

MAINTAIN INDUSTRIAL BOILERS

UNIT CODE: ENG/OS/IPO/CR/01/5/A

UNIT DESCRIPTION

This unit covers competencies required to maintaining industrial boilers. It involves applying industrial boiler maintenance safety procedures, conducting routine/preventative industrial boiler maintenance, troubleshooting equipment/component faults, conducting industrial boiler maintenance-commissioning industrial boiler operations and preparing industrial boiler maintenance report.

ELEMENTS AND PERFORMANCE CRITERIA

Element These describe the key outcomes which make up workplace function.	Performance Criteria These are assessable statements which specify the required level of performance for each of the elements. <i>Bold and italicized terms are elaborated in the Range</i>
1. Apply Industrial boiler maintenance safety Procedures	1.1 Personal safety gear is prescribed observed as per rules and regulations of the <i>Occupational Safety Act</i> 1.2 Safety measures for the operation of the boiler are prescribed as the rules and regulations of the <i>Occupational Safety Act</i> 1.3 Work environment safety is adhered to as per the <i>Occupational Safety Act</i> 1.4 Industrial boiler alarm systems are tested for functionality as per SOPs
2. Conduct routine/preventative industrial boiler maintenance	2.1 Water gauges are checked according to manufacturer's specifications 2.2 Water gauges are cleaned according to manufacturer's recommendations 2.3 Piping and float chamber are clean according to SOPs 2.4 Fuel cut-off feature is tested according to manufacturer specifications 2.5 Water treatment system is checked according to manufacturer instruction 2.6 Condensate recovery system is checked according to manufacturer recommendations 2.7 Corrosion and leakages are checked according to manufacturer recommendations 2.8 Stack gauge temperature is checked according manufacturer instructions 2.9 Analysis of air to fuel ratio is done according to manufacturer recommendations

Element These describe the key outcomes which make up workplace function.	Performance Criteria These are assessable statements which specify the required level of performance for each of the elements. <i>Bold and italicized terms are elaborated in the Range</i>
	2.10 Heat transfer surfaces are cleaned according to manufacturer recommendations 2.11 Economizer is checked and maintained according to manufacturer recommendations
3. Troubleshoot equipment/ component faults	3.1 Boiler is troubleshot for no heat and poor heat according to manufacturer instructions 3.2 Boiler is checked for frozen condensate pipes according to manufacturer instructions 3.3 Boiler is checked for strange noises according to manufacturer instructions 3.4 Boiler is troubleshot for the causes of water leakages according to manufacturer instructions
4. Conduct industrial boiler maintenance	4.1 Logs charts, daily check charts and boiler reports are implemented 4.2 Meantime to repair time is adhered to as per laid down procedures and standards 4.3 Faulty boiler auxiliary/ component isolated and overhauled for service 4.4 Inventory of spares records are updated and maintained according to SOPs 4.5 Lubrication levels for moving parts are checked and addressed as per SOPs 4.6 All manholes are closed properly as per the SOPs 4.7 Return plant to required operational status upon completion of test
5. Re-commissioning industrial boiler Operations	5.1 The laid down start-up procedures are followed depending on the status of the boilers, either warm or cold start-up as per manufacturer's specification 5.2 Industrial boiler is tested for functionality as per manufacturer's specification 5.3 The industrial boiler is re-commissioned for operation

Element	Performance Criteria
These describe the key outcomes which make up workplace function.	These are assessable statements which specify the required level of performance for each of the elements. <i>Bold and italicized terms are elaborated in the Range</i>
6. Prepare Industrial boiler maintenance report	6.1 Standard maintenance procedures are followed as recorded in maintenance manuals 6.2 Maintenance scheduling is documented according to manufacturer specifications 6.3 Maintenance report is developed and stored as per workplace procedure

RANGE

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

Variable	Range
<ul style="list-style-type: none"> • <i>Occupational Safety and Health Act 2007</i> may include but not limited to: 	<ul style="list-style-type: none"> • Personal safety equipment • Responsibility of the employee • Responsibility of the employer • Work area safety • Work area hazards • Accident reporting procedure
<ul style="list-style-type: none"> • <i>Boiler</i> may include but not limited to: 	<ul style="list-style-type: none"> • 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.
<ul style="list-style-type: none"> • <i>Types of boiler</i> may include but not limited to: 	<ul style="list-style-type: none"> • Fire tube boilers • Water tube boilers • Once through boilers • Waste heat boilers • Ly heated boilers
<ul style="list-style-type: none"> • <i>Hazards</i> may include but not limited to: 	<ul style="list-style-type: none"> • Asbestos lagging • Chemical hazards • Thermal hazards • Manual handling hazards

Variable	Range
	<ul style="list-style-type: none"> • Machinery guard requirements □ • Hot exposed steam pipe □ • Leakage of steam • Leakage of fuel • Odour of gas • Fumes from a liquid chemical spill • Faulty/broken ladder or hand rail • Working at heights • Flammable liquids • Fire and explosion • Hazards • Work area, including: <ul style="list-style-type: none"> ▪ Illumination ▪ Excessive noise from machinery ▪ Spillage of oil ▪ Rubbish and combustibles ▪ Obstruction
<ul style="list-style-type: none"> • <i>Risk control methods</i> may include but not limited to: 	<ul style="list-style-type: none"> • Risk control methods refer to the systematic process of eliminating or reducing the risk to personnel and property through the application of controls. • It includes the application of the hierarchy of control: <ul style="list-style-type: none"> • Elimination • Substitution • Isolation • Engineering controls • Administrative controls • Personal protective equipment (PPE)
<ul style="list-style-type: none"> • <i>Appropriate standards</i> may include but not limited to: 	<ul style="list-style-type: none"> • Legislation • Codes of practice • Manufacturer specifications • Technical standards (International) • Industry standards (where applicable)
<ul style="list-style-type: none"> • <i>Procedures</i> may include but not limited to: 	<ul style="list-style-type: none"> • Manufacturer guidelines (e.g. Instructions, specifications or checklists) • Industry operating procedures • Workplace procedures (e.g. Work instructions, operating procedures or checklists)

Variable	Range
<ul style="list-style-type: none"> • <i>Equipment</i> may include but not limited to: 	<ul style="list-style-type: none"> • Gas monitoring equipment • Water testing equipment • Fire-fighting equipment • Workplace first aid equipment • Work platform and associated gear, including walkways • Temperature monitoring equipment
<ul style="list-style-type: none"> • <i>Communication methods</i> may include but not limited to: 	<ul style="list-style-type: none"> • Verbal and non-verbal language written instructions signage • Hand signals • Listening • Questioning to confirm understanding • Appropriate worksite protocol
<ul style="list-style-type: none"> • <i>Appropriate/Relevant personnel</i> may include but not limited to: 	<ul style="list-style-type: none"> • Production personnel • Maintenance personnel • Supervisors and managers • Boiler operators • Suppliers • Colleagues
<ul style="list-style-type: none"> • <i>Records</i> may include but not limited to: 	<ul style="list-style-type: none"> • Operating log books • Maintenance records • Records of faults and potential faults • Isolation procedures • Safe operating procedures • Daily operating inspections • Repairs carried out according to manufacturer recommendations and operating procedures • Workplace record keeping requirements • Details of any daily or periodic maintenance work • Details of yearly programmed or additional maintenance work
<ul style="list-style-type: none"> • <i>Risk control measures</i> may include but not limited to: 	<ul style="list-style-type: none"> • Barricades and controls • Machine guarding • Fall prevention • Pedestrian controls • Adequate illumination • Noise controls • Signage

Variable	Range
	<ul style="list-style-type: none"> • PPE
<ul style="list-style-type: none"> • <i>Personal Protective Equipment (PPE)</i> may include but not limited to: 	<ul style="list-style-type: none"> • Thermally insulated gloves • Helmet • Ear protection (muffs or plugs) • Chemical resistant gloves and apron • Respiratory devices eye protection • Working protective gloves • Whole body fire-resistant clothing • Safety boots
<ul style="list-style-type: none"> • <i>Communication equipment</i> may include but not limited to: 	<ul style="list-style-type: none"> • Two-way radios • Mobile phones • Intercoms • Satellite phones • Local Area Networks
<ul style="list-style-type: none"> • <i>Maintenance</i> may include but not limited to: 	<ul style="list-style-type: none"> • Leaking steam pipe • Pressure gauge accuracy • Exposed wiring • Defective illumination in the workplace • Leaking fuel pump gland • Leaks in high pressure feed line • Leaking gauge glass mounting • Leaking safety valve • Isolation procedures, hardware and equipment
<ul style="list-style-type: none"> • <i>Faults</i> may include but not limited to: 	<ul style="list-style-type: none"> • Abnormal operating conditions • Boiler tube failure • Feedwater supply and/or other major auxiliary loss • Wet steam • High dissolved oxygen • Ph of water • High conductivity • Actuator or valve mechanical or fault/failure • Instruments failure • Steam leak • Insulation failure • Draft failure

