Competency Based Curriculum (CBC)

Boiler Operation and Maintenance

Level-3

Light Engineering Sector

Curriculum Code:CBC-LE-BOM-L3-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 – 3,** Occupation Competency Standards. It covers the information required to implement the **Boiler Operation and Maintenance, Level - 3** 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 –3** 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 -3** 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 –3** as per industry demand-based competency standards. The trainees of **Boiler Operation and Maintenance, Level –3** course can develop themselves as skilled and qualified **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

Table of Content

Course Design

Name of Course: Boiler Operation and Maintenance

Skill Level : National Skills Certificate(NSC)-3

Nominal Hours : 270 Hours

List of Unit of Competency

Generic Unit of Competency

1. Work in the team environment
2. Demonstrate work values

Sector Specific Unit of Competency

Occupation Specific Unit of Competency

3. Interpret Fundamentals of Boiler Functions
4. Interpret Safety and Legislation
5. Perform Boiler Activities
6. Perform Routine Operation of Boiler
7. Perform Boiler Shutdown Activities
8. Troubleshoot Faults 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 work in a self-directed team, demonstrate work values, interpret fundamentals of boiler functions, interpret safety and legislation, perform boiler activities, perform routine operation of boiler, perform boiler shutdown activities and troubleshoot faults 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 **Boiler Operator**
2. Occupational Safety and Health Regulations (OSH) may apply

Financial Learning Outcome

1. Job opportunities will be created as **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 **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	Work in a Self-Directed Team	Working in a Self-Directed Team	1. Identify team goals and processes 2. Communicate and cooperate with team members 3. Work as a team member 4. Solve problems as a team member	15
2	Demonstrate work values	Demonstrating work values	1. Define the purpose of work 2. Apply work values / ethics 3. Deal with ethical problems 4. Maintain integrity of conduct in the workplace	20
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.	Interpret Fundamentals of Boiler Functions	Interpreting Fundamentals of Boiler Functions	1. Interpret boiler 2. Interpret feed pump 3. Identify boiler mountings and accessories 4. Identify boiler control panel board 5. Comprehend water treatment parameters 6. Interpret fundamentals of economizer	20
2.	Interpret Safety and Legislation	Interpreting Safety and Legislation	1. Follow 5s 2. Interpret boiler act 3. Interpret boiler registration procedure 4. Comprehend boiler related rules and regulation	20
3.	Perform Boiler Activities	Performing Boiler Activities	1. Prepare for Boiler operation activities 2. Perform boiler pre-starting activities 3. Check deaerator 4. Start gas fired boiler 5. Start liquid fuel fired boiler 6. Start solid fuel fired boiler	50
4.	Perform Routine Operation of Boiler	Performing Routine Operation of Boiler	1. Hand over and take over shift duties 2. Update logbook 3. Monitor overall boiler operation	60
5	Perform Boiler Shutdown Activities	Performing Boiler Shutdown Activities	1 Prepare for Shutdown work 2 Perform emergency shutdown 3 Perform stop operation of boiler 4 Recheck and ensure shutdown activities	25
6	Troubleshoot Faults of Boiler	Troubleshooting Faults of Boiler	1 Prepare for Troubleshooting 2 Perform maintenance of boiler 3 Identify electrical faults 4 Identify mechanical faults 5 Identify instrumental faults 6 Respond to the emergency situation	60
			Total Hours	**235**

Analysis of Competency

Generic Unit of Competency	Number of Module
1. Work in a Self-Directed Team	01
2. Demonstrate work values	01
Sector SpecificUnit of Competency	
Occupation SpecificUnit of Competency	
3. Interpret Fundamentals of Boiler Functions	01
4. Interpret Safety and Legislation	01
5. Perform Boiler Activities	01
6. Perform Routine Operation of Boiler	01
7. Perform Boiler Shutdown Activities	01
8. Troubleshoot Faults of Boiler	01
Total	**08**

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 Pactice
7. Project Work
8. Problem Solving
9. Brainstorming

Module of Instruction

- Generic
- Sector Specific and
- Occupation Specific

Generic Modules

Unit of Competency	**Work in a Self-Directed Team**
Unit Code	**GU-04-L3-V1**
Module Title	**Working in a Self-Directed Team**
Module Descriptor	This module covers the knowledge, skills and attitudes required to work in a self-directed team It specifically includes dentifying team goals and processes, communicating and cooperating with team members, working as a team member and solving problems as a team member
Nominal Hours	**20 Hours**
Lerning Outcome	After completing the practice of the module, the trainees will be able to perform the following jobs: 1. Identify team goals and processes 2. Communicate and cooperate with team members 3. Work as a team member 4. Solve problems as a team member

Learning Outcome -1: Identify team goals and processes	
Assessment Criteria	1. Team goals and processes are identified. 2. Roles and responsibilities of team members are identified. 3. Relationships within team and with other work areas are identified.
Conditions and Resources	• Workplace or Simulated Workplace • Roles and responsibilities of team members • Team goals • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	1. Team goals 1.1 Identifying the problem 1.2 Consider solutions 1.3 Action 1.4 Follow-up. 2. Roles and responsibilities of team members 3. Relationships within team and with other work areas
Job/ Task/ Activity	1. Identify team goals and processes 2. Identify.roles and responsibilities of team members 3. Identify.relationships within team and with other work areas

Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	1. Written Test 2. Demonstration 3. Oral questioning 4. Portfolio

Learning Outcome -2: Communicate and cooperate with team members	
Assessment Criteria	1. Effective interpersonal skills are used to interact with team members and to contribute to activities and objectives. 2. Formal and informal forms of communication are used effectively to support team achievement. 3. Diversity is respected and valued in team functioning. 4. Views and opinions of other team members are understood and reflected accurately. 5. Workplace staff regulation is used correctly to assist communication.
Conditions and Resources	• Workplace or Simulated Workplace • Formal and informal forms of communication • Workplace staff regulation • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	1. Formal and informal forms of communication 2. Workplace staff regulation 2.1 Organization / company's code of conduct, complaint handling / grievance policies and procedures
Job/ Task/ Activity	1. Use formal and informal forms of communication 2. Identify workplace staff regulation

