Secondary Accreditation Manual

Revised: December 20, 2011

Effective: January 1, 2012

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HVACR TECHNOLOGY
PROGRAM ACCREDITATION

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INTRODUCTION

HVAC Excellence, a non-profit organization, has established minimum skill standards and adopted the National Skill Standards objectives. These objectives are an integral part of each accreditation. Accredited programs shall meet or surpass the standards set forth in the section of this manual labeled **"HVACR PROGRAM STANDARDS"**.

A major benefit of accreditation is the raising of standards among educational institutions and creating goals for improvements of emerging and weaker programs. **HVAC Excellence** grants accreditation status and lists the institution in an official publication with other similarly accredited programs. Accredited programs may more easily articulate credits between its member institutions. Programmatic accreditation helps to identify institutions and programs for the investment of public and private funds, as well as provide one of several considerations used as a basis for determining eligibility for Federal assistance.

HVAC Excellence Accreditation provides the opportunity for institutions and programs to become part of the national movement to create parity in education in the heating, ventilation, air conditioning and refrigeration field.

For complete details regarding the objectives and benefits of programmatic accreditation visit the HVAC Excellence website at hvacexcellence.org and click on the Accreditation tab, or call 1-800-394-5268.

PLANNING

The following instructions will provide an approximate timetable for each step of the accreditation process. Dependent upon your response time, the program may be completed in as little as 90 days or as long as 6 months.

Step 1;

Complete and submit the HVAC Excellence Accreditation Application.

Step 2;

Complete the HVAC Excellence Accreditation Self Study and submit three (3) copies.

Mail To: HVAC Excellence
Accreditation Department
1350 W. Northwest Hwy
Mount Prospect, IL 60056

Average timetable - 120 days.

Step 3;

The HVAC Excellence review committee will assess the Self Study and documents during its monthly meeting.

Average timetable – 15 to 20 days.
Maximum timetable - 45 days.

Step 4;

If HVAC Excellence finds the Self Study and its accompanying documents acceptable, an on-site evaluation team will be selected and a visitation will be scheduled.

Average timetable – 15 to 20 days.
Maximum timetable - 60 days.

Step 5;

The HVAC Excellence review committee assesses the on-site evaluation report and makes a final determination at its monthly meeting.

Average timetable – 30 days.
Maximum timetable - 45 days.

TERMS AND CONDITIONS

Full accreditation from HVAC Excellence is for a period of six years. A training program and/or institution receiving a six-year accreditation will have embraced and surpassed all of the standards within the program.

Training programs and/or institutions that meet most but not all of the accreditation standards may receive accreditation for a lesser period of time with required compliance corrections. Training programs and/or institutions that fail to qualify for accreditation may not reapply for a period of one year.

Required compliance corrections reflect the areas required to upgrade the training program and/or institution to full compliance with accreditation standards. Any program or institution receiving an accreditation with required compliance corrections must submit an implementation plan to correct compliance issues within 90 day of accreditation. All corrections must be completed, documented and filed with HVAC Excellence prior to the first anniversary of accreditation.

HVAC Excellence requires accredited programs to submit an annual report each year during the fourth quarter of each calendar year. Upon receipt, the report is evaluated by the HVAC Excellence review committee. Once it is determined that the annual report reflects continued compliance with the accreditation standards, the school is notified in writing that the accreditation will remain in effect until the next anniversary date. Without your annual report, we cannot determine if in the prior year there were any substantial changes to your faculty and/or program that may affect your compliance with our standards.

Schools that fail to submit an annual report on a timely basis will be notified by telephone call to the HVAC program chair or instructor that they are delinquent in reporting and are given thirty days to comply. After thirty days, if the school fails to comply, the school's chief administrator will be mailed a letter with notification of intent to suspend the accreditation if the annual report is not received within forty five days. After the 45 day period, should the school still fail to comply; the administration will receive a certified letter indicating that program accreditation is officially suspended. The suspension will appear on the listing of accredited HVAC programs at www.hvacexcellence.org.

HVAC Excellence reserves the right to refuse accreditation on the basis that such accreditation may adversely affect the integrity and purpose of the overall program, notwithstanding the fact that the program or institution may have otherwise met the standards for qualifications set forth above. Under such unusual circumstances, HVAC Excellence would refund the application fee to the applying program and/or institution.

FEES

Accreditation Fee Schedule:

Application Fee (Non-Refundable) Due with submittal of application.	$ 500.00
Accreditation & Review Fee. Due after review and acceptance of the self-study prior to on-site visit.	$1,500.00

Projected on-site fees:

Invoiced upon completion of the on-site evaluation.

Team Honorarium (two team members)	$ 400.00
Travel	Actual transportation expense

Includes:

- Air Fare
- Baggage Fees
- Airport Parking
- Ground Transportation (plus fuel)

Lodging	Actual lodging expense

Annual Report

All training programs and/or institutions accredited by HVAC Excellence shall be required to file an annual report. This report shall include a status report on any and all pending implementation of required compliance corrections for which a plan has been filed, as well as any changes, additions or modifications to the program, including, but not limited to, curriculum, staffing, facilities, issues of safety compliance, etc. This report is to be filed in the fourth quarter of each calendar year.

Fee $150.00

HVAC Excellence Program Standards and Self Study Instructions

Revised: December 20, 2011
Effective: January 1, 2012

INSTRUCTIONS FOR DEVELOPING A SELF STUDY FOR HVACR PROGRAMMATIC ACCREDITATION

A self-study is a compilation of narratives and exhibits that demonstrates your program's compliance with the established standards.

A review committee assesses the self-study prior to scheduling an on-site visitation. The purpose of the on-site visitation is to verify and further document the self-study.

It is our goal to provide a cost efficient on-site visit. Self-studies that lack depth or that are less than complete, lead to longer and more expensive on-site visitations. The self-study may be returned to the institution for additions to the narratives and/or exhibits.

Self-Study Instructions

Narratives
Provide a comprehensive narrative that describes your programs compliance with each standard and standard sub-section.

Number each narrative by the standard and standard sub-section number to which the narrative refers. (It is not required to re-state the Standard).

Exhibits
Exhibits may be any type of document, such as a form, report, photograph, letter, minutes, handbook or catalog, or page in a handbook or catalog, etc. If several exhibits for various standards and / or sub-sections of standards are located in the same document, such as a hand book or catalog, only one handbook or catalog (per self-study) is required. Note in the narrative the location i.e. page number of the exhibit. Since we require a permanent record of all exhibits, and since information located within a website changes from time to time printing the appropriate page(s) for inclusion as an exhibit is required.

If you have any questions concerning the above instructions, please call your assigned visiting team member.

Submittal:
Submit your self-study in triplicate to:

HVAC Excellence
Accreditation Department
P.O. Box 491
Mount Prospect, IL 60056
800-394-5268

HVACR PROGRAM STANDARDS

Provide a comprehensive narrative that describes your programs compliance with Standard 1 and each sub-section of Standard 1.

STANDARD I MISSION OF PROGRAM

The mission of the HVACR program and its students shall be clearly stated.

Narrative:

Standard 1.1 Mission for Program Students

The HVACR program student shall be trained and educated to the level(s) as described in the program goals, in order to become gainfully employed at entry level or above. There should be potential jobs available in or near the service area for students of the HVACR program.

Narrative:

Standard 1.2 Program Mission and Description

There shall be a documented program description, listing goals for the students of the HVACR program. This document shall be available to any potential student. A student handbook listing tuition, maintenance fees, special clothing or safety equipment, textbooks, tools and any other pertinent information must be given to each new student during orientation prior to entering the program. Employment potential for students and technical qualifications of the HVACR instructor shall also be included in the orientation.

Narrative:

STANDARD 1 Mission of Program

Provide the following exhibits:

Exhibit 1: A copy of the HVACR program mission statement.

