Outcomes**

1. Use oral communication and written communication effectively.
2. Determine the appropriate ethical action that should occur in a given circumstance.
3. Perform technician duties safely.
4. Service refrigeration systems, repair refrigeration systems, maintain refrigeration systems.
5. Accurately perform calculations related to refrigeration.

6. Work effectively as a team.
7. Troubleshoot refrigeration systems.
8. Accurately perform conversions between various units.

**HVAC 1233. Professional Development and Leadership**

**1 Credit (1)**

As members and/or officers of various student professional organizations, students gain experience in leadership, team building, and community service. Students competing in Skills USA are required to register for the course. May be repeated up to 6 credits.

**Learning Outcomes**

1. Professionally communicate in oral and written forms.
2. Work effectively in a team-based environment.
3. Demonstrate the ability to perform HVAC/R Technician duties in a safe manner.

**HVAC 1238. Introduction to Sheet Metal Fabrication**

**4 Credits (3+2P)**

Introduction to sheet metal fabrication to include hands-on practical laboratory applications, cutting and forming procedures, identifying types and gauges. Design and layout techniques.

**Prerequisite:** OETS 118 or equivalent math or consent of instructor.

**Learning Outcomes**

1. Professionally communicate in oral and written forms.
2. Demonstrate the ability to perform HVAC/R Technician duties in a safe manner.
3. Demonstrate sheet metal design and layout techniques to fabricate ducting and associated fittings accurately.
4. Determine the appropriate ethical action that should occur in a given circumstance.
5. Accurately perform HVAC/R related calculations and interpret results for the purpose of diagnosis, repair, or installation of HVAC/R equipment and systems.

**HVAC 1243. Residential Air Conditioning Systems**

**4 Credits (3+2P)**

Applications and types of equipment used in comfort cooling. Preventive maintenance, service, and repairs common to evaporative coolers and refrigerated air conditioning systems. Air properties and psychometrics. May be repeated up to 4 credits.

**Prerequisite:** C- or better in HVAC 1105 and HVAC 1110.

**Learning Outcomes**

1. Use oral and written communication effectively.
2. Work effectively as a team.
3. Determine the appropriate ethical action that should occur in a given circumstance.
4. Troubleshoot heating systems accurately perform conversions between various units, accurately perform calculations related to heating systems.

**HVAC 1245. Gas Heating Furnaces**

**4 Credits (3+2P)**

The study and application of gas furnaces including installation, operation, service, maintenance and controls. The students will learn about natural gas, and electric heating systems used for residential and/or light commercial heating systems including furnace and boiler package systems and alternative heating sources. Highlights electrical and electronic trouble shooting, service, maintenance, repair and replacement of residential and light commercial heating systems. The course will include service, maintenance and troubleshooting.

**Prerequisite:** C- or better in HVAC 1105 and HVAC 1110.

**Learning Outcomes**

1. Identify the components and describe the sequence of operation of gas furnaces.
2. Use proper procedures to troubleshoot gas furnaces.
3. Describe and demonstrate proper procedures for conducting service calls and delivering customer service.
4. Demonstrate the use of proper procedures for preventative maintenance of gas furnaces.
5. Describe how gas pressure is measured, what unit of measurement is used and what is the purpose of a water manometer, gas combustion, four means of proof flame, why there is a fan-on and fan-off delay, flue gas venting systems, gas piping adjacent to the gas valve, calculate the correct orifice size, derate sea level input for altitude, calculate the correct gas pipe sizing for a one-story building with several gas appliances.

**HVAC 1250. Heat Pump Systems**

**4 Credits (3+2P)**

The student will acquire the knowledge to identify heat pump components, explain the sequence of operation, and develop troubleshooting skills for both mechanical and electrical issues associated with reverse cycle refrigeration systems used in comfort heating and cooling, a while utilizing the proper tools and equipment.

**Prerequisite:** C- or better in HVAC 1105 and HVAC 1110.

**Learning Outcomes**

1. Professionally communicate in oral and written forms.
2. Work effectively in a team-based environment.
3. Accurately perform HVAC/R related calculations and interpret results for the purpose of diagnosis, repair, or installation of HVAC/R equipment and systems.
4. Demonstrate the use of current industry techniques and equipment to diagnose HVAC/R systems and perform appropriate repairs.
5. Demonstrate the use of current industry techniques and equipment to perform the service and maintenance of HVAC/R equipment and systems.
6. Demonstrate the use of current industry techniques and equipment in the installation of HVAC/R equipment and systems.
7. Determine the appropriate ethical action that should occur in each circumstance.

**HVAC 1410. Commercial Refrigeration Systems**

**4 Credits (3+2P)**

This course covers the installation, service, and maintenance of a wide range of refrigeration equipment, including reach-in and walk-in coolers, ice machines, ice cream machines, as well as mechanical and electrical troubleshooting of refrigeration systems. Encompassing the service and maintenance of commercial refrigeration equipment, which involves procedures for evacuation and charging, understanding electrical diagrams, and handling compressors and related accessories.

