

## OPERATE INDUSTRIAL BOILERS

**UNIT CODE:** ENG/OS/IPO/CR/O1/4/A

### UNIT DESCRIPTION

This unit describes competencies required to operate industrial boilers. It involves applying industrial boiler operation safety procedures, identifying industrial boiler parts, starting-up industrial boiler operations, running and monitoring industrial boiler, shutting down industrial boiler, performing industrial boiler basic maintenance and generating industrial boiler operations reports

### ELEMENTS AND PERFORMANCE CRITERIA

<b>Element</b> These describe the key outcomes which make up workplace function	<b>Performance Criteria</b> These are assessable statements which specify the required level of performance for each of the elements.  <i><b>Bold and italicized terms are elaborated in the Range</b></i>
1. Apply Industrial Boiler Operation Safety Procedures	1.1 Prescribed personal safety gear is worn as per rules and regulations of the <i><b>Occupational Safety and Health Act (OSHA)</b></i> 1.2 Safety measures for the operation of the boiler are applied as per the rules and regulations of the <i><b>Occupational Safety and Health Act (OSHA)</b></i> 1.3 Work environment safety rules and regulations are observed as per the <b>Occupational Safety Act</b> 1.4 <i><b>Potential, workplace employee and equipment hazards</b></i> , and their <i><b>risk</b></i> control measures are identified as per OSHA to ensure the safety of personnel and equipment
2. Identify Industrial Boiler Parts	2.1 Operation manuals are obtained and interpreted as per manufacturers specification and SOPs 2.2 The model of the boiler is identified as per manufacturer's specification 2.3 Different components of the boiler are identified as per manufacturer's specification
3. Start-up Industrial Boiler operations	3.1 Boiler is vented to atmosphere prior to <i><b>start-up</b></i> , as required 3.2 <i><b>Pre-start up checks</b></i> are carried out on according to SOPs 3.3 Boiler furnace is purged as per manufactures specification and SOPs 3.4 Industrial boiler is started up as per manufactures specification and SOPs

<b>Element</b> These describe the key outcomes which make up workplace function	<b>Performance Criteria</b> These are assessable statements which specify the required level of performance for each of the elements.  <i><b>Bold and italicized terms are elaborated in the Range</b></i>
	3.5 Steam line operations are checked as per manufactures specification and SOPs 3.6 Line pressure is measured in accordance with the manufacture's specifications and SOPs 3.7 <i><b>Identify any visual faults</b></i> and report according to <i><b>procedures</b></i>
4. Run and Monitor Industrial Boiler	4.1 Industrial boiler is operated in accordance with manufacturers procedures 4.2 Industrial Boiler inputs, valves, fittings, pressure gauges and outputs are monitored according to manufacturer's guidelines and SOPs 4.3 Automatic blow-down is activated in accordance with the manufacturer's <i><b>procedures and SOPs</b></i> 4.4 <i><b>Boiler</b></i> is blown down to adjust total dissolved solids (TDS) levels to according to the manufacture's procedures and SOPs recommendations 4.5 Operating status of the <i><b>boiler is monitored, and check chart updated</b></i> 4.6 <i><b>Operating log</b></i> are clearly and accurately maintained according to <i><b>procedures</b></i>
5. Shut down industrial boiler	5.1 <i><b>Boiler Shut down</b></i> is conducted for inspection according to <i><b>procedures</b></i> 5.2 System checks are conducted as per manufactures specification and SOPs 5.3 Boiler <i><b>operating log</b></i> for <i><b>shutdown are completed</b></i> 5.4 Housekeeping is undertaken in accordance with the SOPs
6. Perform industrial boiler basic maintenance	6.1 <i><b>Maintenance</b></i> requirements are identified according to SOPs 6.2 Isolations associated with in-service <i><b>maintenance</b></i> are completed as per SOPs 6.3 <i><b>Boilers</b></i> are internally cleaned to manufacturer recommendations and <i><b>procedures</b></i> 6.4 Loose Boiler components and auxiliaries are adjusted as per manufactures specification
7. Generate industrial boiler operations reports	7.1 Industrial boiler operations report is generated in accordance with the SOPs 7.2 The report is shared with relevant authorities in accordance with SOPs

## RANGE

This section provides work environment and condition to which the performance criteria (PC) applies. It allows for different work environment and situations that will affect performance.

