

APSM 154C: HYDRONIC HEATING

Foothill College Course Outline of Record

Heading	Value
Effective Term:	Summer 2022
Units:	2
Hours:	25 lecture, 15 laboratory per quarter (40 total per quarter)
Prerequisite:	Per California Code of Regulations, this course is limited to students admitted to the Sheet Metal Apprenticeship Program.
Degree & Credit Status:	Degree-Applicable Credit Course
Foothill GE:	Non-GE
Transferable:	None
Grade Type:	Letter Grade (Request for Pass/No Pass)
Repeatability:	Not Repeatable

Student Learning Outcomes

- A successful student will be able to describe the basic operation of a hydronic heating system.
- A successful student will be able to describe a tankless domestic hot water heater used with hydronic space heating.

Description

Students will learn the basic principles of and equipment used in hydronic heating.

Course Objectives

The student will be able to:

1. Describe the basics of a hydronic heating system
2. Understand the different types of heat sources for hydronic heating (water, steam, geothermal/waste heat, solar)
3. Understand the basic components and operation of boilers
4. Understand the different types of hydronic heating controls
5. Understand the different types of piping systems for hydronic heating
6. Troubleshoot and perform maintenance of boilers

Course Content

1. Describe the basics of a hydronic heating system
 - a. Describe a basic hydronic heating system (Lec)
 - b. Explain the difference between a wet base and a dry base boiler (Lec)
 - c. Describe reasons for a hydronic heating system to have more than one zone (Lec)
2. Understand the different types of heat sources for hydronic heating (water, steam, geothermal/waste heat, solar)
 - a. List four heat sources commonly used in hydronic heating systems (Lec)
3. Understand the basic components and operation of boilers

- a. State the reason a boiler is constructed in sections or tubes (Lec and Lab)
 - b. Discuss the reasons why air should be eliminated from hydronic heating systems (Lec and Lab)
 - c. Explain the effect air has on a cast iron or steel boiler (Lec and Lab)
 - d. Describe the function of an air cushion or expansion tank (Lec and Lab)
 - e. Explain the operation of circulating pumps as they apply to hydronic heating systems (Lec and Lab)
 - f. Describe the importance of "point of no pressure change" (Lec and Lab)
 - g. State the purpose of a pressure relief valve (Lec and Lab)
 - h. State the purpose of a zone valve (Lec and Lab)
4. Understand the different types of hydronic heating controls
 - a. List the various types of zone valves that are available (Lec and Lab)
 - b. Explain how "outdoor reset" can be used to increase system efficiency (Lec and Lab)
 5. Understand the different types of piping systems for hydronic heating
 - a. Sketch a series loop hydronic system (Lec and Lab)
 - b. Sketch a single pipe hydronic heating system (Lec and Lab)
 - c. Explain the function of the diverter tee (Lec and Lab)
 - d. Explain the difference between a two pipe direct return and a two pipe reverse return hydronic heating system (Lec and Lab)
 - e. Explain the application that requires the use of a balancing valve (Lec and Lab)
 - f. List the benefits of primary-secondary pumping (Lec and Lab)
 - g. Describe the operation and function of mixing valves (Lec and Lab)
 - h. Describe the differences of radiant and conventional heating systems (Lec and Lab)
 - i. List three common types of radiant heating system installations (Lec and Lab)
 - j. Describe a tankless domestic hot water heater used with hydronic space heating (Lec and Lab)
 6. Troubleshooting and maintenance of boilers
 - a. List preventative maintenance procedures for hydronic heating systems (Lec and Lab)

Lab Content

1. Observe demonstration of balancing valves and mixing valves function and parts in the lab
2. Assess the uses and effectiveness of the valve used in a hydronic heating system

Special Facilities and/or Equipment

1. Laboratory with sheet metal service tools
2. Personal protective equipment
3. When taught via Foothill Global Access, on-going access to computer with email software and hardware; email address

Method(s) of Evaluation

Methods of Evaluation may include but are not limited to the following:

Results of written quizzes and tests
Responses in class discussions
Comprehensive written final examination
Demonstration of assigned skills to acceptable level per instructor

Method(s) of Instruction

Methods of Instruction may include but are not limited to the following:

Lecture
Discussion
Demonstration
Lab assignments followed by discussion

Representative Text(s) and Other Materials

Whitman, B., B. Johnson, J. Tomczyk, and E. Silberstein. Refrigeration and Air Conditioning Technology, 8th ed.. 2016.

Auvil, Ronnie J.. HVAC Controls Systems, 4th ed.. 2017.

These are the standard sheet metal textbooks/workbooks used for this course. Although one or more may not be within five years of the required published date, they are the most current books used when teaching this course.

Types and/or Examples of Required Reading, Writing, and Outside of Class Assignments

1. Sample reading assignment: From the Refrigeration and Air Conditioning Technology textbook, Unit 33, "Hydronic Heat"
2. Sample writing assignment: Answer review questions related to assigned reading

Discipline(s)

Sheet Metal or Air Conditioning, Refrigeration, Heating