Australian Government

Department of Education, Employment and Workplace Relations

TDMMR2607B OPERATE, TEST AND MAINTAIN MARINE ELECTRICAL AND CONTROL EQUIPMENT

Revision Number: 1

TDMMR2607B OPERATE, TEST AND MAINTAIN MARINE ELECTRICAL AND CONTROL EQUIPMENT

Modification History

Not applicable.

Unit Descriptor

UNIT DESCRIPTOR:
This unit involves the basic skills and knowledge required to operate, **test and maintain electrical machinery and electronic control equipment on a commercial vessel up to 1**,**500 kW propulsion power**, **including low voltage DC equipment and AC generation machinery**, **protective devices and shore power arrangements**.
Note: All installation, maintenance and repair of AC (50 volts or above) or DC (above 115 volts) must be carried out only by a suitably qualified engineer or licensed tradesman. Relevant State/Territory electrical licensing requirements must be fulfilled by any persons carrying out installation, maintenance and repair of electrical circuits and systems at such voltages on a vessel.

Application of the Unit

Application of the unit	The unit has applications in the qualification for a Marine Engine Driver Grade 1 (MED 1) as per relevant sections of Part D of the National Standard for Commercial Vessels (NSCV), i.e. Certificate IV in Transport&Distribution (Marine Engine Driving - Grade 1).

Licensing/Regulatory Information

Licensing/legislative requirements	The unit is consistent with the relevant sections of State and Territory maritime regulations and NSCV/USL Code for a MED 1.

Pre-Requisites

Not applicable.

Employability Skills Information

Not applicable.

Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	*Performance Criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the Evidence Guide.*

Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1 Operate and monitor electrical machinery and electronic control equipment	a The vessel's electrical machinery and electronic control equipment is operated and monitored in accordance with manufacturer's instructions b Shore power arrangements are correctly operated and maintained and performance monitored as per company and shore authority procedures c Poor performance and faults are identified and investigated in accordance with established practice and manufacturer's instructions and appropriate action is initiated to rectify the identified problem or report it for action by a contractor in accordance with established procedures
2 Repair faults in electrical machinery and electronic equipment	a Identified faults in vessel's electrical machinery and electronic control equipment are investigated using established fault-finding techniques on permissible voltages b Malfunctioning or faulty electrical machinery and electronic control equipment is correctly isolated and reported for contract repair, if necessary, as per procedures, permissible voltages, licensing restrictions and manufacturer's instructions

ELEMENT	PERFORMANCE CRITERIA
2 Repair faults in electrical machinery and electronic equipment (continued)	c Damaged or faulty components are repaired, replaced or reported to contractors in accordance with established system procedures, licensing restrictions and manufacturer's instructions d Repaired electrical machinery and electronic control equipment are reassembled in accordance with manufacturer's instructions e Repaired electrical machinery and electronic control equipment and associated safety devices, control systems and alarms are restarted/reactivated and their performance tested in accordance with manufacturer's instructions, licensing restrictions and permissible voltages f Performance against specifications is confirmed and the electrical machinery and electronic control equipment is recommissioned g Coordination of repair processes and assistance to electrical contractors to facilitate repairs is in accordance with established procedures
3 Complete maintenance and repair documentation	a Required records are kept of operation, testing, maintenance and repair activities and equipment failure incidents b All planned maintenance and repair documentation is completed as required
4 Follow safety and hazard control procedures	a Operation and routine maintenance of electrical systems are monitored to ensure compliance with safety regulations b Safety, hazard minimisation and pollution control procedures and regulations are followed at all times c Operational and maintenance hazards related to electrical systems use and basic maintenance are identified and action is taken to minimise or eliminate risk to personnel, vessel

ELEMENT	PERFORMANCE CRITERIA
	and the environment d Action is taken in the event of failure or emergency to ensure the isolation and security of electrical systems and equipment and maintain the safety of the vessel and personnel involved e Vessel's emergency and contingency plans are followed in the event of a failure or emergency involving electrical equipment and systems

Required Skills and Knowledge

REQUIRED KNOWLEDGE

This describes the knowledge required for this unit.

1 Regulations of relevant State/Territory maritime and electrical licensing authorities
Note: All installation, maintenance and repair of AC (50 volts or above) DC (above 115 volts) must be carried out only by a suitably qualified engineer or licensed tradesman. Relevant State/Territory electrical licensing requirements must be fulfilled by any persons carrying out installation, maintenance and repair of electrical circuits and systems at such voltages on a vessel.

2 Relevant OH&S and pollution control legislation, policies and procedures

3 Procedures for carrying out shipboard electrical machinery and electronic control equipment testing, troubleshooting and repair as part of routine maintenance procedures

4 A basic understanding of the power distribution and control circuits used on board vessels of up to 1,500 kW propulsion power and their associated operational electrical machinery and electronic control equipment

5 Operational characteristics and performance specifications for the different types of electrical machinery and electronic control equipment found on a vessel up to 1,500 kW propulsion power

6 The nature and causes of shipboard electrical machinery and electronic control equipment malfunctions and the available methods for their detection and repair

7 Basic characteristics and application of electrical machines used on small vessels, including:

   a AC and DC motors

   b AC generators, including requirements for the parallel operation and the process of synchronisation

   c three phase motors

   d three phase alternators operating singly and in parallel

   e three phase transformers

REQUIRED KNOWLEDGE

8 Basic procedures for the calibration and adjustment of transmitters and controllers in control systems

9 Basic principles of analogue and digital programmable logic controllers (PLCs) as they relate to the limits of responsibility of a Marine Engine Driver Grade 1

10 Basic theory, principles of operation and application in small vessel electrical/electronic equipment of:

a common active devices

b common integrated circuit devices and digital electronic circuits

11 Principles and procedures for electrical measurement, including the use of relevant instruments

12 Maritime communication techniques needed during routine maintenance operations

13 Principles of electrotechnology, including:

a the electric circuit

b basics of cabling, distribution and lighting systems typically used on a small vessel

c deck electrical machinery and related electronic control equipment

d basic electronics

e instruments, calibration and testing

f fire and emergency alarm systems.

c deck electrical machinery and related electronic control equipment

14 Safety, environmental and hazard control precautions and procedures relevant to marine electrical machinery and electronic control equipment inspection and maintenance operations

15 Safe procedures for the use of hand and power tools and maintenance equipment

REQUIRED SKILLS

This describes the basic skills required for this unit.

1 Use verbal communication skills required when operating, testing, and maintaining marine electrical and control equipment

2 Read, interpret and apply operating and service manuals and instructions for marine electrical and control equipment, including all required OH&S procedures and precautions

3 Read and interpret material safety data sheets

4 Read and interpret equipment specifications and drawings

5 Read and interpret electrical machinery and electronic control equipment performance readings and indications

6 Complete any required operational and maintenance records

7 Work safely and collaboratively with others when operating, testing, and maintaining marine electrical and control equipment

8 Select and use relevant tools and equipment as per instructions

9 Recognise faulty equipment and take appropriate action as per operating instructions

10 Recognise routine problems when operating, testing, and maintaining marine electrical and control equipment and take appropriate action

11 Adapt to differences in vessels, electrical and control systems and operating and servicing procedures

12 Operate and test electrical and control systems on vessels of less than 1,500 kW propulsion power

Evidence Guide

Evidence Guide
TDMMR2607B OPERATE, TESTAND MAINTAIN MARINE ELECTRICAL AND CONTROL EQUIPMENT

The Evidence Guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for this Training Package.

1 Critical aspects of evidence required to demonstrate competency in this unit	Assessment must confirm appropriate knowledge and skills to: a Operate and monitor the performance of electrical machinery and electronic control equipment against specifications on a small commercial vessel b Identify malfunctioning and faulty electrical machinery and electronic control equipment and components within permissible voltages and initiate appropriate action for repair or replacement c Make safe faulty electrical systems and equipment d Troubleshoot malfunctioning and faulty electrical machinery and electronic control equipment and carry out required repairs within the limits of permissible voltages and licensing authority restrictions e Exercise all required safety, environmental and hazard control precautions and procedures during the operation, maintenance and repair activities f Identify typical electrical machinery and electronic control equipment maintenance and repair problems and hazards and take appropriate action g Communicate effectively with others during maintenance and repair operations, including effective use of internal communication systems h Ensure adherence to regulatory requirements of relevant State/Territory electrical licensing authorities

Evidence Guide
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2 Evidence required for demonstration of consistent performance	a Performance is demonstrated consistently over a period of time and in a suitable range of contexts b Consistently applies underpinning knowledge and skills when: 1 operating and testing marine electrical machinery and electronic control equipment 2 identifying shipboard electrical machinery and electronic control equipment malfunctions and faulty plant and equipment of a small vessel 3 coordinating repairs of marine electrical machinery and electronic control equipment 4 applying safety precautions relevant to electrical machinery and electronic control equipment maintenance and repair operations 5 completing maintenance and repair documentation and records c Shows evidence of application of relevant workplace procedures, including: 1 relevant sections of marine regulations, NSCV and USL Code

Evidence Guide (**continued**)
TDMMR2607B OPERATE, TESTAND MAINTAIN MARINE ELECTRICAL AND CONTROL EQUIPMENT

2 Evidence required for demonstration of consistent performance (**continued**)	2 OH&S and electrical licensing regulations 3 manufacturer's specifications and instructions for the operation, testing, maintenance and repair of electrical machinery and electronic control equipment 4 following on-board housekeeping processes d Action is taken promptly to report and/or rectify electrical machinery and electronic control equipment malfunctions e Work is managed, controlled and completed systematically

Evidence Guide (continued)
TDMMR2607B OPERATE, TESTAND MAINTAIN MARINE ELECTRICAL AND CONTROL EQUIPMENT

	with required attention to detail f Recognises and adapts appropriately to cultural differences in the workplace, including modes of behaviour and interactions among crew and others
3 Context of assessment	a Assessment of competency must comply with the assessment requirements of the relevant maritime regulations b Assessment of this unit must be undertaken within relevant marine authority approved and audited arrangements by a registered training organisation: 1 As a minimum, assessment of knowledge must be conducted through appropriate written/oral examinations, and 2 Appropriate practical assessment must occur: i at the registered training organisation; and/or ii on an appropriate working or training vessel
4 Specific resources required for assessment	Access is required to opportunities to: a Participate in a range of practical and theoretical assignments, exercises, case studies, simulated fault situations and other assessments that demonstrate the skills and knowledge to operate and basically test and maintain electrical machinery and electronic control equipment within permissible voltages, including the ability to identify an appropriate range of possible electrical machinery and electronic control equipment malfunctions and coordinate related basic maintenance and repair solutions; and/or b Operate and carry out basic tests, maintenance and repairs on electrical machinery and electronic control equipment in a range of operational situations on a commercial or training vessel.

Range Statement

Range Statement
TDMMR2607B OPERATE, TESTAND MAINTAIN MARINE ELECTRICAL AND CONTROL EQUIPMENT

The Range Statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance.

VARIABLE	SCOPE
1. GENERAL CONTEXT	
a. Work must be carried out:	1 in compliance with the relevant sections of State and Territory marine regulations, NSCV and USL Code
b. Work is performed:	1 within broad operational requirements, with responsibility for own outputs in relation to specified quality standards and limited responsibility for others in achieving required outcomes
c. Work involves:	1 the operation, testing and maintenance of electrical and electronic equipment on a vessel and the application of solutions to a defined range of maintenance problems Note: All installation, maintenance and repair of AC (50 volts or above) DC (above 115 volts) must be carried out only by a suitably qualified engineer or licensed tradesman. Relevant State/Territory electrical licensing requirements must be fulfilled by any persons carrying out installation, maintenance and repair of electrical circuits and systems at such voltages on a vessel
2. WORKSITE ENVIRONMENT	

Range Statement **TDMMR2607B OPERATE, TESTAND MAINTAIN MARINE ELECTRICAL AND CONTROL EQUIPMENT**	
a Electrical machinery and electronic control equipment may include:	1 that typically found on any small commercial vessel of up to 1,500 kW propulsion power
b Performance monitoring and repairs may be carried out:	1 by day or night in both normal and emergency situations 2 under any permissible conditions of weather 3 while underway 4 during berthing and unberthing operations 5 while berthed, anchored or moored 6 while in dry dock

