Connecticut Technical Education and Career System

Connecticut-SDE

Heating, Cooling and Sheet Metal Apprenticeship Information Packet

State of Connecticut Heating/Cooling & Sheet Metal Apprenticeship Information Packet 18-19

CSDE
CONNECTICUT STATE DEPARTMENT OF EDUCATION

CTECS
CONNECTICUT TECHNICAL EDUCATION AND CAREER SYSTEM

Connecticut Technical Education and Career System
Connecticut State Department of Education

Heating, Cooling & Sheet Metal
APPRENTICESHIP
INFORMATION PACKET

2018-19

Covering the following licenses:

S-2 HEATING and COOLING
S-4 HEATING MECHANIC
S-6 LIMITED HEATING MECHANIC
S-8 LIMITED HEATING MECHANIC
S-10 LIMITED HEATING and COOLING
B-2/B-4 OIL BURNER SERVICER/INSTALLER
D-2 WARM AIR HEATING and COOLING
D-4 REFRIGERATION MECHANIC
SM-2 SHEET METAL

Concerning related classroom instruction, each apprentice student is expected:

- To purchase the textbooks required for each course
- To complete all instructor assigned quizzes and exams as well as any academic reinforcement activities.

Student Responsibility Enrollment and Attendance:

- Students are held responsible for making informed enrollment decisions and for knowledge of and compliance with CTHSS policies and procedures, current printed class schedule as well as special registration instructions which may be issued on a semester-by-semester basis.

ATTENDANCE:

Based on 3 hour class sessions, the following is a list of total hours in a course and the maximum number of allowed absences (by number of classes) prior to denial of credit:

Total hours in classes	Maximum absences	Total hours in classes	Maximum absences
1 - 9	0	61 - 90	3
10 - 30	1	91 - 120	4
31 - 60	2		

Excessive tardiness and/or early departures will be addressed on an individual basis and may cause denial of credit; example being marked tardy for 3- 1 hour incidents will equate to an absence.

Employers have the right to verify their employee's attendance in a program.

NOTE: A minimum grade of 75% is necessary to pass each course.

All trade area content is based on a strong mathematical foundation. For this reason the baseline for transfer credit needs to be set to a higher standard, as well as being recent. Basic Math transfer credit may be awarded with a minimum of an '85' average completed in a comparable course, and taken within the last five years from date request for credit is submitted. All communications will need to be forwarded through the apprentice school supervisor at the local school. For perusal of waiver, please provide the apprentice school supervisor with the following:

- Transcripts detailing grades earned in the course, showing a minimum proficiency level of an '85' or better.
- Course description from institution listed on transcripts.

EPA Course requirements

EPA Course substitution: The EPA card ***cannot*** be substituted for the required thirty-six hour EPA Refrigerant Standards (A0787) course. Please be advised this is ***not permissible***, as just holding an EPA card is not an allowable substitution for this course.

The following section, Apprentice Responsibilities, is taken from the **State of Connecticut-Apprentice Handbook & Progress Report,** which is given to each apprentice at the beginning of their training by the Office of Apprenticeship Training, Connecticut State Labor Department.

Apprentice Responsibilities:

1. Work safely.
2. Avoid absenteeism and tardiness at work and at school.
3. Attend and participate in related instruction and maintain the highest possible grades.
4. Be involved and show dedication to your training (both on the job and in the classroom).
5. Keep track of your training hours, (either in the form of work records or logbook) and advise your supervisor of any deficiencies in your apprenticeship training.
6. Show dedication and interest in learning the trade.
7. Show respect to the skilled journeypersons training and supervising you.
8. Comply with the provisions of the Apprentice Agreement.
9. Follow your sponsor's written work rules and policies.
10. You must be accompanied by a journeyperson while on the job site.

Regional Apprenticeship Representatives
Office of Apprenticeship Training
Department of Labor
860-263-6085

Contact information and region assigned:

Region 1: Paul Femia, paul.femia@ct.gov (860) 263-6128

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Region 2: Larry Satchell, larry.satchell@ct.gov (860) 263-6084

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Region 3: Owen Golding, owen.golding@ct.gov (860) 263-6083

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Region 4: Gina Knox, gina.knox@ct.gov (860) 263-6277

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Region 5: Tammie Whiting, tammie.whiting@ct.gov (860)263-6154

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Region 6: Isaiah Curtis, Isaiah.curtis@ct.gov (860) 263-6042

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Statewide: Keri Lamontagne, keri.lamontagne@ct.gov (860) 263-6129

Towns Served:

Statewide	**Manufacturing**

Towns and Cities by Regional DOL Rep located on the following page:

REGION 1 PAUL FEMIA	REGION 2 LARRY SATCHELL	REGION 3 OWEN GOLDING	REGION 4 GINA KNOX	REGION 6 ISAIAH CURTIS	REGION 5 TAMMIE WHITING
860-263-6128	860-263-6084	860-263-6083	860-263-6277	860-263-6042	860-263-6154
Berlin	Andover	Avon	Ansonia	Ashford	Beacon Falls
Chester	Bolton	Barkhamsted	Bethel	Bozrah	Bethany
Clinton	Columbia	Bethlehem	Bridgeport	Brooklyn	Branford
Colchester	Coventry	Bloomfield	Darien	Canterbury	Cheshire
Cromwell	East Hartford	Bridgewater	Derby	Chaplin	East Haven
Deep River	East Windsor	Bristol	Easton	Eastford	Hamden
Durham	Ellington	Brookfield	Fairfield	Franklin	Middlebury
East Haddam	Enfield	Burlington	Greenwich	Griswold	Naugatuck
East Hampton	Hartford	Canaan	Milford	Hampton	New Haven
East Lyme	Hebron	Canton	Monroe	Killingly	North Branford
Essex	Manchester	Colebrook	New Canaan	Lebanon	North Haven
Glastonbury	Mansfield	Cornwall	Newtown	Ledyard	Orange
Greenwich	Rocky Hill	Danbury	Norwalk	Lisbon	Oxford
Groton	Somers	East Granby	Redding	Montville	Plainville
Guilford	South Windsor	Farmington	Ridgefield	Norwich	Prospect
Haddam	Stafford	Goshen	Shelton	Plainfield	Seymour
Killingworth	Suffield	Granby	Stamford	Pomfret	Southington
Lyme	Tolland	Hartland	Stratford	Putnam	Wallingford
Madison	Union	Harwinton	Trumbull	Scotland	Waterbury
Marlborough	Vernon	Kent	Weston	Sterling	West Haven
Meriden	Wethersfield	Litchfield	Westport	Thompson	Wolcott
Middlefield	Willington	Morris	Wilton	Woodstock	Woodbridge
Middletown	Windham	New Fairfield			
New Britain	Windsor	New Hartford			
New London	Windsor Locks	New Milford			
Newington		Norfolk			
North Stonington		North Canaan			
Old Lyme		Plymouth			
Old Saybrook		Roxbury			
Portland		Salisbury			
Preston		Sharon			
Salem		Sherman			
Sprague		Simsbury			
Stonington		Southbury			
Voluntown		Thomaston			
Waterford		Torrington			
Westbrook		Unionville			
		Warren			
		Washington			
		Watertown			
		West Hartford			
		Winchester			
		Woodbury			

Department of Consumer Protection
Section 20-330 of the Connecticut General Statutes
"Heating, piping and cooling work" means (A) the installation, repair, replacement, maintenance or alteration of any apparatus for piping, appliances, devices or accessories for heating systems, including sheet metal work, and (B) the installation, repair, replacement, maintenance or alteration of air conditioning and refrigeration systems, boilers, including apparatus and piping for the generation or conveyance of steam and associated pumping equipment and process piping. Heating, piping and cooling work does not include solar work or medical gas and vacuum systems work. For the purposes of this subdivision, "process piping" means piping or tubing that conveys liquid or gas that is used directly in the production of a product for human consumption; **"Sheet metal work**" means the installation, erection, replacement, repair or alteration of duct work systems, both ferrous and nonferrous

S-1 Unlimited Contractor
The holder of this license may do all heating, piping and cooling work as defined in Section 20-330 of the General Statutes.

S-2 Unlimited Journeyperson
The holder of this license may do the same work as the S-1 licensee, but only while in the employ of a contractor licensed for such work.

S-3 Limited Contractor
The holder of this license may perform the installation, repair, replacement, maintenance or alteration of any apparatus for piping, appliances, devices or accessories for heating systems, boilers, including apparatus and piping for the generation or conveyance of steam associated pumping equipment and oil burner installation and servicing (excluding sheet metal work, air conditioning and refrigeration systems). This license also covers the installation of hot, chilled and condensed water as well as steam piping in air conditioning systems.

S-4 Limited Journeyperson
The holder of this license may perform the same work as the S-3 licensee, but only while in the employ of a contractor licensed for such work

S-5 Limited Contractor
The holder of this license may perform only work limited to hot water or steam heating systems for buildings not over three stories high with total heating load not exceeding 500,000 BTU's and steam pressure not exceeding 15 pounds, but does not cover the installation or servicing of oil burners of any size.