**Prerequisite:** Grade of C- or better in HVAC 1105 and HVAC 1110.

**Learning Outcomes**

1. Read and interpret model numbers, nomenclature, and component capacities.
2. Use industry techniques and equipment for diagnosing and repairing HVAC/R systems.
3. Perform service and maintenance on HVAC/R equipment and systems.
4. Determine ethical actions in given circumstances.

5. Demonstrate safe HVAC/R Technician duties.
6. Work effectively in a team-based environment.
7. Accurately perform HVAC/R calculations and interpret results.
8. Communicate professionally, both orally and in writing.
9. Perform leak checks, repairs, recovery, evacuation, and recharging of refrigeration systems. 1
10. Identify components and troubleshoot parallel refrigeration systems. 1
11. Start up, troubleshoot, and explain Lab Systems.1
12. Address various refrigeration accessories. 1
13. Assemble, pipe, pressure test, and operate systems. 1
14. Troubleshoot refrigeration defrost timer systems. 1
15. Calculate heat gain and specify refrigeration systems. 1
16. Understand the use of water and brines as secondary refrigerants. 1
17. Diagnose and repair refrigerant side problems. 1
18. Set controls for temperature regulation. 1
19. Locate information in reference sources. 2
20. Evaluate system performance using data. 2
21. Size and assemble refrigeration systems to meet customer needs. 2
22. Handle refrigerant, including recovery, recycling, and reclamation. 2
23. Identify and troubleshoot various safety controls. 2
24. Troubleshoot line voltage thermostats and compressor contactors. 2
25. Diagnose and repair air side problems. 2
26. Troubleshoot electrical problems using schematics. 2
27. Use pressure/enthalpy charts and understand the refrigeration cycle.

**HVAC 2098. Heating, Ventilating, Air Conditioning, and Refrigeration Field Experience**

**1 Credit (1)**

The course will provide students with actual hands-on exposure to HVAC/R fieldwork, offering insights into the expectations of field technicians as they shadow experienced HVAC/R professionals. Students will gain practical experience through supervised training at an approved Heating, Ventilation, Air Conditioning, and Refrigeration workplace.

**Learning Outcomes**

1. Effectively utilize verbal and written communication, collaborate efficiently within a team, diagnose issues in refrigeration systems, precisely execute unit conversions, accurately conduct refrigeration-related calculations, identify the ethical course of action in specific situations, safely execute technician responsibilities, provide maintenance for refrigeration systems, conduct repairs on refrigeration systems, and service refrigeration systems.

**HVAC 2210. Commercial Air Conditioning and Heating Systems**

**4 Credits (3+3P)**

Covers troubleshooting mechanical and electrical problems associated with HVAC equipment in commercial buildings. Includes gas, electric, and heat pump systems.

**Prerequisite:** Grade of C- or better in HVAC 1105 & HVAC 1110.

**Learning Outcomes**

1. Professionally communicate in oral and written forms.
2. Determine the appropriate ethical action that should occur in a given circumstance.
3. Demonstrate the ability to perform HVAC/R Technician duties in a safe manner.
4. Demonstrate the use of current industry techniques and equipment in the installation of HVAC/R equipment and systems.

5. Demonstrate the use of current industry techniques and equipment to perform the service and maintenance of HVAC/R equipment and systems.
6. Accurately perform HVAC/R related calculations and interpret results for the purpose of diagnosis, repair, or installation of HVAC/R equipment and systems.
7. Demonstrate the use of current industry techniques and equipment to diagnose HVAC/R systems and perform appropriate repairs.
8. Work effectively in a team-based environment.

**HVAC 2990. Practicum**

**3 Credits (3)**

Working in the field with journeymen service technicians. Develop and apply job skills.

**Prerequisite:** HVAC 2098.

**Learning Outcomes**

1. Varies.

**HVAC 2996. Special Topics**

**1-6 Credits**

Topics to be announced in the Schedule of Classes. May be repeated up to 12 credits.

**Learning Outcomes**

1. Varies.

**Name:** Keith Gatalo, Instructor

**Office Location:** DATS 142A

**Phone:** (575) 527-7596

**Email:** KGatalo@dacc.nmsu.edu

**Name:** Jose Torres, Lab Technician

**Office Location:** DASH 142C

**Phone:** (575) 527-7761

**Email:** jtorres@dacc.nmsu.edu

**Name:** Megan Hernandez-Smith, Advanced Technologies Academic Advisor

**Office Location:** DATS 155C

**Phone:** (575) 528-7242

**Email:** mehernandez@dacc.nmsu.edu

**Name:** Karina Diven, Advanced Technologies Administrative Assistant

**Office Location:** DATS 155

**Phone:** (575) 527-7590

**Email:** KDiven@dacc.nmsu.edu

**Website:** <https://dacc.nmsu.edu/academics/programs/heating-ventilation-and-air-control/index.html> (<https://dacc.nmsu.edu/academics/programs/heating-ventilation-and-air-control/>)