

ATPF-1806: SPECIAL TOPICS: COOLING TOWERS AND TROUBLESHOOTING

Cuyahoga Community College

Viewing: ATPF-1806 : Special Topics: Cooling Towers and Troubleshooting

Academic Term:

Fall 2026

Subject Code

ATPF - Applied Ind Tech - Pipefitters

Course Number:

1806

Title:

Special Topics: Cooling Towers and Troubleshooting

Catalog Description:

Course explains cooling tower function and the different types of cooling towers. It discusses flow patterns, the tower sump, makeup water, blowdown and balancing the water flow. Pumps used in cooling towers will also be discussed. This course also explains the startup procedures, operation and maintenance of chilled water equipment including air-cooled, water-cooled and absorption chillers.

Credit Hour(s):

2

Lecture Hour(s):

2

Requisites

Prerequisite and Corequisite

Departmental approval: admission to Pipefitter's apprenticeship program.

Outcomes

Course Outcome(s):

Discuss the purpose and operation of cooling towers

Objective(s):

1. State the relationship of the cooling capacity of the water tower and the wet-bulb temperature of outside air.
2. Describe the purpose of cooling towers with chilled-water systems.

3. State the means by which the cooling tower reduces water temperature.
4. Describe three types of cooling water towers.
5. Explain the purpose of makeup water.

Course Outcome(s):

Describe the components of the cooling tower system

Objective(s):

1. Explain the purpose of the water tower sump.
 2. Describe the operation of the centrifugal pump.
 3. Explain two types of motor-pump alignment.
 4. Discuss water vortexing.
 5. Explain the various uses of fill material in cooling water towers.
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Course Outcome(s):

Describe the startup procedure for a chilled water system

Objective(s):

1. Explain scroll compressor startup procedure.
2. Differentiate startup procedures between chilled-water air-conditioning system and the absorption chilled water system.
3. Describe operating and monitoring procedures for scroll and reciprocating systems.

Course Outcome(s):

Discuss the preventive maintenance and service to be performed on chillers

Objective(s):

1. List maintenance procedures that should be performed periodically on water-cooled chiller systems.
2. List preventive and routine maintenance procedures for an absorption chiller.
3. State the preventive and periodic maintenance procedures for the purge system.
4. Describe personal protective clothing that is required when servicing chilled water equipment.

Methods of Evaluation:

1. Assignments
2. Attendance
3. Practicals
4. Skills evaluation
5. Exams/quizzes

Course Content Outline:

1. Cooling Towers
 - a. Function
 - i. Reject heat
 - ii. Pumps
 - iii. Condenser
 - iv. Design temperature
 - v. Wet-bulb temperature
 - vi. Evaporation
1. Types of Cooling Towers
 - a. Natural draft
 - b. Forced/Induced draft
 - c. Closed loop
1. Cooling Tower Equipment
 - a. External Equipment
 - i. Fan section
 - ii. Tower sump
 - iii. Make-up water
 - iv. Water balancing
1. Water Pumps
 - a. Centrifugal pump
 - b. Base mounted
 - c. Impellers
 - d. Shaft seal
1. Operating a Chilled Water System
 - a. Chiller start-up
 - i. Water flow
 - ii. Pressure drop
 - iii. Pressure test ports

- iv. Interlocked circuits
 - v. Time delay circuits
 - b. Scroll chiller
 - i. Air cooled
 - ii. Water cooled
 - iii. Establish flow
 - iv. Crankcase
 - v. Condenser fan
 - vi. Water temperature
- 1. Reciprocating chiller
 - a. Air cooled
 - b. Water cooled
 - c. Oil level
 - d. Crankcase heater
- 1. Rotary Screw chiller
 - a. Chiller barrel
 - b. Refrigeration valve
 - c. Control circuit
 - d. Liquid flood back
- 1. Maintenance of Chiller
 - a. Scroll and Reciprocating Operation
 - i. Visual inspection
 - ii. Cooling Tower operating
 - iii. Chemical water treatment
- 1. Positive Displacement Chiller Operation
 - a. Visual inspection
 - b. Monitor system pressure
 - c. Document operations
- 2. Air-Cooled Chiller Maintenance
 - a. Inspect power circuit
 - b. Inspect compressor motor connections
 - c. Inspect contactors
 - d. Inspect ground connections
 - e. Inspect compressor oil
- 3. Water-cooled Chiller Maintenance
 - a. Cooling tower strainers
 - b. Water treatment
 - c. Electrical connections
 - d. Condenser water tubes
 - e. Pump alignment
- 4. Absorption Chiller Maintenance
 - a. Document chiller operation
 - b. Purge unit
 - c. Vacuum pump oil
 - d. Steam valves
 - e. Steam traps
 - f. Steam strainers
 - g. Lithium bromide
 - h. Cooling tower water treatment
- 1. Refrigerant Recovery
 - a. Liquid refrigerant
 - b. Vapor refrigerant
 - c. Push-pull method of recovery
 - d. Evacuation level