S-6 Limited Journeyperson
The holder of this license may perform the same work as the S-5 licensee, but only while in the employ of a contractor licensed for such work.

S-7 Limited Contractor
The holder of this license may perform only work limited to hot water or steam heating systems for buildings not over three stories high with a total heating load not exceeding 500,000 BTU's and steam pressure not exceeding 15 pounds. This license also covers the servicing and installation of oil burners handling up to five gallons per hour, as well as gas piping for the work covered by this license.

S-8 Limited Journeyperson
The holder of this license may perform the same work as the S-7 licensee, but only while in the employ of a contractor licensed for such work.

S-9 Limited Contractor
The holder of this license may perform only work limited to hot water or steam heating systems for buildings not over three stories high with total heating load not exceeding 500,000 BTU's, steam pressure not exceeding fifteen pounds, and/or cooling installations up to 35 tons per systems. This license also covers the installation or servicing of oil burners handling up to five gallons per hour as well as LP gas supplied by gas containers and/or natural gas piping for work covered by this limited license.

S-10 Limited Journeyperson
The holder of this license may perform work only while in the employ of a licensed contractor and only limited to hot water or steam heating systems for buildings not over three stories high with total heating load not exceeding 500,000 BTU's, steam pressure not exceeding fifteen pounds, and/or cooling installations up to 35 tons per systems. This license also covers the installation or servicing of oil burners handling up to five gallons

per hour as well as LP gas supplied by gas containers and/or natural gas piping for work covered by this limited license.

B-1 Limited Contractor

The holder of this license may perform only work of installing, servicing or repairing gas or oil burners for domestic and light commercial installations. A domestic or light commercial burner shall be considered as one consuming five gallons or less per hour.

B-2 Limited Journeyperson

The holder of this license may perform the same work as the B-1 licensee, but only while in the employ of a contractor licensed for such work.

B-3 Limited Contractor

The holder of this license may perform the installing, servicing or repairing of any gas or oil fire burners.

B-4 Limited Journeyperson

The holder of this license may perform the same work as the B-3 licensee, but only while in the employ of a contractor licensed for such work.

D-1 Limited Contractor

The holder of this license may perform only work limited to installation, replacement, repair, maintenance or alteration of any warm air, air conditioning and refrigeration system, including necessary piping for the conveyance of heating or cooling media and associated pumping equipment. This license does not include the installation or servicing of oil burners of any size.

D-2 Limited Journeyperson

The holder of this license may perform the same work as the D-1 licensee, but only while in the employ of a contractor licensed for such work.

D-3 Limited Contractor

The holder of this license may perform only work limited to the installation, repair, replacement, maintenance or alteration of all refrigeration systems included in food storage, air conditioning or special process systems.

D-4 Limited Journeyperson

The holder of this license may perform the same work as the D-3 licensee, but only while in the employ of a contractor licensed for such work.

SM-1 Limited Sheet Metal Contractor

The holder of this license may perform only work limited to the installation, erection, replacement, repair or alteration of any duct work system, both ferrous and nonferrous for ductwork systems of any size and type, excluding pneumatic conveyance systems which are covered under sections 20-3325(a), (b), (c), and (d) of these regulations.

SM-2 Limited Sheet Metal Journeyperson

The holder of this license may perform only work limited to the installation, erection, replacement, repair or alteration of any duct work system, both ferrous and nonferrous for ductwork systems of any size and type, excluding pneumatic conveyance systems which are covered under sections 20-3325(a), (b), (c), and (d) of these regulations. The holder of this license may perform such work only while in the employ of a contractor license for such work.

S-2 HEATING and COOLING APPRENTICESHIP
COURSE SEQUENCE AND PREREQUISITES

Related Instruction- 720 Hours **OJT - 8000 Hours**

The following courses are 36 hours each.	Course number	Semester	Prerequisites
FIRST YEAR COURSES:			
Basic Math Computations	A0001	1	
Blueprint Reading	A0031	1	
OSHA 30	A0099	1	
Oil Burner Fundamentals	A0783	2	
Refrigeration Fundamentals	A0781	2	
SECOND YEAR COURSES:			
Heating Fundamentals	A0784	1	
HVAC Math	A0006	1	A0001
Electrical Fundamentals	A0782	1	
HVAC Sheet Metal Theory I	A2901	2	
Brazing, Cutting and Metallurgy	A2113	2	
THIRD YEAR COURSES:			
Heating- Hydronic and Steam	A0789	1	A0784
Refrigeration, Domestic Commercial and Special Systems	A0721	1	A0781
Air Conditioning	A0785	1	
Oil Burner Controls & Servicing	A0791	2	
SMACNA	A2906	2	
FOURTH YEAR COURSES:			
EPA Refrigerant Standards **	A0787	1	
HVAC Sheet Metal Theory II*	A2902	1	A2901
Forced Air Heating and Cooling	A0790	1	A0784
International Mechanical Code	A0729	2	
Related Codes and Standards	A0730	2	

