



Competency Standard (CS)

Marine Engine Technician

Level-2

Light Engineering Sector

Competency Standard Code: CS-LE-MET-L2-EN-V1



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

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This Competency Standard for **Marine Engine Technician** is a document for the development of curricula, teaching and learning materials, and assessment tools. It also serves as the document for providing training consistent with the requirements of industry in order to meet the qualification of individuals who graduated through the established standard via competency-based assessment for a relevant job.

This document has been developed by NSDA in association with **Light Engineering Sector**, industry representatives, academia, related specialist, trainer and related employee. Public and private institutions may use the information contained in this standard for activities benefitting Bangladesh.

Introduction

The NSDA aims to enhance an individual's employability by certifying completeness with skills. NSDA works to expand the skilling capacity of identified public and private training providers qualitatively and quantitatively. It also aims to establish and operationalize a responsive skills ecosystem and delivery mechanism through a combination of well-defined set of mechanisms and necessary technical supports.

Key priority economic growth sectors identified by the government have been targeted by NSDA to improve current job skills along with existing workforce to ensure required skills to industry standards. Training providers are encouraged and supported to work with industry to address identified skills and knowledge to enable industry growth and increased employment through the provision of market responsive inclusive skills training program. "**Marine Engine Technician**" is selected as one of the priority occupations of **Light Engineering** Sector. This standard is developed to adopt a demand driven approach to training with effective inputs from Industry Skills Councils (ISC's), employer associations and employers.

Generally, a competency standard informs curriculum, learning materials, assessment and certification of trainees enrolled in Skills training. Trainees who successfully pass the assessment will receive a qualification in the National Skills Qualification Framework (BNQF) under Bangladesh National Qualification Framework and will be listed on the NSDA's online portal. This competency standard is developed to improve skills and knowledge in accordance with the job roles, duties and tasks of the occupation and ensure that the required skills and knowledge are aligned to industry requirements. A series of stakeholder consultations, workshops were held to develop this document.

The document also details the format, sequencing, wording and layout of the Competency Standard for an occupation which is comprised of Units of Competence and its corresponding Elements.

Overview

A **Competency Standard** is a written specification of the knowledge, skills and attitudes required for the performance of an occupation, trade or job corresponding to the industry standard of performance required in the workplace.

The purpose of a competency standard is to:

- provide a consistent and reliable set of components for training, recognising and assessing people's skills, and may also have optional support materials
- enable industry recognised qualifications to be awarded through direct assessment of workplace competencies
- encourage the development and delivery of flexible training which suits individual and industry requirements
- encourage learning and assessment in a work-related environment which leads to verifiable workplace outcomes

Competency standards are developed by a working group comprised of representative from NSDA, Key Institutions, ISC, and industry experts to identify the competencies required of an occupation in **Light Engineering Sector**.

Competency standards describe the skills, knowledge and attitude needed to perform effectively in the workplace. CS acknowledge that people can achieve technical and vocational competency in many ways by emphasizing what the learner can do, not how or where they learned to do it. With competency standards, training and assessment may be conducted at the workplace or at training institute or any combination of these.

Competency standards consist of a number of units of competency. A unit of competency describes a distinct work activity that would normally be undertaken by one person in accordance with industry standards.

Units of competency are documented in a standard format that comprises of:

- unit title
- nominal duration
- unit code
- unit descriptor
- elements and performance criteria
- variables and range statement
- curricular content guide
- assessment evidence guide

Together, all the parts/components of a unit of competency:

- describe a work activity
- guide the assessor to determine whether the candidate is competent or not yet competent

The ensuing sections of this document comprise of a description of the relevant occupation, trade or job with all the key components of a unit of competency, including:

- a chart with an overview of all Units of Competency for the relevant occupation, trade or job including the Unit Codes and the Unit of Competency titles and corresponding Elements
- the Competency Standard that includes the Unit of Competency, Unit Descriptor, Elements and Performance Criteria, Range of Variables, Curricular Content Guide and Assessment Evidence Guide.

Competency Standards for National Skill Certificate –2 in Marine Engine Technician in Light Engineering Sector

Level Descriptors of Skills Sector, BNQF Level 1-6

Level & Job classification	Knowledge Domain	Skills Domain	Responsibility Domain
6-Mid-Level Manager/ Sub Assistant Engineer	Comprehensive actual and theoretical knowledge within a specific work or study area with an awareness of the validity and limits of that knowledge, able to analyze, compare, relate and evaluate.	Specialised and wider range of cognitive and practical skills required to provide leadership in the development of creative solutions to defined problems. Communicate professional issues and solutions to the team and to external partners/users.	Work under broad guidance and self-motivation to execute strategic and operational plan/s. Lead lower-level management. Diagnose and resolve problems within and among work groups.
5-Supervisor	Broad knowledge of the underlying, concepts, principles, and processes in a specific work or study area, able to scrutinize and break information into parts/components by identifying motives or causes.	Broad range of cognitive and practical skills required to generate solutions to specific problems in one or more work or study areas. Communicate practice-related problems and possible solutions to external partners.	Work under guidance of management and self-direction to resolve specific issues. Lead and take responsibility for the work and actions of group/team members. Bridge between management.
4-Highly Skilled Worker	Broader knowledge of the underlying, concepts, principles, and processes in a specific work or study area, able to solve problems to new situations by comparing and applying acquired knowledge.	A range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying the full range of methods, tools, materials and information. Communicate using technical terminology and IT technology with partners and users as per workplace requirements.	Work under minimal supervision in specific contexts in response to workplace requirements. Resolve technical issues in response to workplace requirements and lead/guide a team/ group.
3-Skilled Worker	Moderately broad knowledge in a specific work or study area, able to perceive ideas and abstract from drawing and design according to workplace requirements.	Basic cognitive and practical skills required to use relevant information in order to carry out tasks and to solve routine problems using simple rules and tools. Communicate with his team and limited external partners upholding the values, nature and culture of the workplace	Work or study under supervision with considerable autonomy. Participate in teams and responsible for group coordination.
2-Semi Skilled Worker	Basic understanding of underpinning knowledge in a specific work or study area, able to interpret and apply common occupational terms and instructions.	Skills required to carry out simple tasks, communicate with his team in the workplace presenting and discussing results of his work with required clarity.	Work or study under supervision in a structured context with limited scope of manipulation
1 –Basic Skilled Worker	Elementary understanding of ability to interpret the underpinning knowledge in a specific study area, able to interpret common occupational terms and instructions.	Specific Basic skills required to carry out simple tasks. Interpret occupational terms and present the results of own work within guided work environment/ under supervision.	Work under direct supervision in a structured context with limited range of responsibilities.

List of Abbreviations

CS	-	Competency Standard
ISC	-	Industry Skills Council
FPS	-	Foot, Pound and Second
LEISC	-	Light Engineering Industry Skills Councils
NSDA	-	National Skills Development Authority
MKS	-	Meter, Kilogram and Second
BNQF	-	Bangladesh National Qualification 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
CNC	-	Computer & Numeric Control
MSP	-	Marine Engine Technician
4 iR	-	4 th Industrial Revolution

Approved by the Authority meeting, held on

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**Competency Standards for National Skill Certificate – 2 in
Marine Engine Technician
Course Structure**

SL.	Unit Code and Title		UoC Level	Nominal Hours
Generic Units of Competencies				40
1	GU-01-L1-V1	Perform Computations Using Basic Mathematical Concepts	1	15
2	GU-02-L1-V1	Apply Occupational Safety and Health (OSH) Procedure in the Workplace	1	15
3	GU-06-L1-V1	Practice House Keeping Procedure	1	10
Sector Specific Units of Competencies				40
4	SU-LE-01-L1-V1	Interpret Technical Drawing and Manuals	1	20
5	SU-LE-02-L1-V1	Use Measuring and Checking Tools and Instruments	1	20
Occupation Specific Units of Competencies				260
6	OU-LE-MET-01-L1-V1	Use Hand Tools and Power Tools	2	20
7	OU-LE-MET-02-L1-V1	Perform Maintenance of Intake and Exhaust System	2	40
8	OU-LE-MET-03-L1-V1	Perform Maintenance of Cooling and Lubricating system	2	50
9	OU-LE-MET-04-L1-V1	Repair and Service Engine Fuel System	2	100
10	OU-LE-MET-05-L1-V1	Perform Maintenance of Starting and Stopping System	2	30
11	OU-LE-MET-06-L1-V1	Test and Replace Battery	2	20
Learning Hours				340
Workplace Visit				20
Total Nominal Hours				360

Units & Elements at a Glance:

Generic Units of Competencies (40 hours)

Code	Unit of Competency	Elements of Competency	Duration (Hours)
GU-01-L1-V1	Perform Computations Using Basic Mathematical Concepts	<ol style="list-style-type: none"> 1. Identify calculation requirements in the workplace 2. Select appropriate mathematical methods for the calculation. 3. Use tool/instrument to perform calculations 	15
GU-02-L1-V1	Apply Occupational Safety and Health (OSH) Procedure in the Workplace	<ol style="list-style-type: none"> 1. Identify OSH policies and procedures. 2. Follow OSH procedure 3. Report hazards and risks. 4. Respond to emergencies 5. Maintain personal well-being 	15
GU-06-L1-V1	Practice House Keeping Procedure	<ol style="list-style-type: none"> 1. Sort and remove unnecessary items 2. Arrange items 3. Maintain work area, tools and equipment 4. Follow standardized work process and procedure 5. Perform work spontaneously 	10
Total Hours			40

Sector Specific Units of Competencies (50 Hours)

Code	Unit of Competency	Elements of Competency	Duration (Hours)
SU-LE-01-L1-V1	Interpret Technical Drawings and Manuals	<ol style="list-style-type: none"> 1. Follow OSH practices 2. Select technical drawing 3. Interpret drawing 4. Interpret and apply information in manuals /specification 	20
SU-LE-02-L1-V1	Use Measuring and Checking Tools and Instruments	<ol style="list-style-type: none"> 1. Prepare for work 2. Select the job to be measured and checked 3. Select measuring and checking tools and instruments 4. Take and check measurements 	20

		5. Record and communicate Measurements 6. Clean and store measuring and checking instruments	
Total Hours			40

Occupation Specific Units of Competencies (260 Hours)

Code	Unit of Competency	Elements of Competency	Hours
OU-LE-MET-01-L2-V1	Use Hand Tools and Power Tools	1. Prepare for work 2. Use hand tools 3. Use power tools 4. Maintain cleanliness and store hand tools and power tools	20
OU-LE-MET-02-L2-V1	Perform Maintenance of Intake and Exhaust System	1. Interpret fundamentals of marine engines 2. Prepare for maintenance 3. Repair/service engine Intake system 4. Repair/service exhaust system 5. Maintain workplace, tools, equipment and materials	40
OU-LE-MET-03-L2-V1	Perform Maintenance of Cooling and Lubricating system	1. Prepare for maintenance 2. Repair/service lubricating system 3. Repair/service cooling system 4. 4.Maintain workplace, tools, equipment and materials	50
OU-LE-MET-04-L2-V1	Repair and Service Engine Fuel System	1. Prepare for work 2. Identify faults of fuel system and its components 3. Repair/service fuel system component 4. Maintain workplace, tools, equipment and materials	100
OU-LE-MET-05-L2-V1	Perform Maintenance of Starting and Stopping System	1. Prepare for work 2. Test and Identify faults 3. Carry out servicing and maintenance of starting system 4. Carry out servicing and maintenance of stopping system 5. Maintain workplace, tools,	30

		equipment and materials	
OU-LE-MET-06-L2-V1	Test and Replace Battery	<ol style="list-style-type: none"> 1. Prepare for work 2. Test batteries 3. Service and charge battery 4. Maintain workplace, tools, equipment and materials 	20
Total Hours			260