Training Method	1. Discussion 2. Presentation 3. Demonstration 4. Guided Practice 5. Individual Practice 6. Project Work 7. Problem Solving 8. Brainstorming
Assessment Method	1. Written Test 2. Demonstration 3. Oral questioning 4. Portfolio

Learning Outcome -3: **Work as a team member**	
Assessment Criteria	1. Duties, responsibilities, authorities, objectives and task requirements are identified and clarified with team. 2. Tasks are performed in accordance with organizational and team requirements, specifications and workplace procedures. 3. Team members support other members as required to ensure team achieves goals and requirements. 4. Agreed reporting lines are followed using standard operating procedures.
Conditions and Resources	• Workplace or Simulated Workplace • Organizational and team requirements, specifications and workplace procedures • CBLM • Handout • Paper, Pen, Pencil, • Internet Facilities
Contents	1. Organizational and team requirements, specifications and workplace procedures 2. Recommendations for improving team work
Job/ Task/ Activity	1. Identify duties, responsibilities, authorities, objectives and task requirements
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work

	• Problem Solving • Brainstorming
Assessment Method	1. Written Test 2. Demonstration 3. Oral questioning 4. Portfolio

Learning Outcome -4: **Solve problems as a team member**	
Assessment Criteria	1. Current and potential problems faced by team are identified. 2. Procedures for avoiding and managing problems are identified. 3. Problems are solved effectively and in a manner that supports the team.
Conditions and Resources	• Workplace or Simulated Workplace • Potential problems and their solutions • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker
Contents	1. Current and potential problems faced by team 2. Procedures for avoiding and managing problems
Job/ Task/ Activity	1. Identify current and potential problem 2. Identify their effective solutions
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	1. Written Test 2. Demonstration 3. Oral questioning 4. Portfolio

Unit of Competency	**Demonstrate work values**
Unit Code	GU-10-L3-V1
Module Title	**Demonstrating Work Values**
Module Description	This unit covers the knowledge, skills and attitudes required to demonstrate work values. It specifically includes, defining the purpose of work, applying work values / ethics, dealing with ethical problems, and maintaining integrity of conduct in the workplace.
Nominal Hours	20 Hours
Learning Outcome	Upon completion of this module, the learners will be able to: LO 1. Define the purpose of work LO 2. Apply work values / ethics LO 3. Deal with ethical problems LO 4. Maintain integrity of conduct in the workplace

Learning Outcome 1. Define the purpose of work

Assessment criteria	1. One's unique sense of purpose for working and the why's of work are identified, reflected on and clearly defined for one's development as a person and as a member of society. 2. Personal mission is in harmony with industry values are defined.
Condition and resources	• Actual workplace or training environment • CBLM • Handouts • Paper, Pen, Pencil and Eraser • Whiteboard and Marker • Laptop/Desktop • Multimedia Projector • Internet Facilities
Content	1. Purpose of work 2. Personal mission is in harmony with industry values
Jobs/Activities	1. Intepret purpose of work 2. Interpret personal mission is in harmony with industry values

Method of Training	• Blended • Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Methods of Assessment	• Written Test • Demonstration • Oral Questioning • Portfolio

Learning Outcome 2: Apply work values / ethics

Assessment Criteria	1. Work values / ethics / concepts are classified and reaffirmed in accordance with the transparent industry ethical standards, policies and guidelines. 2. Work practices are undertaken in compliance with industry work ethical standards, industry policy and guidelines. 3. Personal behavior and relationships with co-workers are maintained as per standards, policy and guidelines. 4. Company resources are used in accordance with transparent company ethical standard, policies and guidelines.
Condition and resources	• Actual workplace or training environment • CBLM • Handouts • Paper, Pen, Pencil and Eraser • Whiteboard and Marker • Laptop/Desktop • Multimedia Projector • Internet Facilities
Content	1. Work values / ethics / concepts 1.1 Commitment / Dedication 1.2 Sense of urgency 1.3 Sense of purpose 1.4 Love for work 1.5 High motivation 1.6 Orderliness 1.7 Reliability 1.8 Competence 1.9 Dependability

	1.10 Goal-oriented 1.11 Sense of responsibility 1.12 Being knowledgeable 1.13 Loyalty to work/company 1.14 Sensitivity to others 1.15 Compassion/Caring attitude 1.16 Balancing between family and work 1.17 Benjamin spirit/teamwork 1.18 Sense of nationalism 1.19 Gender awareness 2. Work practices 2.1 Quality of work 2.2 Punctuality 2.3 Efficiency 2.4 Effectiveness 2.5 Productivity 2.6 Resourcefulness 2.7 Innovativeness / Creativity 2.8 Cost consciousness 2.9 5S 2.10 Attention to details 3. Personal behavior and relationships with co-workers 4. Company resources 4.1 Consumable materials 4.2 Equipment / Machineries 4.3 Human 4.4 Time 4.5 Financial resources 5. Corporate social responsibilities. 6. Company code of conduct / values. 7. Balancing work and family responsibilities. 8. Codes of practice and guidelines for the organization. 9. Organization policy and procedures for negotiations.
Jobs/Activities	1. Classify work values / ethics / concepts 2. Intepret industry compliance supportive wortk practices 3. Interpret use of company resources as per standard
Method of Training	• Blended • Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Methods of Assessment	• Written Test • Demonstration

	• Oral Questioning • Portfolio

Learning Outcome 3: Deal with ethical problems

Assessment Criteria	1. Industry ethical standard, organizational policy and guidelines on the prevention and reporting of unethical conduct are accessed and applied in accordance with transparent company ethical standard, policies and guidelines. 2. Work incidents / situations are reported and/or resolved in accordance with company protocol / guidelines. 3. Resolution and / or referral of ethical problems identified are used as learning opportunities.
Condition and Resources	• Actual workplace or training environment • CBLM • Handouts • Paper, Pen, Pencil and Eraser • Whiteboard and Marker • Laptop/Desktop • Multimedia Projector • Internet Facilities
Content	1. Work incidents / situations 1.1 Violent / intense dispute or argument 1.2 Decision making and conflict resolution strategies procedures. 1.3 Problem solving strategies on how to deal with unexpected questions and attitudes during negotiation. 1.4 Gambling 1.5 Use of prohibited substances 1.6 Pilferages 1.7 Damage to person or property 1.8 Vandalism 1.9 Falsification 1.10 Bribery 1.11 Sexual Harassment 1.12 Blackmail 2. Way of solving incidents / situations
Jobs/Activities	1. Interpret industry ethical standard 2. Demonstate way of solving incidents / situations
Method of Training	• Blended • Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving

	• Brainstorming
Methods of Assessment	• Written Test • Demonstration • Oral Questioning • Portfolio

Learning Outcome 4: Maintain integrity of conduct in the workplace

Assessment Criteria	1. Personal work practices and values are demonstrated consistently with acceptable ethical conduct and company's core values. 2. Instructions to co-workers are provided based on ethical, lawful and reasonable directives. 3. Company values / practices are shares with co-workers using appropriate behavior and language.
Condition and Resources	• Actual workplace or training environment • CBLM • Handouts • Paper, Pen, Pencil and Eraser • Whiteboard and Marker • Laptop/Desktop • Multimedia Projector • Internet Facilities
Content	1. Personal work practices and values 2. Ethical conduct and company's core values. 3. Appropriate behavior and language 4. Company values / practices 5. Instructions 5.1 Verbal 5.2 Written
Jobs/Activities	1. Demonstate personal work practices and values 2. Interpret ethical conduct and company's core values
Method of Training	• Blended • Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming

Methods of Assessment	• Written Test • Demonstration • Oral Questioning • Portfolio

Sector Specific Module

Occupation Specific Module

Unit of Competency	**Interpret Fundamentals of Boiler Functions**
Unit Code	**OU-LE-BOM-01-L3-V1**
Module Title	Interpreting fundamentals of boiler functions
Module Descriptor	This unit covers the knowledge, skills and attitudes required to interpret fundamentals of boiler functions. It includes interpreting boiler, feed pump, identifying boiler mountings and accessories, boiler control panel board, water treatment parameters and fundamentals of economizer
Nominal Hours	**20 Hours**
Learning Outcome	After completing the practice of the module, the trainees will be able to perform the following jobs: 1. Interpret boiler 2. Interpret feed pump 3. Identify boiler mountings and accessories 4. Identify boiler control panel board 5. Comprehend water treatment parameters 6. Interpret fundamentals of economizer

Learning Outcome -1: Interpret boiler	
Assessment Criteria	1. Direct fired and indirect fired boilers are interpreted 2. Types of boiler burner are identified 3. Gas and oil burner parts are identified. 4. Electric Boiler Parts are identified. 5. Burner controller is identified 6. Solid fuel burning system is identified. 7. Safety precaution of boiler operation is stated.
Conditions and Resources	• Workplace or Simulated Workplace • Boiler • CBLM • Handout • Paper, Pen, Pencil and Eraser • White Board and marker
Contents	1. Types of boilers 2. Gas burner parts 2.1 Servo motor (modulation motor) 2.2 Photocell 2.3 Ionization rod 2.4 Programmable controller 2.5 Ignition transformer 2.6 Ignition rod 2.7 Pilot solenoid valve 2.8 Air pressure switch 2.9 Gas pressure switch 2.10 Gas strainer (filter) 2.11 Pressure gauge 2.12 Gas pressure regulator 2.13 Safety shut-up valve 2.14 Main gas solenoid valve / hydro motor 2.15 Air damper 2.16 Gas actuator 2.17 Blower 2.18 Butterfly valve 2.19 Looking glass 2.20 Diffuser 3. Furnace oil burner parts 3.1 Oil nozzle 3.2 Oil preheater 3.3 Programmable controller 3.4 Atomizing air pressure switch 3.5 Atomizing air pressure valve

	3.6 Electric heater 3.7 Strainer / filter 3.8 Oil flow meter 3.9 Inlet pressure gauge 3.10 Inlet temperature meter 3.11 Outlet temperature gauge 3.12 Oil temperature switch 3.13 Outlet pressure gauge 3.14 Oil pressure regulator 3.15 Oil pressure switch 3.16 Oil pressure safety valve 3.17 Main solenoid valve 3.18 Pilot solenoid valve 3.19 Fuel pump 3.20 Bypass oil line 3.21 Oil viscosity meter 3.22 LP regulator 3.23 Ignition transformer 3.24 Ignition cable 3.25 Ignition rod 3.26 Looking glass 3.27 Oil diffuser 3.28 Blower 4. Diesel burner parts 4.1 Oil nozzle 4.2 Programmable controller 4.3 Atomizing air pressure switch 4.4 Strainer/ filter 4.5 Oil flow meter 4.6 Oil Actuator 4.7 Inlet pressure gauge 4.8 Outlet pressure gauge 4.9 Pilot solenoid valve 4.10 Main solenoid valve 4.11 Oil pressure regulator 4.12 Oil pressure switch 4.13 Oil pressure safety valve 4.14 Fuel pump 4.15 Bypass oil line 4.16 LP regulator 4.17 Ignition transformer 4.18 Ignition cable 4.19 Ignition rod 4.20 Looking glass

	4.21 Oil diffuser 4.22 Blower 5. Electric Boiler Parts 5.1 Electrical Heater Coil 5.2 Thermostat 5.3 Magnetic contactor 5.4 Steam Pressure Switch
Job/ Task/ Activity	1. Identify: • types of boiler burner • gas and oil burner parts • electric Boiler Parts • boiler controller • solid fuel burning system • safety precautions of boiler operation
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -2: Interpret feed pump	
Assessment Criteria	1. Feed tank water level and temperature are ensured. 2. Feed pump is prepared for operation. 3. Feed pump is operated as per SOP. 4. Dozing activity is performed.
Conditions and Resources	• Workplace or Simulated Workplace • Boiler • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	1. Feed pump operation procedure 2. Dozing activity
Job/ Task/ Activity	1. Operate feed pump as per SOP 2. Perform dozing activity
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -3: Identify boiler mountings and accessories	
Assessment Criteria	1. Boiler mountings are identified. 2. Usages of boiler mountings in boiler operation is stated. 3. Boiler accessories and auxiliary equipment are identified. 4. Function of boiler accessories and auxiliaries is stated. 5. Application of accessories and auxiliary equipment in boiler operation is comprehended