*** May substitute Welding II A2102**

**** EPA card may NOT be substituted for this course**

S-4 HEATING MECHANIC APPRENTICESHIP
S-6 LIMITED HEATING MECHANIC APPRENTICESHIP
S-8 LIMITED HEATING MECHANIC APPRENTICESHIP

COURSE SEQUENCE AND PREREQUISITES

Related Instruction- 576Hours **OJT - 8000 Hours**

The following courses are 36 hours each.	Course number	Semester	Prerequisites
FIRST YEAR COURSES:			
Basic Math Computations	A0001	1	
Blueprint Reading	A0031	1	
OSHA 30	A0099	2	
HVAC Math	A0006	2	A0001
SECOND YEAR COURSES:			
Heating Fundamentals	A0784	1	
Electrical Fundamentals	A0782	1	
Oil Burner Fundamentals	A0783	2	
Brazing, Cutting and Metallurgy	A2113	2	
THIRD YEAR COURSES:			
Heating- Hydronic and Steam	A0789	1	A0784
Welding II	A2102	1	A2113
Oil Burner Controls and Servicing	A0791	2	A0783
SMACNA	A2906	2	
FOURTH YEAR COURSES:			
HVAC Sheet Metal Theory I	A2901	1	
Related Codes and Standards	A0730	1	
HVAC Sheet Metal Theory II	A2902	2	A2901
International Mechanical Code	A0729	2	

S-10 LIMITED HEATING and COOLING APPRENTICESHIP

COURSE SEQUENCE AND PREREQUISITES

Related Instruction- 576 Hours **OJT - 6000 Hours**

The following courses are 36 hours each.	Course number	Semester	Prerequisites
FIRST YEAR COURSES:			
Basic Math Computations	A0001	1	
Blueprint Reading	A0031	1	
OSHA 30	A0099	1	
HVAC Math	A0006	2	
Oil Burner Fundamentals	A0783	2	
Refrigeration Fundamentals	A0781	2	
SECOND YEAR COURSES:			
Heating Fundamentals	A0784	1	
Electrical Fundamentals	A0782	1	
Oil Burner Controls and Servicing	A0791	1	A0783
Air Conditioning	A0785	2	
Heating- Hydronic and Steam	A0789	2	A0784
THIRD YEAR COURSES:			
Brazing, Cutting and Metallurgy	A2113	1	
Refrigeration, Domestic Commercial and Special Systems	A0721	1	A0781
Forced Air Heating and Cooling	A0790	1	A0784
International Mechanical Code	A0729	2	
Related Codes and Standards	A0730	2	

B-2 OIL BURNER SERVICER/INSTALLER APPRENTICESHIP (Residential/Light commercial)

COURSE SEQUENCE AND PREREQUISITES

Related Instruction- 252 Hours **OJT - 2000 Hours**

The following courses are 36 hours each.	Course number	Semester	Prerequisites
FIRST YEAR COURSES:			
Basic Math Computations	A0001	1	
OSHA 30	A0099	1	
Oil Burner Fundamentals	A0783	2	
Electrical Fundamentals	A0782	2	
SECOND YEAR COURSES:			
Heating Fundamentals	A0784	1	
Related Codes and Standards	A0730	2	
Oil Burner Controls and Servicing	A0791	2	A0783

B-4 OIL BURNER SERVICER/INSTALLER APPRENTICESHIP (unlimited)

COURSE SEQUENCE AND PREREQUISITES

Related Instruction- 324 Hours **OJT - 4000 Hours**

The following courses are 36 hours each.	Course number	Semester	Prerequisites
FIRST YEAR COURSES:			
Basic Math Computations	A0001	1	
Blueprint Reading	A0031	1	
OSHA 30	A0099	1	
Oil Burner Fundamentals	A0783	2	
Electrical Fundamentals	A0782	2	
SECOND YEAR COURSES:			
Heating Fundamentals	A0784	1	
Related Codes and Standards	A0730	2	
International Mechanical Code	A0729	2	
Oil Burner Controls and Servicing	A0791	2	A0783

