

Connecticut Technical High School System

Connecticut-SDE

Heating, Cooling and Sheet Metal Apprenticeship Information Packet

State of
Connecticut
Heating/Cooling
& Sheet Metal
Apprenticeship
Information
Packet 16-17



Connecticut Technical High School System
Connecticut State Department of Education

Heating, Cooling & Sheet Metal
APPRENTICESHIP
INFORMATION PACKET

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2016-17

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:

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

Excessive tardiness will be addressed on an individual basis and may cause denial of credit.

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.

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

Region 1: Paul Femia, paul.femia@ct.gov

(860) 263-6128

Towns Served:

Berlin	Bozrah	Chester
Clinton	Colchester	Cromwell
Deep River	Durham	East Haddam
East Hampton	East Lyme	Essex
Franklin	Glastonbury	Griswold
Groton	Guilford	Haddam
Killingworth	Ledyard	Lisbon
Lyme	Madison	Marlborough
Meriden (city)	Middlefield	Middletown (city)
Montville	New Britain	New London (city)
Newington	Norwich (city)	North Stonington
Old Lyme	Old Saybrook	Portland
Preston	Salem	Sprague
Stonington	Voluntown	Waterford
Westbrook		

Region 2: Larry Satchell, larry.satchell@ct.gov

(860) 263-6084

Towns Served:

Andover	Ashford	Bolton
Brooklyn	Canterbury	Chaplin
Columbia	Coventry	East Hartford
East Windsor	Eastford	Ellington
Enfield	Hampton	Hartford (city)
Hebron	Killingly	Lebanon
Manchester	Mansfield	Plainfield
Pomfret	Putnam	Rocky Hill
Scotland	Somers	South Windsor
Stafford	Sterling	Suffield
Suffield	Tolland	Union
Vernon	Wethersfield	Willington
Windham	Windsor	Windsor Locks
Woodstock		

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

Towns Served:

Avon	Barkhamsted	Bethlehem
Bloomfield	Bridgewater	Bristol (city)
Brookfield	Burlington	Canaan
Canton	Colebrook	Cornwall
Danbury (city)	East Granby	Farmington
Goshen	Granby	Hartland
Harwinton	Kent	Litchfield
Morris	New Fairfield	New Hartford
New Milford	Norfolk	North Canaan
Plymouth	Roxbury	Salisbury
Sharon	Sherman	Simsbury
Southbury	Thomaston	Torrington (city)
Warren	Washington	Watertown
West Hartford	Winchester	Woodbury

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

Towns Served:

Ansonia	Bethel	Bridgeport
Darien	Derby (city)	Easton
Fairfield	Greenwich	Milford (city)
Monroe	Naugatuck (Brgh)	New Canaan
Newtown	Norwalk (city)	Redding
Ridgefield	Shelton (city)	Stratford
Stratford	Trumbull	Weston
Westport	Wilton	

Region 5: Tammie Whiting, tammie.whiting@ct.gov

(860)263-6154

Towns Served:

Beacon Falls	Bethany	Branford
Cheshire	East Haven	Hamden
Middlebury	Naugatuck (Brgh)	New Haven (city)
North Branford	North Haven	Orange
Oxford	Plainville	Prospect
Seymour	Southington	Wallingford
Waterbury (city)	West Haven (city)	Wolcott
Woodbridge		

Region 6: Isaiah Curtis, Isaiah.curtis@ct.gov

(860) 263-6042

Towns Served:

Ashford	Bozrah	Brooklyn
Canterbury	Chaplin	Eastford
Franklin	Griswold	Hampton
Killingly	Lebanon	Ledyard
Lisbon	Montville	Norwich
Plainfield	Pomfret	Putnam
Scotland	Sterling	Thompson
Woodstock		

Statewide: Keri Lamontagne, keri.lamontagne@ct.gov

(860) 263-6129

Towns Served:

Statewide	Manufacturing
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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 Journeyman

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 Journeyman

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 Journeyman

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 Journeyman

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 Journeyman

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 Journeyman

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 Journeyman

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 Journeyman

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 Journeyman

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 Journeyman

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**

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

**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**

- A. Direct Measure
- B. Computed Measure-Area
- C. Computed Measure-Volume
- D. Formulas
- E. Duct Calculations
- F. Trigonometry
- G. Graphs

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 Apprentices

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-Willcox 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

<u>Book Publishers</u>	<u>Phone Numbers</u>	<u>Website</u>
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/