Generic Units of Competencies

Unit Code and Title	GU-01-L1-V1: Perform Computations Using Basic Mathematical Concepts
Unit Descriptor	<p>This unit of competency requires the knowledge, skills and attitude to perform computations using basic mathematical concepts in the workplace.</p> <p>It specifically includes the tasks of identifying calculation requirements in the workplace, selecting appropriate mathematical method/concept for the calculation and using appropriate instruments tools to perform calculation.</p>
Nominal Hours	15 Hours
Elements of Competency	<p>Performance Criteria <u>Bold & Underlined</u> terms are elaborated in the Range of Variables Training Components</p>
1. Identify calculation requirements in the workplace	1.1 Job requirements are identified 1.2 <u>Measurements</u> are selected in accordance with job requirement 1.3 Calculation requirements are identified from <u>workplace information</u>
2. Select appropriate mathematical methods for the calculation.	2.1 Mathematical methods are identified 2.2 <u>Appropriate method</u> is selected to carry out the calculation requirements 2.3 Tolerance and clearance limits are identified and adjusted according to the job requirements
3. Use tool/instrument to perform calculations	3.1 Work instructions are confirmed and applied to the job in hand 3.2 Materials to be measured are identified as per job specification 3.3 Appropriate <u>tool/ instrument</u> is selected based on materials to be measured
Range of Variables	
Variable	Range (may include but not limited to)
1. Measurements	1.1 Length 1.2 Width 1.3 Weight 1.4 Tolerance
2. workplace information	2.1 Job Order 2.2 Design 2.3 Working drawing 2.4 Verbal instructions 2.5 Written Instruction
3. Appropriate method	3.1 Addition 3.2 Subtraction 3.3 Division 3.4 Multiplication 3.5 Conversion 3.6 Percentage and ratio calculation

4. Tool/ Instrument	<ul style="list-style-type: none"> 4.1 Calculator 4.2 Scale 4.3 Measuring tape 4.4 Marker
<p>Evidence Guide The evidence must be authentic, valid, sufficient, reliable, consistent and recent and meet the requirements of the current version of the Unit of Competency.</p>	
1. Critical Aspects of Competency	<p>Assessment required evidence that the candidate:</p> <ul style="list-style-type: none"> 1.1 Identified calculation requirements from workplace information 1.2 Selected appropriate method to carry out the calculation requirements 1.3 Selected measurements 1.4 Selected appropriate methods 1.5 Used tool/instrument 1.6 Added numbers 1.7 Subtracted numbers 1.8 Multiplied numbers. 1.9 Divided numbers. 1.10 Completed calculations using appropriate tools/instruments
2. Underpinning Knowledge	<ul style="list-style-type: none"> 2.1. Numerical concept 2.2. Basic mathematical methods such as addition, subtraction, multiplication and division and percentage. 2.3. Mathematical language, symbols and terminology. 2.4. Measuring units
3. Underpinning Skills	<ul style="list-style-type: none"> 3.1 Interpret numerical concept 3.2 Interpret mathematical methods such as addition, subtraction, multiplication and division and percentage. 3.3 Interpret mathematical language, symbols and terminology. 3.4 Interpret measuring units
4. Underpinning Attitudes	<ul style="list-style-type: none"> 4.1. Commitment to occupational health and safety 4.2. Environmental concerns 4.3. Eagerness to learn 4.4. Tidiness and timeliness 4.5. Respect for rights of peers and seniors in workplace 4.6. Communication with peers and seniors in workplace
5. Resource Implications	<ul style="list-style-type: none"> 5.1. Work place Procedure 5.2. Materials relevant to the proposed activity 5.3. All tools, equipment, material and documentation required. 5.4. Relevant specifications or work instructions
6. Methods of Assessment	<ul style="list-style-type: none"> 6.1. Written Test 6.2. Demonstration 6.3. Oral Questioning 6.4. Portfolio

7. Context of assessment	<p>7.1 Competency assessment must be done in NSDA accredited assessment centre;</p> <p>7.2 Assessment should be done by NSDA certified assessor.</p>
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Accreditation Requirements

Training Providers must be accredited by National Skills Development Authority (NSDA), the National Quality Assurance Body, or a body with delegated authority for quality assurance to conduct training and assessment against this unit of competency for credit towards the award of qualification under BNQF. Accredited providers assessing against this unit of competency must meet the quality assurance requirements set by NSDA.

Unit Code and Title	GU-02-L1-V1: Apply Occupational Safety and Health (OSH) Procedure in the Workplace
Unit Descriptor	This unit covers the knowledge, skills and attitudes (KSA) required in applying occupational safety and health (OSH) procedures in the workplace. It specifically includes identifying OSH policies and procedures, following OSH procedure, reporting to emergencies, and maintaining personal well-being.
Nominal Hours	15 Hours
Elements of Competency	Performance Criteria Bold & Underlined terms are elaborated in the Range of Variables
1. Identify OSH policies and procedures.	1.1. <u>OSH policies</u> and <u>safe operating procedures</u> are accessed and stated; 1.2. <u>Safety signs and symbols</u> are identified and followed; 1.3. Emergency response, evacuation procedures and other contingency measures are determined according to workplace requirements.
2. Follow OSH procedure	2.1 <u>Personal protective equipment (PPE)</u> is selected and collected as required; 2.2 Personal protective equipment (PPE) is correctly used in accordance with organization OHS procedures and practices; 2.3 A clear and tidy workplace is maintained as per workplace standard; 2.4 PPE is maintained to keep them operational and compliant with OHS regulations.
3. Report hazards and risks.	3.1 <u>Hazards</u> and risks are identified, assessed and controlled; 3.2 Incidents arising from hazards and risks are reported to designated authority.
4. Respond to emergencies	4.1 Alarms and warning devices are responded; 4.2 Workplace <u>emergency procedures</u> are followed; 4.3 <u>Contingency measures</u> during workplace accidents, fire and other emergencies are recognized and followed in accordance with organization procedures; 4.4 First aid procedures is applied during emergency situations.
5. Maintain personal well-being	5.1 OHS policies and procedures are adhered to; 5.2 OHS awareness programs are participated in as per workplace guidelines and procedures; 5.3 Corrective actions are implemented to correct unsafe condition in the workplace; 5.4 <u>“Fit to work” records</u> are updated and maintained according to workplace requirements.
Range of Variables	
Variables	Range (may include but not limited to):
1. OSH Policies	1.1. Bangladesh standards for OHS

	1.2. Fire Safety Rules and Regulations 1.3. Code of Practice 1.4. Industry Guidelines
2. Safe Operating Procedures	2.1 Orientation on emergency exits, fire extinguishers, fire escape, etc. 2.2 Emergency procedures 2.3 First Aid procedures 2.4 Tagging procedures 2.5 Use of PPE 2.6 Safety procedures for hazardous substances
3. Safety Signs and symbols	3.1 Direction signs (exit, emergency exit, etc.) 3.2 First aid signs 3.3 Danger Tags 3.4 Hazard signs 3.5 Safety tags 3.6 Warning signs
4. Personal Protective Equipment (PPE)	4.1 Gas Mask 4.2 Gloves 4.3 Safety boots 4.4 Face mask 4.5 Overalls 4.6 Goggles and safety glasses 4.7 Sun block 4.8 Chemical/Gas detectors
5. Hazards	5.1 Chemical hazards 5.2 Biological hazards 5.3 Physical Hazards 5.4 Mechanical and Electrical Hazard 5.5 Mental hazard 5.6 Ergonomic hazard
6. Emergency Procedures	6.1 Fire fighting 6.2 Earthquake 6.3 Medical and first aid 6.4 evacuation`
7. Contingency measures	7.1 Evacuation 7.2 Isolation 7.3 Decontamination
8. "Fit to Work" records	8.1 Medical Certificate every year 8.2 Accident reports, if any 8.3 Eye vision certificate

Evidence Guide

The evidence must be authentic, valid, sufficient, reliable, consistent, recent and meet all requirements of current version of the Unit of Competency

1. Critical aspects of competency	<p>Assessment required evidence that the candidate:</p> <ul style="list-style-type: none"> 1.1 stated OSH policies and safe operating procedures. 1.2 followed safety signs and symbols. 1.3 used personal protective equipment (PPE). 1.4 maintained workplace clear and tidy. 1.5 assessed and controlled hazards. 1.6 followed emergency procedures. 1.7 followed contingency measures. 1.8 implemented corrective actions.
2. Underpinning knowledge	<ul style="list-style-type: none"> 2.1 Define OSH 2.2 OHS Workplace Policies and Procedures 2.3 Work Safety Procedures 2.4 Emergency Procedures 2.5 Hazard control procedure 2.6 Different types of Hazards 2.7 PPE and there uses 2.8 Personal Hygiene Practices 2.9 OHS Awareness
3. Underpinning skills	<ul style="list-style-type: none"> 3.1 Accessing OSH policies 3.2 Handling of PPE 3.3 Handling cleaning tools and equipment 3.4 Writing report 3.5 Responding to emergency procedures
4. Required attitude	<ul style="list-style-type: none"> 4.1 Commitment to occupational health and safety 4.2 Sincere and honest to duties 4.3 Promptness in carrying out activities 4.4 Environmental concerns 4.5 Eagerness to learn 4.6 Tidiness and timeliness 4.7 Respect of peers and seniors in workplace 4.8 Communicate with peers and seniors in workplace
5. Resource implications	<ul style="list-style-type: none"> 5.1 Workplace 5.2 Equipment and outfits appropriate in applying safety measures 5.3 Tools, materials and documentation required 5.4 OSH Policies and Procedures
6. Methods of assessment	<p>Assessment methods may include but not limited to:</p> <ul style="list-style-type: none"> 6.1 written test 6.2 demonstration 6.3 oral questioning 6.4 portfolio
7. Context of assessment	<ul style="list-style-type: none"> 7.1 Competency assessment must be done in NSDA accredited assessment centre; 7.2 Assessment should be done by a NSDA certified/nominated assessor.

Accreditation Requirements

Training Providers must be accredited by National Skills Development Authority (NSDA), the National Quality Assurance Body, or a body with delegated authority for quality assurance to conduct training and assessment against this unit of competency for credit towards the award qualification under BNQF. Accredited providers assessing against this unit of competency must meet the quality assurance requirements set by NSDA.