Conditions and Resources	• Workplace or Simulated Workplace • Boiler mountings • Boiler accessories • Auxiliary equipment • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	1. Boiler mountings 1.1 Safety valve 1.2 Manhole 1.3 Mudhole / handhole 1.4 Main steam stop valve 1.5 Feedwater check valve (non-return valve) 1.6 Steam pressure gauge 1.7 Water level indicator (gauge glass) 1.8 Water level controller 1.9 Blowdown valve 1.10 Blowdown controller 1.11 Air cock (air vent valve) 1.12 Fusible plug 2. Boiler accessories 2.1 Feed water pump and strainer 2.2 Combustion safety door 2.3 Force Draft (FD) fan 2.4 Induced Draft (ID) fan 2.5 Surface blow down cock 2.6 Ground/bottom blowdown cock 2.7 Boiler flue gas stack 2.8 Ferrule 2.9 Steam trap / steam separator / steam doom 2.10 Steam pressure switch 2.11 Modulating valve 3. Auxiliary equipment 3.1 Economizer 3.2 Air preheater 3.3 Water preheater 3.4 Superheater 3.5 Condensate recovery system 3.6 Blowdown vessel 3.7 Deaerator 3.8 Damper 3.9 Feedwater tank
Job/ Task/ Activity	1. List the boiler mountings 2. Interpret use of boiler mountings

	3. List boiler accessories and auxiliary equipment 4. Interpret the function and application of boiler accessories and auxiliary equipment
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -4: Identify boiler control panel board	
Assessment Criteria	1. Control switches of panel board are identified. 2. Functions of control switches are identified. 3. Function of control panel is interpreted.
Conditions and Resources	• 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	1. Boiler control panel board 2. Control switches of boiler panel board 3. Function of control switches
Job/ Task/ Activity	1. Identify the control switches of boiler control panel board 2. Identify the function of control switches; 3. Interpret the function of boiler control panel
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -5: Comprehend water treatment parameters	
Assessment Criteria	1. Water impurity particles are identified. 2. Water treatment process is interpreted. 3. Water parameter standard values are interpreted. 4. Water treatment equipment is used. 5. Quality of water is reported as per SOP.
Conditions and Resources	• Workplace or Simulated Workplace • Water treatment parameters • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	1. Water impurity particles 2. Water parameter 2.1 TH (Total Hardness) 2.2 pH (Potential of hydrogen) 2.3 TDS (Total Dissolved Solid) 2.4 Dissolved oxygen 2.5 Conductivity 2.6 CL, Chloride ion 2.7 Dissolved iron 2.8 Silica content 2.9 Total Suspended Solid (TSS) 3. Water treatment equipment 3.1 Aeration 3.2 Softeners 3.3 DM (De-mineralization) plant 3.4 Iron removal plant 3.5 Filtration 4. Water treatment process
Job/ Task/ Activity	1. Identify water impurity particles 2. Interpret water treatment process 3. List water parameter standard values 4. Use water treatment equipment
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming

Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -6: Interpret fundamentals of economizer	
Assessment Criteria	1. Types of economizers are identified. 2. Function of economizer is intyerpreted. 3. Basic faults of economizer are identified.
Conditions and Resources	• Workplace or Simulated Workplace • Economizers • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	1 Types of economizers 2 Function of economizers 3 Faults of economizers 3.1 Tube leakages 3.2 Tube blockages 3.3 Tube corrosion and erosion 3.4 Carbon deposition
Job/ Task/ Activity	1. Identify types of economizers 2. Identify function of economizers 3. Identify basis faults of economizers
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Unit of Competency	**Interpret Safety and Legislation**
Unit Code	**OU-LE-BOM-02-L3-V1**
Module Title	Interpreting Safety and Legislation
Module Descriptor	This unit covers the knowledge, skills and attitudes required to Interpret safety and legislation. It includes follow 5s, interpret boiler Act, boiler rules, boiler regulations, and boiler registration procedure.
Nominal Hours	**20 Hours**
Learning Outcome	After completing the practice of the module, the trainees will be able to perform the following jobs: 1. Follow 5s 2. Interpret boiler Act 3. Interpret boiler rules 4. Interpret boiler regulations 5. Interpret boiler registration procedure

Learning Outcome -1: Follow 5s	
Assessment Criteria	1. 5s is interpreted 2. 5s is followed
Conditions and Resources	• Workplace or Simulated Workplace • 5s • CBLM • Handout • Paper, Pen, Pencil and Eraser • White Board and marker
Contents	1 5s 1.1 Sort 1.2 Set in order 1.3 Shine 1.4 Standardize 1.5 Sustain
Job/ Task/ Activity	1. Interpret 5s
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -2: Interpret boiler Act	
Assessment Criteria	1. Boiler Act is interpreted. 2. Boiler Act is followed.
Conditions and Resources	• Workplace or Simulated Workplace • Boiler Acts • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker
Contents	1. Boiler Acts
Job/ Task/ Activity	1. Interpret boiler Acts
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -3: Interpret boiler rules	
Assessment Criteria	1. Boiler rules are interpreted. 2. Boiler rules are followed.
Conditions and Resources	• Workplace or Simulated Workplace • Boiler rules • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker
Contents	1. Boiler rules
Job/ Task/ Activity	1. Interpret Boiler rules
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -4: Interpret boiler regulations	
Assessment Criteria	1. Boiler regulations are interpreted. 2. Boiler regulations are followed.
Conditions and Resources	• Workplace or Simulated Workplace • Boiler regulations • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker
Contents	2. Boiler regulations
Job/ Task/ Activity	2. Interpret boiler regulations
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -5: Interpret boiler registration procedure	
Assessment Criteria	1. Boiler registration procedure is interpreted. 2. Boiler registration procedure is followed.
Conditions and Resources	• Workplace or Simulated Workplace • Boiler registration procedure • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker
Contents	1. Boiler registration procedure
Job/ Task/ Activity	1. Interpret registration procedure
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Unit of Competency	**Perform Boiler Activities**
Unit Code	**OU-LE-BOM-03-L3-V1**
Module Title	Performing boiler activities
Module Descriptor	This unit covers the knowledge, skills and attitudes required to Perform Boiler Activities. It includes prepare for Boiler operation activities, perform boiler pre-starting activities, check deaerator, start gas fired boiler, start liquid fuel fired boiler and start solid fuel fired boiler.
Nominal Hours	**50 Hours**
Learning Outcome	After completing the practice of the module, the trainees will be able to perform the following jobs: 1. Prepare for Boiler operation activities 2. Perform boiler pre-starting activities 3. Check deaerator 4. Start gas fired boiler 5. Start liquid fuel fired boiler 6. Start solid fuel fired boiler

