

# HEATING, REFRIGERATION, & AIR CONDITIONING (AH)

## AH 100 Introduction to the Professional Service Trades

2 Class Hours, 2 Lab Hours, 3 Quarter Credit Hours

Students entering the Plumbing, Heating, and Refrigeration trades will be introduced to technology-related personal skill development that affects their employability. They will investigate the daily tasks and career opportunities in their chosen trades, learn the importance of customer service skills with an understanding of the soft skills many employers require from their service technicians. Students will take a historical look at these technologies to get a better understanding of how they make life better for others, develop an intrinsic satisfaction of working with their hands to perform specialized tasks, and the importance of lifelong learning to develop and apply new skills in these ever-changing fields.

## AH 114 Refrigeration Systems Fundamentals

4 Class Hours, 4 Quarter Credit Hours

This course studies basic refrigeration and air conditioning systems. Topics covered include systems designed as freezers, refrigerators and air conditioning. The course is intended to explain the theory of heat transfer, thermodynamics, and the components used to accomplish the cooling of products. This course is intended for those seeking the knowledge and understanding necessary to advance to a more intense program.

## AH 116 Refrigeration Systems Fundamentals Lab

6 Lab Hours, 3 Quarter Credit Hours

Areas of hands-on practice in this course include: fabrication of refrigerant lines and connections that join the various refrigeration components together; the service technique as applied to installing manifold gauge sets and temperature measuring devices; removing, adding or replacing refrigerant charges; and proving operational conditions on live, educational and factory-designed equipment.

## AH 118 Basic Electricity Lab

4 Lab Hours, 2 Quarter Credit Hours

Prerequisites: AH 125 (may be taken concurrently)

Students work on projects concerned with the use of voltmeters, ammeters, ohmmeters, wattmeters, and capacitor bridges. Other projects include proving the effects of voltage drop, high resistance contacts, shorts and opens, and related preventive maintenance. Students will be exposed to reading wiring diagrams, building circuits from a wiring diagram, and taking readings and testing of the circuits they build to include both line and low voltage devices.

## AH 125 Basic Electricity

2 Class Hours, 2 Quarter Credit Hours

Basic Electricity is intended to familiarize RACH and PLBH students with the basic theoretical and practical knowledge of electricity they will encounter in their respective technologies, as well as preparing students for more complex wiring commonly found in their technology. Course goals will be achieved through lectures, self-study, and an extensive laboratory experience to draw together the students' skills to master the curriculum. Components of this course are required to prepare students for the Rhode Island "PJF" license exams.

## AH 126 Electricity for Refrigeration & Air Conditioning

4 Class Hours, 4 Quarter Credit Hours

Prerequisites: AH 114 and AH 116 and OSH 010 and (AH 118 and AH 125 or ELY 122 and ELY 126 and ELY 127)

Students study basic electricity and its relationship to working refrigeration and air conditioning systems. Topics include: semi-conductors which serve as a foundation for more advanced solid-state control systems; procedures required in the use of diverse electrical instruments and how they can be safely employed to diagnose electrical problems; compressor drives, fan motor circuitry and hermetic circuits with their associated starting relays, and motor starting capacitor circuitry.

## AH 128 Electricity for Refrigeration & Air Conditioning Lab

6 Lab Hours, 3 Quarter Credit Hours

Prerequisites: AH 114 and AH 116 and OSH 010 and (AH 118 and AH 125 or ELY 122 and ELY 126 and ELY 127)

Students work on projects concerned with the use of voltmeters, ammeters, ohmmeters, wattmeters and capacitor bridges. Other projects include proving the effects of voltage drop, high resistance contacts, shorts, opens and related preventive maintenance. Students practice wiring and operation of open and hermetic motors with a variety of control systems, as well as troubleshooting all of the common failures, which can put refrigeration plants in jeopardy of improper and costly operation.

## AH 134 Commercial and Industrial Refrigeration

3 Class Hours, 3 Quarter Credit Hours

Students will study advanced refrigeration principles involving motor starters and relays, pump-down, safety interlock, oil protection controls and defrost systems. System components and their practical applications in commercial and industrial refrigeration will be examined. Students will study the operation of commercial equipment such as walk-in coolers, freezers, and commercial ice machines.