Unit Code and Title	GU-06-L1-V1: Practice House Keeping Procedure
Unit Descriptor	<p>This unit covers the knowledge, skills and attitude required to Practice housekeeping procedure.</p> <p>It specifically includes sorting and removing unnecessary items, arranging items, maintaining work area, tools and equipment, following standardized work process and procedure and performing work spontaneously.</p>
Nominal Hours	10 Hours
Elements of Competency	Performance Criteria <u>Bold underlined</u> terms are elaborated in the Range of Variables
1. Sort and remove unnecessary items	<p>1.1 Reusable, recyclable materials are sorted in accordance with company/office procedures;</p> <p>1.2 <u>Unnecessary items</u> are removed and disposed of in accordance with company or office procedures.</p>
2. Arrange items	<p>2.1 Items are arranged in accordance with company/office housekeeping procedures;</p> <p>2.2 Work area is arranged according to job requirements;</p> <p>2.3 Activities are prioritized based on instructions;</p> <p>2.4 Items are provided with clear and visible <u>identification marks</u> based on procedure;</p> <p>2.5 Safety equipment and evacuation passages are kept clear and accessible based on instructions.</p>
3. Maintain work area, tools and equipment	<p>3.1 Cleanliness and orderliness of work area is maintained in accordance with company/office procedures;</p> <p>3.2 Tools and equipment are cleaned in accordance with manufacturer's instructions/manual;</p> <p>3.3 <u>Minor repairs</u> are performed on tools and equipment in accordance with manufacturer's instruction/manual;</p> <p>3.4 Defective tools and equipment are reported to immediate supervisor.</p>
4. Follow standardized work process and procedure	<p>4.1 Materials for common use are maintained in designated area based on procedures;</p> <p>4.2 Work is performed according to standard work procedures. Abnormal incidents are reported to immediate supervisor.</p>
5. Perform work spontaneously	<p>5.1 Work is performed as per instruction;</p> <p>5.2 Company and office <u>decorum</u> are followed and complied with</p> <p>5.3 Work is performed in accordance with OSH requirements.</p>
Range of Variables	
Variable	Range (may include but not limited to):

1. Unnecessary items	<ul style="list-style-type: none"> 1.1 Non-recyclable materials 1.2 Pictures, posters and other materials not related to work activity 1.3 Unserviceable tools and equipment 1.4 Waste materials
2. Identification marks	<ul style="list-style-type: none"> 2.1 Colour coding 2.2 Labels 2.3 Tags
3. Minor repairs	<ul style="list-style-type: none"> 3.1 Application of lubricants 3.2 Replacement of parts/components 3.3 Sharpening of tools 3.4 Tightening of nuts, bolts and screws
4. Decorum	<ul style="list-style-type: none"> 4.1 Behaviour 4.2 Company/office rules and regulations 4.3 Company/office uniform
<p>Evidence Guide</p> <p>The evidence must be authentic, valid, sufficient, reliable, consistent, recent and meet all requirements of current version of the Unit of Competency.</p>	
1. Critical aspects of competency	<p>Assessment required evidence that the candidate:</p> <ul style="list-style-type: none"> 1.1 sorted and removes unnecessary items 1.2 arranged items 1.3 maintained work area, tools and equipment 1.4 followed standardized work process and procedures 1.5 performed work spontaneously
2. Underpinning knowledge	<ul style="list-style-type: none"> 2.1 Environmental requirements relative to work safety 2.2 Principles of 5S 2.3 Reading skills required to interpret instructions 2.4 Work process and procedures 2.5 Work-related documentation requirements
3. Underpinning skills	<ul style="list-style-type: none"> 3.1 Arranging items 3.2 Maintaining work area, tools and equipment 3.3 Following standardizing work process
4. Underpinning attitude	<ul style="list-style-type: none"> 1.1 Commitment to occupational health and safety 1.2 Promptness in carrying out activities 1.3 Sincere and honest to duties 1.4 Environmental concerns 1.5 Eagerness to learn 1.6 Tidiness and timeliness 1.7 Respect for rights of peers and seniors in workplace 1.8 Communication with peers and seniors in workplace

2. Resource implications	<p>The following resources must be provided:</p> <p>5.1 Work place Procedure</p> <p>5.2 Materials relevant to the proposed activity</p> <p>5.3 All tools, equipment, material and documentation required.</p> <p>5.4 Relevant specifications or work instructions</p>
6. Methods of assessment	<p>Methods of assessment may include but not limited to:</p> <p>3.1 written test</p> <p>3.2 demonstration</p> <p>3.3 oral questioning</p> <p>3.4 portfolio</p>
4. Context of assessment	<p>7.1 Competency assessment must be done in NSDA accredited assessment centre;</p> <p>7.2 Assessment should be done by NSDA certified assessor</p>
<p>Accreditation Requirements</p> <p>Training Providers must be accredited by National Skills Development Authority (NSDA), the National Quality Assurance Body, or a body with delegated authority for quality assurance to conduct training and assessment against this unit of competency for credit towards the award of qualification under BNQF. Accredited providers assessing against this unit of competency must meet the quality assurance requirements set by NSDA.</p>	

Sector Specific Units of Competencies

Unit Code and Title	SU- LE -01-L1-V1: Interpret Technical Drawing and Manuals
Unit Descriptor	This unit covers the knowledge, skill and attitude required in interpreting technical drawings. It includes following OSH practices, selecting technical drawing and interpreting drawing.
Nominal Hours	20 Hours
Elements of Competency	Performance Criteria <u>Bold and Underlined</u> terms are elaborated in the Range of Variables.
1. Follow OSH practices	1.1 <u>Safe work practices</u> are followed as required for the work performed; 1.2 Hazards are identified and controlled; 1.3 Necessary PPE are selected and worn as per work requirement.
2. Select technical drawing	2.1 <u>Drawing</u> is selected and checked to ensure that it conforms to the job requirements; 2.2 Drawing is validated.
3. Interpret drawing	3.1 Drawing components, assemblies are identified; 3.2 Dimensions are identified according to job requirement; 3.3 Clearances/tolerances are checked for compliance with work place standards; 3.4 <u>Instructions</u> are identified and followed accurately; 3.5 Material specifications are identified; 3.6 Symbols in drawing/s are interpreted.
4. Interpret manuals /specification	5.1 Relevant sections, chapters of specifications/ manuals are determined in relation to the work to be conducted; 5.2 Information and procedure in the manual are interpreted according to job requirements; 5.3 Work steps are correctly identified in accordance with manufacturer's specification; 5.4 Correct sequencing and adjustments are interpreted in accordance with information contained in the manual or specifications; 5.5 Manual or specification is stored in accordance with workplace requirements.
Range of Variables	
Variables	Range (may include but not limited to):
1. Drawing	1.1 Technical drawing 1.2 Sketch/diagram
2. Instructions	2.1 Note 2.2 Special Instruction 2.3 Precaution

Evidence Guide	
The evidence must be authentic, valid, sufficient, reliable, consistent and recent and meet the requirements of the current version of the Unit of Competency.	
1. Critical aspects of competency	<p>Assessment required evidence that the candidate:</p> <ul style="list-style-type: none"> 1.1 selected and interpreted technical drawing 1.2 used and followed instruction according to job requirement. 1.3 interpreted and applied information of manuals /specification
2. Underpinning knowledge	<ul style="list-style-type: none"> 2.1 OSH 2.2 Instruction 2.3 Workplace standard 2.4 Sequence of drawing 2.5 Methods of interpretation 2.6 Manuals and specifications
3. Underpinning skills	<ul style="list-style-type: none"> 3.1 Practicing workplace safety 3.2 Reading / interpreting information on the drawing, following data 3.3 Interpreting manuals 3.4 Keeping records
4. Underpinning attitudes	<ul style="list-style-type: none"> 4.1 Commitment to occupational health and safety 4.2 Promptness in carrying out activities 4.3 Sincere and honest to duties 4.4 Environmental concerns 4.5 Eagerness to learn 4.6 Tidiness and timeliness 4.7 Respect for rights of peers and seniors in workplace 4.8 Communication with peers and seniors in workplace
5. Resource implications	<ul style="list-style-type: none"> 5.1 Tools, equipment and physical facilities 5.2 Drawings, Manuals and Specifications 5.3 Materials, consumable needed to perform activities
6. Methods of assessment	<p>Assessment methods may include but not limited to:</p> <ul style="list-style-type: none"> 6.1 demonstration 6.2 oral questioning 6.3 written test 6.4 portfolio
7. Context of Assessment	<ul style="list-style-type: none"> 7.1 Competency assessment must be done in NSDA accredited assessment center; 7.2 Assessment should be done by an NSDA certified/ nominated assessor

Accreditation Requirements

Training Providers must be accredited by National Skills Development Authority (NSDA), the National Quality Assurance Body, or a body with delegated authority for quality assurance to conduct training and assessment against this unit of competency for credit towards the award of qualification under BNQF. Accredited providers assessing against this unit of competency must meet the quality assurance requirements set by NSDA.

Unit Code and Title	SU-LE-02-L1-V1: Use Measuring and Checking Tools and Instruments
Unit Descriptor	This unit covers the knowledge, skills and attitudes required to use measuring and checking tools and instruments. It includes the tasks of preparing for work, selecting the job, selecting measuring and checking tools and instruments, taking and checking measurements, recording measurements, cleaning and storing measuring and checking instruments.
Nominal Hours	20 Hours
Elements of Competency	Performance Criteria <u>Bold & Underlined</u> terms are elaborated in the range of variables
1. Prepare for work	1.1 <u>Safe work practices</u> are observed and <u>Personal Protective Equipment (PPE)</u> worn as required for the work performed; 1.2 <u>Hazards</u> are identified and risks are minimized and controlled; 1.3 <u>Measuring and checking tools and instruments</u> are selected and collected for use; 1.4 Rols of work are identified from Toolbox meeting as per workplace standard.
2. Select the job to be measured and checked	2.1 Jobs to be measured are identified; 2.2 Jobs to be checked are identified; 2.3 Jobs specifications <u>Documents</u> and are Interpreted.
3. Select measuring and checking tools and instruments	3.1 Measuring and checking instrument is selected according to job requirements; 3.2 Tolerance and/or clearance, limits are interpreted from the drawing.
4. Take and check measurements	4.1 Measuring and checking instruments are calibrated to ensure accurate reading/measurement; 4.2 <u>Routine adjustments</u> are done as required; 4.3 <u>Measurements</u> are taken precisely/accurately as per supplied drawing or manual; 4.4 Measurements are checked as per <u>manuals</u> and drawing.
5. Record and communicate Measurements	5.1 Measurements are recorded on form/drawings/sketches as per company procedures; 5.2 Recorded measurements are interpreted and communicated to supervisor.
6. Clean and store measuring and checking instruments	6.1 Measuring and checking instruments are cleaned; 6.2 Measuring instruments are stored as per industry procedure.
Range of Variables	
Variable	Range (May include but not limited to)
1. Safe work practices	1.1 Use PPE 1.2 Follow Lockout and Tagout (LOTO) procedure 1.3 Use fire extinguisher 1.4 Response emergency situation

	1.5 Identify hazard 1.6 Control hazards 1.7 Measure risk 1.8 Use first aid 1.9 Report uncontrolled hazards 1.10 Follow stop work authority instruction
2. Personal Protective Equipment (PPE)	2.1 Safety shoes 2.2 Goggles 2.3 Hand gloves 2.4 Safety helmet with color code 2.5 Overall apron/Boiler suit 2.6 Safety Mask 2.7 Ear plug
3. Hazards	3.1 Physical hazard 3.2 Chemical hazard 3.3 Electrical and mechanical hazard 3.4 Biological hazard 3.5 Ergonomic hazard
4. Measuring and checking tools and instruments	4.1 Measuring tools <ul style="list-style-type: none"> ▪ Measuring tape ▪ Slide/Vernier Calipers ▪ Steel Rules ▪ Tri-square ▪ Micrometer ▪ Protector ▪ Combination square set ▪ Vernier height gauge ▪ Depth gauge ▪ Dial indicator set ▪ Tachometer ▪ Hydrometer ▪ Temperature gun/Infrared gun ▪ High discharge tester ▪ Torque wrench ▪ Vibration meter 4.2 Checking tools <ul style="list-style-type: none"> ▪ Inside calipers ▪ Outside calipers ▪ Filler gauge ▪ Thread gauge ▪ Divider ▪ Plug gauge ▪ Snap gauge ▪ Ring gauge ▪ Plastic gauge

	<ul style="list-style-type: none"> ▪ Cylinder bore gauge ▪ Master gauge ▪ Crankshaft deflection gauge
5. Documents	5.1 Drawings 5.2 Sketches/diagram 5.3 Technical manuals 5.4 Specifications 5.5 Written instructions
6. Routine adjustment	6.1 Calibration 6.2 Simple zeroing 6.3 Scale adjustment 6.4 Reference adjustment
7. Measurements	7.1 Measuring length 7.2 Thread pitch 7.3 Angle 7.4 Diameter 7.5 Clearances <ul style="list-style-type: none"> ▪ Tappet clearance ▪ Main bearing clearance ▪ Big end bearing clearance ▪ Gudgeon pin clearance ▪ Piston ring clearance ▪ Piston and cylinder clearance ▪ Valve guide clearance 7.6 Time 7.7 RPM 7.8 Wear
Evidence Guide	
The evidence must be authentic, valid, sufficient, reliable, consistent, recent and meet the requirements of the current version of the Unit of Competency.	
1. Critical aspects of competency	Assessment required evidence that the candidate: <ol style="list-style-type: none"> 1.1 followed OSH practices 1.2 identified the proper measuring instrument 1.3 took measurement 1.4 checked measurement 1.5 recorded measurement
2. Underpinning knowledge	<ol style="list-style-type: none"> 2.1 Relevant OSH. 2.2 Safe work practices 2.3 Hazards and its types 2.4 List of measuring and checking tools and instruments 2.5 Principles of using different measuring instruments. 2.6 Sequence of using the instruments. 2.7 Measurements 2.8 Methods of checking measurement

