

**Architecture and Construction Career Cluster**  
**Heating, Ventilation, Air-Conditioning Refrigeration**  
**Course Number 47.41500**

**Course Description:**

This course is preceded by Introduction to HVACR Systems and provides students with a solid foundation in HVACR skills and knowledge involved with conditioning air within a given space. The course is the third step in gaining a Level One Industry Certification in HVAC, and builds on the concepts of math concepts introduced in Industry Fundamentals and Occupational Safety. Students will acquire knowledge of the hardware and systems used by an HVACR technician and basic installation skills. In addition, students will obtain general knowledge of refrigeration and heating processes, including electronic circuitry, and will learn about the integration between electrical and HVACR fields. The course will provide students with an understanding of joining and piping practices in HVACR systems, as well as an introduction to the skills and knowledge of conduit bending and installation.

**Course Standard 1**

**AC-HVACR1-1**

The following standard is included in all CTAE courses adopted for the Career Cluster/Pathways. Teachers should incorporate the elements of this standard into lesson plans during the course. The topics listed for each element of the standard may be addressed in differentiated instruction matching the content of each course. These elements may also be addressed with specific lessons from a variety of resources. This content is not to be treated as a unit or separate body of knowledge but rather integrated into class activities as applications of the concept.

**Standard: Demonstrate employability skills required by business and industry.**

The following elements should be integrated throughout the content of this course.

**1.1 Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities .**

Person-to-Person Etiquette	Telephone and Email Etiquette	Cell Phone and Internet Etiquette	Communicating At Work	Listening
Interacting with Your Boss	Telephone Conversations	Using Blogs	Improving Communication Skills	Reasons, Benefits, and Barriers
Interacting with Subordinates	Barriers to Phone conversations	Using Social Media	Effective Oral Communication	Listening Strategies
Interacting with Co-workers	Making and Returning Calls		Effective Written Communication	Ways We Filter What We Hear
Interacting with Suppliers	Making Cold Calls		Effective Nonverbal Skills	Developing a Listening Attitude
	Handling Conference Calls		Effective Word Use	Show You Are Listening
	Handling Unsolicited Calls		Giving and Receiving Feedback	Asking Questions
				Obtaining Feedback
				Getting Others to Listen

Nonverbal Communication	Written Communication	Speaking	Applications and Effective Résumés
Communicating Nonverbally	Writing Documents	Using Language Carefully	Completing a Job Application
Reading Body Language and mixed Messages	Constructive Criticism in Writing	One-on-One Conversations	Writing a Cover Letter

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Matching Verbal and Nonverbal communication		Small Group Communication	Things to Include in a Résumé
Improving Nonverbal Indicators		Large Group Communication	Selling Yourself in a Résumé
Nonverbal Feedback		Making Speeches	Terms to Use in a Résumé
Showing Confidence Nonverbally		Involving the Audience	Describing Your Job Strengths
Showing Assertiveness		Answering Questions	Organizing Your Résumé
		Visual and Media Aids	Writing an Electronic Résumé
		Errors in Presentation	Dressing Up Your Résumé

### 1.2 Demonstrate creativity by asking challenging questions and applying innovative procedures and methods.

Teamwork and Problem Solving	Meeting Etiquette
Thinking Creatively	Preparation and Participation in Meetings
Taking Risks	Conducting Two-Person or Large Group Meetings
Building Team Communication	Inviting and Introducing Speakers
	Facilitating Discussions and Closing
	Preparing Visual Aids
	Virtual Meetings

### 1.3 Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations.

Problem Solving	Customer Service	The Application Process	Interviewing Skills	Finding the Right Job
Transferable Job Skills	Gaining Trust and Interacting with Customers	Providing Information, Accuracy and Double Checking	Preparing for an Interview	Locating Jobs and Networking
Becoming a Problem Solver	Learning and Giving Customers What They Want	Online Application Process	Questions to Ask in an Interview	Job Shopping Online
Identifying a Problem	Keeping Customers Coming Back	Following Up After Submitting an Application	Things to Include in a Career Portfolio	Job Search Websites
Becoming a Critical Thinker	Seeing the Customer's Point	Effective Résumés:	Traits Employers are Seeking	Participation in Job Fairs
Managing	Selling Yourself and the Company	Matching Your Talents to a Job	Considerations Before Taking a Job	Searching the Classified Ads
	Handling Customer Complaints	When a Résumé Should be Used		Using Employment Agencies
	Strategies for Customer Service			Landing an Internship
				Staying Motivated to Search

### 1.4 Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity.

Workplace Ethics	Personal Characteristics	Employer Expectations	Business Etiquette	Communicating at Work
Demonstrating Good Work Ethic	Demonstrating a Good Attitude	Behaviors Employers Expect	Language and Behavior	Handling Anger
Behaving Appropriately	Gaining and Showing Respect	Objectionable Behaviors	Keeping Information Confidential	Dealing with Difficult Coworkers

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Maintaining Honesty	Demonstrating Responsibility	Establishing Credibility	Avoiding Gossip	Dealing with a Difficult Boss
Playing Fair	Showing Dependability	Demonstrating Your Skills	Appropriate Work Email	Dealing with Difficult Customers
Using Ethical Language	Being Courteous	Building Work Relationships	Cell Phone Etiquette	Dealing with Conflict
Showing Responsibility	Gaining Coworkers' Trust		Appropriate Work Texting	
Reducing Harassment	Persevering		Understanding Copyright	
Respecting Diversity	Handling Criticism		Social Networking	
Making Truthfulness a Habit	Showing Professionalism			
Leaving a Job Ethically				

