



Competency Based Curriculum (CBC)

Boiler Operation and Maintenance

Level-4

Light Engineering Sector

Curriculum Code: CBC-LE-BOM-L4-EN-V1



**National Skills Development Authority
Chief Adviser's Office
Government of the People's Republic of Bangladesh**

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The curriculum is designed based on NSDA approved **Boiler Operation and Maintenance, Level – 4**, Occupation Competency Standards. It covers the information required to implement the **Boiler Operation and Maintenance, Level - 4** standard. It is an important supporting document for trainers, assessors and curriculum developers.

This document has been developed by NSDA with the support of ISC representatives'/industry representatives from relevant sectors, academia, curriculum specialists, expert trainers and professionals.

All Government-Private-NGO training institutes of the country recognized by NSDA can use this curriculum to implement skill-based training of **Boiler Operation and Maintenance, Level –4** course.

Introduction

The importance of skill-based training in socio-economic development of the country is immense. Demand oriented training is an important area for increasing productivity, creating employment and alleviating poverty. Skill development training institutes established at public and private level in Bangladesh are providing skill development training commercially. It is important to have uniform training curriculum based on occupation to improve and harmonize the overall quality of training conducted in all these training institutions. NSDA as provided in the National Skill Development Authority Act, 2018 is formulating uniform curriculum for training programs conducted across the country in various occupations/trades.

Competency standards for various occupations (level based) are being formulated by NSDA with the aim of creating skilled manpower as per the demand of domestic and international labor market.

Skilled and trained trainers are essential for providing training and assessment according to competency standards. For this purpose, the curriculum of **Boiler Operation and Maintenance, Level -4** has been formulated through an expert committee consisting of ISC/Industry representatives from respective sectors, academia, curriculum specialists, expert trainers and professionals. This curriculum includes essential course design, course structure, course delivery methods, equipment and facilities inventory, and physical facilities. Apart from this, the assessment criteria of trainees, assessment procedure, qualification level and certification process have been inserted.

This curriculum is an NSDA-approved document that describes the overall contents of the training implementation of **Boiler Operation and Maintenance, Level -4** as per industry demand-based competency standards. The trainees of **Boiler Operation and Maintenance, Level -4** course can develop themselves as skilled and qualified **Senior Boiler Operator** by following properly.

Competency Based Learning Materials (CBLM) and Assessment tools are developed following this document. Assessment and certification of trainees will also follow this curriculum.

List of Abbreviations

CS	Competency Standard
ISC	Industry Skills Council
NSDA	National Skills Development Authority
BNQF	Bangladesh National Qualifications Framework
OSH	Occupational Safety and Health
PPE	Personal Protective Equipment
SCVC	Standards and Curriculum Validation Committee
STP	Skills Training Provider
SOP	Standard Operating Procedure
UoC	Unit of Competency
ISO	International Organization for Standardization
OSH	Occupational Safety and Health
PPE	Personal Protective Equipment
SOP	Standard Operating Procedures

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Course Design

Name of Course: Boiler Operation and Maintenance

Skill Level : National Skills Certificate(NSC)-4

Nominal Hours : 270 Hours

List of Unit of Competency

Generic Unit of Competency

1. Lead Small Team
2. Apply Critical Thinking and Problem-Solving Techniques in the Workplace

Sector Specific Unit of Competency

Occupation Specific Unit of Competency

3. Ensure Workplace Safety, Health, and Environmental Practices
4. Apply Safety and Legislation
5. Perform measurement and calculation of boiler parameters
6. Maintain Steam distribution system
7. Ensure energy efficiency and conservation of boiler system
8. Maintain Boiler operational conditions
9. Perform maintenance of boiler

Description of Course

It is a skill-based training course designed to develop the knowledge, skills and workplace attitude required for the Boiler Operation and Maintenance in Light Engineering Sector. The curriculum covers various skills such as lead small team, apply critical thinking and problem-solving techniques in the workplace, ensure workplace safety, health, and environmental practices, apply safety and legislation, perform measurement and calculation of boiler parameters, maintain steam distribution system, ensure energy efficiency and conservation of boiler system, maintain boiler operational conditions and perform maintenance of boiler

Learning Outcome of the Course

Successful completion of this course will lead to certification in **Boiler Operation and Maintenance**, Level-3 under the Bangladesh National Qualification Framework (BNQF). Also, the course has the following functional, economic, and social learning outcomes.

Work Oriented Learning Outcome

1. Can work effectively as a **Senior Boiler Operator**
2. Occupational Safety and Health Regulations (OSH) may apply

Financial Learning Outcome

1. Job opportunities will be created as **Senior Boiler Operator** in country and abroad.
2. Can contribute to socio-economic development by participating in skill development activities

Social Learning Outcome

1. Social status will increase by achieving personal development
2. The share of skilled human resources will increase in line with changing technology
3. The number of skilled and trained **Senior Boiler Operator** will increase in the society

Course Structure

Generic Unit of Competency – 35 Hrs.

Sl. No.	Unit of Competency	Module Title	Learning Outcome	Nominal Hours
1	Lead Small Team	Leading Small Team	<ol style="list-style-type: none">1. Provide team leadership2. Assign responsibilities3. Set performance expectations for team members4. Supervise team performance	20
2	Apply Critical Thinking and Problem-Solving Techniques in the Workplace	Applying Critical Thinking and Problem-Solving Techniques in the Workplace	<ol style="list-style-type: none">1. Examine specific workplace challenges2. Analyze the cause of specific workplace challenges3. Formulate resolutions to specific workplace challenges4. Implement action plans and communicate results	15
Total Hours				35

Sector Specific Unit of Competency – 00 Hrs.

Occupation Specific Unit of Competency–235 Hours

Sl. No.	Unit of Competency	Module Title	Learning Outcome	Nominal Hours
1.	Ensure Workplace Safety, Health, and Environmental Practices	Ensuring Workplace Safety, Health, and Environmental Practices	<ol style="list-style-type: none"> 1. Identify workplace hazards 2. Follow workplace safety practices 3. Maintain environmental safety 4. Respond to workplace incidents 	20
2.	Apply Safety and Legislation	Applying Safety and Legislation	<ol style="list-style-type: none"> 1. Apply boiler act 2. Apply boiler related rules, regulations and codes 	10
3.	Perform measurement and calculation of boiler parameters	Performing measurement and calculation of boiler parameters	<ol style="list-style-type: none"> 1. Identify measurable parameters 2. Identify measuring instruments 3. Measure boiler parameters 4. Perform Unit conversion 5. Keep Record 	20
4.	Maintain Steam distribution system	Maintaining Steam distribution system	<ol style="list-style-type: none"> 1. Maintain insulation of the steam line 2. Identify pipe material & sizing 3. Remove of Condensate from steam line 4. Identify steam line leakages 	40
5	Ensure energy efficiency and conservation of boiler system	Ensuring energy efficiency and conservation of boiler system	<ol style="list-style-type: none"> 1 Operate Economizer 2 Interpret superheater 3 Condensate and flash steam recovery system 4 Waste heat recovery boiler / exhaust gas boiler 5 Optimize energy efficiency related parameters 	40
6	Maintain Boiler operational conditions	Maintaining Boiler operational conditions	<ol style="list-style-type: none"> 1 Monitor Blowdown operation 2 Maintain operating pressure 3 Monitor combustion conditions 	40
7	Perform maintenance boiler	Performing maintenance boiler	<ol style="list-style-type: none"> 1 Prepare for Boiler maintenance 2 Maintain pressure parts 3 Maintain burner 4 Maintain fuel system 5 Maintain valves and fittings 6 Maintain boiler at shutdown condition 	65
Total Hours				235