Learning Outcome -1: Prepare for Boiler operation activities	
Assessment Criteria	1. Personal Protective Equipment (PPE) is used; 2. Hazards are identified and mitigated as per workplace procedure. 3. Log book is received and information are checked before starting boiler. 4. Main circuit breaker is turned on and three phase power supply is ensured; 5. Soft water parameter is checked using appropriate testing kits and devices. 6. Softener is regenerated as per SOP
Conditions and Resources	• Workplace or Simulated Workplace • PPE • Logbook • Testing kits and devices • Boiler • CBLM • Handout • Paper, Pen, Pencil and Eraser • White Board and marker
Contents	1. PPE 2. Logbook 3. Water parameter 3.1 TH (Total Hardness) 3.2 pH (Potential of hydrogen) 3.3 TDS (total dissolved solid) 3.4 CL (Chloride ion) 3.5 Dissolved oxygen 3.6 Conductivity 3.7 Iron test 3.8 Silica content 3.9 Total Suspended Solid (TSS) 4. Testing kits and devices 4.1 pH meter 4.2 TDS meter 4.3 Conductivity meter 4.4 Hardness tester 4.5 DO meter 4.6 Softener regenerative procedure
Job/ Task/ Activity	1 Identify hazard 2 Check logbook 3 Operate main circuit breaker 4 Check of softner water parameter 5 Use regeration chemical

Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -2: Perform boiler pre-starting activities	
Assessment Criteria	1. Feed water temperature is checked and recorded as per SOP. 2. Feed tank water level is checked. 3. Feed water pump is turned ON. 4. Air vent valve position is checked. 5. Blowdown valve is checked. 6. Suction and delivery valve (feed water line) is checked. 7. Water level in boiler is checked. 8. Fuel / energy availability is checked and quality is ensured; 9. Air blower is turned on. 10. Steam header and outlet valve is checked. 11. Function of pneumatic valve is checked. 12. Boiler main power is turned ON. 13. Faulty signal is identified. 14. Fault is solved and informed as per SOP.
Conditions and Resources	• Workplace or Simulated Workplace • Boiler • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device

Contents	1. Feed water temperature 2. Feed tank water level 3. Air vent valve position 4. Blowdown valve 5. Suction and delivery valve 6. Air blower 7. Steam header and outlet valve 8. Pneumatic valve 9. Faulty signal
Job/ Task/ Activity	1. Check; 1.1 feed water temperature 1.2 feed tank water level 1.3 air vent valve position 1.4 blowdown valve 1.5 suction and delivery valve 1.6 water level of boiler 1.7 fuel/energy availability 1.8 steam header and outlet valve 1.9 Function of pneumatic valve 2. Identify fault signal 3. Solve the problem of fault signal
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -3: Check deaerator	
Assessment Criteria	1. Function of deaerator is interpreted. 2. Nessessity of deaerator in boiler operation is identified
Conditions and Resources	• Workplace or Simulated Workplace • Deaerator • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker
Contents	1. Deaerator 1.1 Non-pressurized 1.2 Pressurized 1.3 Function of deaerator 1.4 Necessity of deaerator
Job/ Task/ Activity	1. Interpret the function of deaerator 2. Identify the necessity of deaerator
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -4: Start gas fired boiler	
Assessment Criteria	1. Safety system for running condition is checked. 2. Faults of safety system is identified for malfunctioning condition. 3. Faults of gas fired boiler are solved as per SOP. 4. Gas burner switch is turned on. 5. Purging in combustion area is observed. 6. Ignition and pilot solenoid valve is set in auto mode as per SOP. 7. Indication of opening of main solenoid valve is ensured. 8. Pilot ignition turned off and main solenoid valve turned on is observed. 9. Low load (10-20%) is maintained in the initial stages of boiler startup operation. 10. Boiler inside flame condition is visually observed through looking glass. 11. Boiler starting procedure is monitored in panel board. 12. Main steam stop valve is opened after achieving required steam pressure. 13. Exhaust gas temperature is observed and recorded.
Conditions and Resources	• Workplace or Simulated Workplace • Gas fired boiler • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	1. Safety system for running condition 1.1 Gas pressure 1.2 Steam pressure 1.3 Water level 1.4 Conductivity 2. Gas fired boiler 3. Gas burner 4. Faults of gas fired boiler 4.1 Gas pressure sensor malfunctioning 4.2 Main gas valve blocked 4.3 Filter blocked 4.4 Regulator abnormalities 4.5 Steam pressure sensor malfunctioning 4.6 Water level sensor malfunctioning 4.7 Conductivity sensor malfunctioning 5. Combustion area

