

Heating and Air Conditioning 2

Course Outcome Summary

Course Information

Organization	Madison Area Technical College
Developers	William Lorenz
Development Date	11/10/2005
Course Number	32-462-309
Instructional Level	Two-Year Technical Diploma
Potential Hours of Instruction	90
Total Credits	3

Description

Advanced environmental equipment installation and maintenance course which puts the theory learned in 32-462-308 into practice including boiler competencies.

Types of Instruction

Instruction Type	Contact Hours	Credits
Classroom Presentation	18	3
On-Campus Lab	72	

Textbooks

Whitman, W. C. & Johnson, W. M.. *Refrigeration & Air Conditioning Technology*. Delmar Publishing. **Edition:** 5. **Source:** Albany, NY.

Whitman, W. C. & Johnson, W. M.. *Refrigeration & Air Conditioning Technology Lab Manual*. **Edition:** 5. **Source:** Albany, NY.

Learner Supplies

Safety glasses.

3-ring binder for handouts. **Manufacturer:** ---.

hard-soled leather shoes. **Manufacturer:** ---.

Prerequisites

Heating and Air Conditioning 1 (32-462-308)

OR instructor consent

Exit Learning Outcomes

Core Abilities

- A. Communication
- B. Critical thinking
- C. Ethics
- D. Science and Technology

E. Self-management

Competencies

A. Interpret ladder and label/line electric schematic drawings

Competence will be demonstrated:

- A.1. by submitting completed homework
- A.2. on a written evaluation
- A.3. in lab performance

Criteria - Performance will be satisfactory when:

- A.1. you explore the circuit characteristics of alternating current (AC) circuits
- A.2. you explore the circuit characteristics of direct current (DC) circuits
- A.3. you identify basic electric symbols
- A.4. you identify basic devices
- A.5. you identify motor types and their applications
- A.6. you interpret electrical schematic diagrams
- A.7. you wire current, potential and solid state relay motor starting relay circuits
- A.8. you calculate ampacity of circuit wire
- A.9. you determine circuit protection safety disconnects and their application
- A.10. you interpret the National Electric Code as it affects the heating and air conditioning industry
- A.11. you perform load analysis
- A.12. you wire controls and motors
- A.13. you troubleshoot electrical circuits using Ohms Law

B. Connect basic automatic controls

Competence will be demonstrated:

- C.1. by submitting completed homework
- C.2. on a written evaluation
- C.3. in lab performance

Criteria - Performance will be satisfactory when:

- B.1. homework includes the identification of the various types automatic controls
- B.2. homework includes an explanation of how each automatic control functions
- B.3. you distinguish between conductors and insulators
- B.4. you differentiate between bellows and diaphragm operational controls
- B.5. you make safe and accurate electrical measurements on control devices
- B.6. you use different types of fuses and control wiring safely
- B.7. you troubleshoot basic controls and circuits
- B.8. you differentiate between low and high voltage controls
- B.9. you wire space temperature controls

C. Troubleshoot electric motors

Competence will be demonstrated:

- E.1. on a written evaluation
- E.2. in lab performance

Criteria - Performance will be satisfactory when:

- C.1. you identify various types of electric motors in single and three phase

- C.2. you explore the application of motors in HVAC/R
- C.3. you use various methods of motor starting
- C.4. you troubleshoot motor starters

D. Troubleshoot and repair commercial refrigeration

Competence will be demonstrated:

- D.1. on a written evaluation
- D.2. in lab performance

Criteria - Performance will be satisfactory when:

- D.1. you summarize the different applications of refrigeration equipment
- D.2. you troubleshoot basic refrigeration problems
- D.3. you identify specialized refrigeration systems
- D.4. you install solenoids and space temperature controls in walk-in coolers and freezers
- D.5. you install water cooled condensers for refrigeration
- D.6. you repair basic refrigeration problems if necessary
- D.7. you control chilled water systems used in commercial air conditioning

E. Troubleshoot and repair air conditioning (heating and humidification)

Competence will be demonstrated:

- F.1. on a written evaluation
- F.2. in lab performance

Criteria - Performance will be satisfactory when:

- F.1. you demonstrate safe working practices for working with fossil fuel heating equipment
- F.2. you summarize safety features of fossil fuel heating equipment
- F.3. you operate hydronic and steam heating systems
- F.4. you differentiate between the different methods of heating
- F.5. you diagnose "Sick Building Syndrome"
- F.6. you use various humidification equipment
- F.7. you determine comfort

F. Troubleshoot and repair air conditioning (cooling)

Competence will be demonstrated:

- G.1. on a written evaluation
- G.2. in lab performance

Criteria - Performance will be satisfactory when:

- F.1. you determine necessary changes in system balancing
- F.2. you distinguish between the four factors involved in comfort
- F.3. you use psychometrics for calculations in HVAC/R
- F.4. you explain the effect of rapid moving air in refrigeration
- F.5. you distinguish between package air conditioning equipment
- F.6. you differentiate between mechanical and electrical troubleshooting problems
- F.7. you calculate operating pressures for air conditioning equipment without manifold gauge sets
- F.8. you use meters to troubleshoot complex HVAC/R systems
- F.9. you repair an HVAC/R system, if necessary

G. Troubleshoot and repair air distribution and balance

Competence will be demonstrated:

- H.1. on a written evaluation
- H.2. in lab performance

Criteria - Performance will be satisfactory when:

- G.1. you distinguish between the various air distribution systems
- G.2. you take basic air-pressure measurements using velocity meters
- G.3. you measure air quantities using bolometer
- G.4. you differentiate between types of duct system installations
- G.5. you recognize good air filtration devices for duct systems
- G.6. you install duct systems
- G.7. you troubleshoot air distribution and balance systems
- G.8. you repair air distribution and balance systems, if necessary

H. Troubleshoot and repair all-weather systems

Competence will be demonstrated:

- I.1. on a written evaluation
- I.2. in lab performance

Criteria - Performance will be satisfactory when:

- H.1. you explore ways to condition air
- H.2. you explain year-round air conditioning
- H.3. you explain how to vary air-flow between heating and cooling systems
- H.4. you troubleshoot all-weather systems
- H.5. you repair all-weather systems, if necessary

I. Troubleshoot and repair high and low pressure boilers

Competence will be demonstrated:

- J.1. on a written evaluation
- J.2. in lab performance

Criteria - Performance will be satisfactory when:

- I.1. you identify the basic components of low and high pressure boilers
- I.2. you examine the operation of the boiler controls
- I.3. you determine why boiler water treatment is necessary
- I.4. you determine the regulations that affect the operating environment of a boiler
- I.5. you identify boiler types and configurations (steam and hydronic)
- I.6. you repair steam boiler operational components
- I.7. you repair hydronic boiler operational components
- I.8. you repair a steam trap