Exhibit 1.1: A list of potential jobs located near or in the immediate area.

Exhibit 1.2: A copy of the student handbook and catalog.

Provide a comprehensive narrative that describes your programs compliance with Standard 2 and each sub-section of Standard 2.

STANDARD 2 ADMINISTRATIONAL RESPONSIBILITIES

The HVACR program's instruction and curriculum shall accomplish the goals and mission of the program.

Narrative:

Standard 2.1 Student Achievement Records

The student shall be awarded a diploma, certificate or degree after completion. The student records must clearly specify the demonstrated competency level(s) achieved.

Narrative:

Standard 2.2 Administration Support of the HVACR Program

The HVACR program must have the full support of the institution's administration. Equipment, facilities, trainers, tools, training materials, special equipment needs, and supplies will evidence said support. Any specialized and new equipment training, or update training for the instructor must be supported and encouraged by the administration.

Narrative:

Standard 2.3 The Institution's Requirements

The institution's policies concerning attendance and violations, prohibitions, liabilities, safety, parking, or any other pertinent information must be provided to students and staff of the HVACR program.

Narrative:

STANDARD 2 Administrational Responsibilities

Provide the following exhibits:

Exhibit 2.1: A copy of a diploma, certificate, degree or transcript that clearly specifies level(s) of competency achieved.

Exhibit 2.2A: The line item budgets for the current and two previous years.

Exhibit 2.2B: Prior year's executed purchase orders for the HVACR Department.

Exhibit 2.2C: Evidence of all instructor professional development (Seminars, Classes, Conferences, additional credentials, etc.).

Exhibit 2.3: The location by page number in the student handbook or catalog, the institutions policies concerning attendance and violations, prohibitions, liabilities, safety, parking.

Provide a comprehensive narrative that describes your programs compliance with Standard 3 and each sub-section of Standard 3.

STANDARD 3 FINANCES AND FUNDS

The institution shall support the objectives and goals of the HVACR program by providing adequate funding.

Standard 3.1 Student's Fees

The student shall pay any tuition or maintenance fees deemed necessary by the institution. The student shall be responsible for acquiring supplies, safety equipment, hand tools, and special equipment listed in the student handbook.

Narrative:

Standard 3.2 Annual Budget for HVACR Program

The institution shall develop and implement an annual budget for the HVACR program. The administration shall inform each instructor in all proper and legal procedures for making purchases.

Narrative:

Standard 3.3 Formulation of Budget

It shall be the responsibility of the institution's administration to prepare an annual budget. The HVACR Department shall submit an annual program budgetary needs assessment to the administration prior to preparation of the annual budget. The HVACR Department shall be notified periodically of the available funds.

Narrative:

STANDARD 3 Finances and Funds

Provide the following exhibits:

Exhibit 3.1: A copy of tuition and maintenance fees and a copy of the tools required for purchase by students.

Exhibit 3.2: A copy of the HVACR program's current annual budget.

Exhibit 3.2A: A copy of the purchasing procedures.

Exhibit 3.3: A copy of a periodic HVACR Department notification of available budget funds.

Provide a comprehensive narrative that describes your programs compliance with Standard 4 and each sub-section of Standard 4.

STANDARD 4 STUDENT SERVICES

Student Services shall maintain student records, administer pre-admission procedures, promote job placement and interviews, and perform follow-up. Student services should provide post-completion transition assistance.

Standard 4.1 Pre-admission Procedures

The student shall be pre-tested to assess reading, mathematical and language skills.

Narrative:

Standard 4.2 Student Medical Information

Student services shall keep on file a written document for each student showing any or all allergies, medications and special medical information in case of emergency.

Narrative:

Standard 4.3 Counseling

Student services shall be available for student counseling.

Narrative:

Standard 4.4 Student Transcripts

Student services shall maintain student records for all completers and non-completers, and / or graduates. Student records shall be maintained in duplicate. One copy shall be kept offsite or in a fireproof environment. Both copies shall be maintained in a secure (locked) environment.

Narrative:

Standard 4.5 The School-to-Work Transition

Student services shall assist the HVACR instructor in promoting and implementing job placement assistance for completers and / or graduates of the HVACR program.

Narrative:

STANDARD 4 Student Services

Provide the following exhibits:

Exhibit 4.1: An outline of the student orientation program.

Exhibit 4.1A: A list of assessment tests used to assess reading, mathematical and language skills.

Exhibit 4.2: A copy of the medical information form used to maintain student medical information.

Exhibit 4.3: A copy of the office hours for student services for counseling.

Exhibit 4.4: A copy of a blank student transcript form.

Exhibit 4.5: Your process and /or records establishing proof of compliance with student placement and assistance.

STANDARD 5 INSTRUCTIONAL DESIGN & PROGRAM ELEMENTS

An organized, systematic plan of instruction, which ultimately mirrors the goals of the HVACR program, shall be used. A listing of objectives and task assignments to achieve the goals must be a major part of the instruction plan.

Standard 5.1 Program Design

The program design or plan shall consist of using a curriculum outline, organized in logical sequential procedures, with stated tasks, objectives and competencies. The curriculum shall reflect the requirements for entrance and/or articulation to local Post Secondary programs. Basic skills such as mathematics, reading, communication skills, team concepts and any other related instruction necessary for gainful employment should come as a result of the curriculum.

Narrative:

Standard 5.2 Students Per Instructor

The number of students per instructor shall be reasonable and allow for individual instruction. Lab/Shop classes shall consist of no more than a maximum of 20 students per instructor. (Lab assistants may be used when student numbers exceed 20).

Narrative:

Standard 5.3 Specialized Training Plan

Well-defined exit points shall be established for students that opt to specialize in segments of the program.

Supplemental/part-time preparatory training to meet the specialized training needs of area employers requires that the instructor devise individual training plans to achieve special objectives or goals.

Narrative:

Standard 5.4 Safety

Safety shall be taught during the first week of training and throughout the entire training program. Instruction will include all safety rules and special safety practices. Safety equipment such as eye protection and gloves are required equipment. All safety instructions shall be administered before any student is allowed to operate shop and/or lab equipment. All students shall sign a statement indicating their understanding of all safety procedures in each safety lectures and/or covered in each exam.

Narrative:

Standard 5.5 Work Ethics & Worker Characteristics

The development of high personal standards for the student shall be an on-going part of training. The work ethics exhibited by students shall be comparable to those required by industry. Appropriate work ethics and worker characteristics shall be taught as an on-going part of the students' training. Each student will be evaluated continuously for attendance, tardiness, completion of assigned jobs, tasks and lab projects. This evaluation shall be reviewed with the student each month or grading period.

Narrative:

Standard 5.6 Student Progress Report

Evaluation of the student's progress in the training program will be on a consistent and continuing basis. Performance evaluations shall be included in the student process report. Student progress reports shall be provided to each student every grading period.

Narrative:

Standard 5.7 Lab/Shop Performance Standards

The HVACR instructor will be responsible for assigning shop/lab projects to all students. The instructor shall compile and archive documentation of all projects and evaluations of student competencies. The instructor shall assign a single grade for each performance test. The criterion for evaluation of a student's lab performance shall include established grade values for; task time, process, and outcome.

Prior to each task or project, the student shall be given the standards for acceptable work and be graded at the completion of the task by the instructor. Students shall be notified of unacceptable work, indicating the good and bad characteristics along with any correction. The student must prove task competency before advancing to the next task. To ensure competence of all students, provisions for individuals performing tasks at slower levels should be made.

Narrative:

Standard 5.8 Student Assessments and Instructor Evaluations

The instructor shall, for each specialty area; e.g., Air Conditioning, Heat Pumps, Gas Heat, etc., use a national outcome assessment exam series that provides occupational area specific competency validation, competency breakdown and comparative analysis. The analysis must provide the instructor with the tools to evaluate their programs content and curriculum effectiveness.