	6. Ignition and pilot solenoid valve 7. Main solenoid valve 8. Boiler starting procedure
Job/ Task/ Activity	1. Ensure safety system for running condition of gas fired boiler 2. Solve any malfunctioning condition 3. Turn on gas burner switch 4. Set in auto mode ignition and pilot solenoid valve as per SOP 5. Ensure opening of main solenoid valve 6. Turn off pilot ignition 7. Turn on solenoid valve 8. Monitor boiler starting procedure 9. Open steam stop valve after achieving required pressure 10. Record exhaust gas temperature
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -5: Start liquid fuel fired boiler	
Assessment Criteria	1. Burner switch is turned on. 2. Purging in combustion area is observed. 3. Liquid fuel supply is monitored. 4. Ignition and pilot solenoid valve is set in auto/manual mode according to the requirement. 5. Indication of opening of main solenoid valve is monitored. 6. Fuel supply inside the burner is ensured; 7. Pilot ignition is turned off and main solenoid valve turned on is observed. 8. Low load (10-20%) is maintained in the initial stages of boiler startup operation. 9. Boiler inside flame condition is visually observed through looking glass. 10. Boiler starting procedure is monitored in panel board. 11. Main steam stop valve is opened after achieving required steam pressure. 12. Faults of liquid fired boiler are identified. 13. Faults are solved as per SOP.
Conditions and Resources	• Workplace or Simulated Workplace • Liquid fuel fired boiler • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	1. Liquid fuel fired boiler 2. Burner switch 3. Ignition and pilot solenoid valve 4. Main solenoid valve 5. Main stop valve 6. Faults of liquid fired boiler 6.1 Oil pressure and temperature sensor malfunctioning 6.2 Oil valve blocked 6.3 Filter blocked 6.4 Regulator abnormalities 6.5 Steam pressure sensor malfunctioning 6.6 Water level sensor malfunctioning 6.7 Conductivity sensor malfunctioning 7. Remedy of faults mentined above;
Job/ Task/ Activity	1. Ensure safety system of liquid fuel fired boiler 2. Turn on burner switch 3. Set ignition and solenoid valve as per SOP

	4. Ensure fuel supply inside the burner 5. Turn off pilot ignition 6. Turn on solenoid valve 7. Monitor boiler starting procedure 8. Open steam stop valve after achieving required pressure 9. Identify faults of liquid fired boiler 10. Solve the faults of liquid fired boiler
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -6: Start solid fuel fired boiler	
Assessment Criteria	1. Solid fuel supply is ensured. 2. Pilot Burner switch is turned on. 3. Function of ID fan and FD fan is monitored. 4. Temperature of combustion chamber is monitored, controlled and recorded. 5. Fuel supply inside the combustion chamber is ensured; 6. Low load (10-20%) is maintained in the initial stages of boiler startup operation. 7. Boiler starting procedure is monitored in panel board. 8. Main steam stop valve is opened after achieving required steam pressure. 9. Faults of solid fuel fired boiler are identified. 10. Faults are solved as per SOP.
Conditions and Resources	• Workplace or Simulated Workplace • Solid fuel fired boiler • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	1. Solid fuel 1.1 Coal 1.2 Biomass 1.3 Wood chips 1.4 Rice husk 1.5 Garments waste fabrics 1.6 Bagasse 1.7 Waste papers 2. Pilot burner 3. Boiler starting procedure 4. Faults of solid fuel fired boiler 4.1 Combustion chamber temperature sensor malfunctioning 4.2 Filter blocked 4.3 Soot accumulated 4.4 ID fan and FD fan malfunctioning 4.5 Steam pressure sensor malfunctioning 4.6 Water level sensor malfunctioning 4.7 Conductivity sensor malfunctioning 5. Remedy of faults mentined above;
Job/ Task/ Activity	1. Ensure safety system of solid fuel fired boiler 2. Turn on pilot switch 3. Ensure fuel supply inside the burner

	4. Monitor boiler starting procedure 5. Open steam stop valve after achieving required pressure 6. Identify faults of solid fuel fired boiler 7. Solve the faults of solid fuel fired boiler
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Unit of Competency	**Perform Routine Operation of Boiler**
Unit Code	**OU-LE-BOM-04-L3-V1**
Module Title	Performing Routine Operation of Boiler
Module Descriptor	This unit covers the knowledge, skills and attitudes required to perform routine operation of boiler. It includes hand over and takes over shift duties, update logbook and monitor overall boiler operation.
Nominal Hours	**60 Hours**
Learning Outcome	After completing the practice of the module, the trainees will be able to perform the following jobs: 1. Hand over and take over shift duties 2. Update logbook 3. Monitor overall boiler operation

Learning Outcome -1: Hand over and take over shift duties	
Assessment Criteria	1. Safe work practices are observed and Personal Protective Equipment (PPE) is used 2. Hand over and take over documents are prepared; 3. Boiler and it surrounding conditions are checked. 4. Water level of feed water tank is checked. 5. Boiler operation related information in log book and log sheet is checked and received / handed overed;
Conditions and Resources	• Workplace or Simulated Workplace • Boiler • PPE • Logbook • CBLM • Handout • Paper, Pen, Pencil and Eraser • White Board and marker
Contents	1. PPE 1.1 Safety shoes 1.2 Apron 1.3 Hand gloves 1.4 Helmet 1.5 Mask 1.6 Safety glass 1.7 Ear plug 2. Hand over and take over documents 2.1 Log sheet 2.2 Log book
Job/ Task/ Activity	1. Prepare handover and takeover documents 2. Check boiler and its surrounding conditions 3. Check boiler operation related information in log book and log sheet is checked and received / handed over
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration

	• Oral questioning • Portfolio

Learning Outcome -2: Update logbook	
Assessment Criteria	1. Logbooks are interpreted. 2. Logbooks are filled with appropriate data. 3. Logbook is updated.
Conditions and Resources	• Workplace or Simulated Workplace • Boiler • Logbooks • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	1. Logbook filling and updating procedure
Job/ Task/ Activity	1. Fill logbook with appropriate data 2. Update logbook
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -3: Monitor overall boiler operation	
Assessment Criteria	1. Water level and feedwater line are observed. 2. Overall Boiler operation is monitored. 3. Boiler inlet and outlet flue gas temperature is observed and recorded. 4. Furnace temperature reading is recorded in log book every hour. 5. Chemical solution is dosed using dosing pump as per prescribe recommendation. 6. Panel board is monitored and data is recorded in log book as per workplace procedure. 7. Safety precaution is maintained in every aspect of work
Conditions and Resources	• Workplace or Simulated Workplace • Boiler • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	1. Overall Boiler operation 1.1 Water level 1.2 Fuel quantity 1.3 Gauge glass 1.4 Pressure gauge (steam, water and fuel) 1.5 Flue gas temperature 1.6 Feed water and steam temperature 1.7 Feed pump 1.8 Blowdown 1.9 Boiler vibration 1.10 Chemical dosing 1.11 Steam flow record 1.12 Water parameters record 2. Chemical solutions 2.1 pH control chemical 2.2 Corrosion inhibitor 2.3 Scale inhibitor 2.4 Steam line corrosion inhibitor 3. Data 3.1 Voltage 3.2 Flow 3.2.1 Fuel 3.2.2 Air 3.2.3 Gas 3.2.4 Steam

