

Body of Knowledge For
State of Ohio
Low Pressure Boiler Operator Exam

Licensed Low Pressure Boiler Operators must have knowledge on a variety of subjects relating to the operation compliance standards, boiler devices, feedwater supply arrangement, heating sources, steam distribution, draft, boiler water treatment, boiler operation, boiler operator safety, Ohio laws and Rules, as these pertain to the operation of Low Pressure Boilers.

The State of Ohio Low Pressure Boiler Operator Examination is designed to determine if individuals have such knowledge. The Body of Knowledge is a study guide that provides a list of specific topics about which the boiler operator should be knowledgeable.

Only information covered in the topics outlined in the Body of Knowledge will be utilized for examination questions. Each specific examination may not cover every topic of the Body of Knowledge.

Low Pressure Boilers second edition, by Frederick M. Steingress is the primary reference document. (Excluding Chapters 9 & 10)

Books are not to be brought to the examination site, however non-programmable calculators may be used.

Body of Knowledge For
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1. Principles and Standards

Low Pressure Boiler Operators will be able to define a boiler, describe the types, functions, and uses of boilers that produce steam, under fifteen pounds per square inch pressure. Furthermore, the operator should be able to describe the use of any such steam, giving consideration to the safety, combustion, heat recovery, economics, and conservation.

1.1 Low Pressure Boiler

The Low Pressure Boiler Operator must be able to define a boiler, recognize the difference between a low and high pressure boiler, know how to determine a boiler's horsepower using heating surface and by manufacturer's rating.

1.2 Boiler's Heat

The Low Pressure Boiler Operator must be able to define heating surface, sensible and latent heat, condensate, BTU, temperature, and explain a typical feedwater system. The operator must be able to calculate the BTU content of steam.

1.3 Combustion

The Low Pressure Boiler Operator must be able to identify the types of heat transfer, define combustion, and the types of combustion such as complete, perfect and incomplete. Also be able to identify the types of draft for combustion and how they are produced.

1.4 Air

The Low Pressure Boiler Operator must be able to determine the amount of air necessary for combustion and explain the term MATT.

1.5 Systems and Operations

The Low Pressure Boiler Operator must be able to properly operate and maintain the feedwater, fuel, draft, and steam systems.

1.6 Design and Construction

The Low Pressure Boiler Operator must be able to describe the types of boilers including fire tube, water tube, and cast iron sectional. Know the meaning of the terms: maximum allowable working pressure, atmospheric pressure, and absolute pressure.

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Part 2 Boiler Devices

Each boiler must have devices that ensure safe operation, this section will cover these items that must be on every boiler.

2.1 Safety valves

The Low Pressure Boiler Operator must be able to test, and know the code requirements of safety valves. Know the recommended care, size and number of valves required. Be able to define capacity, set pressure, and blow back. Must know the requirements for proper installation and maintenance.

2.2 Steam gauges

The Low Pressure Boiler Operator must be able to test, maintain, and determine proper size of gauges. The operator must also be knowledgeable of the recommended care, installation, and calibration procedures. The operator should know the difference between pressure, vacuum, and compound gauges, and the meaning of steam gauge readings.

2.3 Water Column

The Low Pressure Boiler Operator must know how to change a gauge glass. The operator must know how to test, maintain, and care for a water column. The operator must know installation requirements and what appliances can be attached to a water column

2.4 Blow down

The Low Pressure Boiler Operator must understand the care, maintenance, and operation of the blow down system. Must also have knowledge of installation requirements. Must also understand boiler water chemistry as it relates to blow down.

2.5 Boiler Vent, Fusible Plug, Pressure Controls

The Low Pressure Boiler Operator must be able to operate, and know the purpose of a boiler's vent. Know the location, the recommended maintenance, and the operation of a fusible plug. The requirements for boiler controls and boiler pressure controls, installation, operation, testing and types used must be thoroughly understood.

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Part 3 Feedwater Arrangement

Boilers must have an adequate supply of water to maintain safe operation.

- 3.1 The Low Pressure Boiler Operator must know the feedwater supply arrangement including types, location of valves and devices used.
- 3.2 Condensate return/makeup systems
The operator must know how to maintain, operate, and test feedwater regulators, low water fuel cutoffs, including evaporation test, and the operation of automatic make up systems.
- 3.3 Pumps
The Low Pressure Boiler Operator must be able to operate, and maintain boiler feedwater and vacuum pumps.

Part 4 Valves, Piping and Accessories

Boilers use piping systems to distribute steam and collect condensate for re-use in the boiler.

