

Connecticut Technical Education and Career System

STATE OF CONNECTICUT HEATING/COOLING & SHEET METAL APPRENTICESHIP INFORMATION PACKET ©

CTECS ADULT EDUCATION APPRENTICESHIP PROGRAM DEPARTMENT; CIARLEGLIO,
PASQUALE (CO)

CTECS | 39 Woodland Street, Hartford, CT. 06105

Connecticut Technical Education and Career System

Heating, Cooling & Sheet Metal APPRENTICESHIP INFORMATION PACKET

Coursework in this packet align to the CT-DOL Related Instruction Requirements for the following apprenticeship classifications:

- S-2 HEATING and COOLING
- S-4 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
- OE-2 OPERATING ENGINEER
- SM-2 SHEET METAL
- SM-4 LIMITED 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 CTECS policies and procedures, current printed class schedule as well as special registration instructions which may be issued on a semester-by-semester basis.

Tuition and Fees Information:

Apprentice Students

- Registration fee and Technology fee of \$50.00 (**non-refundable**) per semester per school due at registration
- Tuition of \$325.00 per course (can be prorated downward for courses of less than 36 hours) payable prior to the completion of the student's 1st class attended.

DEFINITION OF APPRENTICE STUDENT (All criteria below must be satisfied):

- Must be registered with the State Labor Department, Office of Apprenticeship Training
- Possesses a current and valid apprentice card prior to the 1st class session – current and valid is defined as an apprentice card that meets all of the following:
 1. The card is for the student's current employer;
 2. The card has an expiration date of 6/30/ of the subsequent year;
 3. The card is signed by Labor Department Apprentice Program Manager.
- Be enrolled in a class that is part of his/her apprenticeship trade curriculum

Extension Students:

- Registration fee and Technology fee of \$50.00 (non-refundable) per semester per school due at registration
- Tuition of \$350.00 per 36 hours of instruction (will be prorated for courses of more or less than 36 hours) payable prior to the completion of the student's 1st class attended.

Online Students:

- **A \$20.00 Convenience Fee will be added to normal tuition rates. Students are responsible for technology to access content (see minimum requirements below).**

Minimum Technology Requirements and Guidelines for Online Coursework:

- When participating in distance education courses, it is vital to consider the technology needed in order to have a successful course. We recommend that you meet the technical requirements below when attending online programming:

- A computer (desktop/laptop/ Chromebooks) that is less than 3 years old will work.
- Speakers/headphones/earbuds for listening to audio or videos presented in courses.
- **Webcams are required**, and must be on and pointed at the student during class. (There is background blurring technology to uphold privacy that may be utilized)
 - Failure to abide by this will result in removal from class!

Attendance Requirments:

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 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: Larry Satchell, larry.satchell@ct.gov

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Region 2: Owen Golding, owen.golding@ct.gov

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Region 3: Gina Knox, gina.knox@ct.gov

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Region 4: Keri Valente, Keri.Valenti@ct.gov

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Region 5: Isaiah Curtis, Isaiah.curtis@ct.gov

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Region 6: Nicholas Blardo, Nicholas.Blardo@ct.gov

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

Region 1	Region 2	Region 3	Region 4	Region 5		Region 6
Larry Satchell	Owen Golding	Gina Knox	Keri Valente	Isaiah Curtis		Nicholas Blardo
Larry.Satchell@ct.gov	Owen.Golding@ct.gov	Gina.Knox@ct.gov	Keri.Valente@ct.gov	Isaiah.Curtis@ct.gov		Nicholas.Blardo@ct.gov
Berlin	Avon	Bridgeport	Branford	Amston	Niantic	Ansonia
Bolton	Bantam	Darien	Clinton	Andover	North Franklin	Beacon Falls
East Granby	Bethlehem	Easton	Cromwell	Ashford	North Grosvenordale	Bethany
East Hartford	Bloomfield	Fairfield	Durham	Baltic	North Stonington	Bethel
East Windsor	Bridgewater	Greenwich	East Haven	Bozrah	North Windham	Bristol
Ellington	Burlington	Milford	Guilford	Brooklyn	Norwich	Brookfield
Enfield	Canaan	Monroe	Hamden	Canterbury	Oakdale	Cheshire
Glastonbury	Canton	New Canaan	Killingworth	Centerbrook	Old Lyme	Danbury
Granby	Collinsville	Norwalk	Madison	Central Village	Old Saybrook	Derby
Hartford	Cornwall Bridge	Orange	Middlefield	Chaplin	Pawcatuck	Middlebury
Manchester	East Canaan	Redding	Middletown	Chester	Pomfret Center	Naugatuck
Meriden	East Hartland	Shelton	New Haven	Cobalt	Preston	New Britain
Somers	Farmington	Stamford	Newington	Colchester	Sterling	Newton
South Windsor	Forestville	Stratford	North Branford	Coventry	Stonington	Oxford
Stafford	Goshen	Trumbull	North Haven	Danielson	Storrs	Plainville
Suffield	Harwinton	West Haven	Portland	Dayville	Thompson	Prospect
Tolland	Kent	Weston	Rocky Hill	Deep River	Uncasville	Ridgefield
Vernon	Litchfield	Westport	Wallingford	East Haddam	Voluntown	Seymour
Waterbury	Marbledale	Wilton	Wethersfield	East Hampton	Waterford	Southbury
Windsor	Morris		Woodbridge	East Lyme	Westbrook	Southington
Windsor Locks	New Fairfield			Eastford	Willimantic	Terryville
	New Hartford			Essex	Willington	Wolcott
	New Milford			Gales Ferry	Woodstock	
	Northfield			Griswold	Yantic	
	Oakville			Grosvenordale		
	Plymouth			Groton		
	Salisbury			Haddam		
	Sharon			Hebron		
	Sherman			Higganum		
	Simsbury			Killingly		
	Thomaston			Lebanon		
	Torrington			Ledyard		
	Unionville			Lisbon		
	Warren			Lyme		
	Washington Depot			Mansfield		
	Watertown			Marlborough		
	West Hartford			Montville		
	West Simsbury			Moodus		
	Winchester			Moosup		
	Winsted			Mystic		
	Woodbury			New London		

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-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.