Analysis of Competency

Generic Unit of Competency	Number of Module
1. Lead Small Team	01
2. Apply Critical Thinking and Problem-Solving Techniques in the Workplace	01
Sector Specific Unit of Competency	
Occupation Specific Unit of Competency	
1. Ensure Workplace Safety, Health, and Environmental Practices	01
2. Apply Safety and Legislation	01
3. Perform measurement and calculation of boiler parameters	01
4. Maintain Steam distribution system	01
5. Ensure energy efficiency and conservation of boiler system	01
6. Maintain Boiler operational conditions	01
7. Perform maintenance of boiler	01
Total	09

Course Delivery

1. Face to Face
2. Self Paced Learning
3. On the job
4. Off the job
5. Blended

Course Training Method

A variety of methods can be applied to course training depending on the students' learning interests and abilities. Instructors should select appropriate methods to train students. Some of the common methods used during skills training are:

1. Lecture
2. Presentation
3. Discussion
4. Demonstration
5. Guided Practice
6. Individual Practice
7. Project Work
8. Problem Solving
9. Brainstorming

Module of Instruction

- Generic
- Sector Specific and
- Occupation Specific

Generic Modules

Unit of Competency	Lead Small Team
Unit Code	GU-11-L4-V1
Module Title	Leading small team
Module Descriptor	This module covers the knowledge, skills and attitudes required to lead small team It specifically includes the task of providing team leadership, assigning responsibilities, setting performance expectations for team members and supervising team performance
Nominal Hours	20 Hours
Lerning Outcome	After completing the practice of the module, the trainees will be able to perform the following jobs: <ol style="list-style-type: none"> 1. Provide team leadership 2. Assign responsibilities 3. Set performance expectations for team members 4. Supervise team performance

Learning Outcome -1: Provide team leadership	
Assessment Criteria	<ol style="list-style-type: none"> 1. Work requirements are identified and presented to team members 2. Reasons for instructions and requirements are communicated to team members 3. Team members' queries and concerns are recognized, discussed and dealt with
Conditions and Resources	<ul style="list-style-type: none"> • Workplace or Simulated Workplace • Work requirements • Team members' queries and concerns • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	<ol style="list-style-type: none"> 1. Work requirements <ol style="list-style-type: none"> 1.1 Client Profile 1.2 Assignment instructions 2. Team members' queries and concerns <ol style="list-style-type: none"> 2.1 Roster 2.2 Shift details.
Job/ Task/ Activity	<ol style="list-style-type: none"> 1. Identify work requirements 2. Identify team members' queries and concerns

Training Method	<ul style="list-style-type: none"> • Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	<ol style="list-style-type: none"> 1. Written Test 2. Demonstration 3. Oral questioning 4. Portfolio

Learning Outcome -2: Assign responsibilities	
Assessment Criteria	<ol style="list-style-type: none"> 1. Duties, and responsibilities are allocated having regard to the skills, knowledge and attitudes required to properly undertake the assigned task 2. Duties are allocated having regard to individual preference, domestic and personal considerations, whenever possible.
Conditions and Resources	<ul style="list-style-type: none"> • Workplace or Simulated Workplace • Duties, and responsibilities of team members regarding assigned task; • Workplace staff regulation • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	<ol style="list-style-type: none"> 1. Duties, and responsibilities of team members regarding assigned tasks;
Job/ Task/ Activity	<ol style="list-style-type: none"> 1. Perform duties and responsibilities to properly undertake the assigned tasks
Training Method	<ol style="list-style-type: none"> 1. Discussion 2. Presentation 3. Demonstration 4. Guided Practice 5. Individual Practice 6. Project Work 7. Problem Solving 8. Brainstorming

Assessment Method	<ol style="list-style-type: none"> 1. Written Test 2. Demonstration 3. Oral questioning 4. Portfolio
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Learning Outcome -3: Set performance expectations for team members	
Assessment Criteria	<ol style="list-style-type: none"> 1. Performance expectations are established based on client needs and according to assignment requirements 2. Performance expectations are based on individual team members' duties and area of responsibility 3. Performance expectations are discussed and directed to implement in the workplace
Conditions and Resources	<ul style="list-style-type: none"> • Workplace or Simulated Workplace • Performance expectations • CBLM • Handout • Paper, Pen, Pencil, • Internet Facilities • White Board and marker
Contents	<ol style="list-style-type: none"> 1. Performance expectations <ol style="list-style-type: none"> 1.1 Based on client needs 1.2 Based on individual team members' duties and area of responsibility 1.3 Discussed and directed to implement in the workplace
Job/ Task/ Activity	<ol style="list-style-type: none"> 1. Identify performance expectations based on client need and individual team members' duties and area of responsibility
Training Method	<ul style="list-style-type: none"> • Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	<ol style="list-style-type: none"> 1. Written Test 2. Demonstration 3. Oral questioning 4. Portfolio

Learning Outcome -4: Supervise team performance	
Assessment Criteria	<ol style="list-style-type: none"> 1. Monitoring of performance are taken place against defined performance criteria and / or assignment instructions and corrective action taken if required 2. Team members are provided feedback, positive support and advice on strategies to overcome any deficiencies 3. Performance issues which cannot be rectified or addressed within the team are referenced to appropriate personnel 4. Team members are kept informed of any changes in the priority allocated to assignments or tasks which might impact on clients' / customers' needs and satisfaction 5. Team operations are monitored to ensure that employer / client needs and requirements are met 6. Follow-up communication is provided on all issues affecting the team 7. All relevant documentation is completed
Conditions and Resources	<ul style="list-style-type: none"> • Workplace or Simulated Workplace • Supervision procedure • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker
Contents	<ol style="list-style-type: none"> 1. Monitoring of performance <ol style="list-style-type: none"> 1.1 Formal process 1.2 Informal process 2. Team members provided feedback <ol style="list-style-type: none"> 2.1 Formal process 2.2 Informal process 2.3 Sandwich process 3. Performance issues <ol style="list-style-type: none"> 3.1 Work output 3.2 Work quality 3.3 Team participation 3.4 Compliance with workplace protocols 3.5 Safety 3.6 Customer service
Job/ Task/ Activity	<ol style="list-style-type: none"> 1. Demonstate: <ol style="list-style-type: none"> 1.1 monitoring of performance is taken place against defined performance criteria 1.2 providing feedback to team member 1.3 monitoring team operations 1.4 follow-up team activities

Training Method	<ul style="list-style-type: none"> • Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	<ol style="list-style-type: none"> 1. Written Test 2. Demonstration 3. Oral questioning 4. Portfolio

Unit of Competency	Apply Critical Thinking and Problem-Solving Techniques in the Workplace
Unit Code	GU-23-L4-V1
Module Title	Applying critical thinking and problem-solving techniques in the workplace
Module Description	This unit covers the knowledge, skills and attitudes required to apply critical thinking and problem-solving techniques in the Workplace. It specifically includes the tasks of examining specific workplace challenges, analyzing the cause of specific workplace challenges, formulating resolutions to specific workplace challenges and implementing action plans and communicate results.
Nominal Hours	15 Hours
Learning Outcome	Upon completion of this module, the learners will be able to: LO 1. Examine specific workplace challenges LO 2. Analyze the cause of specific workplace challenges LO 3. Formulate resolutions to specific workplace challenges LO 4. Implement action plans and communicate results

