



Department of Teaching & Learning
Parent/Student Course Information

Air Conditioning, Refrigeration and Heating II
(VO8504)
Three Credits, One Year
Grades 11 or 12

Counselors are available to assist parents and students with course selections and career planning. Parents may arrange to meet with the counselor by calling the school's guidance department.

COURSE DESCRIPTION

This instructional program prepares students to install, repair, and maintain the operating conditions of heating, air conditioning, and refrigeration systems. Students work with piping and tubing, study heat and electricity, install duct systems, and comply with EPA regulations. Completion of this sequence may prepare students for a number of certification exams, helpful for employment in a variety of HVAC occupations.

CERTIFICATION

HVAC Excellence: Air Conditioning, Basic Refrigeration and Charging, R-410A Certification
EPA 608
OSHA Certification
National Occupational Competency Testing Institute (NOCTI) Assessment: HVAC

STUDENT ORGANIZATION

SkillsUSA is a co-curricular organization for all students enrolled in trade and industrial education programs. SkillsUSA is a partnership of students, teachers and industry working together to ensure America has a skilled workforce. SkillsUSA helps students excel by providing educational programs, events and competitions that support career and technical education (CTE) in the nation's classrooms. Students are highly encouraged to participate.

PREREQUISITE

Air Conditioning, Refrigeration and Heating I

OPTIONS FOR NEXT COURSE

None

REQUIRED STUDENT TEXTBOOK

None

COMPETENCIES FOR AIR CONDITIONING, REFRIGERATION and HEATING II

Demonstrating Personal Qualities and Abilities

- 1 Demonstrate creativity and innovation.
- 2 Demonstrate critical thinking and problem solving.
- 3 Demonstrate initiative and self-direction.
- 4 Demonstrate integrity.
- 5 Demonstrate work ethic.

Demonstrating Interpersonal Skills

- 6 Demonstrate conflict-resolution skills.
- 7 Demonstrate listening and speaking skills.
- 8 Demonstrate respect for diversity.
- 9 Demonstrate customer service skills.
- 10 Collaborate with team members.

Demonstrating Professional Competencies

- 11 Demonstrate big-picture thinking.
- 12 Demonstrate career- and life-management skills.
- 13 Demonstrate continuous learning and adaptability.
- 14 Manage time and resources.
- 15 Demonstrate information-literacy skills.
- 16 Demonstrate an understanding of information security.
- 17 Maintain working knowledge of current information-technology (IT) systems.
- 18 Demonstrate proficiency with technologies, tools, and machines common to a specific occupation.
- 19 Apply mathematical skills to job-specific tasks.
- 20 Demonstrate professionalism.
- 21 Demonstrate reading and writing skills.
- 22 Demonstrate workplace safety.

Examining All Aspects of an Industry

- 23 Examine aspects of planning within an industry/organization.
- 24 Examine aspects of management within an industry/organization.
- 25 Examine aspects of financial responsibility within an industry/organization.
- 26 Examine technical and production skills required of workers within an industry/organization.
- 27 Examine principles of technology that underlie an industry/organization.
- 28 Examine labor issues related to an industry/organization.
- 29 Examine community issues related to an industry/organization.
- 30 Examine health, safety, and environmental issues related to an industry/organization.

Addressing Elements of Student Life

- 31 Identify the purposes and goals of the student organization.
- 32 Explain the benefits and responsibilities of membership in the student organization as a student and in professional/civic organizations as an adult.
- 33 Demonstrate leadership skills through participation in student organization activities, such as meetings, programs, and projects.
- 34 Identify Internet safety issues and procedures for complying with acceptable use standards.

Exploring Work-Based Learning

- 35 Identify the types of work-based learning (WBL) opportunities.

- 36 Reflect on lessons learned during the WBL experience.
- 37 Explore career opportunities related to the WBL experience.
- 38 Participate in a WBL experience, when appropriate.

