

Course Objectives/Course Outline
Spokane Community College

Course Title: System Servicing and Troubleshooting of Heat Pumps 2

Prefix and Course Number: AIRC 208

Students will further explore heat pump systems, troubleshooting, and diagnostics. Topics include wiring diagrams and schematics, troubleshooting procedures, new high efficiency air to air heat pumps, and heat load calculations. Also covered are environmental factors that affect human comfort, ASHRAE comfort ranges as they apply to heat pumps, air flow problems, air distribution, and duct design. Electrical skills will be further developed, exploring the use of electric motors in heat pump systems, capacitors, motor protective devices, and code compliance. Additional subjects will include a review of thermostats, relays, contractors, starters, test equipment, and troubleshooting. Lab exercises will focus on strengthening technician skills through the use of schematics, troubleshooting procedures, and customer service techniques.

Course Learning Outcomes:

By the end of this course, a student should be able to:

- Explain wiring diagrams and schematics used for water-sources heat pump systems
- Explain issues relation to water-side and air-side systems used in water-source applications
- Explain troubleshooting techniques used when working on a water-source heat pump system
- Explain the features/characteristics of a new-generation high-efficiency air-to-air heat pump systems
- Explain the value of variable-speed blowers used to increase the efficient of air-to-air heat pump systems
- Explain the functions of electronic controllers and safety cut-outs used in WSHP applications
- Explain the terms used to describe heat transfer and how they apply to making a heat load calculation
- Explain key items of concern that must be considered by a system designer when making a site survey
- Explain the basics of ACCA Manual J load calculation data and the process used to make a load calculation
- Refrigerant-Side troubleshooting (Cooling Air-to-Air) Part 2
- Explain the process of comparing actual operating performance to design operating characteristics
- Explain common refrigerant circuit faults that will be encountered by service technicians
- Explain the proper procedure for connecting test instruments to a heat pump for recording heating cycle performance data
- Explain the use of manufacturer performance data to evaluate the heating cycle of a heat system
- Review the proper connection of a refrigerant gauge manifold set for measurement of heating cycle performance
- Explain the impact of improperly connecting a refrigerant gauge manifold set to heat pump equipment
- Review the use of OEM performance data when evaluating heating cycle performance
- Explain diagnostic procedures used to prevent the condemnation and replacement or good components

- Explain common mechanical failures and the procedures for determining their existence
- Explain corrective measures needed for various common system faults
- Explain environmental factors that affect creature comfort (temperature, air movement, humidity, etc.)
- Explain materials used in ductwork fabrication (metal, flexible duct, duct board, insulation, vapor barrier, etc.)
- Explain methods used to measure air flow and the proper use of instruments designed to take measurements
- Explain the process of making a successful service call as it pertains to communicating a positive message to the customer
- Explain the importance of a detailed service invoice

Course Outline:

- I. **Electrical Troubleshooting**
 - A. Refrigerant-side Troubleshooting (Cooling Air-to-Air)
 - B. Refrigerant-side Troubleshooting (Cooling Air-to-Air)
 - C. Refrigerant-side Troubleshooting (Heating Air-to-Air)
 - D. Refrigerant-side Troubleshooting (Heating Air-to-Air)
 - E. Troubleshooting Refrigerant Circuit Components

 - F. Troubleshooting Water-source Heat Pumps
 - G. High Efficiency Air-to-Air Heat Pumps
 - H. Water-source Heat Pumps for Special Applications
 - I. Heat Load Calculations
 - J. Indoor Air Distribution
 - K. Duct Design
 - L. Diagnosing Air Flow Problems
 - M. Customer Relations