Learning Outcome 1. Examine specific workplace challenges

Assessment Criteria	<ol style="list-style-type: none"> 1. Variances are examined from normal operating parameters and product quality. 2. Extent, cause and nature of the specific problem are defined through observation, investigation and analytical techniques. 3. Problems are clearly stated and specified.
Condition and Resources	<ul style="list-style-type: none"> • Actual workplace or training environment • CBLM • Handouts • Paper, Pen, Pencil and Eraser • Whiteboard and Marker • Laptop/Desktop • Multimedia Projector • Internet Facilities
Content	<ol style="list-style-type: none"> 1. Operating parameters: <ol style="list-style-type: none"> 1.1 Processes 1.2 Procedures 1.3 Systems 2. Problems: <ol style="list-style-type: none"> 2.1 Scattergrams 2.2 Routine, non-routine and complex workplace and quality problems 2.3 Equipment selection, availability and failure 2.4 Teamwork and work allocation problem

	<p>2.5 Safety and emergency situations and incidents</p> <p>2.6 Risk assessment and management</p> <p>3. Technique of examining variances from normal operating parameters and product quality</p> <p>4. Technique of identifying extent, cause and nature of the specific problem through observation, investigation and analytical techniques.</p>
Jobs/Activities	<p>1. Examine variances from normal operating parameters and product quality</p> <p>2. Identify extent, cause and nature of the specific problem through observation, investigation and analytical techniques</p>
Method of Training	<ul style="list-style-type: none"> • Blended • Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Methods of Assessment	<ul style="list-style-type: none"> • Written Test • Demonstration • Oral Questioning • Portfolio

Learning Outcome 2: Analyze the cause of specific workplace challenges

Assessment Criteria	<p>1. Possible causes of specific problems are identified based on experience and the use of problem-solving tools / analytical techniques.</p> <p>2. Possible cause statements are developed based on findings.</p> <p>3. Fundamental causes are identified per results of investigation conducted.</p>
Condition and resources	<ul style="list-style-type: none"> • Actual workplace or training environment • CBLM • Handouts • Paper, Pen, Pencil and Eraser • Whiteboard and Marker • Laptop/Desktop • Multimedia Projector • Internet Facilities
Content	<p>1. Analytical techniques.</p> <p>1.1 Brainstorming</p> <p>1.2 Intuitions/logic</p> <p>1.3 Cause and effect diagrams</p>

	1.4 Pareto analysis 1.5 SWOT analysis 1.6 Gant chart and graphs 2. Identifying technique of possible causes of specific problems 3. Solving technique of problems through experience and the use of problem-solving tools / analytical techniques.
Jobs/Activities	1. Identify possible causes of specific problems 2. Solve problems through experience and the use of problem-solving tools / analytical techniques
Method of Training	<ul style="list-style-type: none"> • Blended • Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Methods of Assessment	<ul style="list-style-type: none"> • Written Test • Demonstration • Oral Questioning • Portfolio

Learning Outcome 3: Formulate resolutions to specific workplace challenges

Assessment Criteria	<ol style="list-style-type: none"> 1. All possible options are considered for resolution of the problem. 2. Strengths and weaknesses of possible options are considered. 3. Corrective actions are determined to resolve the problem and possible future causes.
Condition and Resources	<ul style="list-style-type: none"> • Actual workplace or training environment • CBLM • Handouts • Paper, Pen, Pencil and Eraser • Whiteboard and Marker • Laptop/Desktop • Multimedia Projector • Internet Facilities
Content	<ol style="list-style-type: none"> 1. All possible options for resolution any problem 2. Considering strengths and weaknesses of possible options 3. Corrective actions for resolve the problem and possible future causes.
Jobs/Activities	<ol style="list-style-type: none"> 1. At first identify a problem then determine: <ol style="list-style-type: none"> 1.1 all possible options for resolution the problem 1.2 considering strengths and weaknesses of possible options 1.3 corrective actions for resolve the problem and possible future causes.
Method of Training	<ul style="list-style-type: none"> • Blended • Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Methods of Assessment	<ul style="list-style-type: none"> • Written Test • Demonstration • Oral Questioning • Portfolio

Learning Outcome 4: Implement action plans and communicate results

Assessment Criteria	<ol style="list-style-type: none"> 1. Action plans are implemented and evaluated. 2. Results of plan implementation and recommendations are prepared. 3. Recommendations are presented to appropriate personnel. 4. Recommendations are followed-up as required
Condition and Resources	<ul style="list-style-type: none"> • Actual workplace or training environment • CBLM • Handouts • Paper, Pen, Pencil and Eraser • Whiteboard and Marker • Laptop/Desktop • Multimedia Projector • Internet Facilities
Content	<ol style="list-style-type: none"> 1. Action plan <ol style="list-style-type: none"> 1.1 Priority requirements 1.2 Measurables objectives 1.3 Resource requirements 1.4 Timelines 1.5 Co-ordination and feedback requirements 1.6 Safety requirements 1.7 Risk assessment 1.8 Environment requirements 2. Action plan implementation technique 3. Technique of preparing results of plan implementation and recommendation
Jobs/Activities	<ol style="list-style-type: none"> 1. Select an action plan then: <ol style="list-style-type: none"> 1.1 Prepare action plan implementation technique 1.2 Prepare results of plan implementation and recommendation
Method of Training	<ul style="list-style-type: none"> • Blended • Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Methods of Assessment	<ul style="list-style-type: none"> • Written Test • Demonstration • Oral Questioning • Portfolio

Sector Specific Module

Occupation Specific Module

Unit of Competency	Ensure Workplace Safety, Health, and Environmental Practices
Unit Code	OU-LE-BOM-01-L4-V1
Module Title	Ensuring workplace safety, health, and environmental practices
Module Descriptor	This unit covers the knowledge, skills and attitudes required to ensure workplace safety, health, and environmental practices It includes the task of identifying workplace hazards, following workplace safety practices, maintaining environmental safety and responding to workplace incidents
Nominal Hours	20 Hours
Learning Outcome	After completing the practice of the module, the trainees will be able to perform the following jobs: <ol style="list-style-type: none"> 1. Identify workplace hazards 2. Follow workplace safety practices 3. Maintain environmental safety 4. Respond to workplace incidents