Environmental Protection Agency Certification Section 608 training and testing shall be an integral part of the program.

The Administration shall perform an annual evaluation of the instructor by reviewing the instructor's methods of teaching, usage of developed curriculum guides, and implementation of approved curriculum. Existing students shall complete an instructor evaluation form prior to leaving the program. All evaluations shall be maintained on file in a central location.

Narrative:

Standard 5.9 Outside Work Projects (Live work orders)

Students shall not receive monies for work performed on live work orders. Outside work projects must receive approval of the administration. Outside work must reflect the skill level of the student (s) assigned. The instructor shall determine the education value and appropriate level prior to acceptance of the project, and assignment to students. Documentation shall include but not be limited to; a work order, and disclaimer of liability.

Narrative:

Standard 5.10 Maintenance and Repair Reference Materials

The HVACR program shall have service / installation information for all laboratory equipment available to students.

Narrative:

Standard 5.11 Multimedia References and Periodicals

Current HVACR related multi-media reference materials such as; textbooks, newspapers, magazines, periodicals and computer-based programs must be available to students, as well as the instructor. Textbooks and reference materials must be current (written within six years or less). All multimedia materials shall be cataloged (DVD's, CD's VHS Tapes, Films, Etc.). Each catalog listing shall include a title, description, and length. The catalog and its listed materials shall be available for student and instructor use.

Narrative:

Standard 5.12 Multimedia Equipment

Multimedia equipment capable of PowerPoint presentation or equivalent shall be available to enhance the HVACR teaching/learning experience.

Narrative:

Standard 5.13 HVACR Program Advisory Committee

The program chair or instructor shall appoint a craft advisory committee consisting of one each or more of the following; employers, program graduates, local HVACR representatives, manufacturers and/or distributors of HVACR equipment or related equipment. A listing of these members' names, addresses, telephone numbers and business or business connection shall be available for review. The responsibilities of the committee include observation, advice and discussion of the HVACR program, as well as an annual review of the program efficacy as it relates to the community's future workforce requirements.

This committee must meet no less than twice a year. The program chair should provide an agenda prior to the meeting. Minutes for each meeting shall include a list of attendees, and a description of all discussions and proposals. Minutes shall be retained on file for future reference.

The advisory committee's program annual efficacy review shall include but not be limited to; stated mission, curriculum, equipment, lab condition, fees, and testing procedures. Each advisory committee member must sign the annual efficacy review. A copy of the annual program efficacy review shall be maintained on file.

Narrative:

STANDARD 5 INSTRUCTIONAL DESIGN & PROGRAM ELEMENTS

Provide the following exhibits:

Exhibit 5.1: A detailed copy of the curriculum.

Exhibit 5.2: Documentation of your student to instructor ratio.

Exhibit 5.3: A detail of your established exit points for completers.

Exhibit 5.3A: A copy of the course outline/ syllabus for any supplemental / part-time preparatory training provided within the past year.

Exhibit 5.4: A copy of the program safety-training outline.

Exhibit 5.4A: A copy of your student statement of safety understanding.

Exhibit 5.5: A copy of the forms used for student evaluations of attendance, tardiness, completion of assigned jobs, tasks and lab projects.

Exhibit 5.6: A copy of the Student Progress Report.

Exhibit 5.7: A copy of the forms for evaluation of lab projects and performance testing.

Exhibit 5.7A: A copy of a job assignment used in performance testing.

Exhibit 5.8: A copy of a retained knowledge (written) exam.

Exhibit 5.8A: Documentation of program compliance with the national outcome assessment requirement.

Exhibit 5.8B Evidence of how students receive EPA certification prior to completion.

Exhibit 5.8C: A copy of the annual evaluation of the instructor.

Exhibit 5.8D: A copy of the students' exit evaluations of the instructor.

Exhibit 5.9: A copy of a live work order and disclaimer of liability.

Exhibit 5.10: A list and description of laboratory equipment available for training. Example: mid-efficiency gas furnace, condensing gas furnace, air-to-air heat pump, etc. (Supporting material will be inspected during the on-site visit.)

Exhibit 5.11: A catalog or list of all multimedia reference materials.

Exhibit 5.12: A list of multimedia equipment available for student training.

Exhibit 5.13: A copy of the last three advisory committee minutes and agenda.

Exhibit 5.13A: A list of the advisory committee members. (Include; names, addresses, phone numbers, and organizations represented.)

Exhibit 5.13B: A copy of the duties of the advisory committee.

Exhibit 5.13C: A copy of the advisory committee's last efficacy review.

Provide a comprehensive narrative that describes your programs compliance with Standard 6 and each sub-section of Standard 6.

STANDARD 6 PHYSICAL FACILITIES

The HVACR program's physical facilities shall provide a safe learning environment and provide the means to facilitate the achievement of the program goals and mission.

Standard 6.1 Safety

Fire extinguishers, first aid kits, and an eye wash station shall be available and accessible. The location and operation of all safety equipment must be included in the curriculum. All classrooms and lab/work areas must comply with all applicable OSHA regulations. All classrooms and lab/work areas shall comply with local fire codes. The minimum required combined classroom and shop area per student is 120 square feet.

Narrative:

Standard 6.2 Classroom and Office

There shall be an area or room separate from the lab or shop area designated as a classroom, and another room designated as the instructor's office. The classroom must be adequately lighted, heated/ cooled, void of noise or distractions as much as possible, and equipped with a marker board, multimedia equipment, as well as reference materials, internet connected computers (minimum of 1 for every 3 students) and other teaching/learning equipment necessary to enhance learning. The instructor's office shall be separate and convenient for conference needs. The classroom must be kept clean and orderly.

Narrative:

Standard 6.3 Maintenance and Housekeeping

Good housekeeping and maintenance of equipment shall be an on-going priority to assure general safety, establish good work habits, and to provide an adequate training environment. These practices shall be incorporated as part of the student's training.

Narrative:

Standard 6.4 Shop/Lab Area

Training areas or lab stations shall be located in a separate area, and near the classroom. Workbenches, training mock-ups, and equipment shall be readily available in the shop area. The entire area shall be well lighted and contain a positive ventilation system. The Shop/Lab shall have the necessary utilities and fuel supplies to support the stated curriculum such as; three phase power, natural gas, fuel oil, LPG, Etc.

Narrative:

Standard 6.5 Tool Room and Storage Area

An area for storage and for keeping tools, supplies and special training equipment shall be designated. The tool room and storage area shall be securable.

Narrative:

Standard 6.6 Restrooms

A restroom for students adjacent to or near the HVACR shop is mandatory. Provisions for males and females as well as full compliance with the Americans with Disabilities Act are required.

Narrative:

STANDARD 6 Physical Facilities

Exhibits are not required for Standard 6.

The physical facilities will be inspected during the on-site visitation.

Provide a comprehensive narrative that describes your programs compliance with Standard 7 and each sub-section of Standard 7.

STANDARD 7 EQUIPMENT AND TOOLS

In order to meet the goals and fulfill the mission of the HVACR program, training equipment and tools must be readily available. The equipment and tools must be equal in quality to those used in industry. The curriculum shall prescribe the equipment needed.

Standard 7.1 Shop/Lab Equipment

High quality equipment and tools necessary for training shall be located in the shop/lab area.

All tools and equipment shall be available for hands-on comprehensive training and performance testing. The curriculum shall dictate the types and variations of equipment or tools needed for training purposes. At least one piece of functioning live equipment, representative of each phase of the curriculum, must be available. Tools shall be available in sufficient quantities for the students to use during the lab portion of the training program.

