

# REFERENCE SYLLABUS

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For

**FIRED PROCESS HEATER OPERATOR'S**

**CERTIFICATE of COMPETENCY  
EXAMINATION**

**AB-239**

**Edition 3, Revision 1, Issued 2018-07-13**



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FOR  
FIRED PROCESS HEATER OPERATOR'S  
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## **GENERAL INFORMATION**

### **Introduction:**

As provided for under the Power Engineers Regulation, the Administrator in the pressure equipment discipline has established this Syllabus to identify the examination subjects for the Fired Process Heater Operator's Certificate of Competency.

This Syllabus is intended to assist candidates in their preparation to write the examination for the Fired Process Heater Operator's Certificate of Competency. The syllabus contains the body of knowledge to help guide the candidate through the examination topics.

The requirements to qualify for a Fired Process Heater Operator's Certificate of Competency examinations are outlined in the Power Engineers Regulation.

### **Course Requirement:**

It is required that, before undertaking this examination, the candidate successfully complete an approved Fired Process Heater Operator's Course offered through a recognized technical institute or training provider.

### **Application to Undertake Examination:**

A candidate must submit an application (AB-66) and the prescribed fee at least twenty-one (21) days before the date of examination.

The most current and up-to-date forms can be found on our website at:  
<http://www.absa.ca>

The form and payment can be faxed, mailed, or dropped off in person to the address below. If mailed, please ensure it is received by our office a minimum of 21 days prior to the scheduled sitting.

**ABSA  
9410-20 Avenue NW  
Edmonton, AB T6N 0A4**



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**Examination Instructions:**

Exam Type: 100 multiple choice questions  
Writing Time: 3.0 hours  
Passing Grade: 65%

A candidate is allowed to bring and use the following items in the examination room:

- The Safety Codes Act and Regulations under the Safety Codes Act;
- CSA B51, Boiler, Pressure Vessel and Pressure Piping Code;
- Handbook of Formulae and Physical Constants and Steam Tables are normally provided;
- Fired Process Heater Operator Formula Booklet;
- AB-528 Requirements for Reduced Supervision of Power Plants, Thermal Liquid Heating Systems, and Heating Plants;
- A non-technical English language dictionary;
- Pens and pencils; and
- Non-programmable calculator (see applicable note below).

**Notes:**

- The candidate must provide government issued picture ID to the Examiner prior to the examination.
- No cell phone or any electronic communication devices are allowed to be brought into the examination room.
- Reference material permitted in the examination room as noted above must be shown to the Examiner for approval.
- Reference material shall not contain additional annotations, formulas, sketches or paste-ins etc.
- Important: If your calculator is programmable, you must reset it in the company of the Examiner so that the Examiner is sure that all memories are clear. Or the Examiner may request that you remove the battery to erase all memory. This may be done during your examination time, so be aware that you may have less time to complete your exam. If the memories do not clear by resetting the calculator or by removing the battery, the calculator shall not be used. Also, if your calculator fails to function after the reset or battery removal, the Examiner is not responsible and you may be at a significant disadvantage.

## SYLLABUS FOR FIRED PROCESS HEATER OPERATOR

### 1. Applied Mathematics

- a. S.I. units and unit conversions.
- b. Basic arithmetical operations.
- c. Fractions, decimals and percentages.
- d. Ratio and proportion.
- e. Simple algebra.
- f. Mensuration, length, lines.
- g. Simple plane figures, area and volumes.

### 2. Elementary Thermodynamics

- a. Basic thermodynamic concepts.
- b. Temperature and thermal expansion.
- c. Specific, sensible and latent heat.
- d. Basic chemical and physical properties.
- e. Pressure and saturation temperature relationship.

### 3. Acts and Regulations

General knowledge (identify, quote, interpretation and application) of the Act and Regulations as they apply to the Fired Process Heaters and their operation as follows:

- a. The Safety Codes Act.
- b. Pressure Equipment Safety Regulation.
- c. Power Engineers Regulation.
- d. AB-528 – Requirements for Reduced Supervision of Power Plants  
Thermal Liquid Heating Systems and Heating Plants

#### 4. Codes

- a. ASME Section VI – Recommended Rules for the Care and Operation of Heating Boilers
- b. ASME Section VII – Recommended Guidelines for the Care of Power Boilers
- c. CSA Standard B51 – Boiler, pressure vessel, and pressure piping code
- d. API 560 – Fired Heaters for General Refinery Services
- e. ASME CSD-1 – Controls and Safety Devices for Automatically Fired Boilers
- f. CSA B149.3 – Code for the field approval of fuel-related components on appliances and equipment
- g. NFPA 85 – Boiler and Combustion Systems Hazards Code

#### 5. Combustion

- a. Principles of Combustion of fuels.
- b. Combustion equipment and controls.
- c. Thermal liquid heater and fired heater draft equipment.
- d. Natural, induced and balanced draft.
- e. Burner management systems for heating boilers and fired heaters.
- f. Methods of lighting of gas and oil-fired thermal liquid heaters and fired heaters.
- g. Methods of cleaning oil and gas fired burners used in thermal liquid heaters and fired heaters.
- h. Requirements for proper combustion of fuels and combustion chemistry.
- i. Adjustments made for proper burner combustion.
- j. Causes and prevention of furnace explosions.

## **6. Piping and Valves**

- a. Materials: sizes and identification.
- b. Piping, pipe fittings, flanges and connections.
- c. Expansion joints, bends, support, hangers and insulation.
- d. Drainage: separators, traps, water hammer.
- e. Valve types: construction and application.
- f. Safety and Relief Valves.

## **7. Package Boilers and Thermal Liquid Heating Systems**

- a. Package boilers and thermal liquid heater terminology.
- b. Firetube boiler thermal liquid heaters; construction, stays, tubes, tube sheets, shell.
- c. Watertube boiler thermal liquid heaters; construction, drums and walls.
- d. Package boiler thermal liquid heater construction; support, suspension, refractory and insulation.

## **8. Package Boilers and Thermal Liquid Heater Operations**

- a. Package boiler thermal liquid heater pre-start, purge, start-up, operation and shut-down.
- b. Package boiler thermal liquid heater emergency operation.
- c. Chemical and mechanical cleaning, boil-out and lay-up.
- d. Hydrostatic testing and safety precautions.
- e. Package boiler thermal liquid heater maintenance, preparation for inspection and inspection requirements.
- f. Testing safety devices.
- g. Cause and prevention of boiler furnace explosions.
- h. Package boiler thermal liquid heater optimization and troubleshooting.

## 9. Fired Heater Systems

- a. Fired heater terminology.
- b. Vertical direct fired process heaters; construction, tubes, refractory and insulation, stacks, ducts and breeching, radiant and convection sections.
- c. Horizontal direct fired process heaters; construction, tubes, refractory and insulation, stacks, ducts and breeching, radiant and convection sections.
- d. Fired emulsion treaters and free water knockouts; construction, stacks, and insulation.
- e. Indirect fired heaters; glycol bath, salt bath, construction, tubes, stacks, refractory and insulation.

## 10. Fired Heater Operation

- a. Fired heater pre-start, purge, start-up, operation and shut-down.
- b. Fuel and draft equipment adjustments.
- c. Heater emergency operation.
- d. Hydrostatic testing, safety precautions.
- e. Fired heater maintenance and preparation for inspection.
- f. Testing safety devices.
- g. Cause and prevention of furnace explosions.
- h. Heater optimization and troubleshooting.

## 11. Controls and Instrumentation

- a. Instrumentation terms and definitions.
- b. Methods of process measurement (flow, pressure, level and temperature).
- c. Final control elements.
- d. Basic control loop components.
- e. Safety devices (low level, low flow, high temperature, and flame failure).
- f. Thermal liquid heater programmable controls and safety interlocks.
- g. Thermal liquid heater operating controls.
- h. Thermal liquid heater combustion controls.
- i. Fired heater operating controls.
- j. Fired heater combustion controls.

## 12. Plant and Fired Process Heater Systems and Auxiliaries

- a. Glycol heat medium systems, components, auxiliaries, operation and maintenance.
- b. Hot oil heat medium systems, components, auxiliaries, operation and maintenance.
- c. Sulfur plant processes, reaction furnace and non-steam generating waste heat boilers utilized in heat medium service.
- d. Pump types (centrifugal, positive displacement).
- e. Heat medium circulation pumps and pump seals.