D-2 WARM AIR HEATING and COOLING APPRENTICESHIP
COURSE SEQUENCE AND PREREQUISITES

Related Instruction- 432Hours **OJT - 4000 Hours**

The following courses are 36 hours each.	Course number	Semester	Prerequisites
FIRST YEAR COURSES:			
Basic Math Computations	A0001	1	
Blueprint Reading	A0031	1	
OSHA 30	A0099	1	
HVAC Math	A0006	2	A0001
Electrical Fundamentals	A0782	2	
Refrigeration Fundamentals	A0781	2	
SECOND YEAR COURSES:			
HVAC Sheet Metal Theory I	A2901	1	
Air Conditioning	A0785	1	
Heating Fundamentals	A0784	1	
Forced Air Heating and Cooling	A0790	2	A0784 A2901
International Mechanical Code	A0729	2	
Related Codes and Standards	A0730	2	

D-4 REFRIGERATION MECHANIC APPRENTICESHIP
COURSE SEQUENCE AND PREREQUISITES

Related Instruction-360Hours **OJT - 4000 Hours**

The following courses are 36 hours each.	Course number	Semester	Prerequisites
FIRST YEAR COURSES:			
Basic Math Computations	A0001	1	
Blueprint Reading	A0031	1	
OSHA 30	A0099	1	
Refrigeration Fundamentals	A0781	2	
Electrical Fundamentals	A0782	2	
SECOND YEAR COURSES:			
Brazing, Cutting and Metallurgy	A2113	1	
EPA Refrigerant Standards *	A0787	1	
Refrigeration, Domestic, Commercial and Special Systems	A0721	2	A0781
International Mechanical Code	A0729	2	
Welding II	A2102	2	A2113

*** EPA card may NOT be substituted for this course**

SM-2 SHEET METAL APPRENTICESHIP
COURSE SEQUENCE AND PREREQUISITES

Related Instruction- 540 Hours **OJT - 8000 Hours**

The following courses are 36 hours each	Course number	Semester	Prerequisites
FIRST YEAR COURSES:			
Basic Math Computations	A0001	1	
OSHA 30	A0099	1	
HVAC Math	A0006	2	A0001
Brazing, Cutting and Metallurgy	A2113	2	
SECOND YEAR COURSES:			
Blueprint Reading	A0031	1	
HVAC Sheet Metal Theory I	A2901	1	
Welding I	A2101	2	A2113
HVAC Sheet Metal Theory II	A2902	2	A2901
THIRD YEAR COURSES:			
HVAC Sheet Metal Layout I	A2904	1	
Welding II	A2102	1	A2113
SMACNA	A2906	2	
HVAC Sheet Metal Layout II	A2905	2	A2904
FOURTH YEAR COURSES:			
Forced Air Heating & Cooling	A0790	1	A2901
International Mechanical Code	A0729	1	
Related Codes and Standards	A0730	2	

Course Outlines

NOTE: Each apprentice student is expected to complete all instructor assigned quizzes and exams as well as any academic reinforcement activities.

A minimum grade of 75% is necessary to pass each course.

Course: Basic Math Computations A0001 36 Hours

- A. Computations Using Real Numbers
- B. Computations Using Fractions
- C. Computations Using Decimal Fractions
- D. Base, Rate, and Portion
- E. Computation of Area and Volume
- F. Units of Measurements

Course: Blueprint Reading A0031 36 Hours

- A. Application of Building Codes and Standards
- B. Introduction to Blueprint Reading
- C. Alphabet of Lines and Symbols
- D. Orthographic Projection Drawings
- E. Construction Dimensions and Construction Materials
- F. Reading Plot Plans and Contour Maps
- G. Footings, Foundations and Floor Blueprint
- H. Structural Steel, Framing Blueprints
- I. Plumbing System Blueprints
- J. H.V.A.C. System Blueprints
- K. Electrical Systems Blueprints

Course: OSHA-30 A0099 36 Hours

- A. Introduction to OSHA – 2 hours
- B. Managing Safety and Health – 2 hours
- C. OSHA Focus Four Hazards – 6 hours
  - a. (1) Falls (minimum one hour and 15 minutes)
  - b. (2) Electrocution
  - c. (3) Struck-By (e.g., falling objects, trucks, cranes)
  - d. (4) Caught-In or Between (e.g., trench hazards, equipment)
- D. Personal Protective and Lifesaving Equipment – 2 hours
- E. Health Hazards in Construction – 2 hours
- F. Stairways and Ladders – 1 hour.
- G. Electives - 12 hours
  - a. Concrete and Masonry Construction
  - b. Confined Space Entry
  - c. Cranes, Derricks, Hoists, Elevators, & Conveyors
  - d. Ergonomics
  - e. Excavations
  - f. Fire Protection and Prevention
  - g. Materials Handling, Storage, Use and Disposal

h. **Motor Vehicles, Mechanized Equipment and Marine Operations; Rollover Protective Structures and Overhead Protection; and Signs, Signals and Barricades**
i. **Powered Industrial Vehicles**
j. **Safety and Health Programs**
k. **Scaffolds**
l. **Steel Erection**
m. **Tools - Hand and Power**
n. **Welding and Cutting**