	<ul style="list-style-type: none"> 2.9 Methods of taking measurement 2.10 Calibration and instrumentation 2.11 Lockout and Tagout (LOTO)
3. Underpinning skill	<ul style="list-style-type: none"> 3.1 Practicing workplace safety 3.2 Using PPE 3.3 Using measuring instruments 3.4 Interpreting and following data sheet, instruction, manuals and technical drawing 3.5 Performing measurement 3.6 Checking for conformance to specification 3.7 Keeping record and report 3.8 Calibration of instruments.
4. Underpinning attitudes	<ul style="list-style-type: none"> 4.1 Commitment to occupational safety and health 4.2 Promptness in carrying out activities 4.3 Sincere and honest to duties 4.4 Environmental concerns 4.5 Eagerness to learn 4.6 Tidiness and timeliness 4.7 Respect for rights of peers and seniors in workplace 4.8 Communication with peers and seniors in workplace.
5. Resource implications	<ul style="list-style-type: none"> 5.1 Adequate workplaces 5.2 Materials for proposed activities 5.3 Measuring and checking tools and instruments appropriate to propose activities 5.4 Information and documentation 5.5 Drawings, Manual, Codes, Standards and reference materials.
6. Methods of assessment	<p>Assessment methods may include but not limited to:</p> <ul style="list-style-type: none"> 6.1 demonstration 6.2 oral questioning 6.3 written test 6.4 portfolio
7. Context of assessment	<ul style="list-style-type: none"> 7.1 Competency assessment must be done in NSDA accredited assessment centre; 7.2 Assessment should be done by NSDA certified assessor.
<p>Accreditation Requirements</p> <p>Training Providers must be accredited by National Skills Development Authority (NSDA), the National Quality Assurance Body, or a body with delegated authority for quality assurance to conduct training and assessment against this unit of competency for credit towards the award of qualification under BNQF. Accredited providers assessing against this unit of competency must meet the quality assurance requirements set by NSDA.</p>	

Occupation Specific Units of Competencies

Unit Code and Title	OU-LE-MET-01-L1-V1: Use Hand Tools and Power Tools
Unit Descriptor	This unit covers the knowledge, skills and attitudes required to use hand and power tools. It includes the tasks of preparing for work, using hand tools, using power tools, maintaining cleanliness and storing hand tools and power tools.
Nominal Hours	20 Hours
Elements of Competency	Performance Criteria <u>Bold & Underlined</u> terms are elaborated in the Range of Variables
1. Prepare for work	<p>1.1 <u>Safe work practices</u> are followed throughout the work process;</p> <p>1.2 <u>Personal Protective Equipment (PPE)</u> is collected and worn as per work requirement;</p> <p>1.3 Appropriate <u>hand tools</u> are identified and collected as per requirement;</p> <p>1.4 <u>Power tools</u> are identified and collected conforming to task requirements.</p> <p>1.5 Rols of work are identified from Toolbox meeting as per workplace standard.</p>
2. Use hand tools	<p>2.1 <u>Applications</u> of tools and equipment are defined;</p> <p>2.2 Proper keep close observation is applied in the use of hand tools;</p> <p>2.3 Unsafe or faulty tools are identified and marked for repair or reject;</p> <p>2.4 Proper Gripping of tools is followed as per instruction.</p>
3. Use power tools	<p>3.1 Power tools are used for a specific <u>sequence of operations</u> to produce desired outcomes conforming to job specifications;</p> <p>3.2 All safety requirements are compiled before, during and after use;</p> <p>3.3 Unsafe or faulty tools are identified and tagged for repair / reject/replaced before, during and after use according to current procedures;</p> <p>3.4 <u>Operational maintenance</u> of tools is undertaken according to standard procedures.</p>
4. Maintain cleanliness and store hand tools and power tools	<p>4.1 Workplace is cleaned as per standard procedure;</p> <p>4.2 Waste materials are disposed conforming to the environmental compliances;</p> <p>4.3 Hand and power tools are cleaned and stored safe place as per instruction manuals.</p>
Range of Variables	
Variables	Range (may include but not limited to):

1. Safe work practices	<ul style="list-style-type: none"> 1.1 Use PPE 1.2 Follow Lockout and Tagout (LOTO) procedure 1.3 Use fire extinguisher 1.4 Response emergency situation 1.5 Identify hazard 1.6 Control hazards 1.7 Measure risk 1.8 Use first aid 1.9 Follow Safe Working Load (SWL) 1.10 Report uncontrolled hazards
2. Personal Protective Equipment (PPE)	<ul style="list-style-type: none"> 2.1 Safety shoes 2.2 Goggles 2.3 Hand gloves 2.4 Apron 2.5 Helmet with color code 2.6 Overall apron/Boiler suit 2.7 Ear plug
3. Hand tools	<ul style="list-style-type: none"> 3.1 Different types of hammers 3.2 Different type of wrenches/Spanners 3.3 Different types of files 3.4 Different types of chisels 3.5 Screwdriver set 3.6 Hacksaw 3.7 Different types of punches 3.8 Scriber 3.9 Different types pliers 3.10 Sniper 3.11 Wire Brush 3.12 Scraper 3.13 Jigs and fixtures 3.14 C clamp (clamp) 3.15 Allen key set 3.16 Ratchet 3.17 Spirit levels 3.18 Hand Scissor 3.19 Plastic hammer/Mallet 3.20 Grip vice 3.21 Tap and die set 3.22 Circlip opener 3.23 Bearing puller 3.24 Piston ring opener 3.25 Valve spring opener 3.26 Cylinder liner puller 3.27 Gear puller 3.28 Shaft puller

	3.29 Piston puller
4. Power tools	4.1 Portable/Hand Grinders 4.2 Portable/Hand drill 4.3 Pedestal drills 4.4 Pedestal grinders 4.5 Bench grinders 4.6 Power saws 4.7 Powered screw driver
5. Application	5.1 Adjusting 5.2 Aligning 5.3 Clamping 5.4 Cleaning 5.5 Finishing 5.6 Lubricating 5.7 Tightening 5.8 Pulling 5.9 Fitting 5.10 Opening
6. Sequence of Operation	6.1 Clamping 6.2 Alignment 6.3 Adjustment 6.4 Completion of operation
7. Operational maintenance	7.1 Hand sharpening 7.2 Cleaning 7.3 Lubricating 7.4 Tightening 7.5 Simple tools repair and adjustments
Evidence Guide The evidence must be authentic, valid, sufficient, reliable, consistent, recent and meet all requirements of current version of the Unit of Competency.	
1. Critical aspects of competency	Assessment required evidences that the candidate: 1.1 followed proper using procedure of manual tools 1.2 maintained safety precaution for using hand & power tools 1.3 maintained sequence of operation of hand tools and power tools 1.4 used power tools as per workplace requirement. 1.5 undertook operational maintenance
2. Underpinning knowledge	2.1 Classification of tools. 2.2 Types of hand and power tools 2.3 Safely use of hand tools and power tools. 2.4 Preventive maintenance of hand and power tools 2.5 Methods of using hand and power tools 2.6 Storage procedures 2.7 Operational maintenance

	<ul style="list-style-type: none"> 2.8 Sequence of operation 2.9 Application of tools.
3. Underpinning skills	<ul style="list-style-type: none"> 3.1 Identifying tools as per work requirement 3.2 Practicing OSH 3.3 Using hand and power tools safely 3.4 Performing preventive maintenance of tools 3.5 Cleaning and storing tools and equipment.
4. Underpinning attitudes	<ul style="list-style-type: none"> 4.1 Commitment to occupational safety and health 4.2 Promptness in carrying out activities 4.3 Sincere and honest to duties 4.4 Eagerness to learn 4.5 Tidiness and timeliness 4.6 Environmental concerns 4.7 Respect for rights of peers and seniors at workplace 4.8 Communication with peers and seniors at workplace.
5. Resource implications	<ul style="list-style-type: none"> 5.1 Adequate workplaces 5.2 Materials for proposed activities 5.3 Hand tools and power tools appropriate to propose activities 5.4 Information and documentation 5.5 Manual, Codes, Standards and reference materials.
6. Methods of assessment	<ul style="list-style-type: none"> 6.1 Demonstration 6.2 Oral questioning 6.3 Written test 6.4 Portfolio
7. Context of assessment	<ul style="list-style-type: none"> 7.1 Competency assessment must be done in NSDA accredited assessment centre; 7.2 Assessment should be done by NSDA certified assessor.
<p>Accreditation Requirements</p> <p>Training Providers must be accredited by National Skills Development Authority (NSDA), the National Quality Assurance Body, or a body with delegated authority for quality assurance to conduct training and assessment against this unit of competency for credit towards the award of qualification under BNQF. Accredited providers assessing against this unit of competency must meet the quality assurance requirements set by NSDA.</p>	

Unit Code & Title	OU-LE-MET-02-L2-V1: Perform Maintenance of Intake and Exhaust systems.
Unit Descriptor	This unit covers the knowledge, skill and attitude required to perform maintenance of intake, exhaust. system. It includes the tasks of interpreting fundamentals of marine engines, preparing for maintenance, repairing/servicing engine intake system, repairing/servicing exhaust system, maintaining workplace, tools, equipment and materials
Nominal Hours	40 Hours
Elements Of Competency	Performance Criteria <u>Bold & Underlined</u> terms are elaborated in the Range of Variables
1. Interpret fundamentals of marine engines	1.1 <u>Types of marine engine</u> are interpreted; 1.2 <u>Main parts/components of marine engine</u> are identified; 1.3 Working principles of different engines are interpreted; 1.4 Functions of different parts/components are interpreted.
2. Prepare for maintenance	2.1 <u>Safe work practices</u> are followed throughout the work process; 2.2 <u>Personal Protective Equipment (PPE)</u> worn as required for the work to be performed; 2.3 Necessary <u>tools and equipment</u> are identified and collected in accordance with work requirement; 2.4 Necessary <u>materials</u> are collected as per work requirement; 2.5 Rols of work are identified from toolbox meeting as per workplace standard
3. Repair/service engine Intake system	3.1 <u>Main components of air intake system</u> are identified as per instruction manual 3.2 Intake/inlet system is checked as per operation and maintenance manual (O&M) 3.3 <u>Faults</u> of components of intake system are identified based on procedures 3.4 Repairing/servicing of Intake/inlet system is performed as per manufacturer's manual using specified tools and equipment 3.5 Testing of intake system is carried out to ensure proper performance
4. Repair/service exhaust system	4.1 <u>Main components of engine exhaust system</u> are identified as per instruction manual 3.6 Intake/inlet system is checked as per operation and maintenance manual (O&M) 4.2 <u>Faults</u> of components of exhaust system are identified based on procedure. 4.3 Repairing/servicing of Exhaust system is performed as per manufacturer's <u>manual</u> using specified tools and equipment 4.4 Testing of exhaust system is carried out to ensure proper performance