- 4.1 The distribution of steam and return of condensate
The Low Pressure Boiler Operator must be able to operate, maintain, and test steam valves and steam traps to ensure efficiency is maintained.
- 4.2 Steam Traps
The Low Pressure Boiler Operator must be able to operate, maintain, and repair steam traps, and identify the testing methods for traps.
- 4.3 Return / non-return traps
The Low Pressure Boiler Operator must be able to tell the difference between traps and identify how each type and style of trap operates and where each is located.

Part 5 Heating Sources

Boilers require a heat source to generate steam. The Low Pressure Boiler Operator must be able to describe the use of all fossil fuels and the equipment used to handle, store, and combust these fuels.

- 5.1 Fuel oil
The Low Pressure Boiler Operator must be able to define flash point, viscosity, fire point, pour point, atomization, and preheating.

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- 5.2. Fuel oil-burning equipment
The Low Pressure Boiler Operator must know the devices used from the storage to the combustion of the fuel. Must be able to operate, maintain, and test strainers, pumps, and heaters.
- 5.3. Gas
The Low Pressure Boiler Operator must be able to define Natural gas, therm, gas pressure switch, low pressure and high pressure gas supply, and combination gas and fuel oil burners.
- 5.4 Gas firing devices
The Low Pressure Boiler Operator must know the devices used from the supply line to the burner, and must be able to operate, maintain, and test this equipment.
- 5.5 Coal
The Low Pressure Boiler Operator must know each of the following; stokers, hand firing, and smoke.
- 5.6 Stoker firing
The Low Pressure Boiler Operator should be able to operate, maintain and bank stokers (underfeed, screw feed and ram feed types).
- 5.7 Firing Controls
The Low Pressure Boiler Operator must know the on/off controls, modulating controls, microcomputer controls, flame system and operation, programmer and its sequences. Be able to operate, maintain, and test firing equipment, flame scanners, flame rod sensors, and photocell sensors.
- 5.8 Efficiency and Pollution
The Low Pressure Boiler Operator should be able to define primary pollutant and secondary pollutant, and be aware of the 1990 Clean Air Act.

Part 6 Draft

Moving the products of combustion through the boiler and discharging them away from the operator.

- 6.1 The Low Pressure Boiler Operator should be able to define draft, and give an example of the types of draft such as Natural and mechanical, including the use of stacks.

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- 6.2 The Low Pressure Boiler Operator should understand the use of draft and its benefits, be able to measure and control draft, know how to use a manometer, analyze readings, and control and manipulate draft.

Part 7. Make up water and treatment

The applicant needs to know how adverse water conditions develop and be able to recognize and treat these problems

- 7.1 Understand causes and affects of dissolved solids, scale, corrosion, and caustic embrittlement.
- 7.2 The Low Pressure Boiler Operator should be able to control abnormal operating conditions caused by adverse water conditions; perform water treatment, water analysis, chemical treatment (internal), softeners and deairators, (external) and blow downs.
- 7.3 The Low Pressure Boiler Operator should be able to analyze results of the test, and chemically treat accordingly. They also need to maintain softener operations and blow down boilers.

Part 8. Operating procedures

The Low Pressure Boiler Operator must know the steps necessary to prevent damage to equipment and avoid personal injury, using the safety and operating devices provided on the boiler.

- 8.1 The Low Pressure Boiler Operator taking over a shift must know how to perform water column and gauge glass blow down, bottom blow down, and test low water fuel cut off
- 8.2 The Low Pressure Boiler Operator should be able to perform boiler start up, shut down, and normal operations, including valve line up, auxiliary support equipment, monitoring and adjustments to fuel, air, water, and pressures.

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- 8.3 The Low Pressure Boiler Operator needs to know the correct order of events to effectively control abnormal conditions as rapidly and safely as possible. Conditions to be remedied are: low water, high water, over pressure, flame failure, furnace explosion, and feedwater pump failure.
- 8.4 The Low Pressure Boiler Operator needs to know the proper order for boiler isolation, clean up, and preparation for inspectors visit, and documentation of activity, Boiler inspection, tear down, preparation, trouble shooting, hydrostatic test, and boiler room logs.

Part 9 Operating Safely

Adhering to safety guidelines and standards

- 9.1 The Low Pressure Boiler Operator needs to know the agencies and services that are available such as OSHA, EPA, ASME
- 9.2 The Low Pressure Boiler Operator needs to practice safety at all times and maintain a secure boiler room for all personnel involved. These boiler room safety items include; fire protection, confined spaces, hazardous materials, personal protective equipment, lock out – tag out.

Part 10. Laws and Rules

Ohio Laws and Rules pertaining to the licensing of Stationary Steam Engineers and Boiler Operators and Low Pressure Boiler Operators

- 10.1 Horsepower by heating surface
- 10.2 License renewals
- 10.3 License revocation and expiration
- 10.4 Experience and schooling
- 10.5 Display of license
- 10.6 Requirements for boilers over thirty (30) horsepower by heating surface