Course: Oil Burner Fundamentals A0783 36 Hours

A. Combustion Process
B. Oil Burners
C. Air Delivery System
D. Oil Tank Installation
E. Pumps and Nozzles
F. Ignition System
G. Electrical Equipment

Course: Refrigeration Fundamentals A0781 36 Hours

A. Fundamentals of Refrigeration
B. Refrigeration Tools and Materials
C. Basic Refrigeration Systems
D. Compressions Systems and Compressors
E. Refrigeration Controls

Course: Heating Fundamentals A0784 36 Hours

A. Gas Heating Systems
B. Hydronic Radiant Heating Systems
C. Oil Heating Systems
D. Electric Heating Systems
E. Alternate Heating Methods
F. Humidification
G. Solar Energy

Course: HVAC Math A0006 36 Hours

How to solve HVAC/R trade related problems involving the measurement of lines, area, volume, weights, angles, pressure, vacuum, and temperature. Also includes a review of scientific notation, powers, roots, and basic algebra and geometry. Course will cover pertinent laws/formulas utilized in the HVAC career

- **Direct Measure**
- **Computed Measure-Area**
- **Computed Measure-Volume**
- **Formulas**
- **Duct Calculations**
- **Trigonometry**

- **Graphs**
- **Heat loss/Heat gain**
- **Angles and Degrees of a Circle**
- **Ohm's Law**
- **Watt's Law**
- **Boyle's Law**
- **Charles' Law**
- **Dalton's Law**
- **Combined Gas Law**
- **Specific Heat Formula**
- **Sensible Heat Formula**
- **Latent Heat Formula**
- **Total Heat Formula**
- **Pulley Sizing**
- **Thermodynamic Laws**
- **Molecular Theory: Absolute Pressure/Gauge Pressure Conversions, etc.**
- **BTU Calculations and Conversions**

Course: Electrical Fundamentals A0782 36 Hours

A. Electrical-Magnetic Fundamentals
B. Electric Motors
C. Electric Circuits and Controls

Course: HVAC Sheet Metal Theory I A2901 36 Hours

A. Air Distribution
B. Air Measurement and Cleaning

Course: Brazing, Cutting and Metallurgy A2113 36 Hours

A. Brazing, Braze Welding & Soldering
B. Cutting Operations
C. Pipe Welding
D. Welding Metallurgy
E. Metal Identification
F. Weldability of Carbon & Alloy Steels
G. Weldability of Tool Steels and Cast Iron
H. Weldability of Stainless Steel
I. Weldability of Nonferrous Metals
J. Distortion Control
K. Materials & Fabrication Standards & Codes

Course: Heating-Hydronic and Steam A0789 36 Hours

A. Steam Heating Systems
B. Hot Water Heating Systems
C. Domestic Hot Water

Course: Refrigeration: Commercial, Domestic and Special Systems A0721 36 Hours

- **A. Domestic Refrigerators and Freezers**
- **B. Servicing & Installing Small Hermetic Systems**
- **C. Commercial Systems**
- **D. Commercial Systems- Applications**
- **E. Servicing and Installing Commercial Systems**
- **F. Commercial Systems- Heating Loads and Piping**
- **G. Absorption Systems**
- **H. Special Refrigeration Systems and Applications**

Course: Air Conditioning A0785 36 Hours

- **A. Fundamentals of Air Conditioning**
- **B. Cooling and Dehumidification Systems**
- **C. Central Air Conditioning and Heat Pumps**

Course: Oil Burner Controls and Servicing A0791 36 Hours

- **A. Oil Burner Controls**
- **B. Control Circuit Wiring**
- **C. Service Procedures-Burner Not Operating (BNO)**
- **D. Service Procedures-Improper Operation**
- **E. Annual Tune-up**
- **F. Combustion Efficiency Testing**
- **G. Improving Combustion Efficiency**

Course: SMACNA A2906 36 Hours

- **A. Basic Duct Construction standards, including symbols, duct design and performance requirements**
- **B. Pressure classes including water gage, sealant classes, transverse joints and longitudinal seams**
- **C. Fitting construction including elbows, vane requirements & supports, offsets & transitions, and branch connections**
- **D. Flexible duct including grill and register connections, canvas connectors, and flexible duct supports**
- **E. Round and Oval duct including construction standards, pressure gages for round duct and tee's and laterals**
- **F. Hangers and support systems including hanger selection, minimum requirements, trapeze loads, riser supports and unit supports**
- **G. Functional Standards including stability, leakage, vibration and noise generation and transmission**
- **H. Fibrous glass duct construction including requirements & restrictions, fitting and pipe construction, reinforcement, hangers and supports, accessory connections and health and safety**
- **I. Fire and Smoke Dampers including terminology and applications, codes and regulations, fire damper installation, breakaway connections, fibrous glass duct installation, fire damper styles and access doors**
- **J. Radiation dampers including ceiling assemblies, heat stop and installation**

