2011 - 2012

Florida Department of Education
Curriculum Framework

Program Title: **Air-Conditioning, Refrigeration and Heating Technology 1**
Program Type: **Career Preparatory**
Career Cluster: **Architecture and Construction**

PSAV	
Program Number	C400100
CIP Number	0647020304
Grade Level	30, 31
Standard Length	750 Hours
Teacher Certification	AC HEAT ME @7 G REFRG MECH @7 G
CTSO	SkillsUSA
SOC Codes (all applicable)	49-9021
Facility Code	203 - http://www.fldoe.org/edfacil/sref.asp (State Requirements for Educational Facilities)
Targeted Occupation List	http://www.labormarketinfo.com/wec/TargetOccupationList.htm
Perkins Technical Skill Attainment Inventory	http://www.fldoe.org/workforce/perkins/perkins_resources.asp
Industry Certifications	http://www.fldoe.org/workforce/fcpea/default.asp
Basic Skills Level	Mathematics: 10 Language: 9 Reading: 9

Purpose

The purpose of this program is to prepare students for employment or advanced training in the heating, air-conditioning (A/C), and refrigeration and ventilation industry. This program prepares students for employment as A/C, Refrigeration and Heating Helper, A/C, Refrigeration and Heating Mechanic Assistant, A/C, Refrigeration and Heating Mechanic, A/C, Refrigeration and Heating Technician, and Refrigeration Technician (SOC 49-9021).

The student should obtain EPA certification prior to leaving school in order to be employed in any job that requires work with refrigerants.

This program focuses on broad, transferable skills, stresses the understanding of the heating, air-conditioning, refrigeration and ventilation industry, and demonstrates elements of the industry such as planning, management, finance, technical and production skills, the underlying principles of technology, and health, safety, and environmental issues.

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Architecture and Construction career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Architecture and Construction career cluster.

Program Structure

This program is a planned sequence of instruction consisting of three occupational completion points. The recommended sequence allows students to complete specified portions of the program for employment or to remain for advanced training. A student who completes the applicable competencies at any occupational completion point may either continue with the training program or terminate as an occupational completer.

When offered at the postsecondary adult career and technical level, this program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44(3)(b), F.S.

The following table illustrates the program structure:

OCP	Course Number	Course Title	Course Length	SOC Code
A	ACR0041	Air Conditioning, Refrigeration and Heating Helper	250 Hours	49-9021
B	ACR0043	Air Conditioning, Refrigeration and Heating Mechanic Assistant	250 Hours	49-9021
C	ACR0047	Air Conditioning, Refrigeration and Heating Mechanic 1	250 Hours	49-9021

Laboratory Activities

Laboratory activities are an integral part of this program. These activities include instruction in the use of safety procedures, tools, equipment, materials, and processes related to these occupations. Equipment and supplies should be provided to enhance hands-on experiences for students.

Special Notes

Career and Technical Student Organization (CTSO)

SkillsUSA, Inc. is the appropriate career and technical student organization for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered. The activities of such organizations are defined as part of the curriculum in accordance with Rule 6A-6.065, F.A.C.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the program-specific OJT framework apply.

Essential Skills

Essential skills identified by the Division of Career and Adult Education have been integrated into the standards and benchmarks of this program. These skills represent the general knowledge and skills considered by industry to be essential for success in careers across all career clusters. Students preparing for a career served by this program at any level should be able to demonstrate these skills in the context of this program. A complete list of Essential Skills and links to instructional resources in support of these Essential Skills are published on the CTE Essential Skills page of the FL-DOE website (http://www.fldoe.org/workforce/dwdframe/essential_skills.asp).

Basic Skills (if applicable)

In PSAV programs offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C. the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 10.0, Language 9.0, and Reading 9.0. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination. Students may be exempt from meeting the Basic Skills requirements by earning an eligible industry certification. See the Basic Skills Exemption List document for a list of eligible industry certifications (http://www.fldoe.org/workforce/dwdframe/rtf/basic-skills.rtf).

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination pursuant to Section 1008.29, F.S.; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.)