Narrative:

SUGGESTED SHOP TOOLS

ELECTRICAL TEST EQUIPMENT
Digital multi-meter
Inductive amp probe
Capacitor analyzer
Megohmmeter
Wattmeter
Recording voltmeter
Recording ammeter

REFRIGERATION SERVICE EQUIPMENT
Manifold gauge set
Thermometers
- Bi-metal
- Glass tube
- Recording thermometer

Psychrometer
Refrigerant leak detectors
- Halide torch
- Electronic
- Ultrasonic
- Ultra-violet w/ fluorescent die
- Bubble solution

Electronic charging scale
Charging cylinder
Micron vacuum gauge
Vacuum pump
Refrigerant identifier
Refrigerant recovery/recycling equipment
Refrigerant storage tanks
Acid test kit
Oil pump
Oil pressure gauge
Heat gun

HEAT SERVICE EQUIPMENT
U-tube manometer
Inclined manometer
Carbon monoxide tester
Combustion analyzer
Vacuum gauge
Air velocity instruments
Draft gauge
Magnahelix gauge

MISC. SHOP TOOLS
Torque wrenches
C-clamps
Combination squares
Scratch awl
Flare / swage set
Tubing bender
Gear puller set
Pipe thread taps & dies
Pipe wrench set

MISC. SHOP EQUIPMENT
Workbenches w/ vise
Bench grinder
Pipe vise
Drill press
Sheet metal working equip.
Spot welder
Oxy-acetylene welding unit
Nitrogen tank w/ regulator and relief valve
Appliance truck
Vacuum cleaner
Droplights
Heavy-duty extension cords

Standard 7.2 Hand Tools for Students

During the course of study, the student will be required to use basic hand tools. The following is a recommended list of tools for each technician. A tool purchase program should be in place where the student can obtain tools at reasonable cost. The student should purchase hand tools required to perform shop/lab experiments. A listing of necessary hand tools shall be given to each new student by the instructor or by student services. These tools should be acquired by the student and brought to shop/lab each day.

Narrative:

SUGGESTED TOOLS LIST FOR STUDENTS

Socket wrench sets (SAE)
- 1/4" – 3/ 8" – 1/ 2" drive

Wrenches (SAE)
- Combination wrench set
- Flare Nut wrench set
- Adjustable wrenches
- Pipe wrenches
- Hex key wrenches
- Service valve wrenches

Hammers
- Ball peen
- Soft face mallet

Pliers
- Slip joint
- Tongue and groove
- Diagonal cutting
- Linesman pliers
- Long nose pliers
- Locking pliers
- Pinch-off pliers
- Wire-end crimpers

Screwdriver set
- Slotted
- Phillips
- Torx

Nut drivers

Tin snips
- Straight cut
- Left -hand curve cut
- Right -hand curve cut

Drill bits
Cold chisels
Punches
Files
Hacksaw
Tube cutter
Reamer
Fin straightener
Schrader valve core tool
Soldering iron / gun
Multimeter
Electric drill
Tape measure
Flashlight
Thermometer
Drop light
Safety glasses
Gloves
Gauge manifold set

Standard 7.3 Supplies

Supplies such as cleaning equipment, towels, and other expendable supplies shall be provided by the HVACR program and be readily available.

No Narrative Required:

SELF STUDY INSTRUCTIONS

STANDARD 7 Equipment and Tools

Provide the following exhibits:

Exhibit 7.1 A list of all lab equipment (Trainers and Live HVACR Equipment).

Exhibit 7.2A: A copy of the "student tool purchase program" if applicable.

Exhibit 7.2B: A copy of the required student tool list.

Provide a comprehensive narrative that describes your programs compliance with Standard 8 and each sub-section of Standard 8.

STANDARD 8 COOPERATIVE TRAINING

A legally written agreement involving all participants, including the instructor, student, work agent and the administrative office shall be executed before any student participates in any cooperative training program.

Standard 8.1 Performance Standards

All cooperative students shall be under the supervision of an experienced supervisor or instructor while on-the-job. Grading, evaluations, worker characteristics and attendance of student's work and progress, shall be made by this person. These evaluations shall then be returned to the HVACR instructor and to the institution for records and review.

Narrative:

STANDARD 8 Cooperative Training

Provide the following exhibits:

Exhibit 8: A copy of any cooperative training agreements.

Provide a comprehensive narrative that describes your programs compliance with Standard 9 and each sub-section of Standard 9.

STANDARD 9 Instructor Qualifications

The instructor shall meet all state and local government requirements for employment. Each instructor shall meet one or more of the following; be a graduate of an HVACR program, hold an AAS or greater degree, be enrolled in an AAS degree program, be currently working toward a CMHE (Certified Master HVACR Educator) credential, or hold the title of CMHE. In addition, each instructor must have minimum of five years HVACR field experience.

The instructor shall be able to conduct demonstrations, provide explanations and convey ideas, concepts and theories for all aspects of the curriculum. The instructor must reflect an image of high ethical values, honesty, tactfulness, patience and friendliness toward others.

Narrative:

STANDARD 9 Instructor Qualifications

Provide the following exhibits:

Exhibit 9.1: A copy of each instructor's Curriculum Vitae.

Exhibit 9.2: A copy of each instructor's current certifications and licenses.

Exhibit 9.3: Copies of any and all degrees and / or diplomas held by each instructor.

HVACR SECONDARY PROGRAM STANDARDS

STANDARD 1 MISSION OF PROGRAM

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- 5.12 Multimedia Materials and Equipment
- 5.13 HVACR Program Advisory Committee

STANDARD 6 PHYSICAL FACILITIES

- 6.1 Safety
- 6.2 Classroom and Office
- 6.3 Maintenance and Housekeeping
- 6.4 Shop/Lab Area
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- 6.6 Restrooms

STANDARD 7 EQUIPMENT AND TOOLS

- 7.1 Shop/Lab Equipment
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STANDARD 8 COOPERATIVE TRAINING

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STANDARD 9 INSTRUCTOR QUALIFICATIONS

- 9.1 Qualifications

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Minimum Tasks and Competencies for HVAC Excellence Accredited Programs

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About Curriculum Requirements:

The following competencies are required for any coursework listed or published in the program brochure, school catalog, or website corresponding to the following titles;

1. Core Competencies
2. Electrical
3. Electric Heat
4. Air Conditioning
5. Gas Heat
6. Oil Heat
7. Heat Pumps
8. Light Commercial Air Conditioning
9. Light Commercial Refrigeration

It is recommended that:

1. Electrical and Electric Heat competencies be completed prior to the Gas Heat or Oil Heat competencies.
2. Electrical, Electric Heat and Air Conditioning competencies be completed prior to the Heat Pump competencies.
3. Electrical and Air Conditioning competencies be completed prior to the Commercial Air Conditioning and / or Commercial Refrigeration competencies.

Core Competencies

Mathematics for HVACR

Demonstrate proficiency in converting fractions to decimals, and decimals to fractions.
Demonstrate proficiency in calculating squares, cubes, and roots.
Demonstrate proficiency in solving equations.
Calculate ▲ T .

Understand ratios and proportions as they relate to various equipment and components such as;
- Compressors / Pumps
- Pulleys
- Drive systems
- Fans

Calculate areas and volumes of various shapes.
Demonstrate the ability to convert English measurements to metric measurements.

Understand and demonstrate knowledge of proper duct sizing.

Explain the process and demonstrate the ability to calculate heat loss and gain for single family dwelling and residential duplex / two flat.

Electrical

Electrical Theory

Describe the structure of an atom.

Describe the difference between positive and negative charged atoms.

Describe potential difference.

Describe current flow.

Define impedance.

Describe and identify conductors.

Describe and identify insulators.

Describe and identify semi-conductors

Describe Ohm's Law and solve problems applying Ohm's Law.

Demonstrate proficiency in calculating the total resistance of multiple resistors in a series circuit.

Demonstrate proficiency in calculating the total resistance of multiple resistors in a parallel circuit.

Describe and demonstrate the effects of voltage drop in a series circuit.