Applying Basic Construction Safety Standards (Core Safety)

- 39 Comply with federal, state, and local safety legal requirements, including OSHA, VOSH, and EPA.
- 40 Identify personal protective equipment (PPE) requirements.
- 41 Inspect and maintain a safe working environment.
- 42 Explain safe working practices around electrical hazards.
- 43 Identify emergency first-aid procedures.
- 44 Identify the types of fires and the methods used to extinguish them.
- 45 Inspect course-specific hand and power tools to visually identify defects.
- 46 Demonstrate lifting and carrying techniques.
- 47 Demonstrate safe laddering techniques.
- 48 Demonstrate safe scaffolding techniques.
- 49 Report personal injuries, environmental issues, and equipment safety violations to the appropriate authority.
- 50 Demonstrate lockout and tagout procedures.
- 51 Earn the OSHA 10 card.
- 52 Pass a safety test for shop or site safety and for specific tool use.

Understanding Motors and Controls

- 53 Install a magnetic coil in the motor starter.
- 54 Remove or replace the fan motor, blower wheel, and motor.
- 55 Set the V-belt tension or replace.
- 56 Check motor current (i.e., amps).
- 57 Lubricate bearings.

Servicing and Maintaining Fossil Fuel Heating Systems

- 58 Interpret customer heating complaints.
- 59 Adjust gas pressure.
- 60 Adjust the burner primary air on an oil furnace.
- 61 Adjust the burner air on a gas furnace.
- 62 Adjust the pilot flame in relation to the thermocouple.
- 63 Adjust the pilot igniter.
- 64 Adjust the direct-spark igniter.
- 65 Determine furnace efficiency through combustion analysis.
- 66 Test for gas leaks.
- 67 Adjust the oil pump pressure.
- 68 Test oil and gas safety controls.
- 69 Replace the gas orifice and gas burner.
- 70 Replace the gas valve.
- 71 Replace an oil burner (chassis and air tube).
- 72 Replace the burner nozzle.
- 73 Replace the oil burner motor.
- 74 Replace the fuel oil pump.
- 75 Replace the oil filter cartridge.
- 76 Clean furnace and components.
- 77 Convert natural gas components to propane components, using a conversion kit.

Servicing and Maintaining Alternative Fuel Heating Systems

- 78 Summarize the concepts of electric heat, heat pump, and hydronics heating systems.
- 79 Calculate cubic feet per minute (CFM), using the temperature-rise method.
- 80 Identify the components of each alternative system (e.g., electric, heat pump, hydronics).
- 81 Purge air from a hydronics system (e.g., radiators).

Servicing and Maintaining Cooling Systems

- 82 Interpret customer cooling complaints.
- 83 Read various tools and instruments needed for checking, testing, operating, and troubleshooting air-conditioning systems.
- 84 Measure the temperature difference across a coil.
- 85 Install a condensing unit.
- 86 Install the air-handler unit.
- 87 Charge the air-conditioning system, using various methods.
- 88 Check the external components of the system for proper operation.

Sizing and Installing Duct Systems

- 89 Modify existing plenum for evaporator installation.
- 90 Prepare openings for registers, grills, and duct penetration.
- 91 Install the branch duct takeoff from the main, using round metal duct and fittings.
- 92 Install a rectangular metal duct and fittings.
- 93 Install a round duct and fittings.
- 94 Install the main duct (rectangular rigid fiberglass) and fittings.
- 95 Determine the optimal air flow (CFM) based on the size of the unit/equipment and the duct.

Complying with EPA Laws and Regulations

- 96 Identify regulations affecting ozone depletion.
- 97 Identify the evacuation requirements for small appliances.
- 98 Detect non-condensables, using the pressure and temperature relationship (i.e., the P/T chart).
- 99 Install both high- and low-side access valves when recovering refrigerant from small appliances with inoperative compressors.
- 100 Recover refrigerants with system-dependent (passive) and self-contained (active) recovery methods.
- 101 Remove the solderless access fitting at the conclusion of service.
- 102 Identify annual leak rates for commercial and industrial process refrigeration and for other appliances containing more than 50 pounds of refrigerant.
- 103 Identify high-pressure and low-pressure recovery techniques and requirements.
- 104 Identify the components of high-pressure and low-pressure appliances and state of refrigerant.
- 105 Identify pressure-temperature relationships of high-pressure and low-pressure refrigerants.
- 106 Obtain the EPA Section 608 certification.