Religious Accommodation

Before reviewing the course schedule, students should carefully review the following religious accommodation policy and other required instructional policies:

Religious Accommodation:

Students seeking an accommodation for absences permitted under Ohio's Testing Your Faith Act must provide the instructor with written notice of the specific dates for which the student requires an accommodation and must do so not later than fourteen (14) days after the first day of instruction. Please submit requests for accommodations at this link: <https://portal2.tri-c.edu/ReligiousAccommodation/ReligiousAccommodationForm>. Students with questions about their religious accommodations under Ohio's Testing Your Faith Act may contact the College's Office of General Counsel and Legal Services by phone at 216.987.4856 or via email at legal@tri-c.edu.

Other Required Instructional Policies:

<https://www.tri-c.edu/student-resources/curriculum/documents/syllabus-part-b.pdf>

Weekly Schedule

	Topics
Week 1	Types of cooling towers <ul style="list-style-type: none"> • Natural draft towers • Forced draft towers • Shop
Week 2	Types of cooling towers <ul style="list-style-type: none"> • Natural draft towers • Forced draft towers • Shop
Week 3	Types of cooling towers (cont.) <ul style="list-style-type: none"> • Induced draft tower • Closed loop hybrid tower • Adiabatic mode • Shop
Week 4	Types of cooling towers (cont.) <ul style="list-style-type: none"> • Induced draft tower • Closed loop hybrid tower • Adiabatic mode • Shop
Week 5	Cooling tower accessories <ul style="list-style-type: none"> • Fill material • Tower material • Fan section • Tower sump • Make up water • Blowdown • Shop
Week 6	Cooling tower accessories <ul style="list-style-type: none"> • Fill material • Tower material • Fan section • Tower sump • Make up water • Blowdown • Shop
Week 7	Chiller start up <ul style="list-style-type: none"> • Water flow • Condenser water • Chiller circuits • Shop
Week 8	Chiller start up <ul style="list-style-type: none"> • Water flow • Condenser water • Chiller circuits • Shop

Week 9	Chiller start up (cont.) • Scroll chiller • Reciprocating chiller • Rotary chiller • Shop
Week 10	Chiller start up (cont.) • Scroll chiller • Reciprocating chiller • Rotary chiller • Shop
Week 11	Chiller start up (cont.) • Centrifugal chiller • Absorption chiller • Shop
Week 12	Chiller start up (cont.) • Centrifugal chiller • Absorption chiller • Shop
Week 13	Maintaining Chilled Water Systems • Visual equipment inspection • Visual inspection of electrical circuit • Clean equipment room • Inspect compressor condition • Water treatment • Monitor purge unit • Shop
Week 14	Maintaining Chilled Water Systems • Visual equipment inspection • Visual inspection of electrical circuit • Clean equipment room • Inspect compressor condition • Water treatment • Monitor purge unit • Shop
Week 15	Review
Week 16	Assessment

The Course Schedule is subject to change due to pedagogical needs, instructor discretion, parts of term, and unexpected events.

Required/Recommended Readings

Instructor-provided materials

Resources for the Instructor

Frankland, Thomas W. . *Pipe Trades Manual*. McGraw-Hill, 1965.

Andrew D. Althouse, Carl H. Turnquist, A.F. Bracciano, D.C. Bracciano, and G.M. Bracciano. *Modern Refrigeration and Air Conditioning*. 22nd. Goodheart-Wilcox Publisher, 2025.

United Association Training Department. *HVAC/R Training Manual* . Annapolis, MD: United Association, www.ua.org/training

Additional Resources for the Instructor

<http://www.alabamapower.com/business/save-money-energy/energy-know-how/chillers/absorption-chillers/maintenance-considerations.asp>

<http://contractingbusiness.com/commercial/ten-tips-commercial-chiller-0310> (<http://contractingbusiness.com/commercial/ten-tips-commercial-chiller-0310/>)

<http://www.trane.com/commercial/north-america/us/en/products-systems/equipment chillers/water-cooled-chiller/centrifugal-liquid-cooled-chillers/earthwise-centravac.html>

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