### 1.5 Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills.

Expected Work Traits	Teamwork	Time Management
Demonstrating Responsibility	Teamwork Skills	Managing Time
Dealing with Information Overload	Reasons Companies Use Teams	Putting First Things First
Transferable Job Skills	Decisions Teams Make	Juggling Many Priorities
Managing Change	Team Responsibilities	Overcoming Procrastination
Adopting a New Technology	Problems That Affect Teams	Organizing Workspace and Tasks
	Expressing Yourself on a Team	Staying Organized
	Giving and Receiving Constructive Criticism	Finding More Time
		Managing Projects
		Prioritizing Personal and Work Life

### 1.6 Present a professional image through appearance, behavior and language.

On-the-Job Etiquette	Person-to-Person Etiquette	Communication Etiquette	Presenting Yourself
Using Professional Manners	Meeting Business Acquaintances	Creating a Good Impression	Looking Professional
Introducing People	Meeting People for the First Time	Keeping Phone Calls Professional	Dressing for Success
Appropriate Dress	Showing Politeness	Proper Use of Work Email	Showing a Professional Attitude
Business Meal Functions		Proper Use of Cell Phone	Using Good Posture
Behavior at Work Parties		Proper Use in Texting	Presenting Yourself to Associates
Behavior at Conventions			Accepting Criticism
International Etiquette			Demonstrating Leadership
Cross-Cultural Etiquette			
Working in a Cubicle			

### Support of CTAE Foundation Course Standards and Georgia Standards of Excellence L9-10RST 1-10 and L9-10WHST 1-10:

Georgia Standards of Excellence ELA/Literacy standards have been written specifically for technical subjects and have been adopted as part of the official standards for all CTAE courses.

## Course Standard 2

### AC-HVACR1-2

#### Apply mathematical concepts related to HVACR.

- 2.1 Solve algebraic equations that relate to the HVACR trade.
- 2.2 Calculate volume, weight, pressure, vacuum, and temperature related to the HVACR trade.

## Course Standard 3

### AC-HVACR1-3

#### Demonstrate using hand and power tools associated with the HVACR trade in a professional and safe manner.

- 3.1 Demonstrate the ability to correctly use the following: pipe wrenches, torque wrenches, hammers and mallets, tin snips, hand and power hacksaws, drills, and measuring instruments.

## Course Standard 4

### AC-HVACR1-4

#### Demonstrate the proper selection, handling, and methods of joining, installing and supporting of HVACR pipe and tubing.

- 4.1 Describe procedures and precautions that must be taken when preparing and installing HVACR piping.
- 4.2 Braze and solder copper tubing and fittings in a safe and professional manner.
- 4.3 Demonstrate correct preparation and installation of Poly(vinyl chloride) or PVC and Ferrous Metal Piping.

## Course Standard 5

### AC-HVACR1-5

#### Describe how an HVACR system conditions and cools the air within a specified space.

- 5.1 Demonstrate an understanding of the basic refrigeration cycle.
- 5.2 Recognize the major components of a cooling system and explain how they operate.
- 5.3 Identify and describe refrigerants and demonstrate procedures for safe handling of them.
- 5.4 Use temperature and pressure measuring instruments to evaluate the condition of the system.

## Course Standard 6

### AC-HVACR1-6

#### Describe how an HVACR system conditions and heats the air within a specified space.

- 6.1 Explain the three methods of heat transfer.
- 6.2 Recognize the major components of a forced air furnace (gas and electric) and explain their function.
- 6.3 State the factors that must be considered when installing a furnace.
- 6.4 Demonstrate performing preventive maintenance procedures such as cleaning and filter replacement.
- 6.5 Demonstrate an understanding of the sequence of operation of a gas furnace.
- 6.6 Demonstrate an understanding of how to adjust a gas valve.

## Course Standard 7

### AC-HVACR1-7

#### Describe how compressors operate.

- 7.1 Identify and explain the operation of the different kinds of compressors.
- 7.2 Demonstrate the common procedures for servicing and maintenance of both hermetic and semi-hermetic compressors.

## Course Standard 8

### AC-HVACR1-8

#### Demonstrate how to operate the equipment used in the HVAC field.

- 8.1 Demonstrate proper operation of manifold gages.
- 8.2 Demonstrate proper operation of recovery machines, vacuum pumps, micron gages, charging scales, and leak detectors.
  
- 8.3 Demonstrate the ability to check superheat and sub cooling.
- 8.4 Demonstrate recovering refrigerant, evacuating a system, and charging a system.

## Course Standard 9

### AC-HVACR1-9

#### Demonstrate proper assembly of ductwork.

- 9.1 Demonstrate the ability to assemble pre-made sections of ductwork.
- 9.2 Demonstrate how to make S Cleats, Drive Cleats, and Pittsburg seams, and explain how they are installed.
- 9.3 Demonstrate how to install Flex duct, take offs, boots, and registers.

## Course Standard 10

### AC-HVACR1-10

#### Examine how SkillsUSA is a co-curricular part of career and technical education through leadership development, school and community service projects, and competitive events.

- 10.1 Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA.
- 10.2 Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development.
- 10.3 Explore the impact and opportunities that SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs.
- 10.4 Explore the local, state, and national opportunities available to students through participation in SkillsUSA, including but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities.