



Australian Government

Department of Education, Employment and Workplace Relations

TDMMR907B OPERATE ALTERNATORS, GENERATORS AND CONTROL SYSTEMS TO SUPPLY SHIPBOARD ELECTRICAL POWER

Release: 1

TDMMR907B OPERATE ALTERNATORS, GENERATORS AND CONTROL SYSTEMS TO SUPPLY SHIPBOARD ELECTRICAL POWER

Modification History

Not applicable.

Unit Descriptor

UNIT DESCRIPTOR:

This unit involves the skills and knowledge required to operate alternators, generators and control systems to supply shipboard electrical power on board a commercial vessel, including planning the operationsof the plant and systems, operating the plant and systems, identifying malfunctions and taking appropriate action, exercising all required safety and pollution control measures, and keeping all required operational records.

Application of the Unit

Application of the unit	The unit has application in the qualifications for an Engineer Watchkeeper on a vessel greater than 750 kW, i.e. Diploma of Transport&Distribution(Marine Engineering - Engineer Watchkeeper).
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Licensing/Regulatory Information

Licensing/legislative requirements	The unit is consistent with the relevant sections of STCW 95 and Marine Orders under the Australian Navigation Act 1912, describing the role and responsibilities of an Engineer Watchkeeper.
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Pre-Requisites

Not applicable.

Employability Skills Information

Not applicable.

Elements and Performance Criteria Pre-Content

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

ELEMENT	PERFORMANCE CRITERIA
. 1 Operate alternators, generators and control systems	. a Maintain a safe engineering watch and operation of alternators, generators and control systems to supply shipboard electrical power in accordance with operational instructions, vessel and company rules and procedures, and established marine engineering practice b Alternators, generators and control systems are operated to supply shipboard electrical power within specified limits in accordance with established plans and procedures, and manufacturer's instructions and specifications c Alternators and generators are prepared, started, coupled and changed over in accordance with manufacturer's instructions and established marine engineering practice d The performance of shipboard alternators, generators and control systems is monitored in accordance with vessel's survey requirements and manufacturer's instructions and performance is compared with specifications and recommended limits of performance e Out-of-specification performance and faults are identified in consultation with a senior engineer and appropriate action initiated to report or rectify the problem in accordance with marine engineering practice and vessel's procedures f Records of performance are maintained on running sheets and operations logs in accordance with vessel's procedures

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ELEMENT	PERFORMANCE CRITERIA
2 Follow safety and hazard control procedures	- a All required safety precaution and regulations are followed when operating shipboard alternators, generators and associated control systems - b Operational hazards are identified and action is taken to minimise or eliminate risk to personnel, vessel and the environment - c Safety, hazard minimisation and pollution control procedures and national and international regulations are followed at all times during the operation of alternators, generators and control systems - d Where relevant, procedures and precautions necessary for entry into confined spaces on a vessel are correctly followed - e Appropriate action is taken in the event of a failure or emergency associated with shipboard alternators, generators and control systems to isolate and secure the plant and equipment and the vessel and maintain the safety of the vessel and persons involved - f Shipboard emergency and contingency