# Heating, Ventilating, Air Conditioning and Refrigeration

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| **Mode of Delivery** | **Residential** |
| **Credential Awarded** | **Diploma** |
| **Contact Hours** | **960** |
| **Program Quarter Credits** | **64** |
| **Instructional Weeks** | **48.00** |
| **Total Clock Hours** | **Including Recognized Out-of-Class Work Hours: 1,600** |

**Length in Months**: 12 / Quarters: 4*
**Based on full-time enrollment*

**Objective**

The objective of the program is to provide the student with the skills and knowledge required for entry-level employment in the Heating, Ventilation, Air Conditioning and Refrigeration industry. The program is designed to be comprehensive in nature, including extensive hands-on training, covering service for residential and commercial refrigeration, gas and oil furnaces, heat pumps, electric furnaces and air conditioning equipment.

**Description**

The Heating, Ventilation, Air Conditioning & Refrigeration program is designed for persons interested in a career in the field of climate control systems, focusing on learning objectives identified as the key knowledge points for an HVACR Technician. The student will be adept at using a variety of tools to work with refrigerant lines and air ducts. They use voltmeters, thermometers, pressure gauges, manometers, and other testing devices to check airflow, refrigerant pressure, electrical circuits, burners, and other components. Students will be required to take and pass the EPA certification exam. Students are trained to work as heating, air conditioning and/or refrigeration service technicians in both residential and commercial sites.

**Credentialing Exams**

Students in their final quarter are eligible to take the EPA Universal Certification Exam.

**Career Opportunities**

The graduate is prepared to seek entry-level employment in HVACR including but not limited to: service technician, installation technician, and apprentice heating technician. This occupation has a bright outlook (expected to grow rapidly in the next several years, will have large numbers of job openings, or are new and emerging occupations).

## Plan of Study

| Course Code | Name | Contact Hours | Clock Hours | Credits | Quarter Credits |
|---|---|---|---|---|---|
| SKW101 | Introduction to Skilled Professions | 0 | 60 | 4 | 0 |
| HVR105 | Thermodynamics | 0 | 60 | 4 | 0 |
| HVR110 | Practical Applications of Electricity | 0 | 60 | 4 | 0 |

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| HVR115 | HVACR Controls | 0 | 60 | 4 | 0 |
| HVR120 | Controls, Motors and Motor Controls | 0 | 60 | 4 | 0 |
| HVR125 | Refrigerants | 0 | 60 | 4 | 0 |
| HVR130 | Residential Air Conditioning | 0 | 60 | 4 | 0 |
| HVR140 | Commercial Refrigeration Concepts | 0 | 60 | 4 | 0 |
| HVR141 | Industrial Refrigeration and Commercial Air Conditioning | 0 | 60 | 4 | 0 |
| HVR150 | Electric Heat and Heat Pumps | 0 | 60 | 4 | 0 |
| HVR155 | Gas Heating Systems | 0 | 60 | 4 | 0 |
| HVR160 | Oil Heating Systems | 0 | 60 | 4 | 0 |
| HVR165 | HVAC System Performance | 0 | 60 | 4 | 0 |
| HVR170 | Water-Based Heating Systems | 0 | 60 | 4 | 0 |
| HVR175 | HVAC Troubleshooting and Service Calls | 0 | 60 | 4 | 0 |
| HVR180 | EPA Certification Preparation | 0 | 60 | 4 | 0 |

**Schedule**

*Morning: 8:30 a.m. – 1:30 p.m. Monday through Thursday and Evening: 5:30 p.m. – 10:30 p.m. Monday through Thursday.*
*Hours are subject to change. Classes may be scheduled as noted above, including any instructional week which contains a School holiday, in which case, class may also be scheduled on Friday.*

# Course Descriptions

## SKW101 : Introduction to Skilled Professions

In this course students will receive an overview of the trades' professions, and learn the basics of safety, equipment use and a variety of construction prints. Students will learn directives and guidelines set forth by government agencies for the trade's career field. To help students transition successfully into the college environment, this course also explores learning strategies such as reading, critical thinking, test-taking and using computer technology for resources and class assignments.

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| **Credits** | **4** |
| **Clock Hours** | **60** |
| **Lab Hours** | **40** |
| **Lecture Hours** | **20** |
| **Prerequisites** | **None** |

## HVR105 : Thermodynamics

In this course students become familiar with the principles and theory of thermodynamics and how they apply to the HVAC- R industry. The components and features of the HVAC-R system are introduced. Students will also be introduced to Manual "J" calculations. At the conclusion of this course students will have a basic understanding of heat, pressure, temperature, conduction and radiation.

