



Boiler & Pressure Vessel

Reference Syllabus

for

Fifth Class Power Engineer=s (Boiler Endorsement)

Certificate of Qualification Examination

**Boiler & Pressure Vessel Safety Program
Reference Syllabus for 5th Class Boiler Endorsement Examinations**

Note: Please ensure that this is the appropriate reference syllabus for the examination applied for.

General Information

Introduction

This syllabus is intended to assist candidates studying for the 5th Class Boiler Endorsement Examination. You may also access our website at <http://www.safetyauthority.ca/>.

The requirements to qualify for a 5th Class Boiler Endorsement Examination are outlined in the *Safety Standards Act* and applicable regulation.

Recommended Study Programme

It is recommended that, before undertaking a 5th Class Boiler Endorsement examination, the candidate completes a 5th Class Boiler Endorsement Course offered through either a British Columbia or national institute or technical college recognized by the provincial safety manager.

In addition to the foregoing and in order to prepare for the examination, it is recommended that the candidate becomes familiar with the pertinent publications listed in the "Reference Material for Candidates of Power Engineer Examinations", which is obtainable from the various technical colleges.

	5th
<i>Safety Standards Act</i> and applicable regulation	X
Canadian Regulation (C. S. A. B-51, For the Construction and Inspection of Boilers and Pressure Vessels (Latest edition) ISSN # 0317-5669	X
A.S.M.E. Code Section VI Recommended Rules for Care and Operation of Heating Boilers (Latest edition) LCCCN # 56-3934	X
A.S.M.E. Code Section VII Recommended Rules for Care and Operation of Power Boilers (Latest edition) LCCCN # 56-3934	X
A.S.M.E. Code Simplified (Power Boilers-Section 1 - Latest edition) LCCCN # 56-3934	X

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Excerpts:

Power Engineers, Boiler, Pressure Vessel and Refrigeration Safety Regulation

Fifth class power engineer's certificate of qualification (boiler endorsement)

- 23** (1) An applicant for a fifth class power engineer's certificate of qualification (boiler endorsement) must
- (a) have experience for a period of not less than 8 months as a power engineer trainee in a power plant that has a boiler capacity that exceeds 10 m²,
 - (b) have experience for a period of not less than 8 months as a power engineer trainee in a power plant that has a boiler capacity that exceeds 10 m², a low pressure steam plant that has a boiler capacity that exceeds 30 m², a low pressure thermal fluid plant that has a boiler capacity that exceeds 150 m² of boiler capacity or a fluid plant,
 - (c) have experience for a period of not less than 8 months in the design, construction, repair, operation or maintenance of equipment to which this regulation applies, and have successfully completed a fifth class power engineering course (with a boiler endorsement) that has been approved by a provincial safety manager or provide proof of having an equivalent technical educational background that has been approved by a provincial safety manager, or
 - (d) be the holder of a marine engineer (motor) certificate of competency.
- (2) If an applicant holds an engineering degree acceptable to a provincial safety manager or has successfully completed a fifth class power engineering course that has been approved by a provincial safety manager, the required periods of employment referred to in subsection (1) (a) or (b) are reduced by 4 months.

What a fifth class power engineer (boiler endorsement) may do

- 24** A fifth class power engineer's certificate of qualification (boiler endorsement) entitles the holder to be
- (a) chief engineer of a
 - (i) power plant that has a boiler capacity that does not exceed 75 m², or
 - (ii) low pressure steam plant that has a boiler capacity that does not exceed 300 m²,
 - (b) chief engineer of a low pressure fluid plant or a low pressure thermal fluid plant that has a boiler capacity of 500 m² or less,
 - (c) chief engineer of a low temperature low pressure fluid plant that does not exceed 1 000 m² of boiler capacity,
 - (d) chief engineer of an unfired plant that does not exceed 500 m² of boiler capacity, or
 - (e) shift engineer of
 - (i) a power plant that has a boiler capacity of 150 m² or less,
 - (ii) a low pressure steam plant that has a boiler capacity of 500 m² or less,
 - (iii) a low pressure fluid plant or a low pressure thermal fluid plant that has a boiler capacity of 1000 m² or less,
 - (iv) any low temperature low pressure fluid plant, or
 - (v) any unfired plant.