Variable	Range
<ul style="list-style-type: none"> • <i>Diagnose</i> may include but not limited to: 	<ul style="list-style-type: none"> • Senses, including: <ul style="list-style-type: none"> ▪ Audio ▪ Smell ▪ Touch ▪ Visual • Remote or local indicators and recorders • Computers and alarms, including: <ul style="list-style-type: none"> ▪ Visible ▪ Audible
<ul style="list-style-type: none"> • <i>Operating logs</i> may include but not limited to: 	<ul style="list-style-type: none"> • Date and time of checking • Each check, examination and results • Printed and signed name of person who performed the checks • Date and time of any lockout or equipment malfunction • Results of tests on boiler or feed-water • Changes in operation
<ul style="list-style-type: none"> • <i>Valves and fittings</i> may include but not limited to: 	<ul style="list-style-type: none"> • Safety valves • Gauge glasses • Main Steam stop valve • Feedwater stop valve • Feed check valve • Blow-down valve • Steam side/line drain valves • Flame failure detection device • Water level controller • Boiler steam pressure gauge
<ul style="list-style-type: none"> • <i>Monitor</i> may include but not limited to: 	<ul style="list-style-type: none"> • Water supply system • Checks of steam reticulation line • Pressure usage and supply of steam • Quality of steam • Combustion/heat source system and management • Feedwater system • Fuel system • Combustion air supply • Water level • Boiler steam pressure • Boiler and steam manifold valves (where fitted)

Variable	Range
	<ul style="list-style-type: none"> • Soot blowers (where fitted) • Operation of control/safety devices, including control panels
<ul style="list-style-type: none"> • <i>Tests</i> may include but not limited to: 	<ul style="list-style-type: none"> • Response checks • Standby plant 'cut in' tests • Instruments tests • Valve operating checks • Hydrostatic tests • Performance tests • Alarm and protection test • Ph levels • Conductivity • Oxygen • Total dissolved solids (TDS) • Water hardness • Other contaminants
<ul style="list-style-type: none"> • <i>Chemicals</i> may include but not limited to: 	<ul style="list-style-type: none"> • Oxygen scavenger • Feedwater additives • Other chemicals
<ul style="list-style-type: none"> • <i>Handover</i> may include but not limited to: 	<ul style="list-style-type: none"> • Previous load requirements • Maintenance issue, including equipment isolated for maintenance • Operational incidences • Read operating log • General inspection of boiler to detect any defects • Accept responsibility of boiler noted defects • Required equipment tests
<ul style="list-style-type: none"> • <i>Emergencies</i> may include but not limited to: 	<ul style="list-style-type: none"> • Tube failure • Loss of water level • Power failure • Inadequate housekeeping • Explosion • Fire • Personal accidents • Chemical spills • Major steam leaks • Major water leaks and flooding

Variable	Range
	<ul style="list-style-type: none"> • Natural disasters • Oil spills • Fans and pumps failure
<ul style="list-style-type: none"> • <i>Appropriate emergency response</i> may include but not limited to: 	<ul style="list-style-type: none"> • Identification of emergency • Isolation of heat source • Selection and application of appropriate fire-fighting equipment and PPE • Notification of downstream users • Operation of boiler only when safe to do so • Notification of appropriate regulatory authorities
<ul style="list-style-type: none"> • <i>Storage mode</i> may include but not limited to: 	<ul style="list-style-type: none"> • Wet and dry storing • Open or closed position

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 maintenance
- Steam generation process
- Fuels
- Start-up and shut-down procedure of the boiler
- First Aid

Required Skills

The trainee needs to demonstrate the following fundamental skills

- Communication skills
- Numeracy skills
- Digital literacy skills
- Occupational health safety and
- Environmental Literacy
- Employability skills
- Entrepreneurship skills

Practices

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	1.1 Observed safety at workplace 1.2 Identified different types of boiler 1.3 Conducted routine maintenance 1.4 Conducted Preventative/ Condition-based maintenance
2. Resource Implications	2.1 Boiler/model boiler 2.2 Boiler manuals 2.3 OSHA 2.4 Workshop tools
3. Methods of Assessment	Competency may be assessed through: 3.1 Observed behavior of the candidate 3.2 Inspection of written operation procedures 3.3 Inspection of log books
4. Context of Assessment	Competency will be assessed individually in the actual workplace or through accredited institution
5. Guidance information for Assessment	Holistic assessment of other units relevant to the industry sector, workplace and job role is recommended