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities as identified on the secondary student's IEP or 504 plan or postsecondary student's accommodations plan to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their postsecondary service provider. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and

special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

In addition to accommodations, some secondary students with disabilities (ESE) will need modifications to meet their special needs. Modifications change the outcomes or what the student is expected to learn, e.g., modifying the curriculum of a secondary career and technical education course. Note postsecondary curriculum cannot be modified.

Some secondary students with disabilities (ESE) may need additional time (i.e., longer than the regular school year), to master the student performance standards associated with a regular Occupational Completion Point (OCP) or a Modified Occupational Completion Point (MOCP). If needed, a student may enroll in the same career and technical course more than once. Documentation should be included in the IEP that clearly indicates that it is anticipated that the student may need an additional year to complete an OCP/MOCP. The student should work on different competencies and new applications of competencies each year toward completion of the OCP/MOCP. After achieving the competencies identified for the year, the student earns credit for the course. It is important to ensure that credits earned by students are reported accurately. The district's information system must be designed to accept multiple credits for the same course number (for eligible students with disabilities).

Articulation

This program has no statewide articulation agreement approved by the Articulation Coordinating Committee. However, this does not preclude the awarding of credits by any college through local agreements.

For details on statewide articulation agreements which correlate to programs and industry certifications, refer to http://www.fldoe.org/workforce/dwdframe/artic_frame.asp.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance.
02.0 Describe the history and concepts of heating, air-conditioning, and refrigeration/ Demonstrate language arts knowledge and skills.
03.0 Identify, use, and maintain the hand tools and tool accessories used in the heating, air-conditioning, and refrigeration industry.
04.0 Demonstrate science knowledge and skills.
05.0 Demonstrate an understanding of matter and heat behavior.
06.0 Demonstrate mathematics knowledge and skills.
07.0 Demonstrate a working knowledge of fluids, pressures, refrigerants, and related codes.
08.0 Fabricate and service the piping, tubing, and fittings used in the heating, air-conditioning, and refrigeration industry.
09.0 Demonstrate a working knowledge of heating, air-conditioning, and refrigeration system components and accessories.
10.0 Use oral and written communication skills in creating, expressing and interpreting information and ideas.
11.0 Use information technology tools.

12.0 Solve problems using critical thinking skills, creativity and innovation.
13.0 Explain the importance of employability and entrepreneurship skills.
14.0 Demonstrate a practical knowledge of basic electricity and of the electrical components of heating, air-conditioning, and refrigeration equipment.
15.0 Describe the importance of professional ethics and legal responsibilities.
16.0 Demonstrate personal money-management concepts, procedures, and strategies.
17.0 Troubleshoot heating, air-conditioning, and refrigeration electrical control systems and their components.
18.0 Troubleshoot and wire electrical motors and their components.
19.0 Assist in the installation of a residential heating and air-conditioning system and determine start-up procedures.
20.0 Demonstrate a working knowledge of mechanical heating and air-conditioning system operations and of start-up and checkout procedures.
21.0 Identify basic principles for heating, air conditioning, refrigeration and ventilation piping and sizing.
22.0 Demonstrate a practical knowledge of solid-state electronics as used in heating, air-conditioning, and refrigeration systems.
23.0 Utilize and operate mechanical refrigeration servicing and testing equipment.
24.0 Use combustion-type heating servicing and testing equipment.

2011 - 2012

Florida Department of Education
Student Performance Standards

Program Title: **Air-Conditioning, Refrigeration and Heating Technology 1**
PSAV Number: **C400100**

Course Number: ACR0041
Occupational Completion Point: A
A/C, Refrigeration And Heating Helper – 250 Hours – SOC Code 49-9021

