

***Fired Process Heater Operator's  
Certificate of Competency***  
**GENERAL INFORMATION AND EXAMINATION SYLLABUS**

**AB-239**

Edition 2, Revision 0 – Issued 05-26-2016

## 1.0 GENERAL INFORMATION:

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.

## 2.0 ELIGIBLE TO WRITE

To qualify to take a Fired Process Heater Operator's Certificate of Competency examination, a candidate must either

- (a) *have successfully completed a course in fired process heater operation satisfactory to the Administrator, or*
- (b) *hold a degree in mechanical engineering from a university satisfactory to the Administrator*

### ***PER Section 22.2(1)***

## 3.0 EXAMINATION INFORMATION

Exam Type: 100 multiple choice questions

Writing Time: 3.0 hours

Passing Grade: 65%

To apply to write this examination, the form, AB-66 Application to Write a Power Engineering Examination, must be completed and submitted to ABSA, with the required fee, a minimum of 21 days prior to the scheduled sitting.

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

## 4.0 EXAMINATION INSTRUCTIONS

A candidate is allowed to 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, Steam Tables and Refrigeration Tables are normally provided;
- A non-technical English language dictionary;
- Pens and pencils;
- Non-programmable calculator (see *Important* note) and
- Drawing instruments and drawing templates.

Note:

- The candidate must provide 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.
- The items referenced above must be shown to the Examiner for approval.
- No other reference material is allowed.
- *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.

## 5.0 PRACTICAL TIME REQUIREMENTS

A candidate is qualified to receive the Fired Process Heater Operator's Certificate of Competency after having passed the Fired Process Heater Operator's Certificate of Competency examination, and been employed for a period of:

- (i) *12 months assisting in the operation of:*
  - (a) *a power plant that is a thermal liquid under pressure of a blanketing gas not exceeding 700 kPa*
  - (b) *a power plant that does not produce steam and that uses thermal liquid under pressure of a blanketing gas not exceeding 700 kPa or a*

*water-glycol mixture with a minimum of 40% glycol between 20kW to unlimited kW*

- (c) *a thermal liquid heating system plant 250 kW*
- (ii) *24 months assisting in the operation of a pressure plant that is satisfactory to the Administrator.*

**PER Section 22.2(4)**

## **6.0 PLANT SUPERVISION**

A person who holds a Fired Process Heater Operator's Certificate of Competency may supervise;

- (a) *a power plant that uses a thermal liquid under pressure of a blanketing gas not exceeding 700 kPa;*
- (b) *a power plant that does not produce steam and that uses a water-glycol mixture with a minimum of 40% glycol, provided that the plant meets the requirements for reduced supervision as established by the Administrator;*  
*or*
- (c) *a thermal liquid heating system.*

**PER Section 22.2(4) & Section 2.1(1)**

## **7.0 RENEWAL OF CERTIFICATES**

A certificate of competency remains valid providing the yearly renewal fee is paid on or before the annual date of issuance.

## **8.0 SYLLABUS FOR PROCESS FIRED HEATER OPERATOR**

### **8.1 Applied Mathematics**

S.I. units, basic arithmetical operations, fractions, decimals and percentages, ratio and proportion, simple algebra, mensuration, length, lines and simple plane figures, area and volumes

### **8.2 Elementary Thermodynamics**

Basic thermodynamic concepts, temperature and thermal expansion, specific, sensible and latent heat, thermodynamics of steam, basic chemical and physical properties

### **8.3 Acts and Regulations**

General knowledge (identify, quote, interpretation and application) of the Safety Codes Act, boiler and pressure vessel codes and regulations, including Power Engineers Regulation, Occupational Health and Safety regulations as apply to fired heater operation.

### **8.4 Codes**

ASME Section VI – Recommended Rules for the Care and Operation of Heating Boilers

ASME Section VII – Recommended Guidelines for the Care of Power Boilers

CSA Standard B51 – Boiler, pressure vessel, and pressure piping code

API 560 – Fired Heaters for General Refinery Services

**8.5 Combustion**

Principles of Combustion of fuels (natural gas and fuel oil)

Combustion equipment and controls

Thermal liquid heater and fired heater draft equipment; natural, induced, balanced

Burner management systems for heating boilers and fired heaters

Methods of lighting of gas and oil-fired thermal liquid heaters and fired heaters

Methods of cleaning oil and gas fired burners used in thermal liquid heaters and fired heaters

Requirements for proper combustion of fuels

Adjustments made for proper burner combustion

Causes and prevention of furnace explosions

**8.6 Piping and Valves**

Materials: sizes and identification

Piping, pipe fittings and connections

Expansion joints, bends, support, hangers and insulation

Drainage: separators, traps, water hammer

Valve types: construction and application

Safety and Relief Valves

**8.7 Package Boilers used in Thermal Liquid Heating Systems**

Thermal liquid heater terminology

Firetube thermal liquid heaters; construction, stays, tubes, tube sheets, shell

Watertube thermal liquid heaters; construction, drums and walls

Thermal liquid heater construction; support, suspension, refractory and insulation

**8.8 Package Boilers used in Thermal Liquid Heater Operations**

Thermal liquid heater pre-start, start-up, operation and shut-down

Thermal liquid heater emergency operation

Chemical and mechanical cleaning, boil-out and lay-up

Hydrostatic testing and safety precautions

Thermal liquid heater maintenance, preparation for inspection and inspection requirements

Testing safety devices

Cause and prevention of boiler furnace explosions

Thermal liquid heater optimization and troubleshooting

**8.9 Description of Process Fired Heaters**

Fired heater terminology

Vertical direct fired process heaters; construction, tubes, refractory and insulation, stacks, ducts and breeching, radiant and convection sections

Horizontal direct fired process heaters; construction, tubes, refractory and insulation, stacks, ducts and breeching, radiant and convection sections

Fired emulsion treaters and free water knockouts; construction, stacks, and insulation

Indirect fired heaters; glycol bath, salt bath, construction, tubes, stacks, refractory and insulation

### **8.10 Fired Heater Operation**

Fired heater pre-start, start-up, operation and shut-down  
Fuel and draft equipment adjustments  
Heater emergency operation  
Hydrostatic testing, safety precautions  
Fired heater maintenance and preparation for inspection  
Testing safety devices  
Cause and prevention of furnace explosions  
Heater optimization and troubleshooting

### **8.11 Controls and Instrumentation**

Instrumentation terms and definitions  
Methods of process measurement (flow, pressure, level and temperature)  
Final control elements  
Basic control loop components  
Safety devices (low level, low flow, high temperature, and flame failure)  
Thermal liquid heater programmable controls and safety interlocks  
Thermal liquid heater operating controls  
Thermal liquid heater combustion controls  
Fired heater operating controls  
Fired heater combustion controls



**8.12 Plant and Process Fired Heater Systems**

Glycol heat medium systems, components, auxiliaries, operation and maintenance

Hot oil heat medium systems, components, auxiliaries, operation and maintenance

Sulfur plant processes, reaction furnace and non-steam generating waste heat boilers utilized in heat medium service

Heat medium circulation pumps and pump seals