HVAC/R SYSTEM SERVICING & TROUBLESHOOTING RESIDENTIAL
Course Syllabus

Course Number: RHT-1216
OHLAP Credit: No
OCAS Code: None
Course Length: 90 Hours
Career Cluster: Architecture & Construction
Career Pathway: Maintenance/Operations
Career Major(s): HVAC Technician

Pre-requisite(s):

Course Description: This course covers the essential knowledge and skills necessary to perform routine residential central system servicing to promote efficient operation and long life. Extensive attention will be given to troubleshooting techniques used in solving mechanical, electrical, refrigerant, and air flow problems common to small tonnage systems commonly found in residences and small commercial applications.

Textbooks:


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


Course Objectives:

A. Identify Mechanical System Problems.
   1. Develop systematic way to diagnose system problems and demonstrate method.¹
   2. Identify and describe possible causes of failure and how to eliminate causes.¹
   3. Demonstrate use of tools and test equipment following safety practices.¹
   4. Record system data for the mechanical system operation.¹
   5. Verify mechanical system operation is acceptable.¹
   6. Determine cause of failure in system components.¹
   7. Determine actual system air flow using the appropriate test equipment.¹
   8. Determine system air flow requirements.¹

B. Electrical Troubleshooting
   1. Interpret electrical diagrams into sequence of operation.¹
   2. Describe electrical mechanical sequence from electrical schematic.¹
   3. Develop a methodical routine for electrical troubleshooting.¹
   4. Analyze electrical performance of each component.¹
   5. Rewire an HVACR unit using an electrical diagram:¹
      a. Air conditioner¹
      b. Heat pump¹
      c. Furnace¹
6. Record electrical system data.
7. Use electrical test instruments to diagnose electrical troubles and correct electrical system performance.
8. Troubleshoot a faulty compressor overload protector.
9. Change a schematic diagram to a "ladder" diagram in a drawing.

C. Complete an Introduction to Control Circuit Troubleshooting.
   1. Explain the function of a thermostat in an HVAC system.
   2. Describe different types of thermostats and explain how they are used.
   3. Demonstrate the correct installation and adjustment of a thermostat using proper siting and wiring techniques.
   4. Explain the basic principles applicable to all control systems.
   5. Identify the various types of electromechanical, electronic, and pneumatic HVAC controls, and explain their function and operation.
   6. Describe a systematic approach for electrical troubleshooting of HVAC equipment and components.
   7. Recognize and use equipment manufacturer’s troubleshooting aids to troubleshoot HVAC equipment.
   8. Exhibit competence in isolating electrical problems to faulty power distribution, load, or control circuits.
   9. Identify the service instruments needed to troubleshoot HVAC electrical equipment.
  10. Make electrical troubleshooting checks and measurements on circuits and components common to all HVAC equipment.

D. Troubleshoot Electrical Trainers.
   1. Describe and identify power and non-power consuming devices.
   2. Use voltmeter to troubleshoot electrical circuits.
   3. List typical problems in an electrical circuit.
   4. Use an ammeter to troubleshoot an electrical circuit.
   5. Troubleshoot electrical circuit in proper sequence.
   6. Compare characteristics of a pictorial and line-type electrical wiring diagram.
   7. Troubleshoot and identify electrical problems on training boards.

E. Test/Troubleshoot Component Parts.
   1. Verify power at unit.
   2. Test thermostat controls.
   3. Adjust/calibrate thermostat controls.
   4. Test capacitors.
   5. Test potential relay.
   6. Test and install window unit switches and thermostats.

F. Heating: Service and Problem Analysis
   1. Explain combustion theory for gas combustion and oil combustion.
   2. Identify and describe possible causes of failure and how to correct problems.
   3. Determine and measure combustion air, ventilation air and unit/system air requirements.
   4. Develop systematic method(s) to diagnose system problems and demonstrate method.
   5. Determine the cause of failure in a heating system.
   6. Record data and verify system operation.

G. Heat Pump: Service and Problem Analysis
   1. Test and evaluate the operation of the refrigeration cycle in cooling and
heating modes.¹
2. Test the operation of the supplementary heat component(s).¹
3. Test the operation of the emergency heat status for the heat pump system.¹
4. Record appropriate data to evaluate complete system operation.¹
5. Test proper operation of reversing valve.¹
6. Check operation of defrost controls.¹
7. Inspect wiring and tighten connections.¹

H. Air-Conditioning: Service and Problem Analysis
1. Explain proper temperatures and pressures at various system locations.¹
2. Explain proper fan/blower operation.¹
3. Explain heat exchanger inspection.¹
4. Explain thermostat setting and operation.¹
5. Explain sounds that could indicate a problem.¹
6. Explain how electrical measurements could indicate a problem.¹
7. Explain value of nameplate data and service records.¹
8. Discuss the required performance checks.¹
9. Discuss the method of measuring superheat, subcooling, evaporator and condenser splits.¹
10. Discuss the proper procedures for using a voltmeter and an ammeter.¹
11. Explain normal operation of air-conditioning systems.¹
12. Explain the effects of overcharge and undercharge of refrigerant.¹
13. Explain the effects of improper airflow.¹
14. Develop a systematic approach to diagnose mechanical or electrical problems.¹
15. Check system for system leaks.¹
16. Check and clean heat exchangers.¹
17. Check for proper refrigerant charge.¹
18. Check for proper thermostat and electrical controls.¹
19. Check oil sample for acidity.¹
20. Check and replace filter/driers.¹
21. Check available voltage and install high and low side manifold gauges.¹
22. Compare static pressure on a P/T Chart to determine unit refrigerant.¹
23. Start unit and allow to stabilize.¹
24. Measure superheat and subcooling.¹
25. Check evaporator and condenser splits.¹
26. Check amperage of each motor.¹
27. Analyze performance using manufacturers’ specifications.¹
28. Check electrical component operation.¹
29. Check air flow from furnace of air handler.¹
30. Inspect electrical connections.¹
31. Troubleshoot A/C systems from electrical schematics.¹

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.
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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.

College Credit Eligibility:

The student must maintain a grade point average of 2.0 or better.