

**EN410**  
**3rd Class Power Engineering Part B-1**

**4 Credits**

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Created: 26/03/2012

Revised: 20/05/2020

Approval: 20/05/2020

Alternate Delivery: No

The Implementation Date for this Outline is 12/08/2019

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## EN410 Version: 3



### 3rd Class Power Engineering Part B-1

#### Calendar Description

This course follows the SOPEEC 3B1 syllabus and curriculum. This course is a study of the followings: Design, construction operations and control of various types of boilers, high pressure fittings, heat transfer components, burners, draft and flue gas equipment, water treatment, pumps design and calculations, welding procedures and inspections, and pressure vessels.

#### Rationale

This is a required course for Heavy Oil Power Engineering. It prepares the students for part B1 of the Provincial 3rd Class Power Engineer's examination. It provides the students with the knowledge of various types of boilers, their designs, construction and the major components, control and operational procedures so that the students would be able to operate different types of boilers safely when they finish the course.

Pressure vessel and pumps are equipment which power engineers work with every day on the job. This course exposes students to the design and operation of pumps, and its basic calculation and also the construction and code requirement of pressure vessels.

Pressure welding is not a trade which power engineers normally do. Welding and inspection is incorporated into this course so that the student can make an intelligent decision on maintaining and repairing their equipment when welding is involved. It also enables the future power engineers to communicate effectively with different trades and contractors.

#### Prerequisites

A valid 4th Class Certificate and passing grades of 65% in EN110, EN210, HL119 HL129, HL139, and HL149.

#### Co-Requisites

None

## Course Learning Outcomes

Upon successful completion of this course, students will be able to

1. describe common designs, configurations and circulation patterns for modern bent-tube watertube boilers and steam generators and explain how boilers are rated.
2. describe the designs, components, firing methods, and operating considerations for some special boilers used in industry.
3. explain Code requirements, in general terms, and describe construction and assembly methods for the major components of a large boiler.
4. explain the purpose, location, design and operating conditions for the major heat transfer components of a large watertube boiler or steam generator.
5. describe the design and operation of common external and internal fittings attached to the pressure side of a high-pressure boiler.
6. describe the typical components of fuel supply systems and describe common burner/furnace designs for gas, oil, and coal-fired boilers.
7. explain boiler draft systems and fans and describe the equipment used to remove ash from flue gas.
8. explain the components and operation of automatic control systems for boiler water level, combustion, steam temperature, and start-up.
9. describe common procedures in the operation and maintenance of high pressure boilers.
10. define properties of saturated and superheated steam and, using information from the steam tables, calculate the heat required to produce steam at various conditions; determine the evaporation in steam boilers.
11. explain the purpose, principles, equipment, and monitoring of boiler water pretreatment processes.
12. explain proper priming and start-up procedures and considerations for pumps.
13. define terms associated with pumping and perform pump head calculations.
14. explain the processes and applications of different welding techniques and describe the testing of welds and procedures.
15. explain pressure vessel design, stresses, and operating considerations.

## Resource Materials

### ***Required Text(s):***

PanGlobal. (2019). *Power Engineering Third Class* (ed. 2.5). Calgary: PanGlobal Training Ltd.

PanGlobal. *Work Book for Power Engineering Third Class*. Calgary: PanGlobal Training Ltd.

PanGlobal. (2007). *2007 ASME Boiler & Pressure Vessel Code, Sections I, II, IV, VIII, Academic Extract*. Calgary: PanGlobal Training Ltd.

PanGlobal. (2007). *2007 ASME Boiler & Pressure Vessel Code, Sections VIII-UW, IX, B3.1, B31.3, Academic Extract Supplement*. Calgary: PanGlobal Training Ltd.

PanGlobal. *Canadian Standards Association B51 and B52 Academic Extract*. Calgary: PanGlobal Training Ltd.

ABSA, Safety Code Act and Regulations that Pertain to Pressure Equipment Safety Regulation, Power Engineers Regulation, and Pressure Welders Regulation, current edition, Alberta Safety Authority, Edmonton.

**Reference Text(s):**

Reference text is optional.

Kitto, J.B., & Stuetz, S. C. (2005). *Steam, its generation and use*. (ed. 41). Barberton, Ohio: Babcock & Wilcox.

**Conduct of Course**

Method of delivery of the course: Class lectures, and group discussions. The lectures closely follow the PanGlobal text book. Cutaway model and /or actual equipment would be used as demonstration when available. Video would be used to illustrate various aspect of the course.

**Evaluation Procedures**

D2L Assignments	15 %
Assignments	10%
Unit 1 Test	12.5%
Unit 2 Test	12.5 %
Midterm Exam	20 %
Final Exam	30 %

D2L assignments: There is one D2L assignment for each chapter. Multiple attempts are allowed, with the highest grade counts towards your D2L grade.

Class participation: Mark is for behavior in class, participation in discussion and class attendance.

Unit test: Each unit test covers 4 to 5 chapters. The contents and date are determined in class. It may consist of multiple-choice questions and/or long answer questions.

Midterm exam: It will be on all the material covered up to approximately one week before the midterm exam. The contents and date will be determined in class. It may consist of multiple-choice questions and/or long answer questions.

Final exam: It covers the whole course. It consists of 150 multiple choice questions.

*Important Note:*

*To pass each course, both the conditions below must be met:*

- (1) the student must obtain an overall mark of 65%, and
- (2) a minimum mark of 50% on the final exam.

If the student fails to obtain the minimum grade of 50% on the final, one and only one rewrite is permitted. The student who obtains a grade of 50% or more on the rewrite is granted a maximum grade of 50% for the final exam. (There is no rewrite allowed to try to raise a person's overall course mark. The sole purpose of the rewrite is to obtain a minimum grade on the final exam.)

## Grade Equivalents and Course Pass Requirements

*A minimum grade of C+ (65%) is required to pass this course.*

Letter	F	C+	B-	B	B+	A-	A	A+
Percent Range	0-64	65-69	70-74	75-79	80-84	85-89	90-94	95-100
Points	0.00	2.30	2.70	3.00	3.30	3.70	4.00	4.00

## Attendance

A minimum of 80% attendance for all theory courses is required in each semester. Absences will be recorded as excused (E) or unexcused (A). When a student's total absence reaches 5%, the reasons for the absences will be reviewed, and the student may be called in to a disciplinary meeting with the instructor and department Chair or Co-Chair. If poor attendance continues in that semester or the next, the student may be suspended.

## **Course Units/Topics**

Watertube Boiler Designs

Special Boiler Designs

Boiler Construction

Boiler Heat Transfer Components

High Pressure Boiler Fittings

Burner Designs & Supply Systems

Boiler Draft & Flue Gas Equipment

Boiler Control Systems

Boiler Procedures

Internal Water Treatment for Boilers

Boiler Water Pre-treatment

Pump Designs & Operation

Pump Head Calculations

Welding Procedures & Inspection

Pressure Vessels



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