Western Technical College

10601125 HVACR Air Conditioning

Course Outcome Summary

Course Information

Description	This course covers the start up, check out, and operation of residential split system air conditioners, commercial roof top units, air source heat pumps, water source heat pumps, and geothermal heat pumps. Troubleshooting and refrigerant recovery will be emphasized. HVACR is a common reference to Heating, Ventilation, Air Conditioning and Refrigeration.
Career Cluster	Architecture and Construction
Instructional Level	Associate Degree Courses
Total Credits	4
Total Hours	108

Pre/Corequisites

Prerequisite	10601101 HVACR Refrigeration
Prerequisite	10601116 HVACR Electric Motors and Controls

Textbooks

Refrigeration and Air Conditioning Technology. 9th Edition. Copyright 2021. Whitman, Bill, Bill Johnson, John Timczyk, and Eugene Silberstein. Publisher: Cengage Learning. **ISBN-13**:978-0-357-12227-3. Required.

Learner Supplies

Safety glasses with side eye protection that meet Z87 OSHA guidelines. **Vendor:** Campus Shop. Required.

Success Abilities

1. Live Responsibly: Embrace Sustainability
2. Live Responsibly: Foster Accountability

Program Outcomes

1. Service HVACR systems
2. Troubleshoot HVACR systems
3. Analyze HVACR systems

Course Competencies

1. Summarize the operation of residential cooling systems.

Criteria

You will know you are successful when

1.1. you follow steps on a lab task sheet to enter a program into a thermostat
1.2. electrical diagram is complete and 80% accurate
1.3. sequence of operation is complete and 80% accurate

Learning Objectives

1.a. Describe the operation of residential cooling systems
1.b. Identify the needed conditions for successful and efficient operation
1.c. List the sequence of events
1.d. State the relationship between temperature and humidity as it effects comfort
1.e. Measure operating pressures at different ambient conditions
1.f. Explain why compressors fail
1.g. Program a thermostat
1.h. Construct electrical diagrams of air conditioning systems
1.i. Write a sequence of operation for a residential air conditioning system
1.j. Interpret wiring diagrams and the sequence of operation to aid in the understanding of system operation

2. Perform basic air conditioning system service procedures.

Learning Objectives

2.a. Interpret manifold gauge readings
2.b. Recover refrigerant
2.c. Use sling psycrometer
2.d. Use residential air conditioning service valves
2.e. Use a vacuum pump to dehydrate an air conditioning system
2.f. Determine the state of the refrigerant given its pressure
2.g. Use the Properties of Saturated Liquid and Saturated Vapor table
2.h. Analyze components and circuits incorporating a variety of components specific to air conditioning systems
2.i. Minimize refrigerant loss when installing a manifold gauge set
2.j. Minimize refrigerant loss when disconnecting a manifold gauge set

3. Complete an air conditioning start-up, checkout, and operation.

Criteria

You will know you are successful when

3.1. you correctly recover refrigerant according to Lab Task 9-1 "Refrigerant Recovery"
3.2. you successfully complete all steps on a lab task worksheet for charging an air conditioner with a fixed bore metering device
3.3. you successfully complete all steps on a lab task worksheet for charging an air conditioner with a thermostatic expansion valve
3.4. you successfully complete all steps on a lab task worksheet for adjusting the air flow on a furnace using the True Flow Plate

3.5. you minimize refrigerant loss when removing a manifold gauge set

Learning Objectives

3.a. Charge an air conditioner by the superheat method
3.b. Charge an air conditioner by the subcooling method
3.c. Charge an air conditioner using a charging chart
3.d. Charge an air-cooled condenser during cold weather operation
3.e. Use True Flow Plate to adjust furnace air flow

4. Analyze air conditioner problems.

Criteria

You will know you are successful when

4.1. you complete the Troubleshooting Analysis Sheet and determine the likely problem
4.2. you successfully complete twenty air conditioner troubleshooting problems using computer simulation

Learning Objectives

4.a. Diagnose problems using a troubleshooting analysis form
4.b. Interpret wiring diagrams to aid in the diagnosis of air conditioning system problems
4.c. Diagnose typical air conditioning problems using diagrams and appropriate test instruments

5. Summarize the operation of roof top units.

Criteria

You will know you are successful when

5.1. sequence of operation is complete and 80% accurate
5.2. electrical diagram is complete and 80% accurate

Learning Objectives

5.a. Associate operating pressures with different ambient conditions
5.b. Design a roof top electrical circuit and write a sequence of operation
5.c. Construct electrical diagrams of air conditioning systems
5.d. Identify the needed conditions for successful and efficient operation
5.e. Interpret wiring diagrams and the sequence of operation to aid in the understanding of system operation
5.f. List the sequence of events

6. Perform basic roof top unit service procedures.

Criteria

You will know you are successful when

6.1. lab worksheet covering recovery, dehydration, and charging a roof top unit is performed with 80% accuracy

Learning Objectives

6.a. Interpret manifold gauge readings
6.b. Recover refrigerant
6.c. Use a vacuum pump to dehydrate a system
6.d. Analyze components and circuits incorporating a variety of components specific to air conditioning systems