Learning Outcome -1: Identify workplace hazards	
Assessment Criteria	<ol style="list-style-type: none"> 2. Workplace hazards are identified in accordance with standard procedures. 3. Risk assessments are conducted following organizational protocols.
Conditions and Resources	<ul style="list-style-type: none"> • Workplace or Simulated Workplace • Boiler • CBLM • Handout • Paper, Pen, Pencil and Eraser • White Board and marker
Contents	<ol style="list-style-type: none"> 1. Workplace hazards <ol style="list-style-type: none"> 1.1 Physical 1.2 Chemical 1.3 Electrical 1.4 Fire 1.5 Ergonomic 1.6 Confined spaces 2. Risk assessments procedure
Job/ Task/ Activity	<ol style="list-style-type: none"> 2. Identify workplace hazards 3. Conduct risk assessment
Training Method	<ul style="list-style-type: none"> • Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	<ul style="list-style-type: none"> • Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -2: Follow workplace safety practices	
Assessment Criteria	<ol style="list-style-type: none"> 1. Safety protocols are adhered to as per workplace guidelines. 2. Emergency procedures are followed during incidents.
Conditions and Resources	<ul style="list-style-type: none"> • Workplace or Simulated Workplace • Boiler • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker
Contents	<ol style="list-style-type: none"> 1. Safety protocols <ol style="list-style-type: none"> 1.1 Hazard communication 1.2 Emergency drills 1.3 Lockout/tagout 1.4 Fire prevention 1.5 Boiler operational safety <ol style="list-style-type: none"> 1.5.1 Pressure cut-off switch 1.5.2 Safety valve 1.5.3 Water level control 1.5.4 Water level indicator 1.5.5 High temperature cut-off 1.5.6 Fusible plug 2. Emergency procedures <ol style="list-style-type: none"> 2.1 Evacuation plans 2.2 Fire suppression 2.3 Spill containment
Job/ Task/ Activity	<ol style="list-style-type: none"> 1. Demonstrate how we follow emergency procedures during incidents
Training Method	<ul style="list-style-type: none"> • Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	<ul style="list-style-type: none"> • Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -3: Maintain environmental safety	
Assessment Criteria	<ol style="list-style-type: none"> 1. Environmental risks are identified and controlled in compliance with regulations. 2. Waste and pollutants are managed and disposed of following environmental guidelines.
Conditions and Resources	<ul style="list-style-type: none"> • Workplace or Simulated Workplace • Boiler • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	<ol style="list-style-type: none"> 1. Environmental risks <ol style="list-style-type: none"> 1.1 Air and water pollution 1.2 Waste materials 1.3 Noise 1.4 Emissions 1.5 Safety valve 2. Environmental risks control procedure 3. Waste and pollutants dispose procedure of following environmental guidelines.
Job/ Task/ Activity	<ol style="list-style-type: none"> 1. Identify environmental risks. 2. Control environmental risks. 3. Dispose waste and pollutants as per environmental guidelines;
Training Method	<ul style="list-style-type: none"> • Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	<ul style="list-style-type: none"> • Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -4: Respond to workplace incidents	
Assessment Criteria	<ol style="list-style-type: none"> 1. Incidents are reported promptly and documented as per emergency procedures. 2. Corrective actions are taken to address safety and environmental breaches.
Conditions and Resources	<ul style="list-style-type: none"> • Workplace or Simulated Workplace • Boiler control panel board • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	<ol style="list-style-type: none"> 1. Corrective actions <ol style="list-style-type: none"> 1.1 Incident reporting 1.2 Hazard removal 1.3 Retraining 1.4 Process adjustment 2. Incidents reporting procedure
Job/ Task/ Activity	<ol style="list-style-type: none"> 1. List the corrective actions to address safety and environmental breaches. 2. Prepare a incidents report;
Training Method	<ul style="list-style-type: none"> • Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	<ul style="list-style-type: none"> • Written Test • Demonstration • Oral questioning • Portfolio

Unit of Competency	Apply Safety and Legislation
Unit Code	OU-LE-BOM-02-L4-V1
Module Title	Applying Safety and Legislation
Module Descriptor	This unit covers the knowledge, skills and attitudes required to apply safety and legislation It includes the tasks of follow applying boiler Act, boiler rules and boiler regulations/ code
Nominal Hours	10 Hours
Learning Outcome	After completing the practice of the module, the trainees will be able to perform the following jobs: <ul style="list-style-type: none"> 1. Apply boiler Act 2. Apply boiler rules 3. Apply boiler regulations/ code

Learning Outcome -1: Apply boiler Act	
Assessment Criteria	<ol style="list-style-type: none"> 1. Boiler Act is interpreted; 2. Boiler Act is applied;
Conditions and Resources	<ul style="list-style-type: none"> • Workplace or Simulated Workplace • Boiler Acts • CBLM • Handout • Paper, Pen, Pencil and Eraser • White Board and marker
Contents	1 Boiler Acts
Job/ Task/ Activity	1. Interpret Boiler Acts
Training Method	<ul style="list-style-type: none"> • Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	<ul style="list-style-type: none"> • Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -2: Apply boiler rules	
Assessment Criteria	<ol style="list-style-type: none"> 1. Boiler rules are interpreted; 2. Boiler rules are applied;
Conditions and Resources	<ul style="list-style-type: none"> • Workplace or Simulated Workplace • Boiler rules • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker
Contents	<ol style="list-style-type: none"> 1. Boiler rules
Job/ Task/ Activity	<ol style="list-style-type: none"> 1. Interpret boiler rules
Training Method	<ul style="list-style-type: none"> • Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	<ul style="list-style-type: none"> • Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -3: Apply boiler regulations/ code	
Assessment Criteria	<ol style="list-style-type: none"> 1. Boiler regulations are interpreted; 2. Boiler regulations are applied. 3. Relevant regulations / code is applied;
Conditions and Resources	<ul style="list-style-type: none"> • Workplace or Simulated Workplace • Boiler rules • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker
Contents	<ol style="list-style-type: none"> 1. Boiler regulations
Job/ Task/ Activity	<ol style="list-style-type: none"> 1. Interpret Boiler regulations
Training Method	<ul style="list-style-type: none"> • Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	<ul style="list-style-type: none"> • Written Test • Demonstration • Oral questioning • Portfolio

Unit of Competency	Perform measurement and calculation of boiler parameters
Unit Code	OU-LE-BOM-03-L4-V1
Module Title	Performing measurement and calculation of boiler parameters
Module Descriptor	This unit covers the knowledge, skills and attitudes required to Perform measurement and calculation of boiler parameters It includes the task of 1. Identify measurable parameters, identify measuring instruments, measure boiler parameters, perform unit conversion and keep record
Nominal Hours	20 Hours
Learning Outcome	After completing the practice of the module, the trainees will be able to perform the following jobs: <ol style="list-style-type: none"> 1. Identify measurable parameters 2. Identify measuring instruments 3. Measure boiler parameters 4. Perform Unit conversion 5. Keep Record

Learning Outcome -1: Identify measurable parameters	
Assessment Criteria	<ol style="list-style-type: none"> 1. Measurable parameters are selected 2. Measurable parameters are identified
Conditions and Resources	<ul style="list-style-type: none"> • Workplace or Simulated Workplace • Boiler parameters • CBLM • Handout • Paper, Pen, Pencil and Eraser • White Board and marker
Contents	<ol style="list-style-type: none"> 1. Measurable parameters <ol style="list-style-type: none"> 1.1 Fuel: <ol style="list-style-type: none"> 1.1.1 pressure, 1.1.2 temperature, 1.1.3 flowrate 1.2 Water: <ol style="list-style-type: none"> 1.2.1 pH, 1.2.2 TDS, 1.2.3 hardness, 1.2.4 conductivity, 1.2.5 salinity, 1.2.6 flowrate, 1.2.7 temperature. 1.3 Steam: <ol style="list-style-type: none"> 1.3.1 pressure, 1.3.2 temperature, 1.3.3 flowrate 1.4 Exhaust: <ol style="list-style-type: none"> 1.4.1 Temperature 1.4.2 O₂, CO₂, CO, NO_x, SO_x, Particulate Matters
Job/ Task/ Activity	<ol style="list-style-type: none"> 1 Select measurable parameters 2 Identify measurable parameters
Training Method	<ul style="list-style-type: none"> • Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	<ul style="list-style-type: none"> • Written Test • Demonstration

