REFRIGERANT SYSTEM COMPONENTS
Course Syllabus

Course Number: ARCO-0925
OCAS Code: None
Course Length: 90 Hours
Career Cluster: Architecture & Construction
Career Pathway: Maintenance/Operations
Career Major(s): HVAC Technician

Pre-requisite(s):

This course covers the refrigeration cycle and teaches students to recognize the components of refrigeration systems including metering devices, evaporators, compressors, condensers, accessories, and access valves.

Textbooks:

- Refrigeration & Air Conditioning Technology, 7th Ed, (2013), Whitman /Johnson/ Tomczyk Silberstein / Publisher Delmar Cengage

Course Objectives:

A. Utilize Metering Devices.

1. Define types of metering devices:¹
   a. Capillary tubes¹
   b. Thermal expansion valve¹ ²
      1. Describe problems associated with replacement of TXVs.²
      2. Describe the procedure for installing and adjusting selected TXVs.²
   c. Automatic expansion valve¹
   d. Low side float¹
   e. High side float¹
   f. Hand expansion valve¹
   g. Restrictor orifices¹
   h. Electronic expansion valve¹
   i. Solid state expansion valve¹

2. Explain the function of metering devices.²
3. Describe the operation of selected metering devices and expansion valves.²
4. Evaluate system performance when using different types of flow control devices.¹
5. Explain how to size expansion valves.¹
6. Explain how to size a thermal expansion valve.¹
7. Explain how to size an automatic expansion valve.¹
8. Adjust and size metering devices when and where appropriate.¹
9. Check and adjust superheat and/or subcooling to manufacturers' specifications.
10. Install capillary tube.

B. Understand Evaporators.
   1. Identify types of evaporators:
      a. bare-tube
      b. finned
         1. internal
         2. external
      c. plate
      d. unit coolers
      e. chillers
   2. Determine the Mean Effective Temperature Difference (METD).
   3. Adjust for proper coil air flow.
   5. Select and size evaporator based on compressor capacities.

C. Demonstrate Knowledge of Compressors.
   1. Identify types of compressors:
      a. Hermetic
      b. Semi-hermetic
      c. Open type
   2. Identify methods of compression:
      a. Centrifugal
      b. Rotary
      c. Screw
      d. Scroll
      e. Reciprocating
   3. Explain the methods of compression.
   4. Explain methods of capacity control:
      a. Cylinder unloading
      b. Multiple compressors
      c. Hot gas bypass
      d. Variable speed compressors
   5. Select the compressor based on cooling load.
   6. Determine the system balance based on the selected components.

D. Understand Condensers.
   1. Define the types of condensers:
      a. air-cooled
      b. water-cooled
      c. evaporative-cooled
   2. Determine proper air and water flow.
   3. Describe maintenance of a condenser.
   4. Describe maintenance of a cooling tower.
   5. Explain the operation and performance of a condenser.
   6. Explain the terms "range" and "approach" related to cooling towers.
   7. Explain purpose of heat reclaim.
   8. Adjust the air flow for proper temperature difference.
   9. Adjust water flow for proper gallons per minute (GPM) and temperature difference.
  10. Size a cooling tower.
  11. Select and size an air-cooled condenser.
E. Identify Accessories.
1. Identify the proper location of all accessories:
   a. Accumulators
   b. Crankcase heaters
   c. Crankcase pressure regulating valves
   d. Defrost timers
   e. Driers/filters
   f. Evaporator pressure regulating valves
   g. Head pressure controls
   h. Heat exchangers
   i. Hot gas bypass
   j. Low pressure controls
   k. Low ambient controls
   l. Mufflers
   m. Oil separators
   n. Receivers
   o. Solenoid valves
   p. Suction filters
   q. Unloaders
   r. Vibration eliminators
   s. Check valves
   t. Water regulating valve
   u. Liquid sight valve-refrigerant and oil
   v. Relief valve
2. Determine appropriate accessories for systems application.
3. Explain the operation of the above listed accessories (Item #1).
4. Replace a drier/filter.
5. Adjust a crankcase pressure regulating valve.

F. Work with Access Valves
1. Identify front and back seat valves in the:
   a. Operation and use of the suction and discharge service valves that service the compressor
   b. Application and operation of the king valve at the outlet of the receiver
   c. Application and operation of the queen valve where present, near the receiver
   d. Small system high side and low side service ports
   e. Front seating and Schrader valves, OEM and field installed
2. Identify Schrader Type OEM and field installed in the:
   a. Installation and use of clamp on valves
   b. Installation and use of solder (in) or (on) stem valves
   c. Use of A/C front seating/Schrader OEM service valves
   d. Use of quick disconnects with Schrader-Based Valves

G. Adjust and Troubleshoot Automatic Controls and Components.
1. Adjust thermal expansion valve.
2. Adjust low pressure control to desired cut-in and cut-out set points.
3. Adjust high pressure control to desired cut-out set point.
4. Check operation of liquid line solenoid valve to insure correct pumpdown operation.
5. Perform manual pumpdown procedure to isolate refrigerant to high side of system.
6. Front-seat suction service valve and check compressor efficiency.
REFRIGERANT SYSTEM COMPONENTS

H. Troubleshoot and Repair Components of a System.
1. Select instruments for checking an air conditioning unit with a mechanical problem.
2. Determine the standard operating pressures for both standard and high efficiency equipment.
3. Calculate the correct operating pressures at various ambient conditions.
4. Select instruments to troubleshoot electrical problems in an air conditioning system.
5. Check the line and low voltage power supplies.
6. Troubleshoot electrical problems.
7. Use ohmmeter to check the various electrical components.
8. Troubleshoot mechanical problems on a system with a fixed metering device.
9. Troubleshoot mechanical problems on a system with a thermal expansion valve.
10. Troubleshoot a compressor with a locked rotor.
11. Replace a compressor.
12. Install a hard start kit or a compressor.
13. Replace a fan motor on a unit.

1 ODCTE objective
2 NCCER objective
All unmarked objectives are TTC instructor developed.

Teaching Methods: The class will primarily be taught by the lecture and demonstration method and supported by various media materials to address various learning styles. There will be question and answer sessions over material covered in lecture and media presentations. Supervised lab time is provided for students to complete required projects.

Grading Procedures: 1. Students are graded on theory and shop practice and performance.
2. Each course must be passed with seventy (70%) percent or better.
3. Grading scale: A=90-100%, B=80-89%, C=70-79%, D=60-69%, F=50-59%.

Description of Classroom, Laboratories, and Equipment: Tulsa Technology Center campuses are owned and operated by Tulsa Technology Center School District No. 18. All programs provide students the opportunity to work with professionally certified instructors in modern, well-equipped facilities.

Available Certifications/ College Credit The student may be eligible to take state, national or industry exam after completion of the program. College credit may be issued from Oklahoma State University-Okmulgee or Tulsa Community College. See program counselor for additional information.
REFRIGERANT SYSTEM COMPONENTS

College Credit Eligibility: The student must maintain a grade point average of 2.0 or better.