

AIR 155 – Heating Systems II

Revised: Fall 2026

Course Description

Introduces types of fuels and their characteristics of combustion; types, components and characteristics of burners, and burner efficiency analyzers. Studies forced air heating systems including troubleshooting, preventive maintenance and servicing. Part II of II.

Prerequisite:

Credit Hours: 3 Lecture: 2 hours Lab: 2 hours Total: 4 hours per week

Course Objectives (Core Competencies)

- ☒ **Civic Engagement** is the ability to contribute to the civic life and well-being of local, national, and global communities as both as social responsibility and a life-long process. Degree graduates will demonstrate the knowledge and civic values necessary to become informed and contributing participants in a democratic society.
- ☒ **Critical Thinking** is the ability to use information, ideas, and arguments from relevant perspectives to make sense of complex issues and solve problems. Degree graduates will locate, evaluate, interpret, and combine information to reach well-reasoned conclusions and solutions.
- ☒ **Professional Readiness** is the ability to work well with others and display situationally and culturally appropriate demeanor and behavior. Degree graduates will demonstrate skills important for successful transition into the workplace and pursuit of further education.
- ☒ **Quantitative Literacy** is the ability to perform accurate calculations, interpret quantitative information, apply and analyze relevant numerical data, and use results to support conclusions. Degree graduates will calculate, interpret, and use numerical and quantitative information in a variety of settings.
- ☒ **Scientific Literacy** is the ability to apply the scientific method and related concepts and principles to make informed decisions and engage with issues related to the natural, physical, and social world. Degree graduates will recognize and know how to use the scientific method, and to evaluate empirical information.

- ☒ **Written Communication** is the ability to develop, convey, and exchange ideas in writing, as appropriate to a given context and audience. Degree graduates will express themselves effectively in a variety of written forms.

Course Learning Outcomes

After completion of this course, students will be able to:

Upon successful completion of this course, students will be able to explain the principles of low pressure steam and hot water boiler operation; identify and analyze boiler systems including fuel, draft, feedwater, and water treatment; evaluate combustion characteristics and burner efficiency using analyzers; perform troubleshooting, preventive maintenance, and servicing of forced-air and boiler heating systems; and apply knowledge of boiler operation, safety, and code compliance in preparation for facility operating engineer and low pressure boiler operator licensing examinations.

Major Topics to be Included

Throughout the course, the instructor will present material on but not limited to:

1. Review of Fuel Types and Combustion
 - Characteristics of fuels used in heating systems
 - Combustion principles and efficiency
 - Use of burner efficiency analyzers
2. Boiler Operation Principles
 - Low pressure steam and hot water boiler fundamentals
 - Heat transfer concepts and boiler classifications
3. Boiler Components and Systems
 - Steam Boiler Fittings: safety valves, water columns, gauges, blowdown valves
 - Feedwater Systems: pumps, condensate handling, deaerators
 - Steam Systems: distribution, condensate return, traps
 - Fuel Systems: gas and oil supply systems, regulators, and controls
 - Draft Systems: natural, mechanical, and induced draft
4. Boiler Water Treatment
 - Water chemistry and treatment methods
 - Preventing scale, corrosion, and carryover
5. Boiler Operation Procedures
 - Start-up, operation, and shutdown procedures
 - Preventive maintenance and troubleshooting methods
6. Hot Water Boilers and Accessories
 - Hot water boiler construction and fittings
 - Accessories, piping systems, and controls

7. Cooling Systems Overview
 - Integration of boilers with cooling and HVAC systems
8. Boiler Operation Safety
 - Safety devices and safe operating practices
 - Common hazards and emergency procedures
9. Licensing Preparation
 - Code compliance and regulatory requirements
 - Test-taking tips and review of sample licensing exam questions

Assessment Types Used in the Course

- Quizzes and Homework Assignments – covering textbook chapters and lecture material on boiler systems, combustion, and safety.
- Laboratory Reports and Hands-On Exercises – documenting testing of combustion efficiency, inspection of boiler components, and troubleshooting.
- Case Study Analyses – applying boiler code, safety, and operation principles to real-world scenarios.
- Midterm and Final Exams – written assessments evaluating conceptual understanding and application of boiler operation and servicing.
- Practical Skills Test (Hands-On Exam) – demonstrating safe and efficient boiler operation, maintenance, and troubleshooting procedures.
- Licensing Exam Preparation Activities – practice questions, review sessions, and exam simulations aligned with boiler operator and facility engineer licensing requirements.
- Class Participation and Discussion – active engagement in lecture and lab-based problem-solving.