OE-2 OPERATING STATIONARY ENGINEER

The holder of this license may perform operation related work. "Operation" means a work discipline that employs technical knowledge and expertise in the manipulation, adjustment, control and monitoring of heating, air conditioning and refrigeration systems and boilers, with sufficient technical knowledge, as determined by the commissioner, and includes (i) heating systems with a steam or water boiler maximum operating pressure greater than fifteen pounds per square inch gauge, or air conditioning or refrigeration systems with an aggregate of more than fifty horsepower or kilowatt equivalency of fifty horsepower or of two hundred pounds of refrigerant.

This license also permits incidental maintenance, directly on or adjacent to such operating equipment, including daily blow downs, sample and adjust chemical treatment, clean fuel filters, change fuel nozzle, clean strainers and changing of existing fuel types. Refrigeration plant operators may clean condenser water strainers, sample and adjust chemical treatment and perform absorber air purges. This license does not permit any replacement or revisions to existing piping of any system type. Such person may only perform such work while in the employ of properly licensed contractor or as an employee of a building owner for work on the premises owned or leased by such employer.

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.

SM-3 LIMITED SHEET METAL RESIDENTIAL/LIGHT COMMERCIAL CONTRACTOR

The holder of this license may perform only work limited to the installation, erection, replacement, repair or alteration of ductwork system, both ferrous and nonferrous for ductwork systems used within a light commercial or residential building. Light commercial and residential is a building with single air handling units not to exceed 35 tons of cooling, or fans or blowers not exceeding 14,000 cubic feet per minute (volume),

excluding pneumatic conveyance systems which are covered under sections 20-332-5(a)(b)(c) and (d) of the regulations of Connecticut State agencies. The requirements to qualify for this license examination shall be two (2) years as a properly licensed journeyman or equivalent experience and training.

SM-4 LIMITED SHEET METAL RESIDENTIAL/LIGHT COMMERCIAL JOURNEYPERSON

The holder of this license may perform only work limited to the installation, erection, replacement, repair or alteration of ductwork system, both ferrous and nonferrous for ductwork systems used within a light commercial or residential building. Light commercial and residential is a building with single air handling units not to exceed 35 tons of cooling, or fans or blowers not exceeding 14,000 cubic feet per minute (volume), excluding pneumatic conveyance systems which are covered under sections 20-332-5(a)(b)(c) and (d) of the regulations of Connecticut State agencies. The holder of this license may perform such work only while in the employ of a contractor license for such work. The requirements to qualify for this license examination shall be the completion of a registered apprenticeship program or equivalent experience and training.

Heating/Cooling & Sheetmetal
Apprenticeship Program Course Sequence
Sheets listed on the following pages:

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-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

OE-2 OPERATING ENGINEER APPRENTICESHIP

COURSE SEQUENCE AND PREREQUISITES

Related Instruction- 576 Hours

OJT - 6000 Hours

The following courses are 36 hours each.	CREDIT	Course number	Semester	Prerequisites
FIRST YEAR COURSES:				
Basic Math Computations		A0001	1	
Blueprint Reading		A0031	1	
Building Trade Safety / OSHA-30 (eff. 9/1/13)		A0099	2	
Refrigeration Fundamentals		A0781	2	
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
Refrigeration, Domestic Commercial and Special Systems		A0721	1	A0781
Air Conditioning		A0785	2	
Oil Burner Controls & Servicing		A0791	2	
FOURTH YEAR COURSES:				
EPA Refrigerant Standards		A0787	1	
Forced Air Heating and Cooling		A0790	1	A0784
International Mechanical Code		A0729	2	
Related Codes and Standards		A0730	2	

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	

SM-4 SHEET METAL APPRENTICESHIP

COURSE SEQUENCE AND PREREQUISITES

Related Instruction- 324 Hours OJT - 4000 Hours

The following courses are 36 hours each	CREDIT	Course number	Semester	Prerequisites
FIRST YEAR COURSES:				
Basic Math Computations		A0001	1	
Building Trade Safety / OSHA-30 (eff. 9/1/13)		A0099	1	
SMACNA		A2906	2	
Blueprint Reading		A0031	2	
SECOND YEAR COURSES:				
HVAC Sheet Metal Theory I		A2901	1	
HVAC Sheet Metal Theory II		A2902	2	A2901
HVAC Sheet Metal Layout I		A2904	1	
HVAC Sheet Metal Layout II		A2905	2	A2904
International Mechanical Code		A0729	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 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, 2015, 2018, and 2021 Editions, International Code Council Inc., 800-786-4452, <http://shop.iccsafe.org>

For All SM-2 Apprentices:

- International Mechanical Code or International Mechanical Code Commentary, 2015, 2018, and 2021 Editions, International Code Council Inc., 800-786-4452, <http://shop.iccsafe.org>
- 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-Willcox 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, 2015, 2018, and 2021 Editions, International Code Council Inc., 800-786-4452, <http://shop.iccsafe.org>
- International Fuel Gas Code, 2015, 2018, and 2021, International Code Council Inc., 800-786-4452, <http://shop.iccsafe.org>
- 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/