Australian Government

Department of Education, Employment and Workplace Relations

TDMMR2307B OPERATE AND MAINTAIN BATTERIES, STARTER MOTORS AND POWER DISTRIBUTION SYSTEMS

Release: 1

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Modification History

Not applicable.

Unit Descriptor

UNIT DESCRIPTOR: **This unit involves the skills and knowledge required of an Engineer Class 3 to operate and maintain electrical batteries, starter motors and power distribution systems on a commercial vessel less than 3,000 kW propulsion power operating up to offshore limits**. 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 3 as per relevant sections of Part D of the National Standard for Commercial Vessels (NSCV), i.e. Diploma of Transport&Distribution (Coastal Marine Engineering - Engineer Class 3).

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 Marine Engine Driver Grade 3

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
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1 Operate and monitor electrical equipment	a The vessel's batteries, starter motors and power distribution systems are 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
2 Repair faults in electrical equipment	a Identified faults in vessel's batteries, starter motors and power distribution systems are investigated using established fault-finding techniques b Malfunctioning or faulty batteries, starter motors and power distribution systems is correctly isolated and reported or disassembled, if necessary, as per established procedures, licensing restrictions and manufacturer's instructions

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ELEMENT	PERFORMANCE CRITERIA
2 Repair faults in electrical equipment (continued)	c Damaged or faulty components are repaired or replaced as per permissible voltages, licensing restrictions, established system procedures, and manufacturer's instructions d Repaired batteries, starter motors and power distribution systems and associated safety devices, control systems and alarms are restarted/reactivated and their performance tested in accordance with manufacturer's instructions e Performance against specifications is confirmed and the batteries, starter motors and power distribution systems is recommissioned f Coordination of the 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 on operation, testing, maintenance and repair activities and equipment failure incidents b All planned maintenance and repair documentation is completed as required
4 Follow safetyand hazard control procedures	a Operation and routine maintenance of electrical systems is 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 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

ELEMENT	PERFORMANCE CRITERIA
	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

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Required Skills and Knowledge

REQUIRED KNOWLEDGE

This describes the knowledge required for this unit

1 Applicable sections of relevant maritime regulations applicable to the operation and maintenance of batteries, starter motors and power distribution systems on vessels up to 3,000 kW propulsion power

2 Regulations of relevant State/Territory 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.

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

4 Procedures for carrying out testing, troubleshooting and repair of shipboard batteries, starter motors and power distribution systems as part of routine maintenance procedures falling within limits of responsibility of an Engineer Class 3

5 A basic understanding of the power distribution and control circuits used on board vessels of up to 3,000 kW propulsion power and their associated operational electrical machinery and electronic control equipment

6 Typical operational characteristics and performance specifications for the different types of batteries, starter motors and power distribution systems found on a vessel up to 3,000 kW propulsion power

7 The nature and causes of malfunctions in batteries, starter motors and power distribution systems and available methods for their detection and repair

8 Mathematical techniques to solve basic engineering and maintenance problems procedures falling within limits of responsibility of an Engineer Class 3

9 Procedures for the use of instruments and meters for monitoring and measurement

10 The colour coding system used for electric conductors

REQUIRED KNOWLEDGE

11 Definitions of electrical terms and solve basic electrical problems using mathematics.

12 Principles of battery operation and maintenance, including parallel operation of batteries

13 The basic principles of operation and operating procedures for AC and DC generators

14 Basic principles of preventative and remedial maintenance

15 Precautions and procedures for electrical safety during repair and inspection of electrical circuitry and equipment

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

17 Procedures for the reading and interpretation of performance readings and instrumentation

18 Maritime communication techniques needed during maintenance and repair operations

19 Purpose and content of material safety data sheets

20 Specifications, drawings, and manuals for battery systems on a vessel up to 3,000 kW propulsion power

21 Principles of electrotechnology, including:

a the electric circuit

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

c deck electrical machinery and related electronic control equipment

d instruments, calibration and testing

e fire and emergency alarm systems.

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

22 Safety, environmental and hazard control precautions and procedures relevant to maintenance operations on marine batteries, starter motors and power distribution systems

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

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REQUIRED SKILLS

This describes the basic skills required for this unit.

