
Heating, Ventilation, and Air Conditioning (HVAC) Curriculum

Former Title: International Training Institute for the Sheet Metal and Air Conditioning Industry Sheet Metal Apprenticeship: HVAC Curriculum

ACE Transcript Data: SMAC-0003

Organization: International Training Institute for the Sheet Metal and Air Conditioning Industry

Location: Various sites in the United States and Canada.

Length: 458 hours of classroom instruction and 3, 142 hours of supervised practical experience over two years.

Dates: September 2005 – Present

Description: 458 hours of classroom instruction and 3, 142 hours of supervised practical experience over two years. Student will be able to select the system best matched to the heating and cooling needs of a building; construct the optimal duct system to deliver that conditioning; properly perform installation techniques and conduct business on site; quality check an installation to ensure that it meets the design specifications; apply basic electrical principles and measurement techniques; recognize different types of heating systems; understand principles of refrigerants; service air conditioners and heat pumps; protect the environment from harmful effects of CFC release; understand ladder diagrams and control loops, pneumatic controls, and the phase-in of digital control systems; perform basic TAB and system optimization; appreciate the role of the project management; read plans and specifications; and solve HVAC installation problems.

Objective: This course will train technicians to install, maintain and repair HVAC equipment and supervise installation, maintenance, and repair of HVAC systems.

Learning Outcome: Upon successful completion of this course, the student will be able to select the system best matched to the heating and cooling needs of a building; construct the optimal duct system to deliver that conditioning; properly perform installation techniques and conduct business on site; quality check an installation to ensure that it meets the design specifications; apply basic electrical principles and measurement techniques; recognize different types of heating systems; understand principles of refrigerants; service air conditioners and heat pumps; protect the environment from harmful effects of CFC release; understand ladder diagrams and control loops, pneumatic controls, and the phase-in of digital control systems; perform basic TAB and system optimization; appreciate the role of the project management; read plans and specifications; and solve HVAC installation problems.

Instruction: Major topics covered in the course are introduction to HVAC; systems and components; heating; refrigeration; field installation; basic electricity; HVAC automatic controls; basic TAB; commissioning; load calculation and duct design; plans and specifications; and project management. Methods of instruction include lecture, discussion, audiovisual materials, quizzes, projects or examinations and field experience.

Credit Recommendation: In the lower division baccalaureate/associate degree category: 3 semester hours in HVAC Systems and Components; 4 semester hours in Heating; 3 semester hours in Refrigeration; 2 semester hours in Basic Electricity; 2 semester hours in HVAC Automatic Controls; 4 semester hours in HVAC Installation; 3 semester hours in Plans and Specifications; 4 semester hours in HVAC Load Calculation and Duct Design; 4 semester hours in Basic Testing, Adjusting, and Balancing; 1 semester hour in Project Management; and 6 semester hours in Field Experience for a total of 36 semester hours (12/05).

Servicing Environmental Systems Curriculum

Former Title: International Training Institute for the Sheet Metal and Air Conditioning Industry Sheet Metal Apprenticeship: Servicing Environmental Systems

ACE Transcript Data: SMAC-0006

Organization: International Training Institute for the Sheet Metal and Air Conditioning Industry

Location: Various sites in the United States and Canada.

Length: 400 hours of classroom instruction and 3200 hours of supervised practical experience over two years.

Dates: August 1996 – Present

Description: 400 hours of classroom instruction and 3200 hours of supervised practical experience over two years. Student will have the skills and knowledge to lay out, braze and solder piping systems; leak test piping and equipment; evacuate and charge systems with refrigerant; apply proper techniques of recovering and recycling refrigerant; safely service and test electrical components; connect pressure testing equipment; measure system performance; and diagnose system mal-functions.

Objective: To provide knowledge and skills required of sheet metal journeypersons to service, repair, and maintain commercial refrigeration, air conditioning, and industrial systems, as well as domestic refrigeration systems.

Learning Outcome: Upon successful completion of this course, the student will have the skills and knowledge to lay out, braze and solder piping systems; leak test piping and equipment; evacuate and charge systems with refrigerant; apply proper techniques of recovering and recycling refrigerant; safely service and test electrical components; connect pressure testing equipment; measure system performance; and diagnose system mal-functions.

Instruction: Major topics covered in the course are: refrigeration principles and components; air conditioning; diagnostics; electricity; motors; HVAC systems and ventilation; heating systems; heat pumps; commercial systems; pneumatic systems; electronic systems; and energy management. Methods of instruction include lecture, discussion, audiovisual materials, quizzes, and projects or examinations and supervised field experience.