5. Maintain workplace, tools, equipment and materials	5.1 Work area is cleaned in accordance with workplace procedures; 5.2 Unused materials are stored for re-use or disposed following workplace procedures; 5.3 Waste and scrap materials are disposed with following workplace procedures; 5.4 Inventory of tools equipment are conducted and recorded as per checklist; 5.5 Tools and equipment are cleaned and stored as per manufacturer recommendation in appropriate location.
RANGE OF VARIABLES	
VARIABLE	RANGE (May include but not limited to):
1. Types of marine engine	1.1 Based on Engine Design <ul style="list-style-type: none"> ▪ Two-Stroke Engine ▪ Four-Stroke Engine 1.2 Based on Engine Placement <ul style="list-style-type: none"> ▪ Inboard Engine ▪ Outboard Engine 1.3 Based on Application <ul style="list-style-type: none"> ▪ Main Engine (Propulsion Engine) ▪ Auxiliary Engine (Generator Engine) 1.4 Other Specialized Marine Engines <ul style="list-style-type: none"> ▪ Steam Turbine Engine ▪ Battery operated Propulsion System
2. Main parts/components of marine engine	2.1 Cylinder Block and Components <ul style="list-style-type: none"> ▪ Cylinder block ▪ Cylinder liner ▪ Cylinder head ▪ Cylinder head gasket 2.2 Moving Components/Combustion components <ul style="list-style-type: none"> ▪ Piston ▪ Piston rings ▪ Piston pin (gudgeon pin) ▪ Connecting rod ▪ Crankshaft ▪ Flywheel 2.3 Valve and Timing Mechanism <ul style="list-style-type: none"> ▪ Inlet valve ▪ Exhaust valve ▪ Valve seat ▪ Valve guide ▪ Camshaft

	<ul style="list-style-type: none"> ▪ Rocker arm ▪ Push rod ▪ Tappet (or cam follower) ▪ Timing gears or timing chain
2.4	<p>Fuel System</p> <ul style="list-style-type: none"> ▪ Fuel tank ▪ Fuel pump ▪ Fuel injector ▪ Fuel filter ▪ Fuel lines ▪ Injection timing device
2.5	<p>Air Intake and Exhaust (Scavenging) System</p> <ul style="list-style-type: none"> ▪ Turbocharger ▪ Air filter ▪ Intercooler (aftercooler) ▪ Intake manifold ▪ Exhaust manifold ▪ Silencer/muffler ▪ Exhaust pipe
2.6	<p>Lubrication System</p> <ul style="list-style-type: none"> ▪ Oil pump ▪ Oil filter ▪ Oil cooler ▪ Oil sump (oil pan) ▪ Lubricating oil lines
2.7	<p>Cooling System</p> <ul style="list-style-type: none"> ▪ Freshwater pump ▪ Sea water pump ▪ Heat exchanger ▪ Thermostat ▪ Expansion tank ▪ Cooling jackets
2.8	<p>Electric Starting System</p> <ul style="list-style-type: none"> ▪ Starting motor (electric starter or air starter) ▪ Batteries (for electric start)
2.9	<p>Compressed Air Starting System</p> <ul style="list-style-type: none"> ▪ Air starting valve (for air start system) ▪ Starting air bottle (in large engines)
2.10	<p>Monitoring and Control Instruments</p> <ul style="list-style-type: none"> ▪ Pressure gauges (oil, fuel, air) ▪ Temperature gauges (coolant, exhaust, oil) ▪ RPM indicator (tachometer) ▪ Alarm and safety shutdown system ▪ Engine control panel/Dash board
2.11	<p>Ancillary Systems</p>

	<ul style="list-style-type: none"> ▪ Governor (for speed control) ▪ Vibration damper ▪ Crankcase ventilation system ▪ Scavenge pump (in two-stroke engines)
3. Safe work practices	<p>3.1 Use PPE</p> <p>3.2 Follow Lock out and tag out procedure</p> <p>3.3 Use fire extinguisher</p> <p>3.4 Response emergency situation</p> <p>3.5 Identify hazard</p> <p>3.6 Control hazards</p> <p>3.7 Measure risk</p> <p>3.8 Use first aid</p> <p>3.9 Follow Safe Working Load (SWL)</p> <p>3.10 Report uncontrolled hazards</p>
4. Personal Protective Equipment	<p>4.1 Hand Gloves.</p> <p>4.2 Safety Shoes.</p> <p>4.3 Apron/Boiler shoot</p> <p>4.4 Safety goggles</p> <p>4.5 Safety belt</p> <p>4.6 Helmet</p>
5. Tools and equipment	<p>5.1 Hand tools</p> <ul style="list-style-type: none"> ▪ Socket wrench set ▪ Combination wrenches ▪ Adjustable wrenches ▪ Screwdrivers ▪ Hammers ▪ Pliers set ▪ Torque wrench ▪ Scraper ▪ Valve ▪ Allen Key set ▪ Screw extractor <p>5.2 Air gun</p> <p>5.3 Multi meter</p>
6. Materials	<p>6.1 Kerosene</p> <p>6.2 Cotton waste</p> <p>6.3 Gasket set</p> <p>6.4 Anti rust solutions</p>
7. Main components of air intake system	<p>7.1 Air cleaner</p> <p>7.2 Hose pipes</p> <p>7.3 Manifold</p> <p>7.4 Intake air chamber</p> <p>7.5 Air Temperature Sensor</p> <p>7.6 Turbo intercooler</p>
8. Faults of intake system	<p>8.1 Low/high air intake pressure</p>

	8.2 Air filter jam 8.3 Carbon deposit 8.4 intake air temperature high
9. Components of exhaust system	9.1 Silencer/Muffler 9.2 exhaust manifold 9.3 Turbocharger 9.4 Exhaust temperature sensor 9.5 Expansion bellows
10. Faults of exhaust system	10.1 Carbon deposit / Blocked or Clogged Exhaust 10.2 High exhaust temperature 10.3 Smokey exhaust gas 10.4 Exhaust Leaks 10.5 Rust and Corrosion 10.6 Excessive Noise 10.7 Sensor Failures
11. Standard procedure	11.1 Checking of intake system <ul style="list-style-type: none"> ▪ Air cleaner blockage ▪ Hose pipes leakage ▪ manifold leakage ▪ Air Temperature Sensor ▪ Dirty super charger 11.2 Checking of exhaust system <ul style="list-style-type: none"> ▪ Silencer /muffler leakage or damage ▪ exhaust manifold leakage ▪ Manifold Gasket damage ▪ Dirty Turbocharger
12. Manual	12.1 Operation manual 12.2 Service and maintenance Manual 12.3 Parts/components catalog
Evidence Guide The evidence must be authentic, valid, sufficient, reliable, consistent, recent and meet all requirements of current version of the Unit of Competency.	
1. Critical aspects of competency	Assessment requires evidence that the candidate: <ul style="list-style-type: none"> 1.1 identified marine engine components 1.2 identified faults of intake and exhaust system components 1.3 repaired the intake and exhaust system components 1.4 performed maintenance and servicing the systems 1.5 carried out testing of the systems
2. Underpinning knowledge	2.1 Marine engine and its type 2.2 Main parts/components of marine engine and their functions 2.3 Types of system in marine engine 2.4 different components of intake and exhaust system 2.5 Functions of each component of intake and exhaust system 2.6 Working principle of marine engine intake system. 2.7 Working principle of marine engine exhaust system. 2.8 Faults of intake and exhaust system
3. Underpinning skills	3.1 Using and interpretation of repair manual

	<ul style="list-style-type: none"> 3.2 Using proper tools for specific jobs 3.3 Checking the systems 3.4 Diagnosing faults of intake and exhaust system 3.5 Disassembling and assembling components 3.6 Applying the techniques of maintenance and servicing. 3.7 Performing final testing
4. Required Attitude	<ul style="list-style-type: none"> 4.1 Commitment to occupational health and safety 4.2 Promptness in carrying out activities 4.3 Sincere and honest to duties 4.4 Environmental concerns 4.5 Eagerness to learn 4.6 Tidiness and timeliness 4.7 Respect for rights of peers and seniors in workplace 4.8 Communication with peers and seniors in workplace
5. Resource implications	<p>The following resources must be provided:</p> <ul style="list-style-type: none"> 5.1 workplace 5.2 tools and equipment appropriate to maintain workplace 5.3 materials relevant to the proposed activity 5.4 all tools, equipment, material and documentation required. 5.5 relevant drawings, manuals, codes, standards and reference material
6. Method of assessment	<p>Assessment methods may include but not limited to:</p> <ul style="list-style-type: none"> 6.1 Written test 6.2 Demonstration 6.3 Oral Questioning/interview 6.4 Portfolio
7. Context for assessment	<ul style="list-style-type: none"> 7.1 Competency assessment must be done in NSDA accredited assessment centre; 7.2 Assessment should be done by NSDA certified assessor.
<p>Accreditation Requirements Training Providers must be accredited by National Skills Development Authority (NSDA), the National Quality Assurance Body, or a body with delegated authority for quality assurance to conduct training and assessment against this unit of competency for credit towards the award of qualification under BNQF. Accredited providers assessing against this unit of competency must meet the quality assurance requirements set by NSDA.</p>	

Unit Code & Title	OU-LE-MET-03-L2-V1: Perform Maintenance of Cooling and Lubricating System
Unit Descriptor	This unit covers the knowledge, skill and attitude required to perform maintenance of cooling and lubricating system. It includes the tasks of preparing for maintenance, repairing/servicing, lubricating system, repairing/servicing cooling system, maintaining workplace, tools, equipment and materials
Nominal Hours	50 Hours
Elements Of Competency	Performance Criteria <u>Bold & Underlined</u> are elaborated in the Range of Variables
1. Prepare for maintenance	<p>1.1 <u>Safe work practices</u> are observed throughout the work process;</p> <p>1.2 <u>Personal Proactive Equipment (PPE)</u> worn as required for the work to be performed;</p> <p>1.3 Necessary <u>tools and equipment</u> are identified and collected in accordance with work requirement;</p> <p>1.4 Necessary <u>materials</u> are collected as per work requirement;</p> <p>1.5 Rols of work are identified from toolbox meeting as per workplace standard.</p>
2. Repair/service lubricating system	<p>2.1 <u>Main components of marine engine lubricating system</u> are identified as per instruction manual;</p> <p>2.2 <u>Faults of lubricating system</u> are identified as based on <u>standard procedure</u>;</p> <p>2.3 Repairing/servicing of components of lubricating system is performed as per manufacturer's manual using specified tools and equipment;</p> <p>2.4 Testing of lubricating system is carried out to ensure proper performance.</p>
3. Repair/service Cooling system	<p>3.1 <u>Main components of marine engine cooling system</u> are identified as per instruction manual;</p> <p>3.2 <u>Faults of cooling system</u> are Identified based on <u>standard procedure</u>;</p> <p>3.3 Repairing/servicing the components of cooling system is performed as per manufacturer's manual using specified tools and equipment;</p> <p>3.4 Testing of cooling system is carried out to ensure proper performance.</p>
4. Maintain workplace, tools, equipment and materials	<p>4.1 Work area is cleaned in accordance with workplace procedures;</p> <p>4.2 Unused materials are stored for re-use or disposed following workplace procedures;</p> <p>4.3 Waste and scrap materials are disposed with following workplace procedures;</p> <p>4.4 Inventory of tools equipment are conducted and recorded as</p>

	per checklist; 4.5 Tools and equipment are cleaned and stored as per manufacturer recommendation in appropriate location.
Range of Variables	
Variable	Range (May include but not limited to):
1. Safe work practices	1.1 Use PPE 1.2 Follow lock out and tag out (LOTO) procedure 1.3 Use fire extinguisher 1.4 Response emergency situation 1.5 Identify hazard 1.6 Control hazards 1.7 Measure risk 1.8 Use first aid 1.9 Follow Safe Working Load (SWL) 1.10 Report uncontrolled hazards
2. Personal Protective Equipment	2.1 Hand Gloves. 2.2 Safety Shoes. 2.3 /Boiler shoot 2.4 Safety goggles 2.5 Safety belt 2.6 Helmet
3. Tools and equipment	3.1 Hand tools <ul style="list-style-type: none"> ▪ Socket wrench set ▪ Combination wrenches ▪ Adjustable wrenches ▪ Screwdrivers ▪ Hammers ▪ Pliers set ▪ Torque wrench ▪ Scraper ▪ Drain plug remover ▪ Allen Key set ▪ Lub oil filter removing belt 3.2 Water gun 3.3 Air gun 3.4 Multi meter 3.5 Cooling system pressure tester 3.6 Oil pressure gage
4. Materials	6.1 Kerosene 6.2 Cotton waste 6.3 Gasket set 6.4 Lubricating oil 6.5 Anti rust solutions 6.6 Oil filter

