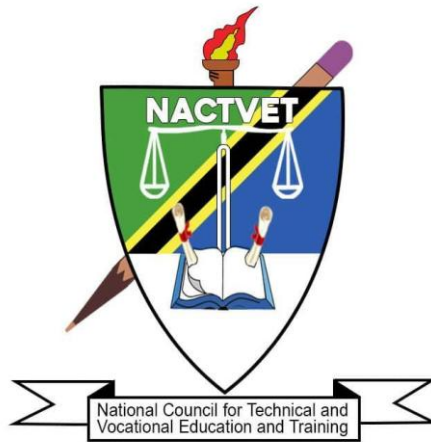


**NATIONAL COUNCIL FOR TECHNICAL AND VOCATIONAL EDUCATION AND
TRAINING**



MARCH 2023

PROPOSED OCCUPATIONAL STANDARDS

OCCUPATION: MARINE ELECTRICAL AND ELECTRONIC TECHNICIAN

LEVEL: NTA 4

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ABBREVIATIONS

BWM	International Convention for the Control and Management of Ships Ballast Water and Sediments
CBET	Competency Based Education and Training Model
ESB	Emergency Switchboard
GMDSS	Global Maritime Distress and Safety Sstem
GPS	Global Positioning System
ISM	International Safety Management (i.e. International Management Code for the Safe Operation of Ships and for Pollution Prevention)
MARPOL	International Convention for the Prevention of Pollution from Ships
MOPP	Maintenance Operation Policies and Procedures
MSB	Main Switchboard
NACTVET	National Council for Technical and Vocational Education and Training
NOS	National Occupational Standards
OS	Occupational Standards
PLC	Programmable Logic Controller
PPE	Personal Protective Equipment
RPM	Revolutions Per Minute
SMS	Safety Management System
SOLAS	International Convention for Safety of Life at Sea
STCW	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers

TET	Technical Education and Training
TVET	Technical and Vocational Education and Training
UPS	Uninterruptible Power Supply

GLOSSARY OF TERMS

Circumstantial knowledge:	Detailed knowledge, which allows the decision-making in regard to different circumstances and cross cutting issues
Competence:	The ability to use knowledge, understanding, practical and thinking skills to perform effectively to the workplace standards required in employment.
Competency:	A description of the ability one possesses when able to perform a given occupational task effectively and efficiently.
Competency-based education:	An instructional programme that derives its content from validated tasks and bases assessment on the learner's performance
Curriculum:	A description or composite of statements about “what is to be learned” by the trainee/student in a particular instructional programme; a product that states the “intended learning outcomes”.
Educational/training programme:	The complete curriculum and instruction (what and how) that is designed to prepare a person for employment in a job or other particular performance situation.
Occupation:	A specific position requiring the performance of specific tasks – essentially the same tasks are performed by all employees having the same title. (Example: baker)
Occupational analysis:	A process used to identify the tasks that are important to employees in any given occupation
Occupational area:	This is a broad grouping of related jobs. (Example: food service)
Occupational Standards:	Specific requirements of competences people are expected to demonstrate in a particular occupational area, including knowledge and relevant attitudes. They also act as performance tool of assessment of the pre – scribed outcomes.
Performance criteria:	indicate the expected end results or outcome in form of evaluative statements.

Skills:	The ability to perform occupational tasks with a high degree of proficiency within a given occupation. Skill is conceived of as a composite of three completely interdependent components: cognitive, affective, and psychomotor.
Standards:	It is a set of statement, which if proved true under working conditions, means that an individual is meeting an expected level and type of performance.
Task analysis:	The process of analysing each task to determine the steps, related knowledge, attitudes, performance standards, tools and materials needed, and safety concerns required of employees performing it.
Task:	A work activity that has a definite beginning and ending, is observable or measurable, consists of two or more definite steps, and leads to a product, service, or decision.
Underpinning Knowledge:	This is crucial knowledge that an individual must acquire in order to demonstrate competences that are associated in performing a given task.
Verification process:	The process of having experts review and conform the importance of the task (competency) statements identified through occupational analysis. Other questions, such as the degree of task learning difficulty are also frequently asked. This process is also sometimes referred to as validation.
Occupational Competence:	The application of knowledge and skills to perform consistently to the standards required in the work context

1.0 INTRODUCTION

Technical Education and Training (TET) is one of the most important education sub-sectors in Tanzania, responsible for developing a skilled workforce to support the country's industrialization economic agenda. Tanzania's Development Vision 2025 intends to raise the country's economy to a middle-income status. This requires a skilled workforce that is aligned with the needs of the public and private sectors of the economy. The National Council for Technical Education has begun the job of drafting Occupational Standards that will eventually be adopted as National Occupational Standards for TET in order to ensure that it meets the needs of the labour market and the country's economic agenda.

National Occupational Standards (NOS) are performance criteria that are matched with labour market demands. Each National Occupation Standard describes functions, performance standards, and knowledge/understanding for one important function or task. They combine skills, knowledge, and attitudes to describe best practice. They are useful tools for establishing job roles, personnel recruiting, supervision, and appraisal, as well as TET standards. They're also helpful for benchmarking and harmonizing qualifications on a national and international level. Standards, in general, provide a solid framework for high-quality TET that is labour market-relevant, current and consistent in delivery across all public and private institutions.

However, it must be noted that, Occupational Standards and Training standards/qualifications standards are different. Occupational standards are defined in terms of activities performed by a person in a selected occupation (e.g., an electrical engineer designs electrical wiring circuits, performs trouble shooting in electrical wiring, etc.) and they are usually defined by employers following procedures agreed upon by all stakeholders. Education and training standards are developed from the activities defined in occupational standards, and they include learning objectives to ensure that the necessary skills and knowledge are developed by a person to enable him or her to function at an agreed level in an occupation. Education and Training standards are used to define curricula in training institutions. It is however critical that there must be a direct link between the occupational standards and the training standards to respond to demands of the labour market.

In TET delivery, Tanzania adopted the Competence Based Education (CBET) approach. The CBET approach focuses on providing learners with the skills and knowledge required to meet the occupational standards. Occupational standards are thus the starting point for developing competency-based training (CBET) programmes. TET institutions will be required to benchmark their curricula with relevant occupational standards.

Occupational Standards are developed based on a given occupation's current and future demands. As a result, they serve as a means of bridging the gap between the worlds of employment and technical education and training (TET).

The Marine Electrical and Electronic Technician Occupation has its own set of occupational standards. The document explains how the occupational standards were developed, as well as the scope, the occupational profile in the form of DACUM charts, and the Occupational Standards.

2.0 OCCUPATIONAL STANDARD DEVELOPMENT PROCESS

The Occupational standards development process began with an examination of major documents that guide Tanzanian skill development. The 10-year National Skills Development Strategy (2016-2026) was one of the documents reviewed, and it outlined six (6) economic sectors that should be prioritized when developing skills development programmes. These sectors include: Transport and Logistics, Tourism and Hospitality, Agribusiness, Construction, Energy and ICT. NACTE labour market reports were also used in the literature review to determine the skills demand in the Tanzanian labour market as a whole.

After the literature review, a workshop comprised of expert workers and educators with substantial knowledge and experience in the occupation conducted an occupational analysis utilizing the DACUM approach to produce the occupational profile. The analysis resulted in DACUM Charts, which are attached as **Appendix 1** to this document.

The occupational standards were then developed. Experts in Occupational Analysis and the Development of Occupational Standards facilitated the workshop. Interviews, online surveys, and a stakeholder forum were used to validate the occupational standards. Engineers, supervisory technicians on the job, and experienced Clearing and Forwarding technicians

were key informants in the survey to discover occupational trends. This information was used to gain insight from the workplaces regarding trends and changes in the profession, including how well graduates are prepared for working in the occupation. A total of 15 online surveys were completed by experts from the labour market across the country. Apart from the survey aiding in defining the scope for the occupational analysis, they served to engage a wide cross-section of experts in the occupation. The stakeholders' forum was attended by 40 participants from different parts of the country representing various companies.

3.0 THE SCOPE AND OVERVIEW OF THE OCCUPATION STANDARDS FOR MARINE ELECTRICAL AND ELECTRONIC TECHNICIAN

These standards cover a broad range of duties and tasks that can be performed by a Marine Electrical and Electronic Technician. However, the occupational standards are not meant to replace individual job descriptions, they are to be used for guidance in defining skill levels and knowledge for the technician in specific settings or positions. The Marine Electrical and Electronic Technician may perform tasks in a number of key areas of the occupational standards, but not necessarily in all areas. For example, in large operations other individuals may be employed or designated to perform specific tasks.

A Marine Electrical and Electronic Technician works under the supervision of the Marine Chief Engineer to complete the safe use of the marine electrical equipment, perform preparatory work to monitor the electrical systems and mechanical operations, utilize manual tools, electrical and electronic measuring equipment for operations, prepare the maintenance and repair of electrical systems and machinery, take preventive measures and contribute to preventing marine environmental pollution, etc. Typically, the Marine Electrical and Electronic Technicians perform the following responsibilities:

- a) Basic operation of ship power station;
- b) Operation of ship internal communication system;
- c) Cleaning the ship electronic and electrical equipment;
- d) Storage and use of electronic and electrical equipment;

- e) Application of relevant international conventions and regulations to prevent marine pollution;
- f) Operation of ship mechanical engineering systems;
- g) Operation and maintenance of ship steering and electrical control systems;
- h) Taking appropriate measures to prevent marine pollution and operating pollution prevention procedures and equipment;
- i) Onboard first aid measures;
- j) Operations related to ship repairs.

The occupational standards have been clustered into NTA qualification levels i.e. NTA level 4, 5 and 6.

4.0 VALIDITY PERIOD

The occupational standards will be valid for 3-5 years due to the fast-changing nature of technology. The review will proceed in the same manner as the previous one, with new occupational standards being developed based on current labour market Information.

5.0 OCCUPATIONAL STANDARDS

5.1 OCCUPATIONAL STANDARDS FOR MARINE ELECTRICAL AND ELECTRONIC TECHNICIAN LEVEL 4

OCCUPATION	MARINE ELECTRICAL AND ELECTRONIC TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	SAFELY USE THE MARINE ELECTRICAL EQUIPMENT	DUTY NO.	401
TASK TITLE	SAFETY INSPECTION BEFORE OPERATION	TASK NO	4011
PERFORMANCE CRITERIA	The person executing the task must be able to follow the safety requirements of the marine electrical equipment to complete the safety precautions before the practical operation, repair and maintenance of the equipment.		
RANGE STATEMENT	The task will be carried out on the ship under the supervision of a senior electrical and electronic technician. The available tools and equipment include: 1. Insulation safety tools: electroprobe, electrical tools with insulation handles, insulating gloves, insulated boots (shoes), insulating mats, insulating workbench, multimeter, insulation resistance tester, clamp meter, etc. 2. Protective safety equipment: safety signs, protective glasses, safety helmets, safety harness, etc.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able do the following: 1. Choose appropriate tools based on equipment parameter; 2. Use an insulation resistance tester to measure the insulation resistance; 3. Perform short-circuit testing by using a multimeter; 4. Check for circuit/equipment leakage by using a clamp meter; 5. Power off the electrical control box safely 6. Conduct short-circuit and insulation testing on marine electrical equipment; 7. Carry out insulation testing on		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Use a multimeter; 1.2 Use an insulation resistance tester; 1.3 Use a clamp meter for detecting leakage current; 1.4 Perform power off and low voltage switch operations. 2.0 Principle The person must be able to explain the principles of: 2.1 Insulation testing; 2.2 Short-circuit testing with a multimeter; 2.3 Tool selection.	

marine electrical network; 8. Utilize safety signs, protective glasses, safety helmet and other protective safety equipment; 9. Inspect and test safety equipment before use.	3.0 Theories The person must be able to explain: 3.1 Common causes of circuit short-circuits; 3.2 Safety operation procedures for electricians; 3.3 Sequence of power on/off procedures. 4.0 Essential skills 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Report writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Complete the safety precautions before the practical operation, repair and maintenance of the equipment.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Maintenance operation policies and procedures ; 2. Occupational Health & Safety.

OCCUPATION	MARINE ELECTRICAL AND ELECTRONIC TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	SAFELY USE THE MARINE ELECTRICAL EQUIPMENT	DUTY NO.	401
TASK TITLE	ISOLATION DURING WORK OR REPAIR	TASK NO	4012
PERFORMANCE CRITERIA	The person executing the task must be able to carry out isolation procedures during electrical equipment work or repair in accordance with the safety requirements for the safe use and operation of ship electrical equipment.		
RANGE STATEMENT	The task will be carried out on the ship under the supervision of a senior electrical and electronic technician. The available tools and equipment include: 1. Insulation safety tools: electroprobe, electrical tools with insulation handles, insulating gloves, insulated boots (shoes), insulating mats, insulating workbench, etc. 2. Protective safety equipment: safety signs, protective glasses, safety helmets, safety harness, etc.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able do the following: 1. Use insulation safety equipment; 2. Use protective safety equipment; 3. Disconnect power to equipment (circuits); 4. Lock the distribution box; 5. Hang a "DO NOT Switch On - Work in Progress" warning sign; 6. Take measures to prevent accidental energization of equipment (circuits); 7. Ensure that all tools (screwdrivers, pliers, electric knives, etc.) have good insulation on their handles.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Use insulation safety equipment; 1.2 Use protective safety equipment. 2.0 Principle The person must be able to explain the principles of: 2.1 Using protective safety equipment; 2.2 Electric arc generation and hazards; 2.3 Using insulation safety equipment. 3.0 Theories The person must be able to explain: 3.1 Isolation procedures during work or repair; 3.2 Isolation functions of contactors, relays, and isolating switches;	

	3.3 Common forms of electric shock. 4.0 Essential skills 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Report writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Complete isolation procedures during work or repair according to technical specifications.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Maintenance operation policies and procedures ; 2. Occupational Health & Safety.

OCCUPATION	MARINE ELECTRICAL AND ELECTRONIC TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	SAFELY USE THE MARINE ELECTRICAL EQUIPMENT	DUTY NO.	401
TASK TITLE	PREVENT ELECTRIC SHOCK, EXPLOSION AND ELECTRICAL FIRE OPERATION	TASK NO	4013
PERFORMANCE CRITERIA	The person executing the task must be able to follow the safety requirements of the marine electrical equipment to perform operations to prevent electric shock, explosion and electrical fire on the actual equipment.		
RANGE STATEMENT	The task will be carried out on the ship under the supervision of a senior electrical and electronic technician. The available tools and equipment include: 1. Insulation safety tools: electroprobe, electrical tools with insulation handles, insulating gloves, insulated boots (shoes), insulating mats, etc. 2. Fire and explosion prevention equipment: carbon dioxide, dry powder, halogenated hydrocarbon fire extinguisher, etc.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able do the following: 1. Ensure that distribution boxes, distribution panels, circuit breakers, push-button switches, sockets, plugs, and wires are in good and safe condition; 2. Close the cover when operating circuit breakers and magnetic switches; 3. Ensure that the enclosures of electrical equipment are properly grounded or connected to neutral protectively according to relevant safety regulations; 4. Avoid situations of overload operation, short circuits, abnormal voltage, and insulation decline in electrical equipment;		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Use different types of fire extinguishers; 1.2 Apply regulations and procedures for quality control of marine electrical equipment. 2.0 Principle The person must be able to explain the principles of: 2.1 Insulation testing; 2.2 Fire extinguishing for different extinguishers. 3.0 Theories The person must be able to explain: 3.1 Causes of electrical fires and explosions on ships; 3.2 Technical requirements for marine electrical	

5. Ventilate and cool down heat generating equipment.	equipment in the maritime environment; 3.3 Applicable scope and methods of different extinguishers; 3.4 Measures to prevent equipment overheating, sparking, and arcing. 4.0 Essential skills 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Report writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Take measures to protect equipment from electric shock, explosion and electrical fire.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Maintenance operation policies and procedures; 2. Occupational Health & Safety; 3. Waste disposal methods.

OCCUPATION	MARINE ELECTRICAL AND ELECTRONIC TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	SAFELY USE THE MARINE ELECTRICAL EQUIPMENT	DUTY NO.	401
TASK TITLE	SAFELY OPERATE THE MARINE LOW-VOLTAGE POWER SYSTEM	TASK NO	4014
PERFORMANCE CRITERIA	The person executing the task must be able to follow the safety requirements of the marine electrical equipment to safely operate the marine low-voltage power system.		
RANGE STATEMENT	The task will be carried out on the ship under the supervision of a senior electrical and electronic technician. The available tools and equipment include: 1. Insulation safety tools: insulating gloves, insulated boots (shoes), insulating mats, etc. 2. Protective safety equipment: safety signs, protective glasses, safety helmets, safety harness, etc.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able do the following: 1. Use insulation safety tools; 2. Use protective safety equipment; 3. Allocate power supply and loads; 4. Monitor power supply and loads; 5. Measure power supply and loads; 6. Protect power supply and loads; 7. Switch power supply and loads; 8. Control power supply and loads.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Allocate power supply and loads; 1.2 Monitor power supply and loads; 1.3 Measure power supply and loads; 1.4 Protect power supply and loads; 1.5 Control power supply and loads. 2.0 Principle The person must be able to explain the principles of: 2.1 The marine low-voltage power system. 3.0 Theories The person must be able to explain: 3.1 Components of the marine low-voltage power system; 3.2 Characteristics of the marine low-voltage power system;	

	3.3 Basic parameters of the marine low-voltage power system. 4.0 Essential skills 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Report writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Safely operate the marine low-voltage power system.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Instructions for using insulation safety equipment; 2. Instructions for using protective safety equipment; 3. Maintenance operation policies and procedures; 4. Occupational Health & Safety.

OCCUPATION	MARINE ELECTRICAL AND ELECTRONIC TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	PREPARE FOR MONITORING ELECTRICAL SYSTEMS AND MECHANICAL OPERATIONS	DUTY NO.	402
TASK TITLE	BASIC OPERATION OF SHIP POWER STATION	TASK NO	4021
PERFORMANCE CRITERIA	The person executing the task must be able to follow the safety requirements of the marine electrical equipment to conduct basic operation of ship power station.		
RANGE STATEMENT	The task will be carried out on the ship under the guidance and supervision of a electrical and electronic technician. The available tools and equipment include: 1. Insulating gloves; 2. Insulating clothing; 3. Insulated shoes; 4. Multimeter.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able do the following: 1. Check the voltage of the marine generator; 2. Check the current of the marine generator; 3. Check the frequency of the marine generator; 4. Check the power of the marine generator; 5. Check the insulation of the marine generator; 6. Check the operating conditions of the ship power station; 7. Perform a lamp test operation on the marine distribution system; 8. Close the master switch of the generator; 9. Open the master switch of the generator.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Check the electrical parameters of voltage, current, frequency, power, insulation, etc. in the ship power station; 1.2 Check the operating conditions of the ship power station; 1.3 Perform a lamp test operation on the marine distribution system; 1.4 Close and open the master switch of the marine generator. 2.0 Principle The person must be able to explain the principles of: 2.1 Safety operating procedures and precautions; 2.2 The ship power station.	

	3.0 Theories The person must be able to explain: 3.1 Composition of the marine power station; 3.2 Structure of the master switch of the generator; 3.3 Types of power distribution equipment. 4.0 Essential skills 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Safe and standardized operation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Perform safe and standardized operations of the ship power station according to occupational requirements.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Maintenance operation policies and procedures; 2. Occupational Health & Safety.

OCCUPATION	MARINE ELECTRICAL AND ELECTRONIC TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	PREPARE FOR MONITORING ELECTRICAL SYSTEMS AND MECHANICAL OPERATIONS	DUTY NO.	402
TASK TITLE	DISASSEMBLY AND ASSEMBLY OPERATIONS OF ELECTRIC MOTORS	TASK NO	4022
PERFORMANCE CRITERIA	The person executing the task must be able to complete the disassembly and assembly operation according to the given type of electric motor.		
RANGE STATEMENT	The task will be carried out on the ship under the guidance and supervision of a electrical and electronic technician. The available tools and equipment include: 1. Three-phase asynchronous motor; 2. Multimeter; 3. Puller; 4. Rubber mallet; 5. Circlip pliers; 6. Marker pen; 7. Double offset ring spanner; 8. Phillips screwdriver; 9. Adjustable wrench.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able do the following: 1. Select appropriate tools for the task; 2. Disconnect the power supply of the three-phase asynchronous motor; 3. Remove the leads of the three-phase asynchronous motor; 4. Disassemble the three-phase asynchronous motor; 5. Assemble the three-phase asynchronous motor; 6. Connect the leads of the		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Select work tools; 1.2 Disassemble a three-phase asynchronous motor; 1.3 Assemble a three-phase asynchronous motor. 2.0 Principle The person must be able to explain the principles of: 2.1 Safety operating procedures and precautions; 2.2 Three-phase asynchronous motor operation.	

three-phase asynchronous motor; 7. Perform a power-on test of the three-phase asynchronous motor.	3.0 Theories The person must be able to explain: 3.1 Three-phase asynchronous motor electromagnetic theory; 3.2 Meaning of parameters on the nameplate of a three-phase asynchronous motor. 4.0 Essential skills 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Safe and standardized operation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Perform safe and standardized operations to disassemble and assemble a three-phase asynchronous motor according to occupational requirements.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Maintenance operation policies and procedures; 2. Occupational Health & Safety; 3. Waste disposal methods.

OCCUPATION	MARINE ELECTRICAL AND ELECTRONIC TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	PREPARE FOR MONITORING ELECTRICAL SYSTEMS AND MECHANICAL OPERATIONS	DUTY NO.	402
TASK TITLE	ASSEMBLY OF ELECTROMAGNETIC STARTER CONTROL BOX	TASK NO	4023
PERFORMANCE CRITERIA	The person executing the task must be able to assemble the electromagnetic starter control box based on provided technical documents such as electrical schematic diagrams, layout diagrams and wiring diagrams.		
RANGE STATEMENT	The task will be carried out on the ship under the guidance and supervision of a electrical and electronic technician. The available tools and equipment include: 1. Electrical control box; 2. Technical documents such as electromagnetic starter control schematic diagrams, layout diagrams and wiring diagrams; 3. Electrical components such as air circuit breaker, contactor, fuse, thermal relay and button; 4. Cable; 5. Phillips screwdriver; 6. Wire cutter; 7. Wire stripper; 8. Multimeter; 9. Control cable.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able do the following: 1. Select appropriate tools for the task; 2. Cut the cables; 3. Strip and terminate the cables; 4. Install electrical components such as air circuit breaker, contactor, fuse, thermal relay and button; 5. Wire the electromagnetic starter control box;		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Use work tools; 1.2 Identify the electromagnetic starter control schematic diagrams, layout diagrams and wiring diagrams; 1.3 Assemble the electromagnetic starter control box; 1.4 Perform electrical testing of the electromagnetic starter control box.	

6. Perform electrical testing on the electromagnetic starter control box.	2.0 Principle The person must be able to explain the principles of: 2.1 Safety operating procedures and precautions; 2.2 Electrical component layout; 2.3 Control box wiring. 3.0 Theories The person must be able to explain: 3.1 Analysis of schematic diagrams, layout diagrams, and wiring diagrams; 3.2 Wiring methods for air circuit breakers, contactors, fuses, thermal relays, buttons, and other electrical components. 4.0 Essential skills 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Safe and standardized operation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Perform safe and standardized operations to assemble a electromagnetic starter control box according to occupational requirements, and pass the testing.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Methods for using work tools; 2. Methods for using measuring instruments; 3. Maintenance operation policies and procedures; 4. Occupational Health & Safety; 5. Waste disposal methods.

OCCUPATION	MARINE ELECTRICAL AND ELECTRONIC TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	PREPARE FOR MONITORING ELECTRICAL SYSTEMS AND MECHANICAL OPERATIONS	DUTY NO.	402
TASK TITLE	CONNECTION OF COMMON CIRCUIT COMPONENTS AND ELECTRICAL MEASURING INSTRUMENTS	TASK NO	4024
PERFORMANCE CRITERIA	The person executing the task must be able to connect circuit components and electrical measuring instruments according to the work manual.		
RANGE STATEMENT	The task will be carried out on the ship under the guidance and supervision of a electrical and electronic technician. The available tools and equipment include: 1. Resistor, capacitor, inductor, and other circuit components; 2. Voltmeter, ammeter, and other electrical measuring instruments; 3. Single-pole switch; 4. Wire; 5. Phillips screwdriver; 6. Wire cutter; 7. Wire stripper; 8. Multimeter.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able do the following: 1. Select appropriate tools for the task; 2. Cut and connect wires; 3. Connect resistor components; 4. Connect capacitor components; 5. Connect inductor components; 6. Connect voltmeters; 7. Connect ammeters; 8. Perform electrical testing.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Use work tools; 1.2 Two common circuit connection methods: series and parallel. 2.0 Principle The person must be able to explain the principles of: 2.1 Safety operating procedures and precautions; 2.2 Common circuit components such as resistors, capacitors and inductors; 2.3 Electrical measuring instruments such as	

	voltmeters and ammeters. 3.0 Theories The person must be able to explain: 3.1 Symbols and functions of common circuit components such as resistors, capacitors and inductors; 3.2 Symbols and functions of electrical measuring instruments such as voltmeters and ammeters. 4.0 Essential skills 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Safe and standardized operation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Perform safe and standardized operations to complete the circuit connection of given circuit components and electrical measuring instruments according to occupational requirements, and pass the testing.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Methods for using work tools; 2. Methods for using measuring instruments; 3. Maintenance operation policies and procedures; 4. Occupational Health & Safety; 5. Waste disposal methods.

OCCUPATION	MARINE ELECTRICAL AND ELECTRONIC TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	PREPARE FOR MONITORING ELECTRICAL SYSTEMS AND MECHANICAL OPERATIONS	DUTY NO.	402
TASK TITLE	OPERATION OF SHIP INTERNAL COMMUNICATION SYSTEM	TASK NO	4025
PERFORMANCE CRITERIA	The person executing the task must be able to operate the ship internal communication system correctly according to the work manual to ensure smooth communication.		
RANGE STATEMENT	The task will be carried out on the ship under the guidance and supervision of a electrical and electronic technician. The available tools and equipment include: 1. Ship automatic telephone; 2. Ship emergency sound-powered telephone; 3. Ship intercom; 4. Ship public broadcasting; 5. Ship operation signaling devices (electrical telegraph, rudder angle indicator).		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able do the following: 1. Use the ship automatic telephone for internal communication; 2. Use the ship emergency sound-powered telephone for internal communication; 3. Use the ship intercom for communication; 4. Use the ship public broadcasting for internal communication; 5. Use the ship electric telegraph to convey instructions; 6. Use the ship rudder angle indicator to indicate steering orders.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Operate the ship automatic telephone; 1.2 Operate the ship emergency sound-powered telephone; 1.3 Operate the ship intercom; 1.4 Operate the ship public broadcasting; 1.5 Operate the ship operation signaling devices (electrical telegraph, rudder angle indicator). 2.0 Principle The person must be able to explain the principles of: 2.1 Safety operating procedures and precautions; 2.2 Ship internal communication system.	

	3.0 Theories The person must be able to explain: 3.1 Composition of the ship internal communication system; 3.2 Functions of the ship internal communication system; 3.3 Location distribution of the ship internal communication system. 4.0 Essential skills 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Safe and standardized operation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Perform safe and standardized operations to manipulate the ship internal communication system correctly according to occupational requirements.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Maintenance operation policies and procedures; 2. Occupational Health & Safety.

OCCUPATION	MARINE ELECTRICAL AND ELECTRONIC TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	UTILIZE MANUAL TOOLS, ELECTRICAL AND ELECTRONIC MEASURING EQUIPMENT FOR OPERATIONS	DUTY NO.	403
TASK TITLE	PERFORM OPERATIONS USING ELECTRONIC AND ELECTRICAL MEASURING INSTRUMENTS	TASK NO	4031
PERFORMANCE CRITERIA	The person executing the task must be able to operate using electronic and electrical measuring instruments according to the work manual.		
RANGE STATEMENT	The task will be carried out on the ship under the guidance and supervision of a electrical and electronic technician. The available tools and equipment include: 1. Multimeter; 2. Clamp meter; 3. Megohmmeter; 4. AC voltmeter; 5. AC ammeter.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able do the following: 1. Select appropriate tools for the task; 2. Use a multimeter to measure voltage, current, resistance, and other electrical parameters; 3. Use a clamp meter to measure circuit current; 4. Use a megohmmeter to measure insulation resistance of electrical equipment; 5. Use an AC voltmeter to measure voltage; 6. Use an AC ammeter to measure current.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Use a multimeter; 1.2 Use a clamp meter; 1.3 Use a megohmmeter; 1.4 Use an AC voltmeter; 1.5 Use an AC ammeter. 2.0 Principle The person must be able to explain the principles of: 2.1 Basic electrical measuring instruments. 3.0 Theories The person must be able to explain:	

	3.1 Structure and components of electrical and electronic measuring instruments. 3.2 Functions of electrical and electronic measuring instruments. 4.0 Essential skills 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Safe and standardized operation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Perform safe and standardized operations to correctly use measuring instruments, mechanical tools, and manual and power tools according to occupational requirements.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Maintenance operation policies and procedures; 2. Occupational Health & Safety; 3. Waste disposal methods.

OCCUPATION	MARINE ELECTRICAL AND ELECTRONIC TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	UTILIZE MANUAL TOOLS, ELECTRICAL AND ELECTRONIC MEASURING EQUIPMENT FOR OPERATIONS	DUTY NO.	403
TASK TITLE	DISASSEMBLE AND REPLACE COMMON ELECTRICAL APPLIANCES	TASK NO	4032
PERFORMANCE CRITERIA	The person executing the task must be able to disassemble and replace common electrical appliances on the ship according to the work manual, ensuring the safe operation of the marine electrical system.		
RANGE STATEMENT	The task will be carried out on the ship under the guidance and supervision of a electrical and electronic technician. The available tools and equipment include: 1. AC contactor; 2. Thermal relay; 3. Time relay; 4. Intermediate relay; 5. Multimeter; 6. Screwdriver.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able do the following: 1. Select appropriate tools for the task; 2. Disassemble the AC contactor; 3. Assemble the AC contactor; 4. Replace the contact points of the AC contactor; 5. Disassemble the intermediate relay; 6. Assemble the intermediate relay; 7. Adjust the set value of the time relay; 8. Replace the time relay.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Disassemble and assemble AC contactor; 1.2 Disassemble and assemble intermediate relay; 1.3 Use megohmmeter; 1.4 Adjust set value of time relay; 1.5 Adjust set value of thermal relay. 2.0 Principle The person must be able to explain the principles of: 2.1 Basic operation of common electrical appliances on the ship.	

	3.0 Theories The person must be able to explain: 3.1 Structural composition and functions of commonly used electrical appliances on the ship. 4.0 Essential skills 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Safe and standardized operation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Perform safe and standardized operations to disassemble and replace common electrical appliances on the ship according to occupational requirements.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Methods for using work tools; 2. Methods for using measuring instruments; 3. Maintenance operation policies and procedures; 4. Occupational Health & Safety; 5. Waste disposal methods.

OCCUPATION	MARINE ELECTRICAL AND ELECTRONIC TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	UTILIZE MANUAL TOOLS, ELECTRICAL AND ELECTRONIC MEASURING EQUIPMENT FOR OPERATIONS	DUTY NO.	403
TASK TITLE	DISASSEMBLE, SPLICE AND REPLACE MARINE CABLES AND FABRICATE CABLE TERMINATIONS	TASK NO	4033
PERFORMANCE CRITERIA	The person executing the task must be able to disassemble, splice and replace marine cables and fabricate cable terminations correctly according to the work manual.		
RANGE STATEMENT	The task will be carried out on the ship under the guidance and supervision of a electrical and electronic technician. The available tools and equipment include: 1. Cable; 2. Wire cutter; 3. Wire stripper; 4. Crimping tool; 5. Terminal connector; 6. Insulating tape.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able do the following: 1. Select appropriate tools for the task; 2. Cut the cable; 3. Connect the cable; 4. Fabricate terminal blocks; 5. Replace the cable.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Properly cut cables; 1.2 Properly connect cables; 1.3 Properly replace cables; 1.4 Properly fabricate terminal blocks. 2.0 Principle The person must be able to explain the principles of: 2.1 Disassembling and replacing marine cables; 2.2 Cable termination fabrication process.	

	3.0 Theories The person must be able to explain: 3.1 Types and structures of marine cables. 4.0 Essential skills 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Safe and standardized operation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Perform safe and standardized operations to disassemble, splice and replace marine cables and fabricate cable terminations correctly according to occupational requirements.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Methods for using work tools; 2. Maintenance operation policies and procedures; 3. Occupational Health & Safety; 4. Waste disposal methods.

OCCUPATION	MARINE ELECTRICAL AND ELECTRONIC TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	UTILIZE MANUAL TOOLS, ELECTRICAL AND ELECTRONIC MEASURING EQUIPMENT FOR OPERATIONS	DUTY NO.	403
TASK TITLE	CHARGING AND DISCHARGING OPERATIONS OF MARINE BATTERIES	TASK NO	4034
PERFORMANCE CRITERIA	The person executing the task must be able to carry out charging and discharging operations on marine batteries according to the work manual, ensuring the proper functioning of the batteries.		
RANGE STATEMENT	The task will be carried out on the ship under the guidance and supervision of a electrical and electronic technician. The available tools and equipment include: 1. Marine batteries; 2. Charging and discharging panel; 3. Multimeter; 4. Hydrometer; 5. Connecting cables.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able do the following: 1. Select appropriate tools for the task; 2. Use a multimeter to assess the status of marine batteries; 3. Use a hydrometer to assess the status of marine batteries; 4. Connect the charging cables to marine batteries; 5. Perform battery charging operations for marine batteries; 6. Perform battery discharging operations for marine batteries; 7. Perform maintenance and upkeep of marine batteries.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Assess the status of marine batteries; 1.2 Perform charging operations for marine batteries; 1.3 Perform discharging operations for marine batteries. 2.0 Principle The person must be able to explain the principles of: 2.1 Charging and discharging marine batteries. 3.0 Theories The person must be able to explain: 3.1 Battery structure;	

	3.2 Precautions for using a hydrometer; 3.3 Relationship between battery status and specific gravity/voltage. 4.0 Essential skills 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Safe and standardized operation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Perform safe and standardized operations to carry out charging and discharging operations on marine batteries according to occupational requirements.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Methods for using work tools; 2. Methods for using measuring instruments; 3. Maintenance operation policies and procedures; 4. Occupational Health & Safety; 5. Waste disposal methods.

OCCUPATION	MARINE ELECTRICAL AND ELECTRONIC TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	PREPARE FOR THE MAINTENANCE AND REPAIR OF ELECTRICAL AND MECHANICAL SYSTEMS	DUTY NO.	404
TASK TITLE	SELECT AND APPLY LUBRICATING GREASE TO MOTOR BEARINGS CORRECTLY	TASK NO	4041
PERFORMANCE CRITERIA	The person executing the task must be able to select and apply lubricating grease to motor bearings correctly according to occupational requirements.		
RANGE STATEMENT	The task will be carried out on the ship under the guidance and supervision of a electrical and electronic technician. The available tools and equipment include: 1. Three-phase asynchronous motor; 2. Hairdryer; 3. Multimeter; 4. Electrical cleaning solution; 5. Bristle brush; 6. Sandpaper; 7. Puller; 8. Rubber mallet; 9. Circlip pliers; 10.Marker pen; 11.Double offset ring spanner; 12.Phillips screwdriver; 13.Marine lubricating grease.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able do the following: 1. Disassemble the electric motor; 2. Inspect the mechanical and electrical performance of components such as rotor, stator windings and bearings; 3. Clean the bearings; 4. Perform drying treatment on the bearings;		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Inspect the mechanical and electrical performance of components such as rotor, stator windings and bearings; 1.2 Apply lubricating grease to the bearings; 1.3 Use work tools.	

5. Select appropriate marine lubricating grease; 6. Apply lubricating grease to the bearings; 7. Assemble the electric motor.	2.0 Principle The person must be able to explain the principles of: 2.1 Functions and applications of lubricating grease; 2.2 Structure of the three-phase asynchronous motor; 2.3 Mechanical and electrical performance standards for components such as rotor, stator windings and bearings. 3.0 Theories The person must be able to explain: 3.1 Inspection procedures for mechanical performance of components such as rotor, stator windings and bearings; 3.2 Inspection procedures for electrical performance of components such as rotor, stator windings and bearings. 4.0 Essential skills 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Safe and standardized operation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Perform safe and standardized operations to select and apply lubricating grease to motor bearings according to occupational requirements.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Disassembly methods of the motor; 2. Assembly methods of the motor; 3. Maintenance operation policies and procedures; 4. Occupational Health & Safety; 5. Waste disposal methods.

OCCUPATION	MARINE ELECTRICAL AND ELECTRONIC TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	PREPARE FOR THE MAINTENANCE AND REPAIR OF ELECTRICAL AND MECHANICAL SYSTEMS	DUTY NO.	404
TASK TITLE	CLEAN THE SHIP ELECTRONIC AND ELECTRICAL EQUIPMENT	TASK NO	4042
PERFORMANCE CRITERIA	The person executing the task must be able to clean the ship electronic and electrical equipment according to occupational requirements.		
RANGE STATEMENT	The task will be carried out on the ship under the guidance and supervision of a electrical and electronic technician. The available tools and equipment include: 1. Electric motors, control boxes; 2. Hair dryer; 3. Multimeter; 4. Electrical cleaner; 5. Brush; 6. Sandpaper; 7. Metal polishing liquid; 8. Universal lubricating antirust agent.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able do the following: 1. Select appropriate tools for the task; 2. Clean the external surface of the three-phase asynchronous motor; 3. Clean the internal components of the three-phase asynchronous motor, such as windings and bearings; 4. Clean the external surface of the electrical control box; 5. Clean the internal components of the electrical control box.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Clean the three-phase asynchronous motor; 1.2 Clean the electrical control box. 2.0 Principle The person must be able to explain the principles of: 2.1 Basic safety operating procedures and precautions; 2.2 Selecting cleaning tools; 2.3 Cleaning electrical equipment.	

	3.0 Theories The person must be able to explain: 3.1 Application of common marine electrical cleaning agents. 4.0 Essential skills 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Safe and standardized operation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Perform safe and standardized operations to clean the ship electronic and electrical equipment according to occupational requirements.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Disassembly methods of the motor; 2. Assembly methods of the motor; 3. Maintenance operation policies and procedures; 4. Occupational Health & Safety; 5. Waste disposal methods.

OCCUPATION	MARINE ELECTRICAL AND ELECTRONIC TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	PREPARE FOR THE MAINTENANCE AND REPAIR OF ELECTRICAL AND MECHANICAL SYSTEMS	DUTY NO.	404
TASK TITLE	STORE AND USE ELECTRONIC AND ELECTRICAL EQUIPMENT OPERATING INSTRUCTIONS AND SHIP OPERATING MANUALS	TASK NO	4043
PERFORMANCE CRITERIA	The person executing the task must be able to properly store and use electronic and electrical equipment operating instructions and ship operating manuals according to workbook.		
RANGE STATEMENT	The task will be carried out on the ship under the guidance and supervision of a electrical and electronic technician. The available tools and equipment include: 1. Electronic and electrical equipment operating instructions; 2. Ship operating manuals.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able do the following: 1. Store electronic and electrical equipment operating instructions; 2. Store ship operating manuals; 3. Use electronic and electrical equipment operating instructions for operating, maintaining, and troubleshooting the equipment; 4. Use ship operating manuals for operations.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Properly store electronic and electrical equipment operating instructions; 1.2 Properly store ship operating manuals; 1.3 Correctly use electronic and electrical equipment operating instructions; 1.4 Correctly use ship operating manuals. 2.0 Principle The person must be able to explain the principles of: 2.1 Safety operating procedures and precautions; 2.2 Storing electronic and electrical equipment operating instructions and ship operating manuals; 2.3 Using electronic and electrical equipment operating instructions and ship operating	

	manuals. 3.0 Theories The person must be able to explain: 3.1 Storage environment and location requirements for electronic and electrical equipment operating instructions and ship operating manuals. 4.0 Essential skills 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Safe and standardized operation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Perform safe and standardized operations to properly store and use electronic and electrical equipment operating instructions and ship operating manuals according to occupational requirements.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. The use of work tools; 2. Methods for storing documents.

OCCUPATION	MARINE ELECTRICAL AND ELECTRONIC TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	UTILIZE MANUAL TOOLS, ELECTRICAL AND ELECTRONIC MEASURING EQUIPMENT FOR OPERATIONS	DUTY NO.	404
TASK TITLE	SWITCH AND INSPECT THE FIXED LIGHTING EQUIPMENT	TASK NO	4044
PERFORMANCE CRITERIA	The person executing the task must be able to switch and inspect the fixed lighting equipment properly.		
RANGE STATEMENT	The task will be carried out on the ship under the guidance and supervision of a electrical and electronic technician. The available tools and equipment include: 1. Searchlight; 2. Ceiling fluorescent light; 3. Deck light; 4. Passage light; 5. Multimeter.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able do the following: 1. Turn on the searchlight, fluorescent light, deck light, passage light, and other fixed lighting equipment. 2. Turn off the searchlight, fluorescent light, deck light, passage light, and other fixed lighting equipment. 3. Inspect the condition of the searchlight, fluorescent light, deck light, passage light, and other fixed lighting equipment.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Turn on the searchlight, fluorescent light, deck light, passage light, and other fixed lighting equipment. 1.2 Turn off the searchlight, fluorescent light, deck light, passage light, and other fixed lighting equipment. 1.3 Inspect the condition of the searchlight, fluorescent light, deck light, passage light, and other fixed lighting equipment. 2.0 Principle The person must be able to explain the principles of: 2.1 Operation of searchlights, fluorescent lights, deck lights, passage lights, and other fixed lighting equipment.	

	3.0 Theories The person must be able to explain: 3.1 Types of ship lighting equipment. 4.0 Essential skills 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Safe and standardized operation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Perform safe and standardized operations to switch and inspect the fixed lighting equipment properly according to occupational requirements.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Methods for using work tools; 2. Methods for using measuring instruments; 3. Maintenance operation policies and procedures; 4. Occupational Health & Safety; 5. Waste disposal methods.

OCCUPATION	MARINE ELECTRICAL AND ELECTRONIC TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	UTILIZE MANUAL TOOLS, ELECTRICAL AND ELECTRONIC MEASURING EQUIPMENT FOR OPERATIONS	DUTY NO.	404
TASK TITLE	SWITCH AND INSPECT MARINE HOUSEHOLD APPLIANCES	TASK NO	4045
PERFORMANCE CRITERIA	The person executing the task must be able to switch and inspect marine household appliances properly according to workbook.		
RANGE STATEMENT	The task will be carried out on the ship under the guidance and supervision of a electrical and electronic technician. The available tools and equipment include: 1. Washing machine; 2. Air conditioner; 3. Electric fan; 4. Water heater; 5. Television; 6. Multimeter.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able do the following: 1. Turn on the washing machine, air conditioner, electric fan, water heater, television, and other household appliances; 2. Turn off the washing machine, air conditioner, electric fan, water heater, television, and other household appliances; 3. Inspect the condition of the washing machine, air conditioner, electric fan, water heater, television, and other household appliances.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Turn on the washing machine, air conditioner, electric fan, water heater, television, and other household appliances; 1.2 Turn off the washing machine, air conditioner, electric fan, water heater, television, and other household appliances; 1.3 Inspect the condition of the washing machine, air conditioner, electric fan, water heater, television, and other household appliances. 2.0 Principle The person must be able to explain the principles of: 2.1 Operation of the washing machine, air conditioner, electric fan, water heater, television,	

	and other household appliances. 3.0 Theories The person must be able to explain: 3.1 Types of ship household appliances; 3.2 Methods for inspecting the condition of ship household appliances. 4.0 Essential skills 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Safe and standardized operation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Perform safe and standardized operations to switch and inspect marine household appliances according to occupational requirements.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Using work tools; 2. Using measuring instruments; 3. Maintenance operation policies and procedures; 4. Occupational Health & Safety; 5. Waste disposal methods.

OCCUPATION	MARINE ELECTRICAL AND ELECTRONIC TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	UTILIZE MANUAL TOOLS, ELECTRICAL AND ELECTRONIC MEASURING EQUIPMENT FOR OPERATIONS	DUTY NO.	404
TASK TITLE	IDENTIFY AND HANDLE ALARMS IN THE SHIP ENGINE CONTROL ROOM	TASK NO	4046
PERFORMANCE CRITERIA	The person executing the task must be able to identify and handle alarms in the ship engine control room according to workbook.		
RANGE STATEMENT	The task will be carried out on the ship under the guidance and supervision of a electrical and electronic technician. The available tools and equipment include: 1. Ship engine control room panel; 2. Engine room alarm indicator light.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able do the following: 1. View the operating parameters of the engine room equipment; 2. Use the ship engine control room panel; 3. Silence the alarm signals in the engine room; 4. Stop the flickering alarm signals in the engine room.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Identify the types of alarms in the ship engine control room; 1.2 Handle alarms in the ship engine control room. 2.0 Principle The person must be able to explain the principles of: 2.1 Handling alarms in the ship engine control room. 3.0 Theories The person must be able to explain: 3.1 Types of alarms in the ship engine control room; 3.2 Methods for handling alarms in the ship engine control room. 4.0 Essential skills	

	4.1 Communication skills; 4.2 Teamwork skills; 4.3 Safe and standardized operation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Perform safe and standardized operations to identify and handle alarms in the ship engine control room properly according to occupational requirements.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Maintenance operation policies and procedures; 2. Occupational Health & Safety.

OCCUPATION	MARINE ELECTRICAL AND ELECTRONIC TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	UTILIZE MANUAL TOOLS, ELECTRICAL AND ELECTRONIC MEASURING EQUIPMENT FOR OPERATIONS	DUTY NO.	404
TASK TITLE	STORE MATERIALS NORMATIVELY	TASK NO	4047
PERFORMANCE CRITERIA	The person executing the task must be able to store materials normatively according to workbook.		
RANGE STATEMENT	The task will be carried out on the ship under the guidance and supervision of a electrical and electronic technician. The available tools and equipment include: 1. Material inventory list; 2. Material requisition form; 3. Material consumption record.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able do the following: 1. Classify ship electrical materials; 2. Deposit ship electrical materials; 3. Store ship electrical materials; 4. Apply for ship electrical materials; 5. Replace ship electrical materials.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Store ship electrical materials; 1.2 Apply for ship electrical materials; 1.3 Replace ship electrical materials. 2.0 Principle The person must be able to explain the principles of: 2.1 Storing ship electrical materials. 3.0 Theories The person must be able to explain: 3.1 Storage location for ship electrical materials; 3.2 Types of ship electrical materials. 4.0 Essential skills 4.1 Communication skills;	

	4.2 Teamwork skills; 4.3 Safe and standardized operation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Perform safe and standardized operations to store materials according to occupational requirements.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. The use of work tools; 2. Maintenance operation policies and procedures; 3. Waste disposal methods.

OCCUPATION	MARINE ELECTRICAL AND ELECTRONIC TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	TAKE PREVENTIVE MEASURES TO PREVENT MARINE ENVIRONMENTAL POLLUTION	DUTY NO.	405
TASK TITLE	APPLIY INTERNATIONAL CONVENTIONS AND REGULATIONS TO PREVENT MARINE POLLUTION	TASK NO	4051
PERFORMANCE CRITERIA	The person executing the task must be able to apply international conventions and regulations to prevent marine environmental pollution according to workbook.		
RANGE STATEMENT	The task will be carried out on the ship under the guidance or supervision of a senior electrical and electronic technician. The following documents are required to support this task: 1. International Convention for the Prevention of Pollution from Ships (MARPOL Convention); 2. International Convention for the Control andManagement of Ships Ballast Water and Sediments (BWM Convention); 3. International Management Code for the Safe Operation of Ships and for Pollution Prevention (ISM Code); 4. Company Safety Management System (SMS).		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able do the following: 1. Apply the MARPOL Convention; 2. Implement the BWM Convention; 3. Follow the ISM Code; 4. Utilize the Company SMS.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Apply the MARPOL Convention and its annexes; 1.2 Implement the BWM Convention; 1.3 Follow the ISM Code; 1.4 Utilize the Company SMS. 2.0 Principle The person must be able to explain the principles of: 2.1 Application of the MARPOL Convention and its annexes; 2.2 Application of the BWM Convention; 2.3 Application of the ISM Code;	

	2.4 Application of the SMS. 3.0 Theories The person must be able to explain: 3.1 The MARPOL Convention and its annexes; 3.2 The BWM Convention; 3.3 The ISM Code; 3.4 The SMS. 4.0 Essential skills 4.1 Ability to access information; 4.2 Communication skills; 4.3 Teamwork skills; 4.4 Report writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Apply international conventions and regulations to prevent marine pollution according to occupational requirements.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Maintenance operation policies and procedures; 2. Waste disposal methods.

OCCUPATION	MARINE ELECTRICAL AND ELECTRONIC TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	TAKE PREVENTIVE MEASURES TO PREVENT MARINE ENVIRONMENTAL POLLUTION	DUTY NO.	405
TASK TITLE	DISPOSE OF MARINE POLLUTANTS USING POLLUTION PREVENTION EQUIPMENT	TASK NO	4052
PERFORMANCE CRITERIA	The person executing the task must comply with international and domestic regulations to prevent marine environmental pollution.		
RANGE STATEMENT	The task will be carried out on the ship under the guidance or supervision of a senior electrical and electronic technician. The available tools and equipment include: 1. Ship oil-water separator; 2. Marine sewage treatment system; 3. Marine incinerator.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able do the following: 1. Use the hip oil-water separator; 2. Use the marine sewage treatment system; 3. Use the marine incinerator.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Apply the MARPOL Convention and its annexes; 1.2 Implement the BWM Convention; 1.3 Follow the ISM Code; 1.4 Utilize the Company SMS. 2.0 Principle The person must be able to explain the principles of: 2.1 Implementing measures to prevent ships from polluting the marine environment. 3.0 Theories The person must be able to explain: 3.1 Procedures for preventing ships from polluting the marine environment; 3.2 Types and functions of pollution prevention equipment;	

	3.3 Approaches of ship pollution to the marine environment. 4.0 Essential skills 4.1 Communication skills; 4.2 Teamwork skills; 4.3 Report writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Always follow procedures for protecting the marine environment.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. The use of work tools; 2. Maintenance operation policies and procedures; 3. Occupational Health & Safety; 4. Waste disposal methods.

TABLE 1: DACUM CHARTS FOR MARINE ELECTRICAL AND ELECTRONIC TECHNICIAN NTA 4

DUTIES	TASKS	ENABLERS
1. Safely use the marine electrical equipment	1.1 Select tools, test insulation, check for short circuits, perform power outage operations, etc.	Generic skills and knowledge - Utilizing communication skills to collaborate with others and report to superiors - Instructions for using insulation safety equipment - Instructions for using protective safety equipment - Instructions for using shipboard fire extinguishers - Knowledge of the composition and characteristics of marine low-voltage power systems - Procedures for isolation during work or repairs - Principles for the safe use of shipboard electrical equipment - Specific measures for electrical fire and explosion prevention - Using safety instructions for electrical equipment Tools and Equipment - Electroprobe, electrical tools with insulation handles, insulating gloves, insulated boots (shoes), insulating mats, insulating workbench and other insulation safety tools - Safety signs, protective glasses, safety helmets, safety harness and other protective safety equipment - Carbon dioxide, dry powder, halogenated hydrocarbon fire extinguisher and other fire and explosion prevention equipment Materials - Connecting cable
	1.2 Implement isolation during work or repair (including disconnecting the master switch).	
	1.3 Take measures for electric shock prevention, fire and explosion prevention, and electrical fire prevention and control.	
	1.4 Safely operate the marine low-voltage power system.	

DUTIES	TASKS	ENABLERS
		Worker behaviors • Team work • Honesty • Sense of obedience • Integrity
2. Prepare for monitoring electrical systems and mechanical operations	2.1 Basic operation of ship power station.	Generic skills and knowledge • Utilizing communication skills to collaborate with others and report to superiors • Using electrical equipment safety manual • Basic components of the ship power station • Structure and principles of the master switch of a generator • Types of distribution devices in the ship power station • Structure and principles of electrical components such as air circuit breakers, contactors, fuses, thermal relays, buttons, etc. • Analysis methods of circuit control schematic diagrams, layout diagrams, wiring diagrams, etc. • Instructions for using disassembly and assembly tools such as puller, rubber mallet, circlip pliers, marker pen, double offset ring spanner, Phillips screwdriver, adjustable wrench, etc. • Symbols and functions of common circuit components such as resistor, capacitor, inductor, etc. • Operating regulations for marine electrical equipment • Structure and principles of electric motors • Basic composition of ship communication systems
	2.2 Disassemble and reassemble electric motors.	
	2.3 Assemble electromagnetic starter control box.	
	2.4 Connection of common circuit components and electrical measuring instruments.	
	2.5 Operation of ship internal communication system.	

DUTIES	TASKS	ENABLERS
		Tools and Equipment • Insulating gloves, insulated boots (shoes), insulating mats, insulating clothing and other insulation safety tools • Puller, rubber mallet, circlip pliers, marker pen, double offset ring spanner, Phillips screwdriver, adjustable wrench and other disassembly and assembly tools • Three-phase asynchronous motor • Electrical control box • Multimeter Materials • Connecting cable • Resistor components • Capacitor components • Inductor components Worker behaviors • Team work • Honesty • Sense of obedience • Integrity
3. Utilize manual tools, electrical and electronic measuring equipment for operations	3.1 Use measuring instruments, mechanical tools, and manual and electric tools for operations.	Generic skills and knowledge • Utilizing communication skills to collaborate with others and report to superiors • Using electrical equipment safety manual • Operation specifications for ship electrical tools • Structure principles and usage methods of multimeter, clamp meter, megohmmeter, and other measuring instruments • Structure, types, cutting
	3.2 Disassemble and replace common electrical appliances.	

DUTIES	TASKS	ENABLERS
	3.3 Disassemble, splice and replace marine cables and fabricate cable terminations.	methods and handling methods of marine cables - Principles of charging and discharging for marine batteries and methods for determining their status - Structure principles of AC contactor, air circuit breaker, intermediate relay, time relay, thermal relay, and other ship low-voltage electrical devices Tools and Equipment - Insulating gloves, insulated boots (shoes), insulating mats, insulating clothing and other insulation safety tools - Phillips screwdriver, double offset ring spanner, adjustable wrench, wire cutter, wire stripper, and other mechanical tools - Multimeter, clamp meter, megohmmeter, AC voltage meter, AC current meter, and other electrical measuring tools Materials - Connecting cable - Contactor - Relay - Battery Worker behaviors - Team work - Honesty - Sense of obedience - Integrity
	3.4 Charging and discharging operations of marine batteries.	
4. Prepare for the maintenance and repair of electrical and mechanical	4.1 Select and apply lubricating grease to motor bearings.	Generic skills and knowledge Utilizing communication skills to collaborate with others and report to superiors

DUTIES	TASKS	ENABLERS
systems	4.2 Use appropriate materials to clean the electronic and electrical equipment.	• Using electrical equipment operating instructions • Operating specifications for ship electrical tools • Structure principles of three-phase asynchronous motors • Mechanical and electrical performance of components such as rotor and stator in three-phase asynchronous motors • Application and selection principles of lubricating grease • Cleaning materials and procedures for electrical equipment • Types and procedures for storage and use of ship electrical materials • Handling methods for alarms in the ship engine control room • Structure principles of marine household appliances, such as washing machines and air conditioners • Structure principles of ship lighting equipment, such as ship fluorescent lights Tools and Equipment • Three-phase asynchronous motor • Ship fluorescent lights and other lighting equipment • Marine household appliances such as washing machines and air conditioners • Auxiliary tools such as multimeters and screwdrivers Materials • Lubricating grease
	4.3 Store and use electronic and electrical equipment operating instructions and ship operating manuals.	
	4.4 Switch and inspect the fixed lighting equipment.	
	4.5 Switch and inspect marine household appliances.	
	4.6 Identify and handle alarms in the ship engine control room.	
	4.7 Store materials normatively.	

DUTIES	TASKS	ENABLERS
		• Lubricating oil • Cleaning agent Worker behaviors • Team work • Honesty • Sense of obedience • Integrity
5. Take preventive measures to prevent marine environmental pollution	5.1 Apply international conventions and regulations to prevent marine pollution.	Generic skills and knowledge • Utilizing communication skills to collaborate with others and report to superiors • The MARPOL Convention and its annexes • The BWM Convention • The ISM Code • Structure and principles of shipboard oily water separators • Structure and principles of shipboard sewage treatment systems • Structure and principles of shipboard incinerators Tools and Equipment • Ship oil-water separator • Marine sewage treatment system • Marine incinerator Materials • The MARPOL Convention and its annexes • The BWM Convention • The ISM Code Worker behaviors • Team work • Honesty • Sense of obedience • Integrity
	5.2 Dispose of marine pollutants using pollution prevention equipment.	