APSM 154B: GAS & ELECTRIC HEATING

Foothill College Course Outline of Record

Heading	Value
Units:	2
Hours:	20 lecture, 20 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 functions of basic components in a gas heating furnace.
- A successful student will be able to perform gas pressure measurements and gas pipe sizing for a common gas heating furnace.

Description

Students explore the operation, maintenance, and repair of gas and electric heating systems.

Course Objectives

The student will be able to:
A. Explain the application and operational sequence of electric and gas heating
B. Explain electrical heating components and controls
C. Troubleshoot electric heating
D. Explain gas heating components
E. Perform gas pressure measurements and gas pipe sizing
F. Describe the process of combustion
G. Understand and demonstrate the use of flue gas analysis instruments
H. Describe the function of different types of gas valves
I. Understand the requirements for sizing and installation of all types of venting for gas heat
J. Troubleshoot and perform maintenance of gas heating
K. Explain special requirements for propane heating

Course Content

A. Explain the application and operational sequence of electric and gas heating
1. Discuss the efficiency and relative operating cost of electric heat (Lec and Lab)
2. List types of electric heaters and state their use (Lec and Lab)
B. Explain electrical heating components and controls
1. Describe how sequencers operate in electric forced air furnaces (Lec and Lab)
2. Trace the circuitry in a diagram of a forced air furnace (Lec and Lab)
C. Troubleshoot electric heating
1. Perform basic tests in troubleshooting electric heaters (Lec and Lab)
2. Describe typical preventative maintenance procedures used in electric heating units and systems (Lec and Lab)
D. Explain gas heating components
1. Describe the components of a gas furnace (Lec and Lab)
2. Discuss flame rollout switches (Lec and Lab)
3. Discuss gas burners and heat exchangers (Lec and Lab)
4. Discuss fan control (Lec and Lab)
5. State the function of an off delay timing device (Lec and Lab)
6. Describe the differences between induced draft and forced draft systems (Lec and Lab)
7. Discuss pilot and ignition systems
a. List three flame proving devices and describe the operation of each (Lec and Lab)
8. Discuss the reasons for the delay in starting and stopping the furnace fan (Lec and Lab)
9. State the purpose of the limit switch (Lec and Lab)
E. Perform gas pressure measurements and gas pipe sizing
1. Explain gas piping as it pertains to furnaces (Lec and Lab)
2. Discuss gas combustion, excess air, dilution air, combustion air, primary air, and secondary air (Lec and Lab)
3. Discuss gas pressure measurements (Lec and Lab)
4. Discuss excess air, dilution air, combustion air, primary air, and secondary air (Lec and Lab)
F. Describe the process of combustion
1. Discuss gas valves (Lec and Lab)
2. List the functions of automatic combination gas valve (Lec and Lab)
3. Discuss gas pressure regulators (Lec and Lab)
4. Discuss the meaning of a redundant gas valve (Lec and Lab)
G. Understand and demonstrate the use of flue gas analysis instruments
1. Describe flue gas venting systems (Lec and Lab)
2. Describe direct vented, non-direct vented and positive pressure systems (Lec and Lab)
3. Discuss flame rectification (Lec and Lab)
4. Discuss high efficiency furnaces (Lec and Lab)
5. Explain dew point and how it relates to high efficiency systems (Lec and Lab)
6. Describe condensate disposal system of a high efficiency systems (Lec and Lab)
7. Identify furnace efficiency ratings (Lec and Lab)
8. Describe a two stage furnace (Lec and Lab)
H. Describe the function of different types of gas valves
1. Interpret gas furnace wiring diagrams (Lec and Lab)
2. Describe procedures for taking flue-gas carbon dioxide and temperature readings (Lec and Lab)
3. Describe typical preventive maintenance procedures for gas furnaces (Lec and Lab)
4. Discuss requirements for unit conversions to propane heating (Lec and Lab)
I. Understand the requirements for sizing and installation of all types of venting for gas heat (Lec and Lab)
J. Troubleshooting and maintenance of gas heating (Lec and Lab)
K. Explain special requirements for propane heating (Lec and Lab)

Lab Content

A. Perform gas pressure measurements and gas pipe sizing.
B. Perform troubleshooting and maintenance on gas heat systems, as assigned.

Special Facilities and/or Equipment

A. Laboratory with sheet metal service tools
B. Personal protective equipment

Method(s) of Evaluation

A. Results of written quizzes and tests
B. Responses in class discussions
C. Comprehensive written final examination
D. Comprehensive final project
E. Demonstration of assigned skills to acceptable level per instructor

Method(s) of Instruction

A. Lecture
B. Discussion
C. Demonstration
D. 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. Boston, MA: Cengage Learning, 2016.

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

A. Sample reading assignment: From the textbook, Units 30 and 31.

B. Sample writing assignment: Answer review questions related to assigned reading.

Discipline(s)

Sheet Metal, Air Conditioning, Refrigeration, Heating