	<ul style="list-style-type: none"> • Oral questioning • Portfolio
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Learning Outcome -2: Identify measuring instruments	
Assessment Criteria	<ol style="list-style-type: none"> 1. Measuring instruments are listed. 2. Measuring instruments are identified. 3. Measuring instruments are used.
Conditions and Resources	<ul style="list-style-type: none"> • Workplace or Simulated Workplace • Measuring instruments • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	<ol style="list-style-type: none"> 1. Measuring instruments <ol style="list-style-type: none"> 1.1 Pressure gauge, 1.2 Temperature gauge, 1.3 Flow meter, 1.4 pH meter, 1.5 Hardness meter, 1.6 Conductivity meter, 1.7 TDS meter, 1.8 Infrared temperature meter, 1.9 Flue gas analyzer.
Job/ Task/ Activity	<ol style="list-style-type: none"> 1. Identify measuring instruments 2. Use measuring instruments
Training Method	<ul style="list-style-type: none"> • Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	<ul style="list-style-type: none"> • Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -3: Measure boiler parameters	
Assessment Criteria	<ol style="list-style-type: none"> 1. Parameters are measured by following SOP 2. Measurable parameters of boiler are recorded
Conditions and Resources	<ul style="list-style-type: none"> • Workplace or Simulated Workplace • Boiler parameters • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker
Contents	1.1 Measurable parameters of boiler as per SOP;
Job/ Task/ Activity	1. Measure and record boiler parameters
Training Method	<ul style="list-style-type: none"> • Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	<ul style="list-style-type: none"> • Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -4: Perform Unit conversion	
Assessment Criteria	<ol style="list-style-type: none"> 1. Units of measured parameters are identified. 2. Units are converted as per workplace requirements.
Conditions and Resources	<ul style="list-style-type: none"> • Workplace or Simulated Workplace • Measuring equipment • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	<ol style="list-style-type: none"> 1. Units <ol style="list-style-type: none"> 1.1 Pressure: <ol style="list-style-type: none"> 1.1.1 mbar, 1.1.2 bar, 1.1.3 kg/cm², 1.1.4 psi, 1.1.5 kpa, 1.1.6 Mpa 1.2 Temperature: <ol style="list-style-type: none"> 1.2.1 °C 1.2.2 °F 1.3 Flow rate: <ol style="list-style-type: none"> 1.3.1 kg/hour, 1.3.2 ton/hour, 1.3.3 lbs/hour, 1.3.4 liter/hour, 1.3.5 liter/minute, 1.3.6 Nm³/hour, 1.3.7 m³/hour 1.4 Energy: <ol style="list-style-type: none"> 1.4.1 kcal, 1.4.2 kJ, 1.4.3 Btu, 1.4.4 TOE, 1.4.5 kWh
Job/ Task/ Activity	<ol style="list-style-type: none"> 1. Convert different units;

Training Method	<ul style="list-style-type: none"> • Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	<ul style="list-style-type: none"> • Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -5: Keep Record	
Assessment Criteria	<ol style="list-style-type: none"> 1. Data record sheets are prepared. 2. Record sheets are filled with measured data.
Conditions and Resources	<ul style="list-style-type: none"> • Workplace or Simulated Workplace • Required data • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	<ol style="list-style-type: none"> 1. Procedure for prepare record sheets
Job/ Task/ Activity	<ol style="list-style-type: none"> 1. Prepare record sheet
Training Method	<ul style="list-style-type: none"> • Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	<ul style="list-style-type: none"> • Written Test • Demonstration • Oral questioning • Portfolio

Unit of Competency	Maintain Steam Distribution System
Unit Code	OU-LE-BOM-04-L4-V1
Module Title	Maintaining steam distribution system
Module Descriptor	This unit covers the knowledge, skills and attitudes required to Maintain Steam distribution system It includes the tasks of maintaining insulation of the steam distribution system, identifying pipe material and sizing, removing condensate from steam line and identifying steam line leakages
Nominal Hours	40 Hours
Learning Outcome	After completing the practice of the module, the trainees will be able to perform the following jobs: <ol style="list-style-type: none"> 1. Maintain insulation of the steam distribution system 2. Identify pipe material and sizing 3. Remove condensate from steam line 4. Identify steam line leakages

Learning Outcome -1: Maintain insulation of the steam distribution system	
Assessment Criteria	<ol style="list-style-type: none"> 1. Necessity of insulation for steam distribution system is identified. 2. Way of detection of insulation defects are identified. 3. Insulation defects of steam distribution system are identified. 4. Defective insulation is replaced / reported.
Conditions and Resources	<ul style="list-style-type: none"> • Workplace or Simulated Workplace • Distribution system • CBLM • Handout • Paper, Pen, Pencil and Eraser • White Board and marker
Contents	<ol style="list-style-type: none"> 1. Way of detection of insulation defects <ol style="list-style-type: none"> 1.1 Visual inspection 1.2 Thermal inspection 2. Insulation defects of steam distribution system <ol style="list-style-type: none"> 2.1 Insulation is missing 2.2 Integration of insulation is missing 2.3 Insulation is damaged 2.4 Lack of thickness of insulation
Job/ Task/ Activity	<ol style="list-style-type: none"> 1. Identify the way of detect insulation defects of steam distribution system 2. Identify insulation defects of steam distribution system
Training Method	<ul style="list-style-type: none"> • Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	<ul style="list-style-type: none"> • Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -2: Identify pipe material and sizing	
Assessment Criteria	<ol style="list-style-type: none"> 1. Pipe material is identified. 2. Pipe sizing is identified. 3. P&I diagram of steam distribution system is interpreted
Conditions and Resources	<ul style="list-style-type: none"> • Workplace or Simulated Workplace • Boiler steam distribution system • P&I diagram • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	<ol style="list-style-type: none"> 1. Pipe material 2. Pipe sizing 3. P&I diagram of steam distribution system
Job/ Task/ Activity	<ol style="list-style-type: none"> 1. Identify pipe material 2. Identify pipe size 3. Interpret P&I diagram of steam distribution system
Training Method	<ul style="list-style-type: none"> • Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	<ul style="list-style-type: none"> • Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -3: Remove condensate from steam line	
Assessment Criteria	<ol style="list-style-type: none"> 1. Condensate removal arrangement is interpreted. 2. Condensate removal arrangement in regular interval is ensured. 3. Steam trap modules are identified. 4. Steam trap modules are used for condensate removal. 5. Steam trap faults are identified.
Conditions and Resources	<ul style="list-style-type: none"> • Workplace or Simulated Workplace • Boiler steam distribution system • Steam trap modules • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	<ol style="list-style-type: none"> 1. Condensate removal arrangement 2. Steam trap modules 3. Steam trap faults
Job/ Task/ Activity	<ol style="list-style-type: none"> 1. Interpret condensate removal arrangement 2. Identify steam trap modules 3. Identify steam trap faults
Training Method	<ul style="list-style-type: none"> • Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	<ul style="list-style-type: none"> • Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -4: Identify steam line leakages	
Assessment Criteria	<ol style="list-style-type: none"> 1. Steam line leakages are identified. 2. Steam valve leakages are identified. 3. Steam line leakages are repaired / reported. 4. Steam valve leakages are repaired / reported.
Conditions and Resources	<ul style="list-style-type: none"> • Workplace or Simulated Workplace • Boiler steam distribution system • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	<ol style="list-style-type: none"> 1. Procedure of identify steam line and valve leakages 2. Repairing and reporting procedure of steam line and valve leakages.
Job/ Task/ Activity	<ol style="list-style-type: none"> 1. Identify steam line and valve leakages 2. Repair steam line and valve leakages. 3. Report steam line and valve leakages.
Training Method	<ul style="list-style-type: none"> • Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	<ul style="list-style-type: none"> • Written Test • Demonstration • Oral questioning • Portfolio