Range Statement (continued) **TDMMR2607B OPERATE, TESTAND MAINTAIN MARINE ELECTRICAL AND CONTROL EQUIPMENT**	
VARIABLE	**SCOPE**
c Types of electrical machinery and electronic control equipment may include:	1 main switchboard and shipboard power distribution systems, including: i distribution circuits and wiring ii circuit breakers and protection devices iii AC motors generators and alternators iv DC motors and generators v paralleling vi electronic instrumentation and power supply circuits

Range Statement (**continued**)
TDMMR2607B OPERATE, **TESTAND MAINTAIN MARINE ELECTRICAL AND CONTROL EQUIPMENT**

	vii emergency supply systems, including emergency generators, emergency switchboard and battery banks 2 programmable logic controllers (PLCs) 3 signal transmission systems used for monitoring and control 4 temperature and pressure sensors 5 electronic PID controllers 6 analogue to digital converters 7 electrical machinery and electronic control equipment space monitoring alarm and control systems 8 electronic governors 9 deck electrical machinery
d Emergencies may include:	1 loss of electrical power 2 short-circuits and open circuits in distribution systems 3 loss of electronic/electrical control of systems 4 flooding of vessel 5 fire or explosion on board vessel 6 failure of emergency alarm and control systems 7 loss of refrigeration 8 overloading of electrical systems
e Testing and repair equipment may include:	1 electronic instrumentation meters and gauges 2 computer displays of performance parameters 3 hand tools, such as soldering irons, pliers, cutters, wire strippers, spanners, wrenches, screwdrivers, hacksaws, etc.

Range Statement (**continued**)
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	4 electric and pneumatic power tools, such as drills, etc.

Range Statement (**continued**)
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VARIABLE	**SCOPE**
e Testing and repair equipment may include: (**continued**)	5 portable and manual lifting equipment, including block and tackle and hydraulic jacks 6 material safety data sheets 7 protective clothing and equipment such as: i eye and ear protection, safety boots and helmet ii dust and fume masks iii boilersuit/overalls
f Maintenance and repair hazards may include:	1 exposed live circuits and faulty earth connections 2 moving heavy loads using unsafe lifting procedures 3 unsecured machinery and equipment 4 sharp tools and implements 5 power tools 6 moving and rotating electrical machinery and electronic control equipment 7 faulty equipment, handling equipment and lifting gear 8 using equipment beyond safe working limits 9 poor housekeeping procedures

Range Statement (**continued**)
TDMMR2607B OPERATE, **TESTAND MAINTAIN MARINE ELECTRICAL AND CONTROL EQUIPMENT**

	10 non-compliance with safe working procedures 11 electrical wiring and systems 12 working at heights 13 overspeed of electrical machinery, emergency trips
g Documentation and records may include:	1 maintenance and repair procedures and instructions 2 electrical machinery and electronic control equipment and vessel manufacturer's specifications, instructions and recommended procedures 3 maintenance logs, running sheets, records 4 vessel's survey procedures and instructions as they relate to vessel's electrical machinery and electronic control equipment 5 vessel's safety and emergency contingency plans and procedures 6 relevant sections of the State and Territory marine regulations, the National Standard for Commercial Vessels and USL Code

Range Statement (**continued**)
TDMMR2607B OPERATE, **TESTAND MAINTAIN MARINE ELECTRICAL AND CONTROL EQUIPMENT**

VARIABLE	**SCOPE**
h Applicable legislation, **regulations and codes may include**:	1 State and Territory marine regulations related to the operation of small vessels 2 National Standard for Commercial Vessels and USL Code 3 relevant Commonwealth, State and Territory OH&S and pollution control legislation

Range Statement (**continued**)
TDMMR2607B OPERATE, **TESTAND MAINTAIN MARINE ELECTRICAL AND CONTROL EQUIPMENT**

4 requirements of relevant State/Territory electrical licensing authorities

Unit Sector(s)

Not applicable.

Field

Field R Carry Out Operations on Equipment and Systems

Relationship to other units

Relationship to other units	The unit may be assessed in conjunction with other units that relate to the functions of the occupation(s) concerned.