Exploring Emerging HVACR Technologies and Industry Considerations

- 107 Describe design choices for a proposed HVACR project that reflect an efficient use of energy.
- 108 Describe design choices for a proposed HVACR system that reflect an efficient use of water.
- 109 Describe design choices that can affect indoor air quality for proposed HVACR projects.
- 110 Describe the history and definition of direct digital control (DDC) systems.
- 111 Install a programmable controller.
- 112 Describe emerging technology and energy-management options in the industry.

Exploring R-410A

- 113 Differentiate between an R-22 and R-410A system and the requirements of each.

- 114 Describe the safety issues related to working with R-410A systems and components.
- 115 Identify the benefits of R-410A systems.

Aaron C. Spence, Ed.D., Superintendent
Virginia Beach City Public Schools
2512 George Mason Drive, Virginia Beach, VA 23456-0038

Produced by the Department of Teaching and Learning.
For further information, please call (757) 263-1070.

Notice of Non-Discrimination Policy

Virginia Beach City Public Schools does not discriminate on the basis of race, color, religion, national origin, sex, sexual orientation/gender identity, pregnancy, childbirth or related medical condition, disability, marital status, age, genetic information or veteran status in its programs, activities, employment, or enrollment, and provides equal access to the Boy Scouts and other designated youth groups. School Board policies and regulations (including, but not limited to, Policies 2-33, 4-4, 5-7, 5-19, 5-20, 5-44, 6-33, 6-7, 7-48, 7-49, 7-57 and Regulations 4-4.1, 4-4.2, 5-44.1, 7-11.1, 7-17.1 and 7-57.1) provide equal access to courses, programs, enrollment, counseling services, physical education and athletic, vocational education, instructional materials, extracurricular activities and employment.

Title IX Notice: Complaints or concerns regarding discrimination on the basis of sex or sexual harassment should be addressed to the Title IX Coordinator, at the VBCPS Office of Student Leadership, 641 Carriage Hill Road, Suite 200, Virginia Beach, 23452, (757) 263-2020, Mary.Dees@vbschools.com (student complaints) or the VBCPS Department of School Leadership, 2512 George Mason Drive, Municipal Center, Building 6, Virginia Beach, Virginia, 23456 (757) 263-1088, Elizabeth.Bryant@vbschools.com (employee complaints). Additional information regarding Virginia Beach City Public Schools' policies regarding discrimination on the basis of sex and sexual harassment, as well as the procedures for filing a formal complaint and related grievance processes, can be found in School Board Policy 5-44 and School Board Regulations 5-44.1 (students), School Board Policy 4-4 and School Board Regulation 4-4.3 (employees), and on the School Division's website at [Diversity, Equity and Inclusion/Title IX](#). Concerns about the application of [Section 504 of the Rehabilitation Act](#) should be addressed to the Section 504 Coordinator/Executive Director of Student Support Services at (757) 263-1980, 2512 George Mason Drive, Virginia Beach, Virginia, 23456 or the Section 504 Coordinator at the student's school. For students who are eligible or suspected of being eligible for special education or related services under IDEA, please contact the Office of Programs for Exceptional Children at (757) 263-2400, Plaza Annex/Family and Community Engagement Center, 641 Carriage Hill Road, Suite 200, Virginia Beach, VA 23452.

The School Division is committed to providing educational environments that are free of discrimination, harassment, and bullying. Students, staff, parents/guardians who have concerns about discrimination, harassment, or bullying should contact the school administration at their school. Promptly reporting concerns will allow the school to take appropriate actions to investigate and resolve issues. School Board Policy 5-7 addresses non-discrimination and anti-harassment, Policy 5-44 addresses sexual harassment and discrimination based on sex or gender. Policy 5-36 and its supporting regulations address other forms of harassment.

Alternative formats of this publication which may include taped, Braille, or large print materials are available upon request for individuals with disabilities. Call or write The Department of Teaching and Learning, Virginia Beach City Public Schools, 2512 George Mason Drive, P.O. Box 6038, Virginia Beach, VA 23456-0038. Telephone 263-1070 (voice); fax 263-1424; 263-1240 (TDD) or email at Brandon.Martin@vbschools.com.

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