Unit of Competency	Ensure Energy Efficiency and Conservation of Boiler System
Unit Code	OU-LE-BOM-05-L4-V1
Module Title	Ensuring energy efficiency and conservation of boiler system
Module Descriptor	This unit covers the knowledge, skills and attitudes required to ensure energy efficiency and conservation of boiler system It includes the task of operating economizer, interpreting superheater, condensate and flash steam recovery system, operating waste heat recovery boiler / exhaust gas boiler and optimizing energy efficiency related parameters
Nominal Hours	40 Hours
Learning Outcome	After completing the practice of the module, the trainees will be able to perform the following jobs: <ol style="list-style-type: none"> 1. Operate Economizer 2. Interpret superheater 3. Interpret Condensate and flash steam recovery system 4. Operate Waste heat recovery boiler / exhaust gas boiler 5. Optimize energy efficiency related parameters

Learning Outcome -1: Operate Economizer	
Assessment Criteria	<ol style="list-style-type: none"> 1. The economizer is operated according to the manufacturer's instructions to maximize heat recovery. 2. Water and exhaust gas temperature are checked and adjusted as necessary. 3. Routine maintenance is conducted on the economizer components, including cleaning and inspecting. 4. Faults such as poor heat recovery, scaling, blockage and leakage tubes are identified / reported.
Conditions and Resources	<ul style="list-style-type: none"> • Workplace or Simulated Workplace • Boiler • PPE • Economizer • CBLM • Handout • Paper, Pen, Pencil and Eraser • White Board and marker
Contents	<ol style="list-style-type: none"> 1. Economizer operating procedure 2. Routine maintenance of economizer 3. General faults economizer <ol style="list-style-type: none"> 3.1 Poor heat recovery 3.2 Scaling 3.3 Blokage 3.4 Leakage tubes
Job/ Task/ Activity	<ol style="list-style-type: none"> 1. Operate economizer as per standard 2. Check and adjust water and exhaust gas temperature; 3. Perform routine maintenance of economizer 4. Identify economizer general faults 5. Prepare report on economizer general faults
Training Method	<ul style="list-style-type: none"> • Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	<ul style="list-style-type: none"> • Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -2: Interpret superheater	
Assessment Criteria	<ol style="list-style-type: none"> 1. Properties of saturated and superheated steam are interpreted. 2. Function of superheater is interpreted
Conditions and Resources	<ul style="list-style-type: none"> • Workplace or Simulated Workplace • Boiler superheater • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	<ol style="list-style-type: none"> 1. Properties of saturated and superheated steam 2. Function of superheater
Job/ Task/ Activity	<ol style="list-style-type: none"> 1. Interpret properties of saturated and superheated steam 2. Interpret function of superheater
Training Method	<ul style="list-style-type: none"> • Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	<ul style="list-style-type: none"> • Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -3: Interpret Condensate and flash steam recovery system	
Assessment Criteria	<ol style="list-style-type: none"> 1. Benefits of condensate and flash steam recovery system is interpreted. 2. Condensate and flash steam recovery system is identified as per standard. 3. Position of steam traps are identified for condensate and flash steam recovery system. 4. Routing of condensate recovery is identified. 5. Regular inspections are performed. 6. Blowdown heat recovery system is interpreted; 7. Feed water tank temperature is monitored;
Conditions and Resources	<ul style="list-style-type: none"> • Workplace or Simulated Workplace • Boiler • Condensate and flash steam recovery system • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	<ol style="list-style-type: none"> 1. Condensate and flash steam recovery system of boiler 2. Position of steam traps 3. Routing of condensate recovery 4. Blowdown heat recovery system
Job/ Task/ Activity	<ol style="list-style-type: none"> 1. Interpret condensate and flash steam recovery system 2. Identify condensate and flash steam recovery system; 3. Identify position of steam traps for condensate and flash steam recovery system; 4. Identify routing of condensate recovery 5. Interpret blowdown heat recovery system
Training Method	<ul style="list-style-type: none"> • Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	<ul style="list-style-type: none"> • Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -4: Operate waste heat recovery boiler / exhaust gas boiler	
Assessment Criteria	<ol style="list-style-type: none"> 1. Principles of energy recovery are interpreted. 2. Methods of waste heat utilization are identified. 3. System components are identified. 4. Functions of each component are interpreted. 5. System parameters are measured and adjusted. 6. Operational issues are identified and reported. 7. Technical documents are interpreted to understand system layout. 8. Start-up procedures are followed according to operational guidelines. 9. Safety systems are verified and confirmed. 10. Maintenance tasks are performed as per the preventive maintenance schedule. 11. System logs and records are maintained.
Conditions and Resources	<ul style="list-style-type: none"> • Workplace or Simulated Workplace • Boiler • Waste heat recovery boiler / exhaust gas of boiler • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	<ol style="list-style-type: none"> 1. Principles of energy recovery 2. Methods of waste heat utilization 3. System components and their fuction 4. System parameters 5. Technical documents of system layout 6. Start-up procedure 7. System preventive maintenance schedule 8. System log and records
Job/ Task/ Activity	<ol style="list-style-type: none"> 1. Interpret principles of energy recovery 2. Identify methods of waste heat utilization 3. Interpret system components and their fuction 4. Measure and adjust system parameters 5. Interpret technical documents of system layout 6. Perform system preventive maintenance schedule 7. Maitain system log and records

Training Method	<ul style="list-style-type: none"> • Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	<ul style="list-style-type: none"> • Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -5: Optimize energy efficiency related parameters	
Assessment Criteria	<ol style="list-style-type: none"> 1. Optimum exhaust gas temperature is maintained 2. Optimum boiler pressure is maintained 3. Excess air ratio is maintained as per standard. 4. Load factor is maintained as per Turn down ratio.
Conditions and Resources	<ul style="list-style-type: none"> • Workplace or Simulated Workplace • Boiler • Waste heat recovery boiler / exhaust gas of boiler • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	<ol style="list-style-type: none"> 1. Optimum exhaust gas temperature 2. Optimum boiler pressure 3. Load factor
Job/ Task/ Activity	<ol style="list-style-type: none"> 1. Maintain optimum exhaust gas temperature 2. Maintain optimum boiler pressure 3. Maintain excess air ratio as per standard. 4. Maintain load factor as per turn down ratio

Training Method	<ul style="list-style-type: none"> • Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	<ul style="list-style-type: none"> • Written Test • Demonstration • Oral questioning • Portfolio