	3.2.5 Water 3.3 Pressure 3.3.1 Steam 3.3.2 Fuel 3.3.3 Feed water 3.4 Temperature 3.4.1 Furnace 3.4.2 Steam 3.4.3 Flue gas 3.4.4 Stack / chimney 3.4.5 panel 3.4.6 Economizer inlet and outlet 3.4.7 Feed water 3.4.8 Air preheater inlet and outlet 3.4.9 Oil 3.5 Level transmitter 3.5.1 Water 3.5.2 Fuel
Job/ Task/ Activity	1. Monitor oveall boiler operation 2. Record furnace temperature in logbook every hour 3. Dose chemical solution using dosing pump 4. Monitor panel board and record data in logbook 5. Maintain safety precautions in every aspect of work;
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Unit of Competency	**Perform Boiler Shutdown**
Unit Code	**OU-LE-BOM-05-L3-V1**
Module Title	Performing Boiler Shutdown
Module Descriptor	This unit coves the knowledge, skills and attitudes required to perform boiler shutdown It includes preparing for Shutdown work, performing emergency shutdown, shutdown operation of boiler, rechecking and ensuring shutdown activities
Nominal Hours	**25 Hours**
Learning Outcome	After completing the practice of the module, the trainees will be able to perform the following jobs: 1. Prepare for Shutdown work 2. Perform emergency shutdown 3. Perform shutdown operation of boiler 4. Recheck and ensure shutdown activities

Learning Outcome -1: Prepare for shutdown works	
Assessment Criteria	1. Safe work practices observed and Personal Protective Equipment (PPE) are used; 2. Hazards are identified and mitigated as per workplace procedure.
Conditions and Resources	• Workplace or Simulated Workplace • Boiler • PPE • Logbook • CBLM • Handout • Paper, Pen, Pencil and Eraser • White Board and marker
Contents	1. PPE 1.8 Safety shoes 1.9 Apron 1.10 Hand gloves 1.11 Helmet 1.12 Mask 1.13 Safety glass 1.14 Ear plug 2. Hazard
Job/ Task/ Activity	1. Maintain safe work practice 2. Identify hazards and mitigate as per workplace procedure.
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -2: Perform emergency shutdown	
Assessment Criteria	1. Emergency switch is activated by pressing. 2. Surrounding conditions are observed. 3. Main steam supply valve is closed. 4. Blowdown valve is opened to normalize the steam pressure in the boiler. 5. Shutdown report is conveyed to the authority
Conditions and Resources	• Workplace or Simulated Workplace • Boiler • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	1. Procedure of emergency shutdown operation of boiler
Job/ Task/ Activity	1. Shutdown boiler by following shutdown operation procedure during emergency condition.
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -3: Perform shutdown operation of boiler	
Assessment Criteria	1. Burner firing condition is set at low; 2. Burner switch is turned off; 3. Gauge glass and water control check is performed; 4. Main steam stop valve is turned off; 5. Blowdown is performed to reduce sludge; 6. Boiler water level is ensured after blowdown 7. Softener plant is shutdown; 8. FD and ID fan are turned off; 9. Panel board main breaker is turned off;
Conditions and Resources	• Workplace or Simulated Workplace • Boiler • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	1. Steps of shutdown operation of boiler
Job/ Task/ Activity	1. Perform shutdown operation of boiler as per SOP;
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -4: Recheck and ensure shutdown activities	
Assessment Criteria	1. Components and parts are rechecked according to the items of checklist 2. Information is recorded in log book.
Conditions and Resources	• Workplace or Simulated Workplace • Boiler • Shutdown procedure checklist • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	1. Items of checklist 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 2. Procedure of recheck shutdown activities
Job/ Task/ Activity	1. Recheck shutdown activities of boiler
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Unit of Competency	**Troubleshoot Faults of Boiler**
Unit Code	**OU-LE-BOM-06-L3-V1**
Module Title	Troubleshooting faults of boiler
Module Descriptor	This unit covers the knowledge, skills and attitudes required to troubleshoot faults of boiler It includes preparing for troubleshooting, performing maintenance of boiler, identifying electrical faults, mechanical faults, instrumental faults and responding to the emergency situation.
Nominal Hours	**60 Hours**
Learning Outcome	After completing the practice of the module, the trainees will be able to perform the following jobs: 1. Prepare for troubleshooting 2. Perform maintenance of boiler 3. Identify electrical faults 4. Identify mechanical faults 5. Identify instrumental faults 6. Respond to the emergency situation

Learning Outcome -1: Prepare for troubleshooting	
Assessment Criteria	1. Safe work practices are observed. 2. Personal Protective Equipment (PPE) is used; 3. Hazard is identified and mitigated as per organizational procedure. 4. Tools and Equipment are collected as per workplace requirement.
Conditions and Resources	• Workplace or Simulated Workplace • PPE • Tools and equipment • Boiler • CBLM • Handout • Paper, Pen, Pencil and Eraser • White Board and marker
Contents	1. PPE 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 2.1 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 Pulley 2.14 Multimeter 3. Hazards of boiler operation
Job/ Task/ Activity	1 Identify hazard 2 Select tools and equipment

Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -2: Perform maintenance of boiler	
Assessment Criteria	1. Preventive maintenance issues are identified. 2. Preventive routine maintenance is ensured. 3. Safety valve is tested automatically and manually as per schedule. 4. Information is recorded in the log book.
Conditions and Resources	• Workplace or Simulated Workplace • Boiler • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	1. Preventive maintenance issues 2. Preventive routine maintenance 2.1 Daily 2.1.1 Checking water level 2.1.2 Checking combustion visually 2.1.3 Blowdown of boiler 2.1.4 Blowdown of water column 2.1.5 Check and record feedwater pressure and temperature 2.1.6 Check and record flue gas temperature 2.1.7 Record oil pressure and temperature 2.1.8 Record gas pressure 2.1.9 Treat water according to the established program