01.0 Demonstrate the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance--The student will be able to:

- 01.01 Describe personal and jobsite safety rules and regulations that maintain safe and healthy work environments. SHE1.0
- 01.02 Explain the reasons for regular safety meetings and for company safety policies.
- 01.03 Explain the need for employee-background checks and medical examinations.
- 01.04 Identify and use appropriate fire extinguishers and other such safety devices.
- 01.05 Identify and follow emergency and rescue procedures.
- 01.06 Identify and use safe-handling practices as they relate to hazardous and volatile fluids, compounds, and gases.
- 01.07 Apply specific safety and recovery practices for refrigerants used in the industry.
- 01.08 Apply specific safety practices as they relate to handling and storing cylinders and materials.
- 01.09 Select and wear proper protective clothing and equipment.
- 01.10 Identify and use specific safety practices when using soldering and brazing skills.
- 01.11 Identify and use Occupational Safety and Health Administration (OSHA) practices when working with heating, air-conditioning, and refrigeration systems and equipment.
- 01.12 Follow safety precautions when using hand and power tools.
- 01.13 Demonstrate an understanding of Cardiopulmonary Resuscitation (CPR) and first aid.
- 01.14 Explain emergency procedures to follow in response to workplace accidents.
- 01.15 Create a disaster and/or emergency response plan. SHE2.0

02.0 Describe the history and concepts of heating, air-conditioning, and refrigeration/ Demonstrate language arts knowledge and skills--The students will be able to: AF2.0

- 02.01 Identify and explain the four major refrigeration components.
- 02.02 Identify and explain the characteristics of a compression-cycle refrigerant system.
- 02.03 Locate, comprehend and evaluate key elements of oral and written information. AF2.4
- 02.04 Differentiate between air-conditioning and refrigeration.
- 02.05 Differentiate between split systems and package systems.
- 02.06 Describe the benefits of conditioned air and environments.
- 02.07 Draft, revise, and edit written documents using correct grammar, punctuation and vocabulary. AF2.5
- 02.08 Discuss the impact of heating, air-conditioning, and refrigeration on society.
- 02.09 Present information formally and informally for specific purposes and audiences. AF2.9

02.10 Discuss current issues and concerns (such as indoor-air quality, the ozone layer, and computer technology) in the heating, air-conditioning, and refrigeration industry and in the environment and explain their future ramifications.
02.11 Describe the purpose and requirements of local, state, and federal heating, air-conditioning, and refrigeration codes and standards and of the manufacturer's installation instructions.
02.12 Identify various professional organizations, associations, and societies, and explain their purposes.

03.0 Identify, use, and maintain the tools and tool accessories used in the heating, air-conditioning, and refrigeration industry--The student will be able to:
03.01 Identify and use:
a. Basic hand tools and tool accessories
b. Power tools (electric, mechanical, and pneumatic, if available)
c. Pipe and tube-working tools of the trade
d. Specialized tools of the trade
03.02 Apply appropriate care and maintenance procedures for tools and tool accessories, following the directions in the tool-equipment manufacturer's manual.

04.0 Demonstrate science knowledge and skills--The students will be able to: AF4.0
04.01 Discuss the role of creativity in constructing scientific questions, methods and explanations. AF4.1
04.02 Formulate scientifically investigable questions, construct investigations, collect and evaluate data, and develop scientific recommendations based on findings. AF4.3

05.0 Demonstrate an understanding of matter and heat behavior--The student will be able to:
05.01 Describe and explain freezing point, critical temperature, and absolute zero.
05.02 Describe matter, heat, and heat transfer.
05.03 Differentiate between heat and temperature.
05.04 Explain and distinguish among the characteristics of the three states of matter.
05.05 Explain the relationship between temperature and humidity.
05.06 Differentiate between latent heat and sensible heat.

06.0 Demonstrate mathematics knowledge and skills--The students will be able to: AF3.0
06.01 Demonstrate knowledge of arithmetic operations. AF3.2
06.02 Analyze and apply data and measurements to solve problems and interpret documents. AF3.4
06.03 Construct charts/tables/graphs using functions and data. AF3.5

07.0 Demonstrate a working knowledge of fluids, pressures, refrigerants, and related codes--The student will be able to:
07.01 Identify the refrigeration cycle.
07.02 Identify and explain general safety issues and EPA rules and regulations regarding the handling of refrigerants.
07.03 Define and explain "pressure," "fluid," and "temperature."
07.04 Explain the standards for and ways to measure and calculate absolute and gauge pressures.
07.05 Identify and explain the classifications, properties, and uses of different refrigerants.