Unit of Competency	Maintain Boiler operational conditions
Unit Code	OU-LE-BOM-06-L4-V1
Module Title	Maintaining boiler operational conditions
Module Descriptor	This unit covers the knowledge, skills and attitudes required to Maintain boiler operational conditions. It includes the task of monitoring blowdown operation, maintaining operating pressure and monitor combustion conditions
Nominal Hours	40 Hours
Learning Outcome	After completing the practice of the module, the trainees will be able to perform the following jobs: <ol style="list-style-type: none"> 1. Monitor Blowdown operation 2. Maintain operating pressure 3. Monitor combustion conditions

Learning Outcome -1: Monitor Blowdown operation	
Assessment Criteria	<ol style="list-style-type: none"> 1. PPE is followed and OSH is observed; 2. TDS of boiler water is checked. 3. Automatic blowdown function is checked. 4. Faults of automatic blowdown is identified. 5. Faulty devices are repaired / replaced as per Standard Operating Procedure (SOP).
Conditions and Resources	<ul style="list-style-type: none"> • Workplace or Simulated Workplace • PPE • Tools and equipment • Boiler • CBLM • Handout • Paper, Pen, Pencil and Eraser • White Board and marker
Contents	<ol style="list-style-type: none"> 1. PPE <ol style="list-style-type: none"> 1.1 Safety shoes 1.2 Boiler Suit 1.3 Heat resistant hand gloves 1.4 Helmet 1.5 Mask 1.6 Safety glass 1.7 Ear plug 1.8 Gas cartridge 1.9 Breathing apparatus 2. Faults of automatic blowdown <ol style="list-style-type: none"> 2.1 Pneumatic fault 2.2 Solenoid coil fault 2.3 Sensor problem 2.4 Controller problem 2.5 Valve leakage 3. TDS of boiler water 4. Automatic blowdown devices faults reparaire/replace procedure
Job/ Task/ Activity	<ol style="list-style-type: none"> 1 Interpret automatic function blowdown 2 Identify faults of automatic blowdown 3 Repair/replace faulty devices as per Standard Operating Procedure (SOP).

Training Method	<ul style="list-style-type: none"> • Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	<ul style="list-style-type: none"> • Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -2: Maintain operating pressure	
Assessment Criteria	<ol style="list-style-type: none"> 1. Benefits of boiler operating at maximum operating pressure is interpreted. 2. Maximum operating pressure is calculated. 3. Maximum operating pressure is maintained.
Conditions and Resources	<ul style="list-style-type: none"> • Workplace or Simulated Workplace • Boiler • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	<ol style="list-style-type: none"> 1. Benefits of boiler operating at maximum pressure 2. Calculation of maximum operating pressure
Job/ Task/ Activity	<ol style="list-style-type: none"> 1. Interpret benefits of boiler operating at maximum pressure 2. Calculate maximum operating pressure 3. Maitain maximum operating pressure
Training Method	<ul style="list-style-type: none"> • Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming

Assessment Method	<ul style="list-style-type: none">• Written Test• Demonstration• Oral questioning• Portfolio
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Learning Outcome -3: Monitor combustion conditions	
Assessment Criteria	<ol style="list-style-type: none"> 1. Supply of sufficient air in the boiler room is ensured. 2. Appropriate flame colour is identified. 3. Flame colour is checked. 4. Flue gas analysis is performed. 5. Burner is tuned. 6. Proper combustion is ensured. 7. Items are maintained mentioned in the checklist.
Conditions and Resources	<ul style="list-style-type: none"> • Workplace or Simulated Workplace • Boiler • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker
Contents	<ol style="list-style-type: none"> 1. Items for monitor combustion conditions; <ol style="list-style-type: none"> 1.1 Power supply of panel board 1.2 Softener plant 1.3 Gas line valve 1.4 Dosing pump 1.5 Feed pump suction/ delivery valve 1.6 Feed water tank steam valve 1.7 Main steam valve 1.8 Softener valve 1.9 Oil reserve tank valve 1.10 Oil reserve tank heater 1.11 Oil service tank heater 1.12 Gas supply valve 1.13 Circulation fuel pump 1.14 Blowdown valve
Job/ Task/ Activity	<ol style="list-style-type: none"> 1. Monitor boiler combustion conditions; 2. Identify flame colour 3. Analyze flue gas 4. Tune burner 5. Maintained items according to the checklist.
Training Method	<ul style="list-style-type: none"> • Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming

Assessment Method	<ul style="list-style-type: none">• Written Test• Demonstration• Oral questioning• Portfolio
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Unit of Competency	Perform Maintenance of Boiler
Unit Code	OU-LE-BOM-07-L4-V1
Module Title	Performing maintenance of boiler
Module Descriptor	This unit covers the knowledge, skills and attitudes required to perform maintenance of boiler It includes the task of preparing for boiler maintenance, maintaining pressure parts, burner, fuel system, valves and fittings, and boiler at shutdown condition
Nominal Hours	65 Hours
Learning Outcome	After completing the practice of the module, the trainees will be able to perform the following jobs: <ol style="list-style-type: none"> 1. Prepare for Boiler maintenance 2. Maintain pressure parts 3. Maintain burner 4. Maintain fuel system 5. Maintain valves and fittings 6. Maintain boiler at shutdown condition

Learning Outcome -1: Prepare for Boiler maintenance	
Assessment Criteria	<ol style="list-style-type: none"> 1. Safe work practices are observed. 2. Personal Protective Equipment (PPE) is worn as per workplace. 3. Hazard is identified and mitigated as per organizational procedure. 4. Tools and Equipment are collected as per workplace requirement
Conditions and Resources	<ul style="list-style-type: none"> • Workplace or Simulated Workplace • Boiler • PPE • Tools and equipments • CBLM • Handout • Paper, Pen, Pencil and Eraser • White Board and marker
Contents	<ol style="list-style-type: none"> 1. PPE <ol style="list-style-type: none"> 1.1 Safety shoes 1.2 Boiler Suit 1.3 Heat resistant hand gloves 1.4 Helmet 1.5 Mask 1.6 Safety glass 1.7 Ear plug 1.8 Gas cartridge 1.9 Breathing apparatus 2. Tools and Equipment <ol style="list-style-type: none"> 2.1 Ring spanner 2.2 Pipe wrench 2.3 Screwdriver 2.4 Allen key set 2.5 Slide wrench 2.6 Hammer 2.7 Whole punch 2.8 Chisel 2.9 Files 2.10 Tube expander 2.11 Ratchet 2.12 Pliers 2.13 Multimeter 3. Hazards 4. Safe work practices
Job/ Task/ Activity	<ol style="list-style-type: none"> 1. Identify hazards 2. Mitigate hazards as per organizational procedure. 1. Collect tools and equipments;