Credit Recommendation: In the lower division baccalaureate/associate degree category: 1 semester hour in HVAC Tools and Equipment; 3 semester hours in Refrigeration Principles and Components; 3 semester hours in Air Conditioning Systems; 4 semester hours in Air Conditioning Systems Maintenance; 7 semester hours in Electrical Controls; 3 semester hours in HVAC Systems; 2 semester hours in Heat Pump Principles and Controls; 3 semester hours in Commercial Systems; and 6 semester hours in Field Experience for a total of 32 semester hours (12/05).

Sheet Metal Apprentice Core Curriculum

Former Title: National Training Fund Sheet Metal and Air Conditioning Apprentice Curriculum: Sheet Metal Apprentice Curriculum

ACE Transcript Data: SMAC-0002

Organization: International Training Institute for the Sheet Metal and Air Conditioning Industry

Location: Various sites in the United States and Canada

Length: 400 hours of classroom instruction and 3, 200 hours of supervised practical experience over two years.

Dates: September 2003 – Present

Description: 400 hours of classroom instruction and 3, 200 hours of supervised practical experience over two years. Student will be able to calculate and use related mathematical applications; calculate air movement and capacities; calculate heating and air conditioning loads; design, layout patterns, and assemble sheet metal components; define characteristics of different sheet metals and fibrous ductwork and their uses; install and test ductwork and architectural sheet metal; use sheet metal tools and power equipment in an efficient and safe manner; explain principles of electric motors and controls; explain basic principles of air conditioning; test and balance circulation systems; and explain and demonstrate safe use of the various welding methods.

Objective: To provide fundamental knowledge and skills required of sheet metal journeypersons in fabricating, installing, and servicing sheet metal formed products.

Learning Outcome: Upon successful completion of this course, the student will be able to demonstrate proper safety techniques; draft and design, layout patterns, and assemble sheet metal components; generate plans, specifications and costing of sheet metal products; use sheet metal tools and associated power equipment properly; define characteristics of different sheet metal materials; perform field installation of sheet metal products; calculate and use related mathematical applications.

Instruction: Major topics covered in the course are an overview of the trade and its history; communication skills; survival skills; trade materials; fabrication; drafting; blueprint reading; layout; safety; plans, specifications and costing; field installation; and trade math and measurement. Methods of instruction include lecture, discussion, audiovisual materials, quizzes, projects or examinations and supervised field experience.

Credit Recommendation: In the lower division baccalaureate/associate degree category: 2 semester hours in Human Relations; 2 semester hours in Environmental Health and Safety; 2 semester hours in Industrial Materials and Fabrication; 2 semester hours in Design and Drafting; 4 semester hours Sheet Metal Layout; 4 semester hours in Installation Estimating and Planning; 2 semester hours in Applied Math; and 6 semester hours in Field Experience for a total of 24 semester hours (12/05).

Sheet Metal Apprentice Curriculum

Former Title: International Training Institute Sheet Metal and Air Conditioning Apprentice Curriculum (Formerly National Training Fund Sheet Metal and Air Conditioning Apprentice Curriculum)

ACE Transcript Data: SMAC-0001

Organization: International Training Institute for the Sheet Metal and Air Conditioning Industry

Location: *Versions 1 and 2:* Various sites in the United States and Canada.

Length: *Version 1:* 720 hours (4-5 years) plus supervised practical experience.; *Version 2:* 720 hours (4-5 year) plus supervised practical experience.

Dates: *Version 1:* September 1985 – February 1995; *Version 2:* March 1995 – Present

Description: *Version 1:* 720 hours (4-5 years) supervised practical experience. Student will be able to calculate related mathematic applications; calculate air movement and capacities; calculate heating and air conditioning loads; design, layout patterns, and assemble sheet metal components; define characteristics of different sheet metals and fibrous ductwork and their uses; install and test ductwork and architectural sheet metal; use sheet metal tools and power equipment in an efficient and safe manner; explain principles of electric motors and controls; explain basic principles of air conditioning; test and balance circulation systems; explain and demonstrate safe use of the various welding methods.; *Version 2:* 720 hours (4-5 year) supervised practical experience. Student will be able to apply appropriate communications and personal relations in the work setting; calculate related mathematics applications; calculate air movement and capacities; calculate heating and air conditioning loads; design, layout patterns, and assemble sheet metal components; define characteristics of different sheet metals and fibrous ductwork and their uses; install and test ductwork and architectural sheet metal; use sheet metal tools and power equipment in an efficient and safe manner; explain principles of electric motors and controls; explain basic principles of air conditioning; test and balance circulation systems; explain and demonstrate safe use of the various welding methods; and demonstrate workable knowledge of applicable OSHA regulations.

Objective: *Versions 1 and 2:* To provide knowledge and skills required of sheet metal journeypersons in fabricating and installing sheet metal products in heating and air conditioning systems and architectural applications.

Learning Outcome: *Version 1:* Upon successful completion of this course, the student will be able to calculate related mathematic applications; calculate air movement and capacities; calculate heating and air conditioning loads; design, layout patterns, and assemble sheet metal components; define characteristics of different sheet metals and fibrous ductwork and their uses; install and test ductwork and architectural sheet metal; use sheet metal tools and power equipment in an efficient and safe manner; explain principles of electric motors and controls; explain basic principles of air conditioning; test and balance circulation systems; explain and demonstrate safe use of the various welding methods.; *Version 2:* Upon successful completion of this course, the student will be able to calculate and use related mathematical applications; calculate air movement and capacities; calculate heating and air conditioning loads; design, layout patterns, and assemble sheet metal components; define characteristics of different sheet metals and fibrous ductwork and their uses; install and test ductwork and architectural sheet metal; use sheet metal tools and power equipment in an efficient and safe manner; explain principles of electric motors and controls; explain basic principles of air conditioning; test and balance circulation systems; and explain and demonstrate safe use of the various welding methods.

Instruction: *Version 1:* Major topics covered in the course are communication skills; applied mathematics; personal relations within the industry; air movements and duct capacities; use of computers in sheet metal work; system design and layout; pattern development; various duct shapes; electric motors, circuits, and controls; heating and air conditioning loads; use of fibrous materials and sheet

metals; installation, testing, and balance of circulation systems; joining and fastening materials; safe use of sheet metal tools, machines, and power equipment; environmental and hazmat safety; principles of air conditioning; emergency procedures; and modern techniques of gas and electric welding, and basic metallurgy. Methods of instruction include lecture, discussion, audio visual materials, unit quizzes, and yearly final examinations. Methods of instruction include lecture, discussion, practical exercises, computer-based activities, projects, written reports, performance tests, and a yearly final examination.; *Version 2:* Major topics covered in the course are communication skills; personal relations within the industry; air movements and duct capacities; use of computers in sheet metal work; system design and layout; pattern development; various duct shapes; electric motors, circuits, and controls; applied mathematics; heating and air conditioning loads; use of fibrous materials and sheet metals; installation, testing, and balance of circulation systems; joining and fastening materials; safe use of sheet metal tools, machines, and power equipment; environmental and hazmat safety; principles of air conditioning; emergency procedures; modern techniques of gas and electric welding; and basic metallurgy. Methods of instruction include lecture, discussion, audiovisual materials, quizzes, projects or examinations and supervised field experience.

Credit Recommendation: *Version 1:* In the vocational certificate or lower division baccalaureate/associate degree category, 2 semester hours in Applied Mathematics; 1 semester hour in Basic Electricity; 5 semester hours in Building Components; 3 semester hours in Environmental Health and Safety; 2 semester hours in Human Relations in the Workplace; 12 semester hours in HVAC Installation and Service; 1 semester hour in HVAC Tools and Equipment; 6 semester hours in Sheet Metal Layout and Fabrication; 16 semester hours in Technical Drawing and Blueprint Reading; and 8 semester hours in Field Experience for a total of 56 semester hours (2/95).; *Version 2:* In the lower division baccalaureate/associate degree category: 2 semester hours in Applied Mathematics; 2 semester hours in Human Relations; 3 semester hours in Environmental Health and Safety; 1 semester hour in Basic Electricity; 6 semester hours in Blue Print Reading and Building Codes; 4 semester hours in HVAC Installation Techniques; 4 semester hours in HVAC Fundamentals; 4 semester hours in Heat Loads and Psychrometrics; 2 semester hours in HVAC Tools and Equipment; 6 semester hours in Sheet Metal Layout; 8 semester hours in Sheet Metal Fabrication; 6 semester hours in Technical Drawing; and 8 semester hours in Field Experience for a total of 56 semester hours (8/01) (12/05).

Testing, Adjusting, and Balancing (TAB) Curriculum

Former Title: International Training Institute for the Sheet Metal and Air Conditioning Industry Sheet Metal Apprenticeship: TAB Curriculum (Testing, Adjusting, and Balancing)

ACE Transcript Data: SMAC-0004

Organization: International Training Institute for the Sheet Metal and Air Conditioning Industry

Location: Various sites in the United States and Canada

Length: 80 hours of classroom instruction and 1720 hours of supervised practical experience over one year.