Calculate and measure the voltage output of a transformer using the number of turns on the primary vs. the secondary sides.

Electrical Safety

Describe and perform "Lock out and Tag" procedures.

Identify the safety ground.

Identify the "Hot" conductor.

Identify "Neutral" conductor.

Describe and demonstrate emergency first aid procedures.

Interpreting Electrical Diagrams

Describe the difference between a "Pictorial", a "Ladder Diagram", and a "Schematic".

Identify standard electrical symbols used in schematics.

Identify inoperative/defective component using schematic wiring diagrams.

Identify voltage between two points using schematic wiring diagrams.

Determine sequence of operation using schematic wiring diagrams.

Knowledge of Electrical Components

Identify the types and describe the proper application and use of “Circuit Protectors”.

Identify, describe, and explain the function and application of; contactors, line starters,

defrost timers, thermostats, heat anticipators, transformers, relays, loads, switches, solenoid valves, positive and negative temperature coefficient thermistors.

Evaluate and replace; contactors, line starters, defrost timers, thermostats, heat anticipators, transformers, relays, loads, switches, solenoid valves, positive and negative temperature coefficient thermistors.

Fundamentals of Motors / Capacitors

Describe how capacitors are rated and tested.

Disassemble and assemble, and describe the function of the parts of an induction motor.

Define and measure Locked Rotor Amps, and Full Load Amps.

Describe how overload protectors function.

Evaluate, replace and describe the function, application and wiring of a start capacitor.

Evaluate, replace and describe the function, application and wiring of a run capacitor.

Describe and explain motor speed.

Explain and change the direction of rotation in a single phase motor.

Describe and demonstrate the method used to change rotation direction in a three phase motor.

Describe a three phase motor.

Explain the difference between a Wye and Delta three phase motor.

Demonstrate and explain the purpose of checking the resistance of motor windings.

Describe a dual voltage three phase motor and demonstrate the wiring configurations.

Describe a permanent split capacitor motor, capacitor start induction run motor, and a multi speed motor.

Describe the operation and characteristics of an Electronically Commutated Motor (ECM).

Describe and demonstrate setup and adjustment of a Variable Frequency Drive (VFD).

Describe and demonstrate setup and adjustment of a Variable Speed Drive (VSD).

Electrical Troubleshooting and Problem Solving

Troubleshooting and Problem Solving involve diagnostic procedures requiring the use of test instruments, data plate information, and wiring diagrams. All of the HVACR electrical system components, circuits, and/or power supply should be included in Troubleshooting and Problem Solving.

Knowledge of the following test instruments and or tools is required.

Ohmmeter	Megger
Ammeter	Capacitor analyzer
Voltmeter	Multimeter

Electric Heat

Theory and Application

Differentiate between a resistive and inductive load.

Define Coefficient of performance.

Define Watts Law.

Identify the formula for sensible heat.

Describe maximum allowable voltage imbalance in a three phase circuit.

Measure voltage imbalance in a three phase circuit.

Identify the heating value of one Watt in BTU's.

Describe and demonstrate the method of measuring static pressure.

Describe the effects of relative humidity on comfort and health.

Describe voltage tolerances.

Describe sensible and latent heat.

Define BTU.

Describe the principles of dehumidification and humidification.

Safety

Describe and demonstrate "Lock out and Tag" procedures.

Identify the safety ground.

Identify the "Hot" conductor.

Identify "Neutral" conductor.

Describe and perform emergency first aid procedures.

Describe and install a GFCI circuit breaker.

Describe and demonstrate safety grounding procedures for electric motors.

Describe the application of and test a fusible link.

Describe and demonstrate the safe usage of extension ladders.

Knowledge of System Components

Describe and properly wire a dual transformer system.

Identify the material used to construct electric heater elements.

Describe the insulating properties of mica and ceramics and their application.

Describe the operation of, and evaluate/replace a limit switch.

Describe the operation of, and evaluate/replace a heat sequencer.

Describe snap discs and their operation.

Describe the operation and purpose of, and evaluate/replace a fan interlock switch.

Describe how electric heating elements are rated.

Describe how a sequencer controls blower operation.

Evaluate and replace a heating element and a sequencer.

Describe the types and proper sizing of drive belts.

Demonstrate the proper sizing and installation of drive belts.

State the typical operating characteristics of a residential direct driven blower

Identify the various types of motor mounts used on residential furnace blower assemblies.

Evaluate, replace, and set a pressure differential switch, and describe its operation.

Evaluate and replace, a duct heater, and describe its operation

Installation and Service

Describe and demonstrate the procedure to adjust air flow on a belt driven blower assembly.

Choose and install the proper bearings for a residential blower motor.

Choose and use the proper lubricant for residential blower motor maintenance.

Describe and demonstrate the method of wiring heating elements in a single phase system.

Describe procedures for retrofit of a combustion system to electric heat.

State the minimum required clearances for service and safety of an electric furnace.

Determine appropriate wire size for electric furnace installation.

Describe and demonstrate the proper soldering procedures for electrical wiring.

Describe and calculate wire sizing as it applies to voltage drop and length of wiring run.

Thermostat

Identify the proper location for and install a conventional thermostat.

Explain the detailed wiring and operation of a set back programmable thermostat.

Explain the procedure for and demonstrate setting a heat anticipator on an electric furnace.

Identify the NEC code requirements for residential thermostat wiring.

Air Flow

Describe and measure temperature rise.

Explain the procedure for determining CFM and demonstrate.

Describe the effects of static pressure on air flow and demonstrate.

Describe the application of and install turning vanes.

State the recommended air velocities throughout the supply and return duct system.

Measure air velocities throughout the supply and return duct system.

Describe the construction and efficiencies of varying filtering media and systems.

Describe, fabricate and install various types of duct connectors.

Describe “R” values and noise reduction elements of various duct materials.

Electric Heat Troubleshooting and Problem Solving

Troubleshooting and Problem Solving involves diagnostic procedures requiring the use of test instruments, data plate information, and wiring diagrams. All of the HVACR electric furnace

system components, circuits, air distribution system, and/or power supply may be part of the Troubleshooting and Problem Solving question area.

Knowledge of the following test instruments and or tools is required.

Voltmeter	Ammeter
Ohmmeter	Megger
Thermometer (wet / dry)	Anemometer
Static pressure gauge	Velometer

Air Conditioning

Fundamentals and Theory

Describe the laws of Thermodynamics.

Describe and demonstrate Convection.

Describe and demonstrate Conduction.

Describe and demonstrate Radiation.

Define enthalpy and entropy.

Explain condensation of a vapor, and its effect on heat.

Explain and demonstrate vaporization of a liquid, and its effect on heat.

Describe the three states of matter.

Describe change of state.

Differentiate between absolute and gauge pressure.

Describe atmospheric pressure and the effect of altitude.

Define vacuum as it is used in the HVACR industry and demonstrate how it is measured.

Use saturation tables.

Describe the principles of dehumidification and humidification.

Describe and define the following; BTU, latent heat, sensible heat, subcooled liquid, superheated vapor, dry bulb temperature, wet bulb, temperature, and dew point.

Refrigerants and Refrigerant Oils

Describe the following oils and their applications; Mineral, Alkylbenzene, Glycols, and Esters.

Describe the thermodynamics of refrigerants

Identify and define; CFC's, HCFC's, and HFC's.

Identify and define the following types of blends; Binary, Ternary, Azeotropic, and Near Azeotropic.

Describe fractionation and its causes.

Describe temperature glide.

System Components

Describe and explain the function of, and evaluate and replace (when feasible) the following components;

- evaporator
- accumulator

suction line

suction line filter

compressor (reciprocating, scroll, rotary, screw, centrifugal)

discharge line

condenser

liquid line

receiver

liquid line filter/drier

pump down solenoid

sight glass

head pressure controls

low pressure controls

oil safety switch

heat exchangers

metering device (capillary tube, thermostatic expansion valve, automatic expansion valve).

Describe the state of refrigerant, in each major component during normal operation.

Describe and perform a compressor efficiency test.

Recovery / Recycling / Reclamation

Define and demonstrate refrigerant recovery

Define and demonstrate refrigerant recycling

Define reclaim

Leak Detection / Testing

Describe the six types of leak detectors.

Explain and demonstrate the method for pinpointing a leak.

Explain and demonstrate the proper use of each type of leak detector and their applicability.

Explain and demonstrate the proper use and handling of nitrogen in the leak detection process

Describe and demonstrate proper soldering and brazing techniques.

Evacuation and Charging

Describe and demonstrate the operation and use of a gauge manifold assembly.

Identify and demonstrate proper charging of a blended refrigerant into an operating system.

Identify and demonstrate proper charging of a blended refrigerant into an empty system.

Identify and demonstrate proper charging of a compound refrigerant into an empty system.

Identify and demonstrate proper charging of a compound refrigerant into an operating system.

Select the proper refrigerant oil and add it to an operating system.

Describe and demonstrate charging using the superheat method.

Describe and demonstrate charging using the subcooling method.

Explain vacuum pump selection.

Describe and demonstrate the triple evacuation method.

Identify the types of micron gauges.

Explain and demonstrate the proper method of connecting and a micron gauge to the system.

Air Conditioning Troubleshooting and Problem Solving

Troubleshooting and Problem Solving involve diagnostic procedures requiring the use of test equipment, manufacturers installation and start up procedures, and data plate information.

Knowledge of the following test instruments and or tools is required.

- Thermometers (wet and dry)
- Gauge manifold assembly
- Recovery equipment
- Vacuum pump
- Micron gauge
- Refrigerant throttling valve
- Charging scale and Charging cylinder
- Soldering and brazing equipment
- Nitrogen Cylinder
- Leak detector

Gas Heat

Combustion Theory and Heating Fuels

- State the BTU content of various fuels.
- State the specific gravity of various fuels.
- Describe the various categories of furnaces as classified by the National Fuel Gas Code.
- State the typical flue gas temperatures of the varying categories of furnaces.
- State the proper chemical names of various fuels.
- Define BTU
- Determine the quantity of combustion air required to burn one cubic foot of various fuels.
- State the ignition temperature of various fuels.
- Define and differentiate between primary air and excess air.
- State the cubic feet of flue gas required for every one cu ft. of various fuels burned.
- Describe and state the causes of burner “Flashback”.
- Describe and state the causes of a lifting flame.
- Describe and state the causes of yellow flame.
- Describe and state the causes of floating flame.
- State the percentage of Carbon Dioxide present in the flue gases of a natural gas furnace, if perfect combustion occurred.
- State the percentage of Carbon Dioxide present in the flue gases of a properly operating LP furnace.

Safety

- State the national standard for burners and ignition source height for a garage installation.
- Describe and demonstrate ladder safety procedures.
- Describe the safety procedure to be followed upon discovery of a defective heat exchanger.
- State the distance that type B vent pipe must be kept from combustible materials.
- State the minimum number of inches required for service access.
- Determine the acceptable ppm of Carbon Monoxide in a flue gas sample.
- State the proper safety procedures to follow upon discovering a gas leak.

Knowledge of Heating Systems and Components

- Describe the operation of and test a thermocouple.
- Describe the operation of and test a millivolt generator.
- Describe the operation of and test a door safety switch.
- Describe the operation of and test a spark igniter.
- Describe the operation of and test a hot surface igniter.
- Describe the operation of and test a flame sensor.

Describe the operation of and test an ignition module.

Describe and test the operation of gas valve used with residential furnaces.

Describe the operation of and test a vent pressure switch.

Describe a pilot burner and orifice and explain its operation.

Describe a main burner and orifice and explain its operation.

Describe the operation of and test a combustion fan limit switch.

Describe the various fan controls and test their operation.

Describe the operation of and test a limit switch.

Describe the operation of and test a blower motor relay.

Describe the operation of and test a vent motor relay.

Describe the operation of and test a vent blower.

Describe and inspect the condition of a heat exchanger.

Describe, test, and install a run and start capacitor.

Describe and set a heat anticipator on a thermostat.

Describe and install a single stage thermostat.

Describe and install a dual stage thermostat.

Adjust primary air and describe the procedure.

Describe and clean flue baffles.

Describe and install a blower housing cut-off plate.

State the materials used in the construction of Type B vent pipe.

Measure static pressure and describe the appropriate range in residential furnaces.

Describe the types of burners used on residential gas furnaces.

Differentiate between the bonnet rating and input rating of a furnace.

State the reason for appropriate polarity wiring on solid state circuits.

Describe the principles of dehumidification and humidification.

Installation and Service

State the generally accepted standard gas manifold pressure for a residential furnace.

Measure manifold gas pressure.

Describe the proper venting configurations of mid and high efficiency furnaces.

State the National Fuel Gas Code maximum fuel line pressure drop allowance.

State the proper procedures for installation of gas piping.

Cut and thread gas pipe.

State the standard acceptable supply pressures of various fuels.

Describe the purpose of and install a fire stop support plate.

Describe the types of and install duct connectors and hangers.

Describe “R” values and noise reduction elements of various duct materials.

Describe and size wire as it applies to voltage drop and length of wiring run.

Describe and demonstrate proper soldering procedures for electrical wiring.

Describe the procedure and adjust air flow on a belt driven blower assembly.

State the formula for sensible heat.

Describe the procedure to de-rate a gas furnace at altitudes of 2,000 feet and above.

Identify the different types of conduit used for power wiring.

Adjust blower fan speed.

Gas Heat Troubleshooting and Problem Solving

Troubleshooting and Problem Solving involves diagnostic procedures requiring the use of test instruments, data plate information, and wiring diagrams. All of the gas furnace system components, circuits, air distribution system, and/or power supply should be part of Troubleshooting and Problem Solving.

Knowledge of the following test instruments and or tools is required.

- Combustion analyzer
- Combustible gas detector
- Carbon Monoxide detector
- Manometer
- Voltmeter
- Soldering and brazing equipment
- Tap and die set
- Pipe cutter
- Pipe Reamers
- Velometer
- Ammeter
- Ohmmeter

Oil Heat

Combustion Theory and Heating Fuels

- State the BTU content of fuel oil #1 and #2.
- Describe the various categories of furnaces as classified by the National Fuel Gas Code.
- State typical flue gas temperatures of the varying categories of furnaces.
- Define BTU
- Define AFUE
- State the quantity of combustion air required to burn one gallon of fuel oil.
- State the ignition temperature of fuel oil.
- Define and differentiate between primary air and secondary air.
- State the cubic feet of flue gas produced for every one cu ft. of fuels burned.
- Describe the characteristics of good burner flames.
- Describe and state the causes of “Flashback”.
- Describe and state the causes of flame problems.
- State the percentage of Carbon Dioxide present in the flue gas if perfect combustion occurred.

Safety

- State the national standard for burners and ignition source height for a garage installation.
- Describe and demonstrate ladder safety procedures.
- Describe the safety procedure to be followed upon discovery of a defective heat exchanger.
- State the distance that type vent pipe must be kept from combustible materials.
- State the minimum number of inches required for service access.

Knowledge of Heating Systems and Components

- Describe the operation of and test a high voltage ignition system.
- Describe the operation of and test a door safety switch.
- Describe the operation of and test a flame sensor.
- Describe the operation of and test a primary control.
- Describe and test the various types of residential furnace fuel oil units (pumps).
- Describe and install fuel oil supply and return piping.
- Describe the operation of and test a combustion fan limit switch.
- Describe the operation of and test the various fan controls.
- Describe the operation of and test a blower motor relay.
- Describe a heat exchanger.

Describe the operation of, and test and install a run and start capacitor.

Describe and set a heat anticipator on a thermostat.

Describe and install set back programmable thermostat.

Describe the operation of and install a single stage thermostat.

Describe the operation of and install a dual stage thermostat.

Adjust primary air.

Describe and install a blower housing cut-off plate.

State the materials used in the construction of a vent pipe.

Describe and measure static pressure and state the appropriate range in residential furnaces.

Describe the types of burners used on residential furnaces.

Differentiate between the bonnet rating and input rating of a furnace.

State the reason for appropriate polarity wiring on solid state circuits.

Describe the construction and application of oil guns.

Check the operation of an oil gun.

Set “spark gap”.

Describe the purpose of and install flame detention rings

Describe the purpose of and check the operation of delayed oil valve.

Describe the operation of and adjust a barometric draft control.

Describe the operation of and test a fuel unit cut-off device.

Explain the procedure to determine combustion air requirements.

Describe the principles of dehumidification and humidification.

Installation and Service

Describe the relationship of nozzles to their application.

Describe the proper venting configurations of standard and high efficiency furnaces.

State the proper procedures for installation of oil piping.

Cut and thread pipe.

Describe and install a fire stop support plate.

Describe and install various types of duct connectors and hangers.

Describe “R” values and noise reduction elements of various duct materials.

Describe wire sizing as it applies to voltage drop and length of wiring run.

Describe and demonstrate proper soldering procedures for electrical wiring.

Adjust air flow on a belt driven blower assembly.

State the formula for sensible heat.

Describe the procedure to de-rate a oil furnace at altitudes of 2,000 feet and above.

Identify the different types of conduit used for power wiring.

Adjust blower fan speed.

Describe the proper location of oil storage tanks.

Describe the equipment used and the procedure to smoke test a furnace.

Smoke test a furnace.

Oil Heat Troubleshooting and Problem Solving

Troubleshooting and Problem Solving involves diagnostic procedures requiring the use of test instruments, data plate information, and wiring diagrams. All of the oil furnace system components, circuits, air distribution system, and/or power supply should be part of Troubleshooting and Problem Solving.

Knowledge of the following test instruments and or tools is required.

Combustion analyzer

Pipe cutter

Carbon Monoxide detector

Tap and die set

Ohmmeter

Pipe Reamers

Manometer/ Magnehelic gauge
Velometer
Voltmeter
Ammeter
Soldering and brazing equipment
Oil Pressure Gage
Stack Thermometers
Anemometer

Heat Pumps

Core Competencies

Define and demonstrate refrigerant recovery

Define and demonstrate refrigerant recycling

Define reclaim

Describe the six types of leak detectors.

Explain and demonstrate the method for pinpointing a leak.

Explain and demonstrate the proper use of each type of leak detector and their applicability.

Explain and demonstrate the proper use and handling of nitrogen in the leak detection process.

Describe and demonstrate proper soldering and brazing techniques.

Describe and demonstrate the operation and use of a gauge manifold assembly.

Identify and demonstrate the proper method of charging a blended refrigerant into an operating system.

Identify and demonstrate the proper method of charging a blended refrigerant into an empty system.

Identify and demonstrate the proper method of charging a compound refrigerant into an empty system.

Identify and demonstrate the proper method of charging a compound refrigerant into an operating system.

Describe and demonstrate charging using the superheat method.

Describe and demonstrate charging using the subcooling method.

Explain vacuum pump selection.

Describe and demonstrate the triple evacuation method.

Identify the types of micron gauges.

Explain and demonstrate the proper method of connecting a micron gauge to the system.

Describe the thermodynamics of refrigerants

Describe the principles of dehumidification and humidification.

Competencies:

Describe the function of, and install a lockout relay in a circuit.

Describe, test, and install a run and start capacitor.

Describe and install a compressor potential start relay.

Describe the operation of and test a high pressure switch.

Describe the operation of and test a low pressure switch.

Test a blower or fan motor and its circuit.

Identify and differentiate between the various types of service valves.

Describe and wire the terminal connections of a thermostat temperature control.

Describe and install a liquid line drier.

Describe and instal liquid line bi-flow drier.

Describe and install suction line filter drier.

Describe the procedure for and perform a compressor efficiency test.

Describe the operation of and install heat/cool relay.

Describe the operation of the following defrost controls, mechanical, time/temperature, and solid state.

Install and test a defrost control.

State the purpose of and test a bimetal outdoor coil temperature sensor.

Describe and test thermistor type temperature sensors (PTC & NTC).

Describe a heat pump's design, configuration, and demonstrate operation in both the heating and cooling cycle.

Describe the sequence of the defrost cycle.

Describe the operation of, and install/test a defrost relay.

Describe, install, and set an outdoor thermostat.

Describe how the set points for outdoor thermostats are established.

Describe the operation of a reversing valve.

Describe and demonstrate the procedures for testing the operation of a reversing valve.

State the purpose of an accumulator.

Describe the principle of operation of a capillary tube, fixed orifice, thermostatic expansion valve, and electronic expansion valve.

Describe and check a Control Circuit Fuse.

Describe and check a printed circuit board (PC).

Describe and install a heat pump thermostat with emergency heat feature.

Describe a defrost board and its operation.

Define SEER, HSPF, and COP.

Describe and demonstrate heat pump charging procedures.

Replace a reversing valve, following proper procedures .

Describe crankcase heating methods and how they operate.

Describe the required CFM for system operation and demonstrate the methods for calculating air flow.

Describe a check valve, its function and operation.

Differentiate between a compressor designed for use in a heat pump and one that is designed for use in a cooling only air conditioner.

Heat Pump Troubleshooting and Problem Solving

Troubleshooting and Problem Solving involves diagnostic procedures requiring the use of test equipment, manufacturers installation and start up procedures, and data plate information.

Knowledge of the following test instruments and or tools is required.

Thermometers (wet and dry)

Gauge manifold assembly

Recovery equipment

Vacuum pump

Micron gauge

Leak detector

Nitrogen Cylinder

Soldering and brazing equipment

Charging scale and Charging cylinder

Refrigerant throttling valve

Ohmmeter

Ammeter

Voltmeter

Sling Psychrometer

Light Commercial Air conditioning

Core Competencies

Define and demonstrate refrigerant recovery

Define and demonstrate refrigerant recycling

Define reclaim

Describe the six types of leak detectors.

Explain and demonstrate the method for pinpointing a leak.

Explain and demonstrate the proper use of each type of leak detector and their applicability.

Explain and demonstrate the proper use and handling of nitrogen in the leak detection process.

Describe and demonstrate proper soldering and brazing techniques.

Describe and demonstrate the operation and use of a gauge manifold assembly.

Identify and demonstrate the proper method of charging a blended refrigerant into an operating system.

Identify and demonstrate the proper method of charging a blended refrigerant into an empty system.

Identify and demonstrate the proper method of charging a compound refrigerant into an empty system.

Identify and demonstrate the proper method of charging a compound refrigerant into an operating system.

Describe and demonstrate charging using the superheat method.

Describe and demonstrate charging using the subcooling method.

Explain vacuum pump selection.

Describe and demonstrate the triple evacuation method.

Identify the types of micron gauges.

Explain and demonstrate the proper method of connecting a micron gauge to the system.

Describe the thermodynamics of refrigerants

Describe the principles of dehumidification and humidification.

Define SEER and EER.

Competencies:

Describe the function of, and install a lockout relay in a circuit.

Describe the operation of and install a contactor.

Describe, test, and install a run and start capacitor.

Describe and install a compressor potential start relay.

Describe the operation of and test a high pressure switch.

Describe the operation of and test a low pressure switch.

Test a blower or fan motor and its circuit.

Identify and differentiate between the various types of service valves.

Describe and wire the terminal connections of a thermostat temperature control.

Describe and install a liquid line drier.

Describe and install a suction line filter drier.

Describe the application and operation of the following types of compressors; (reciprocating, scroll, rotary, screw, centrifugal).

Describe and test thermistor type temperature sensors (PTC & NTC).

Describe the function and check the operation and of an oil pressure safety control.

Describe the operation of and test a solenoid valve.

Describe the operation of and test a hot gas bypass valve.

Describe the operation of and test a liquid line solenoid valve.

Describe a accumulator and its function.

Describe the operation of and adjust an inline, and pilot operated evaporator pressure regulator.

Describe a Head Master and its operation.

Describe a chilled water system and its operation.

Describe a capillary / distributor tube sizing and selection procedure.

Describe the operation of and install a fixed orifice metering device.

Describe the operation of and install a thermostatic expansion valve.

Describe the operation of and install a refrigerant receiver.

Describe a oil separator and its function.

Describe dry type evaporators and their operation.

Describe an air cooled condenser, its function, and operating parameters.

Describe and demonstrate the proper procedure for measuring and adjusting superheat.

Describe the operation and function of a flooded evaporator and its metering device.

Install and adjust a water regulating valve.

Install and adjust a low ambient temperature control.

Describe cooling towers and their operating limitations.

Describe the function and purpose of a multiple compressor system

Describe the automatic pumpdown system and its operation.

Describe the various fan controls, their application and operation.

Describe the purpose and check the operation of a crankcase heater.

Define fractionation and temperature glide.

State the reason why capillary tube systems require a critical charge.

Size, design, and install refrigerant lines.

Define compression ratio.

Describe the various methods of compressor capacity control.

State the selection process for refrigerant oils.

Explain the procedures to retrofit a system from a CFC to an HFC, & an HCFC to an HFC.

Describe the required CFM for system operation and calculate air flow.

Define wet bulb depression.

Describe the design structure ,function, operation, and selection of refrigerant distributors and feeder tubes.

Describe the function, selection and installation of a vibration eliminator.

Thermometers (wet and dry)
Gauge manifold assembly
Recovery equipment
Vacuum pump
Micron gauge
Leak detector
Nitrogen Cylinder
Soldering and brazing equipment
Charging scale and Charging cylinder
Refrigerant throttling valve
Oil pressure gauge
Oil pump
Ohmmeter
Ammeter
Voltmeter
Sling Psychrometer

Describe the piping configuration for a multiple evaporator systems.

Install a condensate drain.

Describe and install an economizer.

Describe the principles of dehumidification and humidification.

Light Commercial Air Conditioning Troubleshooting and Problem Solving

Troubleshooting and Problem Solving involves diagnostic procedures requiring the use of test equipment, manufacturers installation and start up procedures, and data plate information.

Knowledge of the following test instruments and or tools is required.

Light Commercial Refrigeration

Core Competencies

Describe the laws of Thermodynamics.

Define and demonstrate recovery

Define and demonstrate recycling

Define reclaim

Describe the six types of leak detectors.

Explain and demonstrate the method for pinpointing a leak.

Explain and demonstrate the proper use of each type of leak detector and their applicability.

Explain and demonstrate the proper use and handling of nitrogen in the leak detection process.

Describe and demonstrate proper soldering and brazing techniques.

Describe and demonstrate the operation and use of a gauge manifold assembly.

Demonstrate the proper method of charging a blended refrigerant into an operating system.

Demonstrate the proper method of charging a blended refrigerant into an empty system.

Demonstrate the proper method of charging a compound refrigerant into an empty system.

Demonstrate the proper method of charging a compound refrigerant into an operating system.

Describe and demonstrate charging using the superheat method.

Describe and demonstrate charging using the subcooling method.

Explain vacuum pump selection.

Describe and demonstrate the triple evacuation method.

Identify the types of micron gauges.

Explain and demonstrate the proper method of connecting a micron gauge to the system.

Describe the thermodynamics of refrigerants

Describe the principles of dehumidification and humidification.

Competencies:

Describe the operation of and test a lockout relay.

Describe the operation of and test a contactor.

Describe, test, and install a run and start capacitor.

Describe the operation of and install compressor potential start relay.

Describe the operation of and install a compressor current start relay.

Describe a service valve and its operation.

Describe the operation of and test a high pressure switch.

Describe the operation of and test a low pressure safety switch.

Install and adjust a low pressure switch used for temperature control.

Describe the operation of and install a thermostat.

Describe the operation of and install a liquid line drier.

Describe the operation of and install a suction line filter drier.

Describe the application and operation of the following types of compressors; (reciprocating, scroll, rotary, screw, centrifugal).

Describe the operation of and adjust an oil pressure safety control.

Install and adjust a mechanical or electronic defrost timer.

Describe the operation of and test a defrost heater and a defrost terminator.

Describe defrost cycle initiation and termination.

Describe the purpose and applicability of a defrost cycle.

Describe a drain and drain pan heater and their operation.

Install a condensate drain.

Describe and test thermistor type temperature sensors (PTC & NTC).

Describe the operation of and test a solenoid valve.

Describe the operation of and test a hot gas bypass valve.

Describe the operation of and test a liquid line solenoid valve.

Describe an accumulator and its function.

Describe the operation of and install/adjust a crankcase pressure regulator (CPR).

Describe the operation of and install/adjust a evaporator pressure regulator (EPR).

Describe the operation of and install a operating pressure regulator (OPR).

Describe a Head Master and its operation.

Describe a capillary / distributor tube sizing and selection procedure.

Describe a fixed orifice metering device and its operation.

Describe the operation of and install/adjust an automatic expansion valve.

Describe the operation of and install/adjust a thermostatic expansion valve.

Describe a refrigerant receiver and its function.

Describe a oil separator and its function.

Describe dry type evaporators and their operation.

Describe an air cooled condenser, its function, and operating parameters.

Describe the proper procedure for measuring and adjusting superheat.

Describe the proper maintenance of a low temperature evaporator.

Describe the operation and function of a flooded evaporator and its metering device.

Describe types of water cooled condensers and their operation.

Install and adjust a water regulating valve.

Describe and test low ambient temperature controls.

Describe cooling towers and their operating limitations.

Describe the function and purpose of a multiple compressor system.

Describe the purpose and proper selection of, and install a suction line heat exchanger.

Describe a cascade system its application and operation.

Describe the automatic pumpdown system and its operation.

Describe the operation of and test various fan controls.

Describe the purpose of and check the operation of a crankcase heater.

Define and state the applications of High, Medium, and Low temperature refrigeration.

Define fractionation and temperature glide.

State the reason why capillary tube systems require a critical charge.

Define “Expendable Refrigerant”.

Define and explain the use of high humidity evaporator coils.

Size, design and install refrigerant lines.

Determine refrigerant line pressure drop and explain the effects of pressure drop on a system.

Define compression ratio.

Describe the various methods of compressor capacity control.

Describe the function, selection and installation of a vibration eliminator.

Describe the basic operation of ice makers.

State the selection process for refrigerant oils.

Add refrigerant oil to an operating system.

Explain the procedures to retrofit a system from a CFC to an HFC, & an HCFC to an HFC.

Define Cryogenics.

Describe the design structure ,function, operation, and selection of refrigerant distributors and feeder tubes.

Commercial Refrigeration Troubleshooting and Problem Solving

Troubleshooting and Problem Solving involves diagnostic procedures requiring the use of test equipment, manufacturers installation and start up procedures, and data plate information.

Knowledge of the following test instruments and or tools is required.

Thermometers (wet and dry)

Vacuum pump

Leak detector

Soldering and brazing equipment

Charging scale and Charging cylinder

Refrigerant throttling valve

Oil pressure gauge

Oil pump

Ohmmeter

Ammeter

Voltmeter

Sling Psychrometer

Gauge manifold assembly

Recovery equipment

Micron gauge

Nitrogen Cylinder