07.06 Explain how fluids react and flow in a closed versus an open environment or vessel.
07.07 Define and identify "color-coding" of refrigerant cylinders.
07.08 Compare Pressure and Temperature (P/T) charts.
07.09 Explain the proper methods of transferring, storing, and recovering refrigerants.
07.10 Explain the effects of an improper refrigerant and contaminants in a system.

08.0 Fabricate and service the piping, tubing, and fittings used in the heating, air-conditioning, and refrigeration industry--The student will be able to:
08.01 Identify and explain the purpose of the piping, tubing, and fittings used in the heating, air-conditioning, and refrigeration industry.
08.02 Bend tubing, using tube benders.
08.03 Connect tubing, using:
a. Flared fittings
b. Compression fittings
08.04 Connect tubing, using solderless connectors.
08.05 Connect tubing, using a swaged-joint connection.
08.06 Identify and use various types of torches.
08.07 Identify, select, and use appropriate soldering and brazing alloys, materials, and skills.
08.08 Explain the purposes and procedures for protecting piping materials and fabrication, such as valves, fittings, and products, from heat.
08.09 Solder and/or braze tubing, including aluminum.
08.10 Silver-braze brass, steels, and copper.
08.11 Demonstrate an understanding of the procedures for installing pipe and tubing insulation.
08.12 Explain the procedures required for installing heating, air-conditioning, refrigerant, and ventilation accessories.
08.13 Fabricate and leak-test the piping, tubing, and fittings used in the heating, air-conditioning, and refrigeration industry.
08.14 Maintain project time and materials lists.

09.0 Demonstrate a working knowledge of heating, air-conditioning, and refrigeration system components and accessories--The student will be able to:
09.01 Explain the types, operation, use, and maintenance requirements of:
a. Compressors (such as reciprocating, rotary, screw, and scroll)
b. Condensers and evaporators (such as evaporative condensers, evaporative coils, shell and tube, tube within a tube, and fin and tube)
c. Metering devices (such as adjusting automatic and thermostatic expansion valves, fixed orifices, and other devices available on the local market)
09.02 Evaluate metering-device performance.
09.03 Explain the methods of compression, lubrication, and compressor loading and unloading.
09.04 Analyze the operating condition of a compressor.
09.05 Test, troubleshoot, and correct the causes of mechanical problems in a heating, air-conditioning, and refrigeration system.
09.06 Identify the location and explain the uses of refrigerant flow accessories.
09.07 Identify the location and explain the uses of heating, air-conditioning, and refrigeration-system accessories (such as receivers, dryers/filers, solenoid valves, heat exchangers, accumulators, suction filter, oil separators, evaporator

pressure-regulating valve, crankcase pressure-regulating valves, and check valves).

09.08 Evaluate system performance.

10.0 Use oral and written communication skills in creating, expressing and interpreting information and ideas--The students will be able to:

10.01 Select and employ appropriate communication concepts and strategies to enhance oral and written communication in the workplace. CM1.0

10.02 Locate, organize and reference written information from various sources. CM3.0

10.03 Design, develop and deliver formal and informal presentations using appropriate media to engage and inform diverse audiences. CM5.0

10.04 Interpret verbal and nonverbal cues/behaviors that enhance communication. CM6.0

10.05 Apply active listening skills to obtain and clarify information. CM7.0

10.06 Develop and interpret tables and charts to support written and oral communications. CM8.0

10.07 Exhibit public relations skills that aid in achieving customer satisfaction. CM10.0

11.0 Use information technology tools--The students will be able to:

11.01 Use Personal Information Management (PIM) applications to increase workplace efficiency. IT1.0

11.02 Employ technological tools to expedite workflow including word processing, databases, reports, spreadsheets, multimedia presentations, electronic calendar, contacts, email, and internet applications. IT2.0