Training Method	<ul style="list-style-type: none"> • Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	<ul style="list-style-type: none"> • Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -2: Maintain pressure parts	
Assessment Criteria	<ol style="list-style-type: none"> 1. Pressure parts are identified. 2. Routine maintenance of pressure parts is interpreted. 3. Pressure parts are repaired as per standard. 4. Fundamental routine maintenance is performed and recorded.
Conditions and Resources	<ul style="list-style-type: none"> • Workplace or Simulated Workplace • Boiler pressure parts • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	<ol style="list-style-type: none"> 1. Pressure parts <ol style="list-style-type: none"> 1.1 Water drum 1.2 Fire drum 1.3 Tubes 1.4 Manhole 1.5 Mudhole / handhole 1.6 Fusible plug 2. Routine maintenance of pressure parts <ol style="list-style-type: none"> 2.1 Cleaning fireside surfaces 2.2 Cleaning drum 2.3 Cleaning tubes 2.4 Inspecting waterside surfaces 2.5 Performing hydraulic test 2.6 Performing descaling if necessary 2.7 Check Boiler shell thickness
Job/ Task/ Activity	<ol style="list-style-type: none"> 1. Identify pressure parts 2. Interpret routine maintenance of pressure parts

	<ol style="list-style-type: none"> 3. Repair pressure parts as per standard 4. Perform fundamental routine maintenance
Training Method	<ul style="list-style-type: none"> • Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	<ul style="list-style-type: none"> • Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -3: Maintain burner	
Assessment Criteria	<ol style="list-style-type: none"> 1. Burners are identified. 2. Routine maintenance of burners is interpreted. 3. Fundamental routine maintenance is performed and recorded.
Conditions and Resources	<ul style="list-style-type: none"> • Workplace or Simulated Workplace • Boiler • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	<ol style="list-style-type: none"> 1. Burner <ol style="list-style-type: none"> 1.1 Gas burner 1.2 Light oil burner 1.3 Heavy oil burner 2. Routine maintenance of burners <ol style="list-style-type: none"> 2.1 Perform air-fuel ratio adjustment 2.2 Cleaning blower 2.3 Cleaning ignition rod 2.4 Ignition rod positioning and adjustment 2.5 Cleaning and adjustment of diffuser 2.6 Fuel spray nozzle adjustment and cleaning 2.7 Cleaning flame detector / photocell
Job/ Task/ Activity	<ol style="list-style-type: none"> 1. Identify burners 2. Interpret routine maintenance of burners 3. Perform fundamental routine maintenance
Training Method	<ul style="list-style-type: none"> • Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	<ul style="list-style-type: none"> • Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -4: Maintain fuel system	
Assessment Criteria	<ol style="list-style-type: none"> 1. Fuel system is identified. 2. Routine maintenance of fuel system is interpreted. 3. Fundamental routine maintenance is performed and recorded.
Conditions and Resources	<ul style="list-style-type: none"> • Workplace or Simulated Workplace • Boiler • boiler • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	<ol style="list-style-type: none"> 1. Fuel system <ol style="list-style-type: none"> 1.1 Gas fuel system <ol style="list-style-type: none"> 1.1.1 Pilot solenoid valve 1.1.2 Air pressure switch 1.1.3 Gas pressure switch 1.1.4 Gas strainer (filter) 1.1.5 Pressure gauge 1.1.6 Gas pressure regulator 1.1.7 Safety shut-off valve 1.1.8 Main gas solenoid valve / hydro motor 1.1.9 Gas flow meter 1.1.10 Gas actuator 1.2 Liquid fuel system <ol style="list-style-type: none"> 1.2.1 Oil pre heater 1.2.2 Atomizing air pressure switch 1.2.3 Atomizing air pressure valve 1.2.4 Strainer/ filter 1.2.5 Oil flow meter 1.2.6 Inlet pressure gauge 1.2.7 Inlet temperature meter 1.2.8 Outlet temperature gauge 1.2.9 Oil temperature switch 1.2.10 Outlet pressure gauge 1.2.11 Oil pressure regulator 1.2.12 Oil pressure switch 1.2.13 Oil pressure safety valve 1.2.14 Main solenoid valve 1.2.15 Pilot solenoid valve 1.2.16 Fuel pump 1.2.17 Bypass oil line 1.2.18 Oil viscosity meter 1.2.19 LP regulator 1.3 Routine maintenance of fuel system

	1.3.1 Fuel filter 1.3.2 Cleaning of Fuel actuator 1.3.3 Calibration of gauges used in boiler operation 1.3.4 Adjustment of Fuel pressure regulator 1.3.5 Adjustment of Fuel pump
Job/ Task/ Activity	1. Identify fuel system 2. Interpret routine maintenance of fuel system 3. Perform fundamental routine maintenance
Training Method	<ul style="list-style-type: none"> • Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	<ul style="list-style-type: none"> • Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -5: Maintain valves and fittings	
Assessment Criteria	1. Valves and fittings are identified. 2. Routine maintenance of valves and fittings are interpreted. 3. Fundamental routine maintenance is performed and recorded.
Conditions and Resources	<ul style="list-style-type: none"> • Workplace or Simulated Workplace • Boiler • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	1. Valves and fittings 1.1 Safety valve 1.2 Globe valve 1.3 Butterfly valve 1.4 Non-return valve 1.5 Blowdown valve 1.6 Water level indicator

	<ol style="list-style-type: none"> 1.7 Pressure gauge 1.8 Air vent 2. Routine maintenance of valves and fittings <ol style="list-style-type: none"> 2.1 Setting of safety valve 2.2 Checking of valves 2.3 Cleaning of Water level indicator 2.4 Calibration of pressure gauges
Job/ Task/ Activity	<ol style="list-style-type: none"> 1. Identify valves and fittings 2. Interpret routine maintenance of valves and fittings 3. Perform fundamental routine maintenance
Training Method	<ul style="list-style-type: none"> • Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	<ul style="list-style-type: none"> • Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -6: Maintain boiler at shutdown condition	
Assessment Criteria	<ol style="list-style-type: none"> 1. Boiler shutdown is performed as per standard. 2. Maintenance procedure is followed during shutdown. 3. Long time shutdown procedures are maintained.
Conditions and Resources	<ul style="list-style-type: none"> • Workplace or Simulated Workplace • Boiler • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	<ol style="list-style-type: none"> 1. Boiler shutdown procedure 2. Maintenance procedure 3. Long time shutdown procedures
Job/ Task/ Activity	<ol style="list-style-type: none"> 1. Perform boiler shutdown as per standard 2. Demonstate maintenance during shutdown. 3. Demonstate long time shutdown procedures
Training Method	<ul style="list-style-type: none"> • Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	<ul style="list-style-type: none"> • Written Test • Demonstration • Oral questioning • Portfolio

Competency based curriculum (CBC)

The CBC is also termed as Competency Based Curriculum and is developed based on NCS and labour market needs.

CBT curricula are designed considering the following principles.

- Identification of competencies in consultation with experts from industries and training institutes
- Adopting 21st century pedagogy and methodology
- Training must be in line with labour market need and industrial standard
- Creating training modality to experience real working situation through platform such as OJT and Industrial visit

What is Competency-Based Curriculum (CBC)

- A competency-based curriculum is a framework or guide for the subsequent detailed development of competencies, associated methodologies, training and assessment resources.
- The CBC specifies the outcomes which are consistent with the requirements of the workplace as agreed through the industry or community consultations.
- CBC can be developed immediately when competency standards exist.
- When competency standards do not exist, curriculum developers need to clearly define the learning outcomes to be attained. The standard of performance required must be appropriate to industry and occupational needs through the industry/enterprise or specified client group consultations.

Validation of Competency Based Curriculum

The Competency Based Curriculum for National Skills Certificate in Boiler Operation and Maintenance, Level-4 is developed by NSDA with assistance of GIZ on 05-06 and 11-13 February 2025.

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