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| **Credits** | **4** |

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| **Clock Hours** | 60 |
| **Lab Hours** | 40 |
| **Lecture Hours** | 20 |
| **Prerequisites** | None |

## HVR110 : Practical Applications of Electricity

This course delivers the practical applications of electricity in relation to the Heating, Ventilation, Air Conditioning (HVAC) systems & the electrical panels. Topics include basic principles of electricity, circuits, interpreting wiring diagrams, the principles of electric motors and testing, troubleshooting, servicing, maintaining and installing HVAC electrical components. Students will be focusing on alternating current circuits, proper wiring of electrical boards, the application of electrical laws to practical wiring applications and safety in the process.

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| **Credits** | 4 |
| **Clock Hours** | 60 |
| **Lab Hours** | 40 |
| **Lecture Hours** | 20 |
| **Prerequisites** | None |

## HVR115 : HVACR Controls

In this course students gain a basic understanding of the principles and theory of controls used in the HVACR industry. Students will apply electrical and energy theory to applications; learn control components, the basics of troubleshooting, and types of electric motors. At the completion of this course the student will be prepared to use Ohms law to analyze circuits, identify types of mechanical, electro-mechanical, and electronic controls to sense and control temperature, level, flow, and pressure, the use of basic electrical troubleshooting techniques, and identify types of motors and state their characteristics.

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| **Credits** | 4 |
| **Clock Hours** | 60 |
| **Lab Hours** | 40 |
| **Lecture Hours** | 20 |
| **Prerequisites** | None |

## HVR120 : Controls, Motors and Motor Controls

In this course, students will be introduced to direct digital controls (DDCs): control applications, types of control systems, and components. The application of motors: safety, voltages, environments, insulation, bearings and drives. Motor controls: safety, control devices, motor protection, and troubleshooting electric motors. Upon completion of this course the student will be prepared to explain control terminology, describe electronic control components, explain service factor amperage (SFA), full load amperage (FLA), and rated load amperage (RLA); and describe motor applications.

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| **Credits** | 4 |
| **Clock Hours** | 60 |
| **Lab Hours** | 40 |
| **Lecture Hours** | 20 |
| **Prerequisites** | None |

## HVR125 : Refrigerants

This course introduces the physics of the basic refrigeration cycle, refrigerants, the pressure and temperature relationship, and pressure-enthalpy to the student. The methods and principles associated with evacuation, recovery and charging of refrigeration and air conditioning equipment are explored. At the completion of this course students will be prepared to identify the main components in a refrigeration cycle, use a pressure temperature chart, measure superheat and sub- cooling, plot a pressure-enthalpy diagram, correctly recover, evacuate and charge an air conditioning or refrigeration system within compliance of EPA608 guidelines, identify refrigerants, and determine the temperature application.

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| **Credits** | 4 |
| **Clock Hours** | 60 |
| **Lab Hours** | 40 |
| **Lecture Hours** | 20 |
| **Prerequisites** | None |

## HVR130 : Residential Air Conditioning

In this course students become familiar with indoor air quality and major air conditioning system components including: condensers, compressors, accumulators, suction lines, evaporators, metering devices, receivers, suction-, discharge-, liquid- and condensate lines. How equipment is selected using manual J heat gain and heat loss calculations are explored. At the end of this course the student will have a foundation of indoor air quality issues and methods that can address these issues. The student will be able to speak about use of manual J to apply proper selection of equipment and installation and use of major air conditioning components.

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| **Credits** | 4 |
| **Clock Hours** | 60 |
| **Lab Hours** | 40 |
| **Lecture Hours** | 20 |
| **Prerequisites** | None |

## HVR140 : Commercial Refrigeration Concepts

Commercial Refrigeration Concepts provides the student with a basic understanding of the components, methods, principles and troubleshooting associated with HVAC-R equipment used in commercial HVAC-R systems. Topics include the major components, controls

and accessories used in refrigeration systems, the identification of appropriate systems for given applications, and diagnosis and service of refrigeration systems. At the end of this course, students will be able to define, describe and identify the concepts, functions, components and troubleshooting strategies involved in commercial refrigeration.

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| **Credits** | 4 |
| **Clock Hours** | 60 |
| **Lab Hours** | 40 |
| **Lecture Hours** | 20 |
| **Prerequisites** | HVR125 |

## HVR141 : Industrial Refrigeration and Commercial Air Conditioning

Industrial Refrigeration provides the student with a basic understanding of the components, methods, and principles associated with large-scale industrial facilities. Topics include the components, processes and troubleshooting of chillers, cooling towers and chilled water air conditioning systems. At the end of this course, students will be able to define, describe and identify the concepts, functions, and components involved in servicing industrial-style refrigeration systems.
Additionally, this course focuses on the installation, start-up, and operation of commercial air-conditioning equipment. High-pressure, low-pressure, absorption chilled-water systems, cooling towers and pumps, operation, maintenance, and a troubleshooting of chilled water air conditioning systems, commercial packaged rooftop equipment, economizers, variable air volume, variable refrigerant flow and variable air flow system will be covered. Upon completion of this course students will be able to recognize components and types of commercial air conditioning systems.