	6.7 Flashing oil
5. Main components of marine engine lubricating system	5.1 Oil filter 5.2 Oil pump 5.3 Oil control/pressure valve 5.4 Oil sump 5.5 Strainer 5.6 Oil cooler
6. Faults of lubricating system	6.1 Clogged sea water strainer: 6.2 Sea water pump failure: 6.3 Blocked or fouled heat exchanger: 6.4 Coolant leaks: 6.5 Corroded or eroded components: 6.6 Thermostat malfunction: 6.7 Air locks in the system: 6.8 Low coolant level: 6.9 Faulty temperature sensor or gauge: 6.10 Burst or collapsed hoses: 6.11 Water ingress in coolant: 6.12 Poor circulation in jacket water system
7. Main components of marine engine cooling system	7.1 Cooler 7.2 Reservoir/Expansion tank 7.3 Pressure cap 7.4 Water pump 7.5 belt 7.6 Thermostat valve 7.7 Hose pipes 7.8 Lube oil cooler 7.9 Jacket water cooling system
8. Faults of cooling system	8.1 Clogged sea water strainer – Blocks the flow of cooling water, causing overheating. 8.2 Blocked or scaled heat exchanger – Reduces heat transfer efficiency. 8.3 Coolant leakage – Leads to loss of coolant and engine overheating. 8.4 Pump failure (sea water or fresh water pump) – Results in poor coolant circulation. 8.5 Thermostat malfunction – Causes incorrect engine temperature regulation. 8.6 Air lock in cooling system – Prevents proper coolant flow. 8.7 Corroded or damaged pipes – Leads to leaks or reduced flow efficiency. 8.8 Low coolant level – Causes inadequate cooling. 8.9 Worn-out or broken impeller in sea water pump – Reduces or stops water flow. 8.10 Faulty temperature sensors – Gives incorrect temperature readings or fails to trigger alarms. 8.11 Radiator or tank blockage (for closed systems) – Hinders

	coolant circulation. 8.12 Improper coolant mixture (wrong antifreeze concentration) 8.13 Internal leakage (e.g., head gasket failure)
9. Standard procedure	9.1 Checking of Lubricating system <ul style="list-style-type: none"> ▪ Dirty Oil filter ▪ Oil pump pressure ▪ Oil control/pressure valve adjustment ▪ Oil sump leakage ▪ Dirty Strainer ▪ Oil Passage Blocked ▪ Intercooler leakage ▪ Lubricating oil appearance ▪ Valve seal and guide damage 9.2 Checking of cooling system <ul style="list-style-type: none"> ▪ Radiator and reservoir jam ▪ Pressure cap performance ▪ Water pump noise and pressure ▪ Fan belt tension ▪ Thermostat valve performance ▪ Hose pipes leakage ▪ Sea water corrosion ▪ Piston cooler leakage or jam ▪ Jacket cooler leakage or jam
10. Manual	10.1 Maintenance Procedure Manual 10.2 Periodic Maintenance Data 10.3 Service Manual 10.4 Parts/components Checklist
Evidence Guide The evidence must be authentic, valid, sufficient, reliable, consistent, recent and meet all requirements of current version of the Unit of Competency.	
1. Critical aspects of competency	Assessment requires evidence that the candidate: <ul style="list-style-type: none"> 1.1 identified faults of cooling and lubricating system components 1.2 repaired the cooling and lubricating system components 1.3 Performed maintenance and servicing the cooling and lubricating systems 1.4 carried out testing of the systems,
2. Underpinning knowledge	2.1 Different components of lubrication system and their function. 2.2 Different components of cooling system and their function. 2.3 Working principle of marine engine lubricating system. 2.4 Working principle of marine engine cooling system. 2.5 Faults of lubricating system 2.6 Faults of cooling system 2.7 Faults of jacket cooling system,
3. Underpinning skills	3.1 Using and interpretation of repair manual

	<ul style="list-style-type: none"> 3.2 Using proper tools for specific jobs 3.3 Checking the systems 3.4 Using appropriate lubricating oil grade as per Original Equipment Manufacturer (OEM) recommendation 3.5 Diagnosing faults of lubricating system 3.6 Diagnosing faults of cooling system 3.7 Disassembling and assembling components 3.8 Applying the techniques of maintenance and servicing 3.9 Performing the test run.
4. Required Attitude	<ul style="list-style-type: none"> 4.1 Commitment to occupational health and safety 4.2 Promptness in carrying out activities 4.3 Sincere and honest to duties 4.4 Environmental concerns 4.5 Eagerness to learn 4.6 Tidiness and timeliness 4.7 Respect for rights of peers and seniors in workplace 4.8 Communication with peers and seniors in workplace.
5. Resource implications	<ul style="list-style-type: none"> 5.1 The following resources must be provided: 5.2 Workplace 5.3 Tools and equipment appropriate to maintain workplace 5.4 Materials relevant to the proposed activity 5.5 All tools, equipment, material and documentation required. 5.6 Relevant drawings, manuals, codes, standards and reference material.
6. Method of assessment	<p>Methods of assessment may include but not limited to:</p> <ul style="list-style-type: none"> 6.1 Written test 6.2 Demonstration 6.3 Oral questioning 6.4 Portfolio
7. Context for assessment	<ul style="list-style-type: none"> 7.1 Competency assessment must be done in NSDA accredited assessment centre; 7.2 Assessment should be done by NSDA certified assessor.

Accreditation Requirements

Training Providers must be accredited by National Skills Development Authority (NSDA), the National Quality Assurance Body, or a body with delegated authority for quality assurance to conduct training and assessment against this unit of competency for credit towards the award of qualification under BNQF. Accredited providers assessing against this unit of competency must meet the quality assurance requirements set by NSDA.

Unit Code & Title	OU-LE-MET-04-V1: Repair and Service Marine Engine Fuel System
Unit Descriptor	This unit of competency describes the skills, knowledge and attitude required to repair and service marine engine fuel systems. It includes preparing for work, identifying faults of fuel system and its components, repairing/servicing fuel system component and maintaining workplace, tools, equipment and materials.
Nominal Hours	100 Hours
Elements Of Competency	Performance Criteria
	<u>Bold and Underlined</u> terms are elaborated in the Range of Variables
1. Prepare for work	<p>1.1 <u>Safe work practices</u> are observed throughout the work process</p> <p>1.2 <u>personal protective equipment</u> (PPE) worn as required for the work performed.</p> <p>1.3 Necessary <u>tools and equipment</u> are identified and collected in accordance with work requirement.</p> <p>1.4 Necessary <u>materials</u> are collected in accordance with work requirement.</p> <p>1.5 Rols of work are identified from Toolbox meeting as per workplace standard</p> <p>1.6 Precaution in relation to working with fuel system components are observed as per work procedure.</p>
2. Identify faults of fuel system and its components	<p>2.1 Primary/Feed and High-pressure fuel injection pump pressure is checked based on manuals and standard procedure.</p> <p>2.2 Injector pressure is checked based on manuals and standard procedure.</p> <p>2.3 Relevant basic electric wiring is checked based on manuals and procedure.</p> <p>2.4 <u>Components</u> of fuel system are disassembled as per instruction manuals</p> <p>2.5 Governor linkage and jam are checked based on instruction manuals and standard procedure</p> <p>2.6 <u>Faults</u> of the components are identified based on <u>checking and testing.</u></p>
3. Repair/service fuel system component	<p>3.1 Correct information is accessed and interpreted from instruction manuals</p> <p>3.2 <u>Repairing and servicing of fuel system/components</u> are carried out as per instruction manuals</p> <p>3.3 Adjustments of fuel system component are done during the servicing as per instruction manuals</p> <p>3.4 air bleeding/purging of fuel system is performed as per standard procedure</p> <p>3.5 Test run is carried out and fuel system is tested for correct</p>

	operation.
4. Maintain workplace, tools, equipment and materials	<p>4.1 Work area is cleaned in accordance with workplace procedures.</p> <p>4.2 Unused materials are stored for re-use or disposed following workplace procedures.</p> <p>4.3 Waste and scrap materials are disposed with following workplace procedures.</p> <p>4.4 Inventory of tools equipment are conducted and recorded as per checklist.</p> <p>4.5 Tools and equipment are cleaned and stored as per manufacturer's recommendation in appropriate location.</p>
Range Of Variable	
Variable	Range (May include but not limited to):
1.	<p>1.1 Use PPE</p> <p>1.2 Follow lock out and tag out (LOTO) procedure</p> <p>1.3 Use fire extinguisher</p> <p>1.4 Response emergency situation</p> <p>1.5 Identify hazard</p> <p>1.6 Control hazards</p> <p>1.7 Measure risk</p> <p>1.8 Use first aid</p> <p>1.9 Follow Safe Working Load (SWL)</p> <p>1.10 Report uncontrolled hazards</p>
2. Personal Protective Equipment	<p>2.1 Apron /boiler suit</p> <p>2.2 Hand gloves.</p> <p>2.3 Safety goggles</p> <p>2.4 Safety helmet</p> <p>2.5 Safety belt</p> <p>2.6 Safety shoes</p> <p>2.7 Ear muff</p> <p>2.8 Mask /Respirator</p>
3. Tools and Equipment	<p>3.1 Hand and power tools</p> <ul style="list-style-type: none"> ▪ Socket wrench set ▪ Combination wrenches ▪ Adjustable wrenches ▪ Screwdrivers ▪ Hammers ▪ pliers set ▪ Allen key set <p>3.2 Multimeter</p> <p>3.3 Vernier calliper</p> <p>3.4 Depth gauge</p> <p>3.5 Injector tester/Pop tester</p> <p>3.6 Air gun</p>

4. Fuel system components	<p>Conventional Components:</p> <ul style="list-style-type: none"> 8.1 Feed/primary pump 8.2 High pressure injection pump 8.3 High pressure fuel line 8.4 Fuel injectors, 8.5 Fuel filters/Fuel strainer. 8.6 Power supply <p>Fuel Eclectic Components:</p> <ul style="list-style-type: none"> 8.7 Low pressure Electric pump 8.8 Injector rail 8.9 Fuel discharge valve 8.10 Electric control injector 8.11 High pressure pump 8.12 Fuel discharge rail 8.13 Fuel filter 8.14 Electronic control unit 8.15 Fuel pressure gauge 8.16 Water separator
5. Materials	<ul style="list-style-type: none"> 5.1 Kerosene 5.2 Diesel 5.3 Cotton waste 5.4 Spare parts/components
6. Faults	<ul style="list-style-type: none"> 6.1 Fuel leakage – Due to worn-out seals, gaskets, or loose connections. 6.2 Air in the fuel system – Causes improper fuel injection and engine misfiring. 6.3 Low injection pressure – Caused by worn plunger, delivery valve, or pump wear. 6.4 Faulty plunger or barrel – Leads to poor fuel delivery or timing issues. 6.5 Sticking delivery valve – Affects injection timing and pressure. 6.6 Improper timing of fuel injection – Results in power loss and high fuel consumption. 6.7 Worn camshaft or cam follower – Reduces plunger movement, affecting injection pressure. 6.8 Clogged or dirty fuel filters – Restricts fuel flow to the pump. 6.9 Water or dirt contamination in fuel – Causes corrosion and wear in pump components. 6.10 Broken or weak springs (in delivery valve or control mechanism) Causes irregular injection. 6.11 Excessive wear of internal components – Leads to loss of efficiency and improper fuel delivery. 6.12 Governor malfunction – Causes unstable engine speed and or fuel control. 6.13 Fuel rack or linkage sticking – Leads to improper control of fuel quantity. 6.14 Overheating of pump – Due to insufficient cooling or lubrication.