	2.1.10 Record atomizing air pressure 2.2 Weekly 2.2.1 Check electric control 2.2.2 FD and ID fan checking 2.2.3 Water controller checking 2.2.4 Feed pump 2.2.5 Oil filter clean 2.3 Monthly 2.3.1 Inspecting burner 2.3.2 Inspecting for the flue gas leak 2.3.3 Inspecting for hot spots 2.3.4 Checking cams 2.3.5 Checking for tight closing of fuel valve 2.3.6 Checking fuel and air leakage 2.3.7 Checking indicating lights and alarms 2.3.8 Checking operating and limit controls 2.3.9 Checking safety and interlock controls 2.3.10 Checking for leaks, noise, vibration, unusual conditions 2.3.11 Checking low water cutoff operation 2.3.12 Draining of pressure gauge, sensors and switches 2.4 Half yearly 2.4.1 Cleaning low water cutoff 2.4.2 Cleaning oil pump strainer, filter 2.4.3 Cleaning air cleaner and air/oil separator 2.4.4 Inspecting refractory 2.4.5 Removing and cleaning oil preheater 2.4.6 Checking air pump coupling alignment 2.4.7 Inspecting/repairing burner housing to refractory seal 2.5 Yearly 2.5.1 Cleaning fireside surfaces 2.5.2 Cleaning breeching 2.5.3 Inspecting waterside surfaces 2.5.4 Checking operation and setting of safety valves 2.5.5 Performing hydraulic test 2.5.6 Performing descaling if necessary
Job/ Task/ Activity	1. Identify issues of preventive maintenance 2. Test safety valve automatically and manually as per schedule. 3. Perform preventive maintenance of boiler 4. Record maintenance report in the log book

Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -3: Identify electrical faults	
Assessment Criteria	1. Boiler operation is monitored during starting and running operation. 2. Electrical faults are identified and recorded in the log book before recheck. 3. Identified problems are reported to the designated authority. 4. Assistance is provided to the maintenance team.
Conditions and Resources	• Workplace or Simulated Workplace • Boiler • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker
Contents	1. Monitoring procedure of boiler during starting and running operation; 2. Electrical faults of boiler 2.1 Burner related faults 2.1.1 Carbon or gap in ignition rod 2.1.2 Air pressure switch 2.1.3 Photocell 2.1.4 Gas pressure switch 2.1.5 Dual solenoid valve 2.1.6 Steam pressure limit switch 2.1.7 Pressure transmitter 2.1.8 FD fan motor fault 2.1.9 ID fan motor fault 2.1.10 Servo motor board fault 2.1.11 Sequence controller / programme controller lock 2.1.12 Ignition transformer faults 2.1.13 Ignition cable faults 2.2 Panel 2.2.1 Magnetic contact problem 2.2.2 Timer problem 2.2.3 Relay problem 2.2.4 Control transformer 2.2.5 Circuit breaker 2.2.6 Indicating lamp
Job/ Task/ Activity	1. Monitor boiler during starting and running operation; 2. Identify electrical faults and record in the log book before recheck 3. Report identified problems to the designated authority

Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -4: Identify mechanical faults	
Assessment Criteria	1. Boiler operation is monitored. 2. Mechanical faults are identified and recorded in the log book. 3. Fuel system is cleaned as per SOP.
Conditions and Resources	• Workplace or Simulated Workplace • Boiler • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	1. Monitoring procedure of boiler operation; 2. Mechanical faults: 2.1 Pipe leakage 2.2 Valve leakage 2.3 Valve gland packing leakage 2.4 Flange gasket leakage 2.5 Safety valve leakage 2.6 Feed water pump problem 2.7 Blower/fans problem 3. Cleaning procedure of fuel system as per SOP
Job/ Task/ Activity	1. Identify mechanical faults and record in the log book. 2. Clean fuel system as per SOP
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -5: Identify instrumental faults	
Assessment Criteria	1. Boiler operation is monitored during starting and running operation. 2. Instrumental faults are identified and recorded in the log book before recheck. 3. Identified problems are reported to the designated authority. 4. Assistance is provided to the maintenance team.
Conditions and Resources	• Workplace or Simulated Workplace • Boiler • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	1. Monitoring procedure of boiler operation 2. Instrumental faults: 2.1 Pressure gauge faults 2.2 Level transmitter faults 2.3 Pressure transmitter faults 2.4 Logic controller faults 2.5 Pressure switch 2.6 Sensor problem
Job/ Task/ Activity	1. Monitor boiler operation during starting and running operation 2. Identify instrumental faults and record in the log book before recheck. 3. Report identified problems to the designated authority.
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• Written Test • Demonstration • Oral questioning • Portfolio

Learning Outcome -6: Respond to the emergency situation	
Assessment Criteria	1. Panel board is observed. 2. Emergency breakdown situation is identified. 3. Boiler operation is shutdown as per SOP. 4. Identified situations are reported to the designated authority for immediate solution. 5. Assistance is provided to the maintenance team.
Conditions and Resources	• Workplace or Simulated Workplace • Boiler • CBLM • Handout • Paper, Pen, Pencil and Eraser • Internet Facilities • White Board and marker • Audio video device
Contents	1. Emergency breakdown situation: 1.1 Steam pipe main line leakage (within boiler room) 1.2 Blowdown valve leakage 1.3 Shortage of feed water 1.4 Feedwater delivery pipe line leakage 1.5 Fire drum is damaged 1.6 Non return valve malfunctioning 1.7 Feed water suction strainer jam 1.8 Safety valve problem 1.9 Boiler body/ tube leakage 2. Emergency shutdown procedure of boiler
Job/ Task/ Activity	1. Identify emergency breakdown situation 2. Shutdown boiler as per SOP 3. Prepare report for emergency shutdown;
Training Method	• Discussion • Presentation • Demonstration • Guided Practice • Individual Practice • Project Work • Problem Solving • Brainstorming
Assessment Method	• 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-3 is developed by NSDA with assistance of GIZ on 05-06 and 11-13 February 2025.

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