11.03 Employ computer operations applications to access, create, manage, integrate, and store information. IT3.0

11.04 Employ collaborative/groupware applications to facilitate group work. IT4.0

12.0 Solve problems using critical thinking skills, creativity and innovation--The students will be able to:

12.01 Employ critical thinking skills independently and in teams to solve problems and make decisions. PS1.0

12.02 Employ critical thinking and interpersonal skills to resolve conflicts. PS2.0

12.03 Identify and document workplace performance goals and monitor progress toward those goals. PS3.0

12.04 Conduct technical research to gather information necessary for decision-making. PS4.0

13.0 Explain the importance of employability and entrepreneurship skills--The students will be able to:

13.01 Identify and demonstrate positive work behaviors needed to be employable. ECD1.0

13.02 Develop personal career plan that includes goals, objectives, and strategies. ECD2.0

13.03 Examine licensing, certification, and industry credentialing requirements. ECD3.0

13.04 Maintain a career portfolio to document knowledge, skills, and experience. ECD5.0

13.05 Evaluate and compare employment opportunities that match career goals. ECD6.0

13.06 Identify and exhibit traits for retaining employment. ECD7.0

13.07 Identify opportunities and research requirements for career advancement. ECD8.0

13.08 Research the benefits of ongoing professional development. ECD9.0

13.09 Examine and describe entrepreneurship opportunities as a career planning option. ECD10.0

Course Number: ACR0043
Occupational Completion Point: B
A/C, Refrigeration And Heating Mechanic Assistant – 250 Hours – SOC Code 49-9021

14.0 Demonstrate a practical knowledge of basic electricity and of the electrical components of heating, air-conditioning, and refrigeration equipment--The student will be able to:
- 14.01 Explain the principles of electricity.
- 14.02 Explain single- and three-phase power distribution.
- 14.03 Define and explain watts, ohms, volts, and amps.
- 14.04 Identify and explain electrical measuring tools and devices.
- 14.05 Explain the standards for and ways to measure watts, resistance, voltage, and amperage, using appropriate instruments or devices.
- 14.06 Identify and explain appropriate electrical wiring symbols.
- 14.07 Draw and explain a wiring schematic diagram for a control system.
- 14.08 Create a wiring schematic for each of the following, using all components and symbols for safe and effective operation and interpretation:
  - a. An air-conditioner
  - b. An electric furnace
  - c. A heat pump
  - d. An oil furnace
  - e. A gas furnace
- 14.09 Explain codes and standards and safety requirements for working with the electrical components used in heating, air conditioning, and refrigeration.
- 14.10 Troubleshoot protection devices, such as fuses and breakers.
- 14.11 Interpret tables and charts from the National Electrical Codes (NEC).

15.0 Describe the importance of professional ethics and legal responsibilities--The students will be able to:
- 15.01 Evaluate and justify decisions based on ethical reasoning. ELR1.0
- 15.02 Evaluate alternative responses to workplace situations based on personal, professional, ethical, legal responsibilities, and employer policies. ELR1.1
- 15.03 Identify and explain personal and long-term consequences of unethical or illegal behaviors in the workplace. ELR1.2
- 15.04 Interpret and explain written organizational policies and procedures. ELR2.0

16.0 Demonstrate personal money-management concepts, procedures, and strategies--The students will be able to:
- 16.01 Identify and describe the services and legal responsibilities of financial institutions. FL2.0
- 16.02 Describe the effect of money management on personal and career goals. FL3.0
- 16.03 Develop a personal budget and financial goals. FL3.1
- 16.04 Complete financial instruments for making deposits and withdrawals. FL3.2
- 16.05 Maintain financial records. FL3.3
- 16.06 Read and reconcile financial statements. FL3.4
- 16.07 Research, compare and contrast investment opportunities.

17.0 Troubleshoot heating, air-conditioning, and refrigeration electrical control systems and their components--The student will be able to:
- 17.01 Identify and explain the operations of electrical control systems and their components (such as heat anticipators, heat and cool thermostats, outdoor

thermostats/low ambient controls, defrost controls/timers, and auxiliary heating controls).

17.02 Identify, install, and troubleshoot controls for heating, air-conditioning, and refrigeration systems.
17.03 Explain the operation of different types of electromechanical thermostats.
17.04 Wire basic heating, air-conditioning, and refrigeration systems.
17.05 Troubleshoot operational problems for different types of electromechanical thermostats.
17.06 Explain the electrical and mechanical operations of the basic heat pump.

18.0 Troubleshoot and wire electrical motors and their components--The student will be able to:
18.01 Identify and explain the functions of various types of motors and their components.
18.02 Troubleshoot, test, and analyze motors, using various methods.
18.03 Identify, troubleshoot, and wire various types of electric motors.
18.04 Reverse the rotation of a motor.