Course: EPA Refrigerant Standards A0787 36 Hours

A. Refrigerants
B. Refrigerant Recovery/Recycling/Reclaiming
C. EPA Certification Exams

Course: HVAC Sheet Metal Theory II A2902 36 Hours

A. Sheet Metal Tools and Machinery
B. Safety in a Sheet Metal Shop
C. Types of Sheet Metal
D. Sheet Metal Materials
E. Fasteners
F. Patterns and Cutting Metal
G. Punching, Drilling and Riveting

Course: Forced Air Heating and Cooling A0790 36 Hours

A. Basic heating and Air Conditioning Systems
B. Air Conditioning & Heating Control Systems
C. Air Conditioning Systems- Heating & Cooling Loads

Course: International Mechanical Code A0729 36 Hours

A. Administration of the International Mechanical Code

Course: Related Codes and Standards A0730 36 Hours

A. International Residential Code
B. National Fire Protection Association Standards

Course: Welding II A2102 36 Hour

A. Gas Tungsten Arc Welding (GTAW)
B. Flux Cored Arc Welding (FCAW)
C. Brazing, Braze Welding & Soldering
D. Cutting Operations

ADDITIONAL SHEET METAL COURSES

Course: Welding I A2101 36 Hour

A. Oxyacetylene Welding (OAW)
B. Shielded Metal Arc Welding (SMAW)
C. Gas Metal Arc Welding (GMAW)

Course: HVAC Sheet Metal Layout I A2904 36 Hours

A. Folding edges and making seams
B. Turning, Burring and Raising
C. Forming, Crimping, Beading and Grooving
D. Soldering
E. Drawing for pattern drafting

F. Making and notching simple patterns

Course: HVAC Sheet Metal Layout II A2905 36 Hours

A. Parallel line development
B. Triangulation
C. Radial line development
D. Sheet metal in the building trades
E. Short method pattern development
F. Projects

Required Booklist for Heating/Cooling & Sheet metal Apprentice Students:

Following are the required textbooks that each student must purchase for each course.

For Basic Math Computations (A0001):

- Applied Mathematics, R. Jesse Phagan, Goodheart-Willcox Company, Inc. ISBN 1-56637-995-4
- Workbook: Applied Mathematics, R. Jesse Phagan, Goodheart-Willcox Company, Inc., ISBN 1-56637-996-2

For HVAC Math (A0006):

- Practical Problems in Mathematics for Heating and Cooling Technicians, Third Edition, Russell B. DeVore, Thomson Delmar Learning**),** ISBN# 0-8273-7948-X

For Blueprint Reading (A0031):

- Print Reading for Construction, Residential and Commercial by Walter C. Brown and Daniel P. Dorfmueller, Goodheart-Willcox Company, Inc.**,** ISBN 1-59070-347-2.

For OSHA 30 (A0099):

- Code of Federal Regulations - 29 CFR Part 1926 (OSHA), with latest available amendments

For All S-2, S-4, and S-8 Apprentices:

- Modern Refrigeration and Air Conditioning, 19th or 20th Edition, Althouse, Turnquist, & Bracciano, Goodheart-Willcox Publisher
- Residential Oil Burners. 3rd Edition, 2007, Herb Weinberger, Delmar/Thomson Learning
- Steam Plant Operation, 9th edition, 2012, Lammers, Woodruff, Lammers, McGraw-Hill
- Sheet Metal Second Edition by Leo Meyer, American Technical Publishers ISBN 0-8269-1910-3
- Manual J - Residential Load Calcs, reprinted 2006, Eighth Full Edition, Air Conditioning Contractors of America (ACCA)
- Manual N - Load Calculation for Small Commercial Buildings, Fifth Edition, 2008, Air Conditioning Contractors of America (ACCA)
- NFPA 54: National Fuel Gas Code or National Fuel Gas Code Handbook, 2012
- NFPA 58: Liquefied Petroleum Gas Code, 2014, National Fire Protection Association
- ACCA Ductulator, Air Conditioning Contractors of America
- HVAC Duct Construction Standards, 2005, 3rd Edition, SMACNA
- Modern Hydronic Heating for Residential and Light Commercial Buildings, John Siegenthaler, 2004, 2nd edition, Cengage Learning

For All S-10, B-2, and B-4 Apprentices:

- Modern Refrigeration and Air Conditioning by Althouse, Turnquist and Bracciano, Goodheart-Wilcox Company, Inc. ISBN 1-59070-280-8
- Residential Oil Burners. 3rd Edition, 2007, Herb Weinberger, Delmar/Thomson Learning
- International Mechanical Code or International Mechanical Code Commentary, 2009, 2012, or 2015 Editions, International Code Council Inc.