	6.15 Improper calibration – Leads to imbalanced fuel distribution among cylinders.
7. Checking and Testing	7.1 Visual inspections and documents 7.2 Injector testing using pop tester 7.3 Adjustments and operational testing 7.4 Spill timing
8. Repairing and servicing of fuel system/components	8.1 Feed/primary pump 8.2 Replacing high pressure injection pump 8.3 High pressure fuel line 8.4 Fuel injectors, 8.5 Fuel filters/Fuel strainer. 8.6 Low pressure Electric pump 8.7 Mount Injector rail 8.8 Fuel filter 8.9 Fuel pressure gauge 8.10 Replacing Water separator
Evidence Guide	
The evidence must be authentic, valid, sufficient, reliable, consistent, recent and meet all requirements of current version of the Unit of Competency.	
1. Critical aspects of competency	Assessment requires evidence that the candidate: 1.1 disassembled components of fuel system in sequential procedure. 1.2 checked governor linkage and jam 1.3 conducted inspection and testing to identify faults 1.4 repaired of fuel leaks 1.5 tested and maintained correct fuel pressure 1.6 calibrated of fuel injectors and fuel pumps 1.7 checked and replaced worn or damaged fuel lines and connections 1.8 monitored and adjusted fuel injection timing 1.9 ensured proper operation of fuel transfer and booster pumps 1.10 carried out testing of the systems to ensure proper performance.
2. Underpinning Knowledge	2.1 Principles of diesel engine fuel system operation 2.2 Types and functions of fuel system components (e.g. fuel tanks, filters, pumps, injectors) 2.3 Common fuel system faults and their symptoms 2.4 Tools and Equipment used for fuel system 2.5 Bleeding procedures/Air purging procedure 2.6 Purpose of using phasing and calibrating machine 2.7 Fuel Injector testing procedure 2.8 Fuel properties and types used in marine engines 2.9 Fuel contamination sources and control methods 2.10 Fuel injection timing and pressure principles 2.11 Safety procedures related to handling fuel and working in fuel

	<p>systems</p> <p>2.12 Maintenance schedules and service procedures for fuel systems</p> <p>2.13 Environmental regulations and compliance related to fuel handling</p> <p>2.14 Use of measuring and diagnostic tools for fuel system inspection.</p>
3. Underpinning Skill	<p>3.1 Using diagnostic tools and instruments</p> <p>3.2 Reading and interpreting technical manuals and fuel system diagrams</p> <p>3.3 Dismantling and assembling fuel system components (filters, pumps, injectors)</p> <p>3.4 Cleaning and servicing fuel injectors and fuel pumps</p> <p>3.5 Identifying and repairing fuel system leaks</p> <p>3.6 Performing pressure and flow testing of the fuel system</p> <p>3.7 Calibrating injectors and fuel pumps</p> <p>3.8 Applying safety procedures while handling fuel and fuel system parts/components</p> <p>3.9 Trouble shooting skills to diagnose and resolve fuel system faults</p> <p>3.10 Testing the performance of fuel system</p> <p>3.11 Basic record-keeping and documentation skills.</p>
4. Required Attitude	<p>4.1 Commitment to occupational safety and health</p> <p>4.2 Promptness in carrying out activities</p> <p>4.3 Sincere and honest to duties</p> <p>4.4 Eagerness to learn</p> <p>4.5 Tidiness and timeliness</p> <p>4.6 Environmental concerns</p> <p>4.7 Respect for rights of peers and seniors at workplace</p> <p>4.8 Communicate with peers and seniors at workplace.</p>
5. Resources Implication	<p>The following resources must be provided:</p> <p>5.1 Workplace</p> <p>5.2 A range of diesel fuel injection and components relevant to the application</p> <p>5.3 Materials relevant to servicing diesel fuel injection systems</p> <p>5.4 Equipment, hand and power tooling appropriate to servicing fuel injection systems</p> <p>5.5 Specifications and work instructions.</p>
6. Method of assessment	<p>Assessment methods may include but not limited to:</p> <p>6.1 Written Test</p> <p>6.2 Demonstration</p> <p>6.3 Oral Questioning/interview</p> <p>6.4 Portfolio</p>
7. Context for Assessment	<p>7.1 Competency assessment must be done in NSDA accredited</p>

	<p>assessment centre</p> <p>7.2 Assessment should be done by a NSDA certified/nominated assessor</p>
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Accreditation Requirements

Training Providers must be accredited by National Skills Development Authority (NSDA), the National Quality Assurance Body, or a body with delegated authority for quality assurance to conduct training and assessment against this unit of competency for credit towards the award of qualification under BNQF. Accredited providers assessing against this unit of competency must meet the quality assurance requirements set by NSDA.

Unit Code & Title	OU-LE-MET-05-L2-V1: Perform Maintenance of Starting and Stopping System
Unit Descriptor	This unit covers the knowledge, skill and attitude required to perform maintenance of starting system of a diesel engine. It includes the tasks of preparing for work, testing and identifying fault, carrying out servicing and maintenance of starting system, carrying out servicing and maintenance of stopping system, maintaining workplace, tools, equipment and materials
Nominal Hours	30 Hours
Elements of Competency	Performance Criteria <u>Bold & Underlined</u> terms are elaborated in the Range of Variables
1. Prepare for work	<ul style="list-style-type: none"> 1.1 <u>Safe work practices</u> are observed throughout the work process; 1.2 <u>Personal Proactive Equipment</u> (PPE) worn as required for the work performed; 1.3 Necessary <u>tools and equipment</u> are identified and collected in accordance with work requirement; 1.4 Necessary <u>materials</u> are collected in accordance with work requirement; 1.5 Rols of work are identified from Toolbox meeting as per workplace standard; 1.6 Precaution in relation to working with starting system are observed as per work procedure.
2. Test and Identify faults	<ul style="list-style-type: none"> 2.1 Information is accessed and interpreted from appropriate manufacturer specifications; 2.2 <u>Tests of starting system components</u> are carried out to determine faults using relevant tools and techniques; 2.3 <u>Faults</u> are identified and repaired based on testing/checking results.
3. Carry out servicing and maintenance of starting system	<ul style="list-style-type: none"> 3.1 Sequence of disassembling of starting system <u>components and accessories</u> are performed for maintenance and servicing according to instruction manual and work place procedure; 3.2 Servicing and necessary adjustments are made in accordance with instruction manual; 3.3 Replacement of starting system components and necessary accessories are performed in accordance with manufacturer/component supplier specifications; 3.4 The <u>starting motor</u> is fitted with the engine in accordance with manufacturer manual; 3.5 A test-run of the system is carried out to ensure the performance as per workplace expectation.

<p>4. Carry out servicing and maintenance of stopping system</p>	<p>4.1 The <u>stopping system components are inspected</u> for any wear and tear, corrosion, or damage;</p> <p>4.2 The operation of the emergency shutdown system (ESD) is tested;</p> <p>4.3 Clean and lubricate mechanical parts/components of the shutdown mechanism;</p> <p>4.4 Check and service pneumatic or hydraulic control systems (if applicable);</p> <p>4.5 Examine electrical connections, fuses, and relays related to the stopping system;</p> <p>4.6 Replace worn-out or faulty components as per manufacturer's manual;</p> <p>4.7 A test-run of the system is carried out to ensure the performance as per workplace expectation.</p>
<p>5. Maintain workplace, tools, equipment and materials</p>	<p>4.1 Work area is cleaned in accordance with workplace procedures;</p> <p>4.2 Unused materials are stored for re-use or disposed following workplace procedures;</p> <p>4.3 Waste and scrap materials are disposed with following workplace procedures;</p> <p>4.4 Inventory of tools equipment are conducted and recorded as per checklist;</p> <p>4.5 Tools and equipment are cleaned and stored as per manufacturer recommendation in appropriate location.</p>
<p>Range of Variable</p>	
<p>Variable</p>	<p>Range (May include but not limited to):</p>
<p>1. Safe work practices</p>	<p>1.1 Use PPE</p> <p>1.2 Follow lock out and tag out procedure</p> <p>1.3 Use fire extinguisher</p> <p>1.4 Response emergency situation</p> <p>1.5 Identify hazard</p> <p>1.6 Control hazards</p> <p>1.7 Measure risk</p> <p>1.8 Use first aid</p> <p>1.9 Follow Safe Working Load (SWL)</p> <p>1.10 Report uncontrolled hazards</p>
<p>2. Personal Protective Equipment</p>	<p>2.1 Helmet</p> <p>2.2 Safety Mask/respiratory</p> <p>2.3 Hand Gloves.</p> <p>2.4 Safety Shoes.</p> <p>2.5 Boiler suits</p> <p>2.6 Safety goggles</p> <p>2.7 Ear muffs</p>

3. Tools and equipment	3.1 Hand and power tools <ul style="list-style-type: none"> ▪ Socket wrench set ▪ Combination wrenches ▪ Different type screwdriver ▪ Plier set. 3.2 Multi meter 3.3 Bench vice. 3.4 Soldering equipment 3.5 Load testing equipment																
4. Materials	4.1 Minor spare parts/components 4.2 Grease 4.3 Kerosene 4.4 Cotton waste 4.5 Lead and Flux																
5. Tests of starting system component	<table border="0" style="width: 100%;"> <tr> <td style="width: 50%;">5.1 Starting switch contact</td> <td style="width: 50%;">5.6 Fuses</td> </tr> <tr> <td>5.2 Battery voltage (on cranking duration)</td> <td>5.7 Solenoids</td> </tr> <tr> <td>5.3 Ground/short circuit test</td> <td>5.8 Cranking motor.</td> </tr> <tr> <td>5.4 Open circuit test</td> <td>5.9 quick pinion and ring gear condition</td> </tr> <tr> <td>5.5 Related basic wiring.</td> <td>5.10 compressor air presser</td> </tr> <tr> <td></td> <td>5.11 Air starting control valve performance</td> </tr> </table>	5.1 Starting switch contact	5.6 Fuses	5.2 Battery voltage (on cranking duration)	5.7 Solenoids	5.3 Ground/short circuit test	5.8 Cranking motor.	5.4 Open circuit test	5.9 quick pinion and ring gear condition	5.5 Related basic wiring.	5.10 compressor air presser		5.11 Air starting control valve performance				
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7. Faults	7.1 Starting switch burnt 7.2 Loose connection and burnt wiring 7.3 Battery low voltage 7.4 Improper gear shifting 7.5 Improper clutch operation 7.6 Improper Bendix operation 7.7 Short/Open solenoids coil 7.8 Cranking motor. <ul style="list-style-type: none"> ▪ Armature short or open ▪ Field coil short/open ▪ Broken/wear carbon brass ▪ Burnt/short commutator 																