19.0 Assist in the installation of a residential heating and air-conditioning system and determine start-up procedures--The student will be able to:
19.01 Read and comply with dispatch orders.
19.02 Explain local codes and ordinances.
19.03 Select and use appropriate tools and safety practices to test equipment.
19.04 Determine the electrical requirements of equipment.
19.05 Assist in the installation of a heating and air-conditioning system to the manufacturer's installation and operation specifications, using a practical knowledge of duct fabrication methods.
19.06 Determine the proper charge in a residential air-conditioning unit and adjust superheat.
19.07 Determine the temperature drop across the evaporator.
19.08 Determine the temperature rise across the condenser.
19.09 Write a service report.
19.10 Apply good customer-relations skills.

20.0 Demonstrate a working knowledge of mechanical heating and air-conditioning system operations and of start-up and check-out procedures--The student will be able to:
20.01 Identify and explain:
a. Air-to-air heat-pump systems
b. Water-to-air heat-pump systems
c. Water-to-water heat-pump systems
d. Air-to-ground heat-pump systems (geothermal)
e. Open-loop heat-pump systems
f. Closed-loop heat-pump systems
20.02 Determine the start-up and checkout procedures recommended by different manufacturers.
20.03 Determine the electrical requirements of equipment.
20.04 Select and use appropriate tools, instruments, and test equipment, following safety precautions.
20.05 Determine the temperature drop across the outdoor coil on a heat pump.
20.06 Determine the temperature rise across the indoor coil on a heat pump.
20.07 Test for a proper refrigerant charge in a residential heat pump.

20.08 Apply good customer-relations skills.

21.0 Identify basic principles of heating, air conditioning, refrigeration and ventilation piping sizing--The student will be able to:
- 21.01 Identify and explain various types of heating, air-conditioning, and refrigeration piping.
- 21.02 Identify basic principles of sizing various heating, air conditioning, refrigeration and ventilation for various tasks.
- 21.03 Explain pressure and temperature drops.

Course Number: ACR0047
Occupational Completion Point: C
A/C, Refrigeration And Heating Mechanic 1 – 250 Hours – SOC Code 49-9021

22.0 Demonstrate a practical knowledge of solid-state electronics as used in heating, air-conditioning, and refrigeration systems--The student will be able to:
- 22.01 Explain the basic principles and functions of Direct Digital Control (DDC).
- 22.02 Explain basic solid-state circuits and boards.
- 22.03 Identify, test, and replace circuits and boards.
- 22.04 Identify and explain the functions of a building-management system.
- 22.05 Program a programmable thermostat.

23.0 Utilize and operate mechanical refrigeration servicing and testing equipment--The student will be able to:
- 23.01 Identify the effects of superheat and subcooling on a system.
- 23.02 Identify and explain the functions of servicing and testing equipment (such as vacuum pumps, micron gauges, EPA-approved equipment, leak detectors, and charging systems).
- 23.03 Operate a refrigerant recovery system.
- 23.04 Explain the standards for and ways to measure, test, maintain, and evacuate a mechanical heating, air-conditioning, and refrigeration system.
- 23.05 Evacuate the refrigerant system with various vacuum methods.
- 23.06 Demonstrate compliance with Environmental Protection Agency (EPA) rules and regulations and, if possible, take the EPA test.
- 23.07 Charge various air-conditioning and mechanical refrigeration systems by various methods.
- 23.08 Demonstrate the effects of superheat and subcooling on a system utilizing test equipment (such as thermometers and gages)

24.0 Use combustion-type heating servicing and testing equipment--The student will be able to:
- 24.01 Explain combustion theory and the safety precautions for using combustion-type-heating servicing and testing equipment.
- 24.02 Install a combustion-type-heating unit to the manufacturer's and code requirements.
- 24.03 Identify and explain the various types of combustion-type heating servicing and testing equipment (such as draft gauge, U-tube manometer, sling psychrometer, millivolt meter, and oil-furnace testing equipment).
- 24.04 Use the servicing and testing equipment.
- 24.05 Test, analyze, and troubleshoot combustion-type-heating systems.