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Part AA@ Examination

3 2 Hours

I. Applied Science

A. Applied Mathematics:

Arithmetic, mensuration, volumes and areas, knowledge of S.I. System of Measurement

B. Elementary Thermodynamics:

Temperature measurement, Celsius, Fahrenheit, heat, sensible and latent, boiling point of liquid, volume and expansion of steam, saturated steam, gauge and absolute pressure, steam tables and their use

II. The *Safety Standards Act* and applicable regulation

Thorough knowledge of the *Safety Standards Act* and regulations as applied to the boiler operators

III. Codes

A. A.S.M.E. Section VI - suggested rules for care and operation of heating boilers

B. A.S.M.E. Section VII - suggested rules for care and operation of power boilers

C. C.S.A. Standard B-51 - Boiler, Pressure Vessel and Pressure Piping Code

IV. Basic design of Heating Boilers

A. Types of heating boilers

B. Materials used in construction

C. Boiler Terminology

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V. Boiler Fittings

- A. A thorough knowledge of the operation and testing of boiler gauge glass and water column
- B. A thorough knowledge of the operation and testing of boiler safety valves
- C. A thorough knowledge of the operation of all other fittings and methods of testing same

VI. Fuels and Combustion

- A. Types of fuels
- B. Basic principles of combustion
- C. Storage of fuels
- D. Working knowledge of operating firing equipment for coal, oil, and gas fuels
- E. Thorough knowledge of lighting gas and oil fired boilers
- F. Use of natural, forced, and induced draught
- G. Thorough knowledge of causes and prevention of furnace explosions

VII. Boiler Controls

- A. Thorough knowledge of operation and testing of low water level fuel cut-off
- B. Knowledge of operating controls
- C. Knowledge of flame failure safety devices
- D. Testing Controls

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VIII. Boiler Operation and Maintenance, Feedwater Treatment

- A. Steam system; start up for first time, starting up after shut down, precautions, routing operations
- B. Hot water system; start up for first time, charging system, starting up after shut down, precautions, routine operations
- C. Shutting down and laying up a boiler; methods, general maintenance and cleaning, lubrication
- D. Routine start up and shut down procedures
- E. Cleaning and preparing boiler for inspection
- F. Causes and results of scaling and corrosion in boilers
- G. Elementary water treatment

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Part AB@ Examination

3 2 Hours

I. Pumps, Valves and Piping

- A. Theory of pumping, types of pumps and their applications
- B. Pump details, construction and parts, single and multi-stage, wear rings, shaft sealing, glands, packing, mechanical seals, bearings, lubrication, cooling, maintenance
- C. Pump alignment, flexible coupling, types, methods of alignment
- D. Pump operation, priming, trouble shooting, maintenance
- E. Piping, materials, fittings, joints and connections, pipe expansion and contraction, joints, anchors and supports, drainage, steam traps, strainers, water hammer, insulation
- F. Valves: types, design, application, pressure reducing, operation and maintenance

II. Environmental Comfort, Heating Systems

- A. Human comfort, heat losses
- B. Steam heating, heating equipment, radiators, convectors, unit heaters, unit ventilators, air vents, valves, traps, pumps, systems, controls, operation and maintenance, trouble shooting
- C. Hydronic heating, accessories, controls, pumps, valves, expansion tanks, types, pressures, point of no pressure change, converters, radiant panel heating, operation and maintenance, trouble shooting
- D. Warm air heating
- E. Electric heating
- F. Heating system controls

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III. Electricity

- A. Basic electricity
- B. Simple circuits
- C. Switches, fuses
- D. Elementary trouble shooting

IV. Plumbing

- A. Water systems
- B. Hot water heaters
- C. Heater fittings
- D. Pipes and valves, water hammer
- E. Maintenance and trouble shooting

V. Safety

- A. Operator's responsibility
- B. General safety precautions, cleaning, work equipment, paints, storage, lifting
- C. Electrical safety, hazards, electric shock, artificial respiration
- D. Fire, protection, prevention, fire fighting equipment, types of fires, alarm and detection systems
- E. Fire protection standards, laws and regulations, emergency lighting

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VI. Basic Design of Power Boilers

- A. Types of power boilers
- B. Materials used in construction
- C. Boiler terminology

VII. Air Compression

- A. Theory, altitude, barometers
- B. Reciprocating compressors; construction stages, cooling components, valves, control, lubrication and operation
- C. Axial; construction, components, lubrication and operation
- D. Systems; receivers, intercoolers, aftercoolers, driers, moisture, safety devices