	<ul style="list-style-type: none"> ▪ Damaged bearing <p>7.9 Wear/broken drive pinion and ring gear/fly wheel rim</p> <p>7.10 Improper air pressure</p> <p>7.11 Air control valves do not work.</p> <p>7.12 Leakage of air lines</p>
8. Manuals	<p>8.1 Maintenance Procedure Manual</p> <p>8.2 Periodic Maintenance Data</p> <p>8.3 Service Manual</p> <p>8.4 Parts/components Checklist</p> <p>8.5 Maintenance schedule</p>
9. Stopping system components	<p>9.1 Stopping lever</p> <p>9.2 Governor linkage</p> <p>9.3 Stopping switch</p> <p>9.4 Emergency stopping switch</p>
<p>Evidence Guide</p> <p>The evidence must be authentic, valid, sufficient, reliable, consistent, recent and meet all requirements of current version of the Unit of Competency.</p>	
1. Critical aspects of competency	<p>Assessment requires evidence that the candidate:</p> <p>1.1 performed sequence of disassembling of starting system components and accessories</p> <p>1.2 conducted the proper inspection to identify faults</p> <p>1.3 performed servicing of starting system components and accessories</p> <p>1.4 carried out necessary adjustments of starting system components and accessories</p> <p>1.5 tested the performance of starting system.</p>
2. Underpinning knowledge	<p>2.1 Types of marine engine starting and stopping system</p> <p>2.2 Starting system components (air and electric starting system)</p> <p>2.3 Operating principles (air and electric starting system)</p> <p>2.4 Repair procedures</p> <p>2.5 Engine capacity</p> <p>2.6 Measuring and testing procedures of different components of starting system</p> <p>2.7 Key components and their functions</p> <p>2.8 Symptoms and diagnosis of faults</p> <p>2.9 Standard Operating Procedures (SOP).</p>
3. Underpinning skills	<p>3.1 Interpreting the diagram of air and electric starting system</p> <p>3.2 Undertaking inspection/testing of the starting system</p> <p>3.3 Using relevant tools and equipment</p> <p>3.4 Adjusting starting system components</p> <p>3.5 Maintaining orderliness and cleanliness</p> <p>3.6 Operating testing equipment</p> <p>3.7 Applying the techniques of maintenance and servicing of</p>

	<p>starting system components</p> <p>3.8 Using the procedure of final performance testing.</p>
4. Required Attitude	<p>4.1 Commitment to occupational health and safety</p> <p>4.2 Promptness in carrying out activities</p> <p>4.3 Sincere and honest to duties</p> <p>4.4 Environmental concerns</p> <p>4.5 Eagerness to learn</p> <p>4.6 Tidiness and timeliness</p> <p>4.7 Respect for rights of peers and seniors in workplace</p> <p>4.8 Communication with peers and seniors in workplace.</p>
5. 5. Resource implications	<p>The following resources must be provided:</p> <p>5.1 Workplace location or simulated workplace</p> <p>5.2 Material relevant to the inspection and servicing of starting systems</p> <p>5.3 Equipment, hand and power tooling appropriate to the inspection and servicing of starting and stopping system</p> <p>5.4 Equipment and outfits appropriate in applying safety measures in Manufacturer's repair manual.</p>
6. Method of assessment	<p>Assessment methods may include but not limited to:</p> <p>6.1 Written test</p> <p>6.2 Demonstration</p> <p>6.3 Oral Questioning/interview</p> <p>6.4 Portfolio</p>
7. Context for assessment	<p>7.1 Competency assessment must be done in NSDA accredited assessment centre;</p> <p>7.2 Assessment should be done by NSDA certified assessor.</p>
<p>Accreditation Requirements</p> <p>Training Providers must be accredited by National Skills Development Authority (NSDA), the National Quality Assurance Body, or a body with delegated authority for quality assurance to conduct training and assessment against this unit of competency for credit towards the award of qualification under BNQF. Accredited providers assessing against this unit of competency must meet the quality assurance requirements set by NSDA.</p>	

Unit Code & Title	OU-LE-MET-06-L2-V1: Test and Replace Battery
Unit Descriptor	This unit identifies the competence required to service, remove, replace, test and charge batteries. It includes the tasks of preparing for work, test batteries, servicing and charging battery, maintaining workplace, tools, equipment and materials.
Nominal Hours	20 Hours
Elements Of Competencies	Performance Criteria <u>Bold & Underlined</u> are elaborated in the Range of Variables
1. Prepare for work	<p>1.1. <u>Safe work practices</u> are followed throughout the work process;</p> <p>1.2. <u>Personal Proactive Equipment</u> (PPE) worn as required for the work performed;</p> <p>1.3. Necessary <u>tools and equipment</u> are identified and collected in accordance with work requirement;</p> <p>1.4. Necessary <u>materials</u> are collected in accordance with work requirement;</p> <p>1.5. Rols of work are identified from Toolbox meeting as per workplace standard;</p> <p>1.6. Precaution in relation to working with battery are followed as per work procedure.</p>
2. Test batteries	<p>2.1 Correct information is accessed and interpreted from appropriate manufacturer specifications;</p> <p>2.2 Appropriate test equipment is selected;</p> <p>2.3 <u>Testing</u> is carried out according to industry safety procedures/guidelines;</p> <p>2.4 <u>Faults</u> are identified and preferred repairing action is determined based on testing/checking.</p>
3. Service and charge battery	<p>3.1 water level is checked and topped up as necessary;</p> <p>3.2 Battery/terminals are cleaned and greased by petroleum jelly (Vaseline);</p> <p>3.3 Battery cell caps are cleaned as per standard procedure;</p> <p>3.4 Vent holes are kept free from dust;</p> <p>3.5 charging activities are carried out according to industry safety procedures/guidelines using battery charger;</p> <p>3.6 Battery is replaced in case of poor performance.</p>
4. Maintain workplace, tools, equipment and materials	<p>4.1 Work area is cleaned in accordance with workplace procedures;</p> <p>4.2 Unused materials are stored for re-use or disposed following workplace procedures;</p> <p>4.3 Waste and scrap materials are disposed with following</p>

	<p>workplace procedures;</p> <p>4.4 Inventory of tools equipment are conducted and recorded as per checklist;</p> <p>4.5 Tools and equipment are cleaned and stored as per manufacturer recommendation in appropriate location.</p>
Range of Variable	
Variable	Range (May include but not limited to):
1. Safe work practices	<p>1.1 Use PPE</p> <p>1.2 Follow lock out and tag out (LOTO) procedure</p> <p>1.3 Use fire extinguisher</p> <p>1.4 Response emergency situation</p> <p>1.5 Identify hazard</p> <p>1.6 Control hazards</p> <p>1.7 Measure risk</p> <p>1.8 Use first aid</p> <p>1.9 Follow Safe Working Load (SWL)</p> <p>1.10 Report uncontrolled hazards</p>
2. Personal protective equipment	<p>2.1 Helmet</p> <p>2.2 Safety Mask/respiratory</p> <p>2.3 Rubber hand Gloves.</p> <p>2.4 Safety Shoes.</p> <p>2.5 Boiler suits/Chemical suit</p> <p>2.6 Safety goggles with shield</p> <p>2.7 Ear muffs</p>
3. Tools and equipment	<p>3.1 Hand and power tools</p> <ul style="list-style-type: none"> ▪ Socket wrench set ▪ Combination wrenches ▪ Different type screwdriver ▪ Plier set. <p>3.2 Multi meter</p> <p>3.3 High discharge tester</p> <p>3.4 Hydrometer</p>
4. Materials	<p>4.1 Minor spare parts/components</p> <p>4.2 Cotton waste</p> <p>4.3 Battery terminal</p> <p>4.4 Petroleum jelly</p> <p>4.5 Distilled water</p>
5. Tests of battery	<p>5.1 Check for corrosion, cracks, leaks, loose terminals, and physical damage</p> <p>5.2 Measures the battery voltage</p> <p>5.3 Electrolyte specific gravity</p> <p>5.4 Load test</p>

	<ul style="list-style-type: none"> 5.5 Battery capacity test 5.6 Conductance test 5.7 Internal resistance test 5.8 Cranking voltage test 5.9 Charging system test 5.10 Earthing test
6. Faults	<ul style="list-style-type: none"> 6.1 Low state of charge (discharged battery) 6.2 Bulging of plates 6.3 Internal short circuit 6.4 Plate corrosion or shedding 6.5 Cracked or leaking battery case 6.6 Loose or corroded terminals 6.7 Low electrolyte level 6.8 Undercharging 6.9 Dead cell or weak cell 6.10 Bulging of battery case 6.11 Self-discharge 6.12 Stratification of electrolyte
7. Manuals	<ul style="list-style-type: none"> 7.1 Maintenance procedure manual 7.2 Periodic maintenance data 7.3 Service manual 7.4 Parts/components checklist
<p>Evidence Guide The evidence must be authentic, valid, sufficient, reliable, consistent, recent and meet all requirements of current version of the Unit of Competency.</p>	
1. Critical aspects of competency	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> 1.1 Inspected battery for physical damage, corrosion, leakage, or loose terminals. 1.2 Tested battery voltage using a multimeter or appropriate battery tester. 1.3 Conducted load tests or specific gravity tests (for wet-cell batteries) to assess battery health. 1.4 Cleaned battery terminals and cable ends to remove corrosion. 1.5 Charged the battery using the correct charger and follow safe charging procedures. 1.6 Disposed of old batteries safely according to environmental regulations.
2. Underpinning knowledge	<ul style="list-style-type: none"> 2.1 Basic electrical principle 2.2 Battery types and construction 2.3 Battery specifications and ratings 2.4 Battery testing procedures 2.5 Charging systems and methods

	<ul style="list-style-type: none"> 2.6 Battery maintenance and inspection techniques 2.7 Safety practices and precautions 2.8 Battery disposal and environmental regulations 2.9 Tools and equipment used 2.10 Symptoms and diagnosis of battery faults.
3. Underpinning skills	<ul style="list-style-type: none"> 3.1 Using Electrical Testing Instruments 3.2 Performing Battery Test 3.3 Interpreting Test Results 3.4 Handling and Servicing Batteries Safely 3.5 Connecting and Disconnecting Battery Terminals 3.6 Applying Troubleshooting Techniques 3.7 Using Hand Tools and Equipment 3.8 Following Standard Operating Procedures (SOP) 3.9 Reading and Interpreting Labels and Safety Signs 3.10 Reading and interpretation instruction manual 3.11 Practicing Environmental Responsibility.
4. Required Attitude	<ul style="list-style-type: none"> 4.1 Commitment to occupational health and safety 4.2 Promptness in carrying out activities 4.3 Sincere and honest to duties 4.4 Environmental concerns 4.5 Eagerness to learn 4.6 Tidiness and timeliness 4.7 Respect for rights of peers and seniors in workplace 4.8 Communication with peers and seniors in workplace.
5. Resource implications	<p>The following resources must be provided:</p> <ul style="list-style-type: none"> 5.1 workplace location or simulated workplace 5.2 material relevant to the inspection and servicing of starting systems 5.3 equipment, hand and power tooling appropriate to the inspection and servicing of starting system 5.4 equipment and outfits appropriate in applying safety measures in manufacturer's repair manual.
6. Method of assessment	<p>Assessment methods may include but not limited to:</p> <ul style="list-style-type: none"> 6.1 Written test 6.2 Demonstration 6.3 Oral Questioning/interview 6.4 Portfolio
7. Context for assessment	<ul style="list-style-type: none"> 7.1 Competency assessment must be done in NSDA accredited assessment centre;

	7.2 Assessment should be done by NSDA certified assessor.
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Accreditation Requirements

Training Providers must be accredited by National Skills Development Authority (NSDA), the National Quality Assurance Body, or a body with delegated authority for quality assurance to conduct training and assessment against this unit of competency for credit towards the award of qualification under BNQF. Accredited providers assessing against this unit of competency must meet the quality assurance requirements set by NSDA.

References:

- CS of Bangladesh Technical Education Board (BTEB)

Development of Competency Standard

The Competency Standards for National Skills Certificate Level-2 in **Marine Engine Technician** is Developed by NSDA on 13-14 July, 2025.

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Validation of Competency Standard

The Competency Standards for National Skills Certificate Level-2 in **Marine Engine Technician** is Validated by SCVC on 21 July, 2025.

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