1 Use verbal communication skills required when operating and maintaining batteries, starter motors and power distribution systems on a small vessel

2 Read and interpret maintenance and service manuals and instructions and equipment specifications and drawings for equipment and machinery, including all required OH&S procedures and precautions

3 Read and interpret material safety data sheets

4 Read and interpret machinery performance readings and indications

5 Complete any required operational and maintenance records

7 Work safely and collaboratively with others when operating and maintaining batteries, starter motors and power distribution systems on a small vessel

8 Plan and organise the operation and maintenance of batteries, starter motors and power distribution systems on a small vessel

9 Monitor the selection and use of relevant tools and equipment as per instructions

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

11 Recognise routine problems when operating and maintaining batteries, starter motors and power distribution systems on a small vessel and take appropriate action

12 Adapt to differences in vessels, equipment and machinery and operating and servicing procedures

REQUIRED SKILLS

13 Ensure that all safety precautions and procedures are followed when operating and maintaining batteries, starter motors and power distribution systems on a small vessel

Evidence Guide

Evidence Guide

TDMMR2307B OPERATE AND MAINTAIN BATTERIES, STARTER MOTORS AND POWER DISTRIBUTION SYSTEMS

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 batteries, starter motors and power distribution systems against specifications on a vessel up to 3,000 kW propulsion power b Identify malfunctioning and faulty batteries, starter motors and power distribution systems and components and initiate appropriate action for repair or replacement c Make safe faulty electrical systems and equipment d Troubleshoot malfunctioning and faulty batteries, starter motors and power distribution systems and carry out required repairs within limits of responsibility of an Engineer Class 3 and relevant electrical licensing authority restrictions e Exercise all required safety and hazard control precautions and procedures when overseeing the operation, maintenance and repair of vessel's batteries, starter motors and power distribution systems f Identify typical operational and maintenance and repair problems and hazards and take appropriate action within limits of responsibility of an Engineer Class 3 g Communicate effectively with others during maintenance and repair operations, including effective use of internal

	communication systems h Ensure adherence to relevant maritime regulations and requirements of relevant State/Territory electrical licensing authorities
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 batteries, starter motors and power distribution systems 2 identifying shipboard malfunctions in batteries, starter motors and power distribution systems on a vessel up to 3,000 kW propulsion power 3 applying safety precautions relevant to batteries, starter motors and power distribution systems maintenance and repair operations 4 completing maintenance and repair documentation and records c Shows evidence of application of relevant workplace procedures, including: 1 relevant maritime regulations 2 OH&S and electrical licensing regulations

Evidence Guide (**continued**)

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2 Evidence required for demonstration of consistent performance (**continued**)	3 manufacturer's specifications and instructions for the operation, testing and maintenance of batteries, starter motors and power distribution systems 4 following on-board housekeeping processes d Action is taken promptly to report and/or rectify malfunctions in batteries, starter motors and the power

	distribution system e Work is managed, controlled and completed systematically 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 2 Appropriate practical assessment must occur: i at the registered training organisation; and/or ii on an appropriate working or training vessel
4 Specificresourcesrequired 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, test and maintain batteries, starter motors and power distribution systems; and/or b Operate, test and maintain batteries, starter motors and power distribution systems over a range of operational situations on a commercial or training vessel.

Range Statement

Range Statement

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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 maritime regulations
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 batteries, starter motors and power distribution systems on a vessel up to 3,000 kW propulsion power and the application of solutions to a defined range of operational and maintenance problems falling within limits of responsibility of an Engineer Class 3 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	

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

a Power generation equipment, batteries, starter motors andpower distribution systems may include:	1 those typically found on a commercial vessel of up to 3,000 kW propulsion power operating within inshore limits
b Performance monitoring and repair of shipboard batteries, starter motors and power distribution systems 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 in dry dock 7 when bunkering

Range Statement (**continued**)

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VARIABLE	SCOPE
c Power distribution systems may include:	1 distribution circuits and wiring 2 protection devices 3 circuit breakers 4 AC motors, generators and alternators 5 DC motors and generators

VARIABLE	SCOPE
	6 electronic instrumentation and power supply circuits 7 emergency supply systems, including emergency generators, emergency switchboard and battery banks
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 *damaged batteries* 5 *flooding, 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. 4 electric and pneumatic power tools, such as drills, etc. 5 portable/manual lifting equipment, including block and tackle and hydraulic jacks 6 material safety data sheets 7 protective clothing and equipment such as: i safety boots, helmet and eye and ear protection ii dust and fume masks iii boilersuit/overalls

VARIABLE	SCOPE
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

Range Statement (**continued**)

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VARIABLE	SCOPE
f Maintenance and repair hazards may include:	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 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 safety management system plans, procedures, checklists and instructions 2 maintenance and repair procedures and instructions 3 specifications, instructions and recommended procedures of the manufacturer's of the vessel's batteries, starter motors and power distribution systems

VARIABLE	SCOPE
	4 maintenance logs and records 5 vessel's survey procedures and instructions as they relate to vessel's batteries, starter motors and power distribution systems 6 vessel's safety and emergency contingency plans and procedures 7 relevant sections of State and Territory maritime regulations, NSCV and USL Code dealing with maintenance and repair
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 ISM Code 4 relevant Commonwealth, State and Territory OH&S and pollution control legislation 5 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.