

COURSE: **Steam Generators** **EN-3131** **Fall 2024**

INSTRUCTOR: CDR Todd Hibbert Office: Room C210A Harrington
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Office Hours: 3rd period, Mon. Wed. Fri.

TEXT: Modern Marine Engineer's Manual, Vol. 1 (Osbourne or Hunt)
Engineering Training Manual TS Kennedy (Haynes)
Marine Engineering Workbooks, Vol. 1, 2, and 3 (Haynes)

DESCRIPTION: EN-3131 covers the design, construction, and operation of steam generators (boilers). It also considers fuels and their combustion, combustion equipment, combustion control, feedwater regulators, air heaters, economizers, superheaters, re-heaters, boiler water treatment, and auxiliary boilers. A laboratory in the Breshnahan Steam Lab is included, emphasizing boiler external fittings, safety valves, fuel oil systems, and main and auxiliary steam systems. [Lab time required]

PREREQUISITE: Calculus I

GRADING: Quizzes (60%), Final (30%), Labs (10%)

NOTE: This is a STCW required course. The lowest passing grade is a C-.

ATTENDANCE: There will be **NO** quiz make-ups. No excuses! Labs are mandatory and any missed labs will result in an **"F"** for the course.

NOTE: Programmable calculators are not allowed during quizzes and exams.
Cell Phones are not allowed in class. If a cell phone or any other electronic communication device is found during class there will be a zero given for a test grade.

MMA is committed to providing reasonable accommodations to students with documented disabilities. Students who believe they may need accommodations in this class are required to contact Ms. Elaine Cradhead, Director of Disability Compliance, within the first two weeks of class at ext. 5120 or by email at ecraghead@maritime.edu

Learning Objectives

At the completion of this course, the student should be able to:

- Understand the design, construction, and operation of marine boilers
- Comprehend basic thermodynamics and steam tables
- Demonstrate proficiency in solving fundamental engineering calculations
- Understand both firetube and water tube boiler fundamentals and operation
- Explain boiler refractories
- Comprehend internal boiler fittings
- Describe properties of superheaters and desuperheaters
- Compare/Contrast heat recovery devices
- Classify and Examine external boiler fittings
- Explain combustion theory
- Demonstrate knowledge of boiler water chemistry and treatment
- Show proficiency in boiler operation

Reading Assignments: Will be given out and amended as the course moves along

1. Introduction to Course: Basic concepts: BTU's, pressure, temperature, etc.

2. Properties of Steam: Superheated and saturated steam, latent heat, quality of steam, etc.
3. Boiler Capacity Limitations: Circulation, carryover, combustion rate, heat transfer
4. Boiler Classification: Firetube boilers, water tube boilers, electric boilers
5. Design and Construction of Boilers
6. Boiler Refractories
7. Internal Boiler Fittings
8. Superheaters and Desuperheaters
9. Heat Recovery Devices
10. Boiler Water Chemistry
11. External Boiler Fittings
12. Feedwater Regulators
13. Combustion: Atomizers, registers, fuel oil, fuel oil systems
14. Combustion: Chemistry of combustion, stack gas analysis
15. Auxiliary Boilers
16. Boiler Operation and Controls

STCW Learning Objectives:

Demonstrate knowledge and understanding of the following STCW elements:

- **OICEW-A4.1** Basic construction and operation principles of marine boilers
- **OICEW-A4.3** Preparation, operation, fault detection and measures to prevent damage for steam boiler and associated auxiliaries
- **OICEW-A4.3** Preparation, operation, fault detection and measures to prevent damage for steam systems
- **OICEW-B1.2** Steam boiler automatic controls
- **RFPEW-A2.1** Safe operation of boilers

Demonstrate proficiency in the following skills:

- **OICEW-5-2D** Boiler water test