For All SM-2 Apprentices:

- International Mechanical Code or International Mechanical Code Commentary, 2003 thru 2009 Editions, International Code Council Inc.
- NFPA 96: Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations, 2001 or 2014 Edition, National Fire Protection Association

- NFPA 90A: Standard for the Installation of Air Conditioning and Ventilation Systems, 2002 or 2012 Edition
- ACCA Ductulator, Air Conditioning Contractors of America
- Fibrous Glass Duct Standards, 2002, North American Insulation Manufacturers Association (NAIMA)
- HVAC Duct Standards, Metal And Flexible – 3rd edition, 2005, SMACNA
- Modern Welding, 2013, 11th Edition, Althouse/Turnquist/Bowditch/Bowditch/Bowditch, The Goodheart-Willcox Company, Inc.
- NFPA 80: Standard for Fire Doors and Other Opening Protectives, 2013 Edition, National Fire Protection Association
- Modern Refrigeration and Air Conditioning by Althouse, Turnquist and Bracciano, Goodheart-Wilcox Company, Inc. ISBN 1-59070-280-8
- Sheet Metal Second Edition by Leo Meyer, American Technical Publishers ISBN 0-8269-1910-3
- HVAC Duct Construction Standards, 2005, 3rd Edition, SMACNA

For Brazing**, Cutting and Metallurgy and Welding I & II**

- Modern Welding, 2013, 11th Edition, Althouse/Turnquist/ Bowditch/Bowditch/Bowditch, The Goodheart-Willcox Company, Inc
- Welding Skills 3rd Edition, Moniz and Miller, American Technical Publishers Item number 3010
- Welding Skills Workbook, Moniz and Miller, American Technical Publishers Item number 3011
- Pipe Welding Procedures, Rampaul, H. (2nd Ed., 2002). Industrial Press, Inc., 200 Madison Avenue, New York, NY 10016, (888) 528-7852, www.industrialpress.com.
- Welding Technology Fundamentals, 3rd Edition, Kevin E. Bowditch, William A. Bowditch.
- Welding Print Reading, 5th Edition, W. Richard Polanin, John R. Walker.
- Oxyfuel Gas Welding, 6th Edition, Kevin E. Bowditch, Mark A. Bowditch.
- Arc Welding, 7th Edition, W. Richard Polanin, John R. Walker.

For International Mechanical Code (A0729) and Related Codes and Standards (A0730)

- International Mechanical Code or International Mechanical Code Commentary, 2009, 2012, or 2015 Editions, International Code Council Inc.
- International Fuel Gas Code, 2012, International Code Council Inc.
- International Residential Code Book 2006, International; Code Council
- NFPA 31: Standard for the Installation of Oil-Burning Equipment. (2006 or 2011).
- NFPA 54: National Fuel Gas Code or National Fuel Gas Code Handbook, 2012
- NFPA 58: Liquefied Petroleum Gas Code, 2014,
- NFPA 85 Boiler and Combustion Systems Hazards Code
- NFPA 90A Standard for the Installation of Air Conditioning and Ventilation Systems
- NFPA 90B Standard for the Installation of Warm Air heating and Air Conditioning Systems
- NFPA 96 Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations

APPRENTICE PROGRAM
BOOK PUBLISHERS PHONE ORDER NUMBERS & WEBSITES

Book Publishers	Phone Numbers	Website
Goodheart-Willcox	1-800-323-0440	www.goodheartwillcox.com
Thomson Delmar Learning	1-800-347-7707	www.delmarlearning.com
National Fire Protection Association (NFPA)	1-800-344-3555	www.nfpa.org/index.asp
American Technical Publishers	1-800-323-3471	www.go2atp.com
International Code Council (ICC)	1-800-786-4452	http://shop.iccsafe.org/
CRC Press	1-800-272-7737	https://www.crcpress.com/
Amazon Bookstore	1-800-201-7575	www.amazon.com
BICSI	1-813-979-1991	www.bicsi.org/
Prentice Hall	1-800-282-0693	http://vig.prenhall.com/catalog/