7. Complete a roof top unit start-up, checkout, and operation.

Criteria

You will know you are successful when

7.1. you successfully complete all steps on a lab task worksheet for charging a roof top unit with a fixed bore metering device
7.2. you successfully complete all steps on a lab task worksheet for charging a roof top unit with a thermostatic expansion valve

Learning Objectives

7.a. Charge a roof top unit by the superheat method
7.b. Charge a roof top unit by the subcooling method

8. Analyze roof top unit problems.

Criteria

You will know you are successful when

8.1. you complete the Troubleshooting Analysis Sheet and determine the likely problem

Learning Objectives

8.a. Diagnose problems using a troubleshooting analysis form
8.b. Interpreting a pressure / temperature chart
8.c. Interpret wiring diagrams to aid in the diagnosis of air conditioning system problems
8.d. Diagnose typical air conditioning problems using diagrams and appropriate test instruments

9. Summarize the operation of air source heat pumps.

Criteria

You will know you are successful when

9.1. electrical diagram is complete and 80% accurate
9.2. sequence of operation is complete and 80% accurate

Learning Objectives

9.a. Explain how heat pumps differ from air conditioners
9.b. Describe the various applications for the heat pump

9.c. Describe the functions of heat pump systems controls
9.d. Describe how heat pumps are rated
9.e. List the sequence of events
9.f. Explain the operation of four-way valves
9.g. Determine typical operating conditions of heat pumps
9.h. Interpret wiring diagrams and the sequence of operation to aid in the understanding of system operation
9.i. Design a heat pump electrical circuit and write a sequence of operation
9.j. Construct electrical diagrams of heat pump systems
9.k. Explain how to size heat pumps
9.l. Associate how heat pump capacity with the outside temperature

10. Perform air source heat pump service procedures.

Criteria

You will know you are successful when

10.1. lab worksheet covering recovery, dehydration, and charging an air source heat pump is performed with 80% accuracy

Learning Objectives

10.a. Interpret manifold gauge readings
10.b. Recover refrigerant
10.c. Use a vacuum pump to dehydrate system
10.d. Analyze components and circuits incorporating a variety of components specific to heat pump systems

11. Complete an air source heat pump start-up, checkout, and operation

Criteria

You will know you are successful when

11.1. you successfully complete all steps on a lab task worksheet for charging an air source heat pump with a fixed bore metering device

Learning Objectives

11.a. Charge a heat pump by the superheat method
11.b. Determine the performance of a heat pump
11.c. Charge a heat pump using a charging chart
11.d. Test a heat pump for non-condensible gases

12. Analyze air source heat pump problems.

Criteria

You will know you are successful when

12.1. you complete the Troubleshooting Analysis Sheet and determine the likely problem

Learning Objectives

12.a. Diagnose problems using a troubleshooting analysis form
12.b. Diagnose typical air conditioning problems using diagrams and appropriate test instruments
12.c. Check for defrost system operation
12.d. Check for leaky 4 way valve
12.e. Interpreting a pressure / temperature chart
12.f. Interpret wiring diagrams to aid in the diagnosis of heat pump system problems

13. Summarize the operation of geothermal heat pumps.

Criteria

You will know you are successful when

13.1. electrical diagram is complete and 80% accurate
13.2. sequence of operation is complete and 80% accurate

Learning Objectives

13.a. Explain how geothermal heat pumps differ from air source heat pump
13.b. Explain how geothermal heat pumps are rated
13.c. List the sequence of operation
13.d. Explain how to size geothermal heat pumps
13.e. Design a geothermal heat pump electrical circuit and write a sequence of operation
13.f. Interpret wiring diagrams and the sequence of operation to aid in the understanding of system operation
13.g. Determine typical operating conditions of geothermal heat pumps
13.h. Construct electrical diagrams of geothermal systems

14. Perform geothermal heat pump service procedures.

Criteria

You will know you are successful when

14.1. lab worksheet covering recovery, dehydration, and charging a geothermal heat pump is performed with 80% accuracy

Learning Objectives

14.a. Recover refrigerant
14.b. Use vacuum pump to dehydrate system
14.c. Interpret manifold gauge readings
14.d. Analyze components and circuits incorporating a variety of components specific to geothermal heat pump systems

15. Complete a geothermal heat pump start-up, checkout, and operation.

Criteria

You will know you are successful when

15.1. you successfully complete all steps on a lab task worksheet for charging a geothermal heat pump with a fixed bore metering device

Learning Objectives

15.a. Test a geothermal heat pump for non-condensible gases
15.b. Charge a geothermal heat pump by the superheat method
15.c. Charge a geothermal heat pump using a charging chart
15.d. Set the water regulating valve on a geothermal heat pump
15.e. Determine the performance of a geothermal heat pump

16. Analyze geothermal heat pump problems.

Criteria

You will know you are successful when

16.1. you complete the Troubleshooting Analysis Sheet and determine the likely problem

Learning Objectives

16.a. Diagnose problems using a troubleshooting analysis form
16.b. Check for leaky 4 way valve
16.c. Interpreting a pressure / temperature chart
16.d. Diagnose typical air conditioning problems using diagrams and appropriate test instruments
16.e. Interpret wiring diagrams to aid in the diagnosis of geothermal system problems