

Connecticut Technical High School System
Connecticut State Department of Education

HEATING and COOLING
AND
SHEET METAL(SM-2)
APPRENTICESHIP
INFORMATION PACKET
2009-10

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

The following section, **Apprentice Responsibilities**, is taken from the **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.**

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.

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

**CONNECTICUT TECHNICAL HIGH SCHOOL SYSTEM
APPRENTICE RELATED INSTRUCTION LOCATIONS AND STAFF**

Kathleen Mason, Education Consultant Kathy.Mason@ct.gov	Central Office 25 Industrial Park Rd., Middletown 06457	PHONE # 860-807-2219
Henry Abbott THS Hayestown Ave. Danbury 06810	Jaime Rivera, Apprentice Supervisor Jaime.Rivera@ct.gov	203 -797-4460 X 4423 Fax 203-797-4382
Ella Grasso THS 189 Fort Hill Rd. Groton 06340	Tony Baker, Apprentice Supervisor Tony.Baker@ct.gov	860-448-0220 Fax 860-446-9895
Oliver Wolcott THS 75 Oliver St. Torrington 06790	Keith Bishop, Apprentice Supervisor Keith.Bishop@ct.gov	860-496-5300 x539 Fax 860-496-9022
	Ken Woolley, Apprentice Supervisor Kenneth.Woolley@ct.gov	860-496-5300 Fax 860-496-9022
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Bristol Technical Education Ctr 431 Minor ST. Bristol 06010	Ben Russell, Apprentice Supervisor Ben.Russell@ct.gov	860-584-8433 X380 Fax 860-584-0795
	Allen Meyerhoff, Apprentice Supervisor Allen.Meyerhoff@ct.gov	860-584-8433 X380 Fax 860-584-0795
Howell Cheney THS 791 W. Middle Tpke. Manchester 06040	Bruce McKechnie, Apprentice Supervisor Bruce.McKechnie@ct.gov	860-649-5396 Fax 860-649-5263
	Peter Boudo, Apprentice Supervisor Peter.Boudo@ct.gov	860-649-5396 Fax 860-649-5263
A.I.Prince THS 401 Flatbush Ave., Hartford 06106	Peter Jennings, Apprentice Supervisor Peter.Jennings@ct.gov	860-951-7112 x3332 Fax 860-951-1529
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Vinal THS 60 Daniels St. Middletown 06457	Eric Hilversum, Apprentice Supervisor Eric.Hilversum@ct.gov	860-344-7100 Fax 860-344-2622
	Frank Sesto, Apprentice Supervisor Frank.Sesto@ct.gov	860-827-7736 X312 Fax 860-827-7862
Norwich THS 7 Mahan Drive, Norwich, 06360	Mary Lunt, Apprentice Supervisor MaryEllen.Lunt@ct.gov	860-889-8453 x2174 Fax 860-886-4632
	Gilda Puccio, Apprentice Supervisor Gilda.Puccio@ct.gov	860-889-8453 x2116 Fax 860-886-4632
Emmett O'Brien THS 141 Prindle Ave. Ansonia 06401	Vacant, Apprentice Supervisor @ct.gov	203-732-1832 Fax 203-735-6236
	Brian Schaefer Apprentice Supervisor Brian.Schaefer@ct.gov	203-579-6888 Fax 203-579-6904
Bullard Havens THS 500 Palisade Ave. Bridgeport 06610	Thomas Grace, Apprentice Supervisor	203-579-6888
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Eli Whitney THS 71 Jones Road, Hamden 06604	Henry Galarraga, Apprentice Supervisor Henry.Galarraga@ct.gov	203-397-4031 X326 Fax 203-397-4129
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J.M. Wright THS P.O.Box 1416, Stamford 06904		

Regional Apprenticeship Representatives
Office of Apprenticeship Training
Department of Labor

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

(860) 263-6128

Towns Served:

Amston	East Lyme	Lisbon	North Windham	Stonington
Andover	Franklin	Lyme	Oakdale	Storrs
Bozrah	Gales Ferry	Mansfield	Old Lyme	Taftville
Ballouville	Griswold	Montville	Pawcatuck	Voluntown
Baltic	Groton	Moosup	Plainfield	Waterford
Brooklyn	Hampton	Mystic	Preston	Willimantic
Canterbury	Hebron	New London	Quaker Hill	Windham
Chaplin	Jewett City	Niantic	Scotland	Yantic
Columbia	Killingly	North Franklin	South Lyme	Uncasville
Coventry	Lebanon	North Stonington	Sprague	
Danielson	Ledyard	Norwich	Sterling	
Dayville				

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

(860) 263-6084

Towns Served:

Ashford	Glastonbury	Rockville	Stafford Springs	Willington
Bolton	Grasvenordale	Rocky Hill	Thompson	Windsor
Broad Brook	Manchester	Somers	Tolland	Windsor Locks
East Windsor	North Grasvenordale	South Glastonbury	Union	Woodstock
East Woodstock	Promfret Center	South Windsor	Vernon	Woodstock Valley
Eastford	Putnam	Rockville	Suffield	West Suffield
Ellington	Quinebaug	Enfield		

Region 3: Owen Golding, owen.golding@ct.gov

(860) 263-6083

Towns Served:

Avon	Collinsville	Granby	Oakville	Thomaston
Bantam	Cornwall	Hartland	Pequabuck	Unionville
Barkhamstead	Cornwall Bridge	Harwinton	Pine Meadow	Watertown
Bethlehem	East Canaan	Lakeville	Pleasant Valley	Weatogue
Bloomfield	East Granby	Litchfield	Plymouth	West Granby
Bristol	East Hartford	Morris	Riverton	West Hartford
Bridgewater	Enfield	New Hartford	Salisbury	West Hartland
Burlington	Falls Village	Norfolk	Sharon	West Simsbury
Canaan	Farmington	North Canaan	Simsbury	West Suffield
Canton	Forestville	North Canton	Suffield	Winsted
Canton Center	Goshen	North Granby	Terryville	Wolcott
Gaylordsville	New Milford	Roxbury	South Kent	Warren
Kent	New Preston	Sherman	Torrington	Washington
				Washington Depot

Regional Apprenticeship Representatives

Region 5: Gina Knox, gina.knox@ct.gov

(860) 263-6277

Towns Served:

Bridgeport	Fairfield	Norwalk	Stamford	Weston
Cos Cob	Greenwich	Old Greenwich	Stratford	Westport
Darien	Milford	Riverside	Trumbull	Wilton
Danbury	Monroe	Rowayton	Bethel	Ridgefield
East Norwalk	New Canaan	South Norwalk	Brookfield	Sandy Hook
Easton	New Fairfield	Newtown	Redding	

Region 6: Tammie Whiting, tammie.whiting@ct.gov

(860)263-6154

Towns Served

Bethany	Durham	Hamden	New Haven	Orange
Branford	East Haddam	Higganum	North Branford	Salem
Centerbrook	East Hampton	Ivoryton	North Haven	West Haven
Chester	East Haven	Killingworth	North Salem	Westbrook
Clinton	Essex	Madison	Northford	Woodbridge
Colchester	Guilford	Marlborough	Old Saybrook	
Deep River	Haddam	Moodus		

Region 7: Keri Lamontagne, keri.lamontagne@ct.gov

(860) 263-6129

Towns Served:

Berlin	Kensington	Middletown	Plantsville	Southington
Cheshire	Marion	Milldale	Portland	Wallingford
Cromwell	Meriden	New Britain	Rockfall	Yalesville
East Berlin	Middlefield	Plainville	South Meriden	

Region 8: Robert Albini, robert.albini@ct.gov

(860) 263-6585

Towns Served:

Ansonia	Huntington	Oxford	South Britain
Beacon Falls	Middlebury	Prospect	Southbury
Derby	Naugatuck	Seymour	Waterbury
		Shelton	Woodbury

Region 9: Ken Duff, kenneth.duff@ct.gov

(860) 263-6167

Towns Served:

East Hartford	Newington
Hartford	Wethersfield

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 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 an 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 an 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	
Building Trade Safety	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	A07911	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	
Building Trade Safety	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	
Building Trade Safety	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	
Building Trade Safety	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	
Building Trade Safety	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	
Building Trade Safety	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	
Building Trade Safety	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	
Building Trade Safety	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	

HEATING & COOLING

Table of Contents

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
Structural Steel, Framing Blueprints
- H: Plumbing System Blueprints
- I: H.V.A.C. System Blueprints
- J: Electrical Systems Blueprints

Course: Building Trade Safety A0099 36 Hours

- A. Introduction to Building Trade Safety
- B. Identify Potential Danger
- C. Safety and Protective Equipment (PPE)
- D. Hand Tool Safety
- E. Ladder Safety
- F. Lock-out / Tag-out
- G. Portable Electrical Tools and Equipment
- H. Identify Hazardous Material, Using a Material Safety Data (M.S.D.S.)
- I. Lifting Objects
- J. Assured Grounding
- K. Trenches
- L. Rigging Equipment for Material Handling

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

- **Basic Duct Construction standards, including symbols, duct design and performance requirements**
- **Pressure classes including water gage, sealant classes, transverse joints and longitudinal seams**
- **Fitting construction including elbows, vane requirements & supports, offsets & transitions, and branch connections**
- **Flexible duct including grill and register connections, canvas connectors, and flexible duct supports**
- **Round and Oval duct including construction standards, pressure gages for round duct and tee's and laterals**
- **Hangers and support systems including hanger selection, minimum requirements, trapeze loads, riser supports and unit supports**
- **Functional Standards including stability, leakage, vibration and noise generation and transmission**
- **Fibrous glass duct construction including requirements & restrictions, fitting and pipe construction, reinforcement, hangers and supports, accessory connections and health and safety**
- **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**
- **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

Booklist for Heating and Cooling/ Sheet Metal Apprentice Students:

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 Building Trade Safety (A0099):

- OSHA 1926 CFR 29

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

- Modern Refrigeration and Air Conditioning by Althouse, Turnquist and Bracciano, Goodheart-Wilcox Company, Inc., ISBN 1-59070-280-8
- Residential Oil Burners, 2nd Edition, by Herb Weinberger Delmar Publishing, ISBN 0-7668-1828-4
- Sheet Metal Second Edition by Leo Meyer, American Technical Publishers ISBN 0-8269-1910-3

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, 2nd Edition, by Herb Weinberger Delmar Publishing, ISBN 0-7668-1828-4
- International Mechanical Code Book 2006, International Code Council

For All SM-2 Apprentices:

- 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

For Brazing, Cutting and Metallurgy and Welding I & II

- 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

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

- International Mechanical Code Book 2006, International Code Council
- International Residential Code Book 2006, International; Code Council
- NFPA 31 Standard for the Installation of Oil Burning Equipment
- NFPA 54 National Fuel Gas Code
- 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	www.iccsafe.org/e/category.html
CRC Press	1-800-272-7737	www.crcpress.com/default.asp
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/