Variable	Range
<ul style="list-style-type: none"> <li>• <i>Occupational Safety and Health Act 2007</i> May include but not limited to:</li> </ul>	<ul style="list-style-type: none"> <li>• Personal safety equipment</li> <li>• Responsibility of the employee</li> <li>• Responsibility of the employer</li> <li>• Work area safety</li> <li>• Work area hazards</li> <li>• Accident reporting procedure</li> </ul>
<ul style="list-style-type: none"> <li>• <i>Types of boilers</i> May include but not limited to:</li> </ul>	<ul style="list-style-type: none"> <li>• Fixed and modulating combustion controls and a single heat source. Operation includes a battery of boilers and boilers that have a single thermal or solar heat source.</li> <li>• Fire tube boilers</li> <li>• Water tube boilers</li> <li>• Once through boilers</li> <li>• Waste heat boilers</li> <li>• Electrically heated boilers</li> </ul>
<ul style="list-style-type: none"> <li>• <i>Hazards</i> May include but not limited to:</li> </ul>	<ul style="list-style-type: none"> <li>• Asbestos lagging</li> <li>• Chemical hazards</li> <li>• Thermal hazards</li> <li>• Manual handling hazards</li> <li>• Machinery guard requirements □</li> <li>• Hot exposed steam pipe □</li> <li>• Leakage of steam</li> <li>• Leakage of fuel</li> <li>• Odour of gas</li> <li>• Fumes from a liquid chemical spill</li> <li>• Faulty/broken ladder or hand rail</li> <li>• Working at heights</li> <li>• Flammable liquids</li> <li>• Fire and explosion</li> <li>• Electrical hazards</li> <li>• Work area, including:</li> </ul>

Variable	Range
	<ul style="list-style-type: none"> <li>• Illumination</li> <li>• Excessive noise from machinery</li> <li>• Spillage of oil</li> <li>• Rubbish and combustibles</li> <li>• Obstruction</li> </ul>
<ul style="list-style-type: none"> <li>• <i>Risk control methods</i> may include but not limited to:</li> </ul>	<ul style="list-style-type: none"> <li>• Elimination</li> <li>• Substitution</li> <li>• Isolation</li> <li>• Engineering controls</li> <li>• Administrative controls</li> <li>• Personal protective equipment (PPE)</li> </ul>
<ul style="list-style-type: none"> <li>• <i>Appropriate standards</i> may include but not limited to:</li> </ul>	<ul style="list-style-type: none"> <li>• Legislation; <ul style="list-style-type: none"> <li>○ OSHA 2007</li> <li>○ NEMA 1999</li> <li>○ NCA regulations 2017</li> </ul> </li> <li>• Codes of practice</li> <li>• Manufacturer specifications</li> <li>• Technical standards (International)</li> <li>• Industry standards (where applicable)</li> </ul>
<ul style="list-style-type: none"> <li>• <i>Procedures and sops</i> may include but not limited to:</li> </ul>	<ul style="list-style-type: none"> <li>• Manufacturer guidelines (e.g. Instructions, specifications or checklists)</li> <li>• Industry operating procedures</li> <li>• Workplace procedures (e.g. Work instructions, operating procedures or checklists)</li> </ul>
<ul style="list-style-type: none"> <li>• <i>Equipment</i> may include but not limited to:</li> </ul>	<ul style="list-style-type: none"> <li>• Gas monitoring equipment</li> <li>• Water monitoring equipment</li> <li>• Fire-fighting equipment</li> <li>• Workplace first aid equipment</li> <li>• Work platform and associated gear, including walkways</li> <li>• Temperature monitoring equipment</li> </ul>
<ul style="list-style-type: none"> <li>• <i>Communication methods</i> may include but not limited to:</li> </ul>	<ul style="list-style-type: none"> <li>• Verbal and non-verbal language written instructions signage</li> <li>• Hand signals</li> <li>• Listening</li> <li>• Questioning to confirm understanding</li> <li>• Appropriate worksite protocol</li> </ul>