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| **Credits** | 4 |
| **Clock Hours** | 60 |
| **Lab Hours** | 40 |
| **Lecture Hours** | 20 |
| **Prerequisites** | HVR125 |

## HVR150 : Electric Heat and Heat Pumps

Students are introduced to the principles and theory of electric heat and heat pump systems. Focus is on the equipment and controls of electric heating and how to maintain, test, and troubleshoot electrical problems. This course also provides students with a basic understanding of the principles and theory of heat pumps. The equipment and controls of air-source and geothermal heat pumps are covered. At completion of this course the student should be prepared to identify the components, trace electrical schematics, describe operating sequence, perform basic maintenance and tests in troubleshooting electric heat and heat pump systems.

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| **Credits** | 4 |
| **Clock Hours** | 60 |
| **Lab Hours** | 40 |
| **Lecture Hours** | 20 |

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| **Prerequisites** | HVR105 |

## HVR155 : Gas Heating Systems

Gas Heating Systems exposes students to the theory of gas combustion and gas heating equipment and controls. Throughout the course students gain practical knowledge of gas furnaces along with safety considerations, and students will implement techniques used for troubleshooting, maintaining, and installing gas-heating equipment. After successfully completing this course, students will have the knowledge and skills necessary to begin supervised service and maintenance as well as installation of gas heating systems.

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| **Credits** | 4 |
| **Clock Hours** | 60 |
| **Lab Hours** | 40 |
| **Lecture Hours** | 20 |
| **Prerequisites** | None |

## HVR160 : Oil Heating Systems

Oil Heating Systems introduces students to the equipment and controls of oil heating components. Throughout the course students will gain valuable knowledge and experience with different types of oil furnaces, the combustion process, and oil heating equipment. After successfully completing this course, students will have the skills necessary to begin supervised maintenance and repair of oil heating systems and equipment.

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| **Credits** | 4 |
| **Clock Hours** | 60 |
| **Lab Hours** | 40 |
| **Lecture Hours** | 20 |
| **Prerequisites** | HVR105 |

## HVR165 : HVAC System Performance

This course provides the student with the basic principles for the design and installation of HVACR equipment and how these practices assure proper system performance. The principles and theory of airflow requirements, indoor air quality, duct design, load calculation, and sheet metal fabrication are covered in this course. Manual “J” will be introduced. At the completion of this course the student will be prepared to develop a basic load calculation resulting in a properly sized system, recognize good installation practices and analyze system performance.

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| **Credits** | 4 |
| **Clock Hours** | 60 |
| **Lab Hours** | 40 |

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| **Lecture Hours** | 20 |
| **Prerequisites** | HVR105 |

## HVR170 : Water-Based Heating Systems

Water-Based Heating Systems introduces students to the equipment and controls of hot water and steam-based heating systems, as well as the strategies used to reduce indoor air pollution. Throughout the course students will gain valuable knowledge and experience with safety procedures, tools, piping, valves, and control systems used with water- based heating systems, and the tools and components used for providing indoor quality air. After successfully completing this course, students will have the knowledge and skills necessary to begin supervised maintenance and repair of water-based heating systems and be able to explain procedures used to create indoor quality air.

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| **Credits** | 4 |
| **Clock Hours** | 60 |
| **Lab Hours** | 40 |
| **Lecture Hours** | 20 |
| **Prerequisites** | HVR105 |

## HVR175 : HVAC Troubleshooting and Service Calls

This course provides the student with the basic principles for troubleshooting HVACR equipment. The methods for repairing problems identified in HVACR equipment are practiced. The focus is on HVACR service calls for residential and commercial equipment. At the completion of this course, the student will be prepared to make service calls for troubleshooting and repairing problems in basic HVACR equipment.

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| **Credits** | 4 |
| **Clock Hours** | 60 |
| **Lab Hours** | 40 |
| **Lecture Hours** | 20 |
| **Prerequisites** | HVR105, HVR125 |

## HVR180 : EPA Certification Preparation

This course provides an extensive review of refrigeration and air conditioning systems fundamentals and lab practical. The Core, Type I, Type II and Type III certifications will be covered. Emphasis will be placed on the safe and proper handling of refrigerants in compliance with Section 608 of the Clean Air Act. At the end of this course the student will be prepared for the EPA Certification-Universal Exam.

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| **Credits** | 4 |
| **Clock Hours** | 60 |
| **Lab Hours** | 40 |

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| **Lecture Hours** | 20 |
| **Prerequisites** | HVR105 and HVR125 |