Dates: September 2003 – Present

Description: 80 hours of classroom instruction and 1720 hours of supervised practical experience over one year. Student will be able to calculate and verify electrical measurements; balance HVAC systems; adjust the total system to meet design specifications; measure and establish the fluid quantities of the system as required to meet design specifications; verify the performance of all equipment and automatic controls; calculate and apply related mathematical applications; measure sound and vibration; document results of testing.

Objective: To provide knowledge and skills required of sheet metal journeypersons to balance heating, ventilating, and air-conditioning (HVAC) systems.

Learning Outcome: Upon successful completion of this course, the student will be able to calculate and verify electrical measurements; balance HVAC systems; adjust the total system to meet design specifications; measure and establish the fluid quantities of the system as required to meet design specifications; verify the performance of all equipment and automatic controls; calculate and apply related mathematical applications; measure sound and vibration; document results of testing.

Instruction: Major topics covered in the course are instrument care; basics of heating, ventilating, and air-conditioning systems; airflow; psychometrics; heat and heat transfer; fundamentals of electricity; electrical measurements; motors and starters; rotational speed measurements; temperature measurements; air-pressure and airflow measurements; methods of airflow measurements; duct systems; automatic controls; fans; fan laws and v-belt drives; preparation for balancing and TAB forms; methods of balancing; hydronic systems; hydronic pressure and flow measurements; pumps and pump laws; principles of the cooling tower; hydronic balancing; and TAB-related disciplines. Methods of instruction include lecture, discussion, audiovisual materials, unit quizzes, and projects or examinations and supervised field experience.

Credit Recommendation: In the lower division baccalaureate/associate degree category: 1 semester hour in Basic Electricity; 1 semester hour in HVAC Fundamentals; 2 semester hours in HVAC Systems Testing, Adjusting, and Balancing; and 4 semester hours in Field Experience for a total of 8 semester hours (12/05).

Welding Curriculum

Former Title: International Training Institute for the Sheet Metal and Air Conditioning Industry Sheet Metal Apprenticeship: Welding Curriculum

ACE Transcript Data: SMAC-0005

Organization: International Training Institute for the Sheet Metal and Air Conditioning Industry

Location: Various sites in the United States and Canada.

Length: 160 hours of classroom instruction and 7, 040 hours of supervised practical experience over four years.

Dates: January 2004 – Present

Description: 160 hours of classroom instruction and 7, 040 hours of supervised practical experience over four years. Student will be able to safely weld utilizing different types of welding and cutting technologies: Gas Metal Arc Welding (GMAW); Gas Metal Arc Welding Pulse (GMAW-P); Gas Metal Arc Welding Surface Tension Transfer (GMAW-STT); Oxygen Fuel Cutting (OFC); Shield Metal Arc Welding (SMAW); Gas Tungsten Arc Welding (GTAW); Gas Tungsten Arc Welding Pulse (GTAW-P); Flux Cored Arc Welding (FCAW); Plasma Arc Cutting (PAC).

Objective: To provide hands-on knowledge and skills in welding required of sheet metal journeypersons.

Learning Outcome: Upon successful completion of this course, the student will be able to safely weld utilizing different types of welding and cutting technologies: Gas Metal Arc Welding (GMAW); Gas Metal Arc Welding Pulse (GMAW-P); Gas Metal Arc Welding Surface Tension Transfer (GMAW-STT); Oxygen Fuel Cutting (OFC); Shield Metal Arc Welding (SMAW); Gas Tungsten Arc Welding (GTAW); Gas Tungsten Arc Welding Pulse (GTAW-P); Flux Cored Arc Welding (FCAW); Plasma Arc Cutting (PAC).

Instruction: Major topics covered in the course are communication skills; welding safety; Gas Metal Arc Welding (GMAW); Gas Metal Arc Welding Pulse (GMAW-P); Gas Metal Arc Welding Surface Tension Transfer (GMAW-STT); Oxygen Fuel Cutting (OFC); Shield Metal Arc Welding (SMAW); Gas Tungsten Arc Welding (GTAW); Gas Tungsten Arc Welding Pulse (GTAW-P); Flux Cored Arc Welding (FCAW); Plasma Arc Cutting (PAC). Methods of instruction include general instruction, demonstrations, quizzes, projects or examinations and supervised field experience.

Credit Recommendation: In the lower division baccalaureate/associate degree category: 1 semester hour in Welding Safety; 2 semester hours in Oxy-Fuel Gas Cutting/Plasma Arc Cutting; 1 semester hour in Shielded Metal Arc Welding; 2 semester hours in Gas Metal Arc Welding; 1 semester hour in Flux Core Arc Welding; 1 semester hour in Gas Tungsten Arc Welding; 1 semester hour in Carbon Arc Welding/Oxy-Acetylene Welding; and 8 semester hours in Field Experience for a total of 17 semester hours.