## AH 138 Commercial and Industrial Refrigeration Lab

6 Lab Hours, 3 Quarter Credit Hours

Students will apply hands-on practice with advanced refrigeration principles including motor starters and relays, pump-down, safety interlock, oil protection controls and defrost systems. Detailed examination and practical study of system components and their applications, and the operation and troubleshooting of commercial equipment such as walk-in coolers, freezers, and commercial ice machines.

## AH 140 System Electrical Controls I

1 Class Hours, 1 Quarter Credit Hours

Prerequisites: AH 126 and AH 128 and OSH 010

This course builds on the concepts learned in Basic Electricity and Electricity for Refrigeration, Air Conditioning and Heating. Topics covered are temperature and pressure controls, switches, relays and solenoids. Also discussed are thermocouples, thermistors, overload protection devices and motorized valves and dampers.

## AH 141 Systems Electrical Controls I Lab

2 Lab Hours, 1 Quarter Credit Hours

Prerequisites: AH 126 and AH 128 and OSH 010

Students obtain hands-on experience wiring electrical controls into circuits, measuring voltages, current and resistance, and troubleshooting problems placed into the circuits by faculty. Projects begin with single controls in each circuit and progress to multiple controls as found in systems in the field.

**AH 143 Systems Electrical Controls II Lab**

2 Lab Hours, 1 Quarter Credit Hours

Prerequisites: AH 125 and (OSH 010 or ELY 135)

The Electrical Controls and Systems Lab will afford students hands-on opportunities to identify various controls and their functions, build the circuits from a wiring diagram, and explain how all of the various controls and devices operate in conjunction with each other. To develop/build troubleshooting skills, various service situations will be incorporated into their projects, requiring them to troubleshoot using their VOM Meters.

**AH 144 System Electrical Controls II**

2 Class Hours, 2 Quarter Credit Hours

Prerequisites: AH 125 and (OSH 010 or ELY 135)

This course is designed to illustrate the various electrical safety and operating controls and devices that direct the modern heating system in a safe and efficient manner. Students are exposed to pressure devices, water level controls, hydronic controls, air temperature and humidity control, relays, valves, and how these controls and devices interact with each other to operate the entire system.

**AH 212 Refrigeration Technician Certification**

2 Class Hours, 2 Quarter Credit Hours

Prerequisites: AH 114 and AH 116

This course is intended to familiarize students with the federal laws and regulations involving the use and handling of refrigerants. Students study the effects of CFC and HCFC use on the environment, past and present. Other topics include the Montreal Protocol's reaction to global environmental problems, such as ozone depletion and global warming, and the proper use of equipment that complies with The Clean Air Act of 1990. Students also receive training and certification testing for the safe handling of R-410A refrigerant.

**AH 214 Air Conditioning**

3 Class Hours, 3 Quarter Credit Hours

Topics studied include: air and its properties; psychrometric functions of air conditioning systems and an analysis of equipment installation and diagnostic procedures; the fundamentals of liquid chillers, cooling towers and water-cooled condensers with concentration directed to components, controls, and overall operation; and heat load calculations and selection of equipment to be installed.

**AH 215 Air Conditioning Lab**

6 Lab Hours, 3 Quarter Credit Hours

Students apply the principles of psychometrics in testing an operating air conditioning system; study the various components that make up the system; trace the many refrigerant and electrical circuits used in domestic and commercial systems; and use air measuring instruments to determine the actual volume and weight of air being circulated.

**AH 234 Modern Heating Systems**

4 Class Hours, 4 Quarter Credit Hours

Plumbing and HVAC students will be exposed to the various heating systems they will encounter in their respective technologies. Students will briefly explore the steam plant and its operation and components within the setting of a commercial application. Students will continue their exploration with warm air heating system variations within conventional systems, including heat pumps and hybrid hydro-air systems. The final system studied will be the hydronic systems used in conventional settings. These hydronic systems studies include low mass boilers with hydraulic separators, radiant systems utilizing boilers, water heaters, and solar. Included in this course will be heat loss calculations and hydronic system design, with emphasis on pipe sizing, head pressure calculations, and layout of a series baseboard system.

**AH 235 Modern Heating Systems Lab**

4 Lab Hours, 2 Quarter Credit Hours

Corequisites: AH 234

Students service steam, hot water, and warm air heating systems in the laboratory. Accessories and energy-conservation devices are installed as part of students' lab work. Troubleshooting procedures are analyzed on the burners. Complete combustion testing is done on operational heating units. Students make recommendations to improve the operation of these units.

**AH 238 Gas Heating Systems**

4 Class Hours, 4 Quarter Credit Hours

Gas Technology is designed to give students a practical working knowledge of gas-fired equipment and the associated practices and procedures for the installation, troubleshooting, and servicing of this type of equipment. The objectives for the course are accomplished through the study of gas properties, combustion theory, distribution systems and regulators, various burner designs, control systems, and venting requirements set forth in the National Fuel Gas Code.

**AH 240 Blueprints, Pipe Fitting and Duct Layout**

4 Class Hours, 4 Quarter Credit Hours

Prerequisites: AH 234 and AH 235

Students will study the requirements and methods for the installation of piping systems and ductwork that would be required in their respective trades. A review of blueprint reading as it pertains to these two courses of study will be presented. Proper piping materials, fittings, techniques, and fabrication will be discussed. Sheet metal design and installation considerations will also be presented. This will include cutting and fabricating ducts, installing plenums, and the installation of trunk work and take-offs.

**AH 241 Blueprints, Pipe Fitting and Duct Layout Lab**

4 Lab Hours, 2 Quarter Credit Hours

Prerequisites: AH 234 and AH 235

The Lab component will allow the students, from a blueprint, to calculate, cut, and install gas piping, near boiler piping and connections to radiation. Students will also be exposed to radiant floor heating using the newest materials used for this type of system. Students will install piping and duct to create complete operational systems.

**AH 242 Gas Heating Systems Lab**

6 Lab Hours, 3 Quarter Credit Hours

Corequisites: AH 238

Gas Technology Lab students are able to apply the theory learned in class to live units in the lab. The lab experience affords students valuable hands-on application in areas such as testing, troubleshooting, and servicing on the same type of equipment that is the currently used in the field.

**AH 244 Oil Heating Systems**

4 Class Hours, 4 Quarter Credit Hours

Prerequisites: AH 125

Corequisites: AH 246

Various oil burner designs will be studied. Every major oil burner component will be examined as to its function, operational testing, and replacement. Chimneys and alternate venting methods will be presented. Combustion chambers, draft and combustion analysis are studied in detail. Students will study various methods of improving combustion efficiency.

**AH 246 Oil Heating Systems Lab**

6 Lab Hours, 3 Quarter Credit Hours

Prerequisites: AH 125

Corequisites: AH 244

This course provides challenging lab projects, giving students hands-on experience in diagnostic testing and analysis, and repair through the installation and replacement of oil burner components.

**AH 250 Renewable Energy Systems**

4 Class Hours, 4 Quarter Credit Hours

Prerequisites: AH 125 and AH 118 and AH 143 and AH 144 and AH 234 and AH 235

The Renewable Energy course will explore the use of solar energy for the production of domestic hot water and heating for a residential application. Instruction will include the use of geo-thermal energy for the same purpose. Included in this course will be discussions of locating true solar south, altitude and azimuth, as well as determining proper panel placement for different types of systems. A discussion of controls, components, and types of piping systems are covered. There will be a component that will cover both passive and active types of systems used in heating buildings.

**AH 251 Renewable Energy Systems Lab**

6 Lab Hours, 3 Quarter Credit Hours

Prerequisites: AH 125 and AH 118 and AH 143 and AH 144 and AH 234 and AH 235

In the lab portion of this course, students will design a solar collector, and determine the proper location and solar altitude for producing the best results for their collectors. The collectors will also be combined to produce heat with the use of a radiant underfloor heating system. Included will be an opportunity for students to design and build a parabolic solar concentrator and take measurements to determine its efficiency. Students will also be able to monitor the production of hot water from our active solar domestic hot water collector system.