Variable	Range
<ul style="list-style-type: none"> <li>• <i>Appropriate/Relevant personnel</i> may include but not limited to:</li> </ul>	<ul style="list-style-type: none"> <li>• Production personnel</li> <li>• Maintenance personnel</li> <li>• Supervisors and managers</li> <li>• Other boiler operators</li> <li>• Suppliers</li> <li>• Colleagues</li> </ul>
<ul style="list-style-type: none"> <li>• <i>Records</i> may include but not limited to:</li> </ul>	<ul style="list-style-type: none"> <li>• Operating log books</li> <li>• Isolation procedures</li> <li>• Safe operating procedures</li> <li>• Daily operating inspections</li> <li>• Workplace record keeping requirements</li> </ul>
<ul style="list-style-type: none"> <li>• <i>Risk control measures</i> may include but not limited to:</li> </ul>	<ul style="list-style-type: none"> <li>• Barricades and controls</li> <li>• Machine guarding</li> <li>• Fall prevention</li> <li>• Pedestrian controls</li> <li>• Adequate illumination</li> <li>• Noise controls</li> <li>• Signage</li> <li>• PPE</li> </ul>
<ul style="list-style-type: none"> <li>• <i>Personal protective equipment (PPE)</i> may include but not limited to:</li> </ul>	<ul style="list-style-type: none"> <li>• Thermally insulated gloves</li> <li>• Helmet</li> <li>• Ear protection (muffs or plugs)</li> <li>• Chemical resistant gloves and apron</li> <li>• Respiratory devices eye protection</li> <li>• Working protective gloves</li> <li>• Whole body fire-resistant clothing</li> <li>• Safety boots</li> </ul>
<ul style="list-style-type: none"> <li>• <i>Communication equipment</i> may include but not limited to:</li> </ul>	<ul style="list-style-type: none"> <li>• Two-way radios</li> <li>• Mobile phones</li> <li>• Intercoms</li> <li>• Satellite phones</li> <li>• Local Area Networks</li> </ul>
<ul style="list-style-type: none"> <li>• <i>Pre-start up checks</i> may include but not limited to:</li> </ul>	<ul style="list-style-type: none"> <li>• Testing warning lamps or visual</li> <li>• Warning indicators control panel checks</li> <li>• Checks of feed-water supply</li> </ul>

Variable	Range
	<ul style="list-style-type: none"> <li>• System fuel supply/heat source</li> <li>• System operation and position of boiler valves</li> <li>• Combustion air supply system</li> <li>• Boiler water level</li> <li>• Essential fittings and gauges</li> <li>• Selection of PPE</li> <li>• Inspection and location of inspection and explosion doors (where applicable)</li> <li>• Identification of hazards and management of risks and maintenance problem</li> <li>• Fire-fighting equipment</li> <li>• Manufacturer recommendations and checklists relevant records and logs</li> </ul>
<ul style="list-style-type: none"> <li>• <i>Start-up</i> may include but not limited to:</li> </ul>	<ul style="list-style-type: none"> <li>• Purge boiler furnace</li> <li>• Heat input</li> <li>• Warm-up reticulation system</li> <li>• Venting the boiler of air, where required</li> <li>• Steam traps and steam line purge system operations</li> <li>• Reticulation line pressure</li> <li>• Steam usage and supply</li> </ul>
<ul style="list-style-type: none"> <li>• <i>Maintenance</i> may include but not limited to:</li> </ul>	<ul style="list-style-type: none"> <li>• Leaking steam pipe</li> <li>• Pressure gauge accuracy</li> <li>• Exposed electrical wiring</li> <li>• Defective illumination in the workplace</li> <li>• Leaking fuel pump gland</li> <li>• Leaks in high pressure feed line</li> <li>• Leaking gauge glass mounting</li> <li>• Leaking safety valve</li> <li>• Isolation procedures, hardware and equipment</li> </ul>

Variable	Range
<ul style="list-style-type: none"> <li>• <i>Faults</i> may include but not limited to:</li> </ul>	<ul style="list-style-type: none"> <li>• Abnormal operating conditions</li> <li>• Feedwater supply and/or other major auxiliary loss</li> <li>• Wet steam</li> <li>• Valve mechanical or electrical fault/failure</li> <li>• Instruments failure</li> <li>• Steam leak</li> <li>• Insulation failure</li> <li>• Draft failure</li> </ul>
<ul style="list-style-type: none"> <li>• <i>Diagnose</i> may include but not limited to:</li> </ul>	<ul style="list-style-type: none"> <li>• Senses, including:</li> <li>• Audio</li> <li>• Smell</li> <li>• Touch</li> <li>• Visual</li> <li>• Remote or local indicators and recorders</li> <li>• Computers and alarms, including:</li> <li>• Visible</li> <li>• Audible</li> </ul>
<ul style="list-style-type: none"> <li>• <i>Operating logs</i> may include but not limited to:</li> </ul>	<ul style="list-style-type: none"> <li>• Date and time of checking</li> <li>• Each check, examination and results</li> <li>• Printed and signed name of person who performed the checks</li> <li>• Date and time of any lockout or equipment malfunction</li> <li>• Results of tests on boiler or feed-water <input type="checkbox"/></li> <li>• Changes in operation</li> </ul>
<ul style="list-style-type: none"> <li>• <i>Valves and fittings</i> may include but not limited to:</li> </ul>	<ul style="list-style-type: none"> <li>• Safety valves</li> <li>• Gauge glasses</li> <li>• Main Steam stop valve</li> <li>• Feed water stop valve</li> <li>• Feed check valve</li> <li>• Blow-down valve</li> <li>• Steam side/line drain valves</li> <li>• Flame failure detection device</li> <li>• Water level controller</li> <li>• Boiler steam pressure gauge</li> </ul>

Variable	Range
<ul style="list-style-type: none"> <li>• <i>Monitor</i> may include but not limited to:</li> </ul>	<ul style="list-style-type: none"> <li>• Water supply system</li> <li>• Checks of steam reticulation line</li> <li>• Pressure usage and supply of steam</li> <li>• Quality of steam</li> <li>• Combustion/heat source system and management</li> <li>• Feedwater system</li> <li>• Fuel system</li> <li>• Combustion air supply</li> <li>• Water level</li> <li>• Boiler steam pressure</li> <li>• Boiler and steam manifold valves (where fitted)</li> <li>• Soot blowers (where fitted)</li> <li>• Operation of control/safety devices, including control panels</li> </ul>
<ul style="list-style-type: none"> <li>• <i>Handover</i> may include but not limited to:</li> </ul>	<ul style="list-style-type: none"> <li>• Previous load requirements</li> <li>• Maintenance issue, including equipment isolated for maintenance</li> <li>• Operational incidences</li> <li>• Read operating log</li> <li>• General inspection of boiler to detect any defects</li> <li>• Accept responsibility of boiler noted defects</li> <li>• Required equipment tests</li> </ul>
<ul style="list-style-type: none"> <li>• <i>Emergencies</i> may include but not limited to:</li> </ul>	<ul style="list-style-type: none"> <li>• Tube failure</li> <li>• Loss of water level</li> <li>• Power failure</li> <li>• Inadequate housekeeping</li> <li>• Explosion</li> <li>• Fire</li> <li>• Personal accidents</li> <li>• Chemical spills</li> <li>• Major steam leaks</li> <li>• Major water leaks and flooding</li> <li>• Natural disasters</li> <li>• Oil spills</li> <li>• Fans and pumps failure</li> </ul>



Variable	Range
<ul style="list-style-type: none"> <li>• <i>Appropriate emergency response</i> may include but not limited to:</li> </ul>	<ul style="list-style-type: none"> <li>• Identification of emergency</li> <li>• Isolation of heat source</li> <li>• Selection and application of appropriate fire-fighting equipment and PPE</li> <li>• Notification of downstream users</li> <li>• Operation of boiler only when safe to do so</li> <li>• Notification of appropriate regulatory authorities</li> </ul>
<ul style="list-style-type: none"> <li>• <i>Shutdown</i> may include but not limited to:</li> </ul>	<ul style="list-style-type: none"> <li>• Checks of water level</li> <li>• Cooling down process</li> <li>• Valve settings</li> <li>• Equipment isolation</li> <li>• Boiler pressure/vacuum</li> <li>• Fuel/heat source isolation in accordance with manufacturer recommendations</li> <li>• Boiler post-purge</li> </ul>

## REQUIRED KNOWLEDGE SKILLS

This section describes the skills and knowledge required for this unit of competency

### Required Knowledge

The trainee needs to demonstrate knowledge of:

- Occupational Safety and Health Act of Kenya laws 2007 with focus on personal safety, equipment safety and workplace
- Types of boiler
- Boiler auxiliaries and mountings
- Preventative Basic maintenance
- Steam generation process
- Fuels
- Start-up and shut-down procedure of the boiler
- Work planning
- Monitoring operations
- Report writing
- Industrial boiler Basic maintenance

### Required Skills

The trainee needs to demonstrate the following fundamental skills

- Communication skills
- Numeracy skills
- Digital literacy skills
- Monitoring skills
- First Aid

- Listening skills
- Observation skills
- Report writing

## EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical Aspects of Competency	<ul style="list-style-type: none"> <li>1.1 Observed safety at workplace</li> <li>1.2 Prepared industrial boiler operations work plan</li> <li>1.3 Started industrial boiler as per SOPs</li> <li>1.4 Operated Industrial boiler</li> <li>1.5 Monitored industrial boiler</li> <li>1.6 Shut down industrial boiler</li> <li>1.7 Conducted routine basic maintenance</li> <li>1.8 Conducted Preventative/ Condition-based maintenance</li> <li>1.9 Generated records on industrial boiler template</li> </ul>
2. Resource Implications	<ul style="list-style-type: none"> <li>2.1 Boiler/model boiler</li> <li>2.2 Boiler manuals</li> <li>2.3 OSHA</li> <li>2.4 Workshop Equipment and tools</li> </ul>
3. Methods of Assessment	<p>Competency may be assessed through:</p> <ul style="list-style-type: none"> <li>3.1 Observation</li> <li>3.2 Written</li> <li>3.3 Oral</li> <li>3.4 Inspection of log books</li> </ul>
4. Context of Assessment	Competency may be assessed in the actual workplace or at accredited institution
5. Guidance information for Assessment	Holistic assessment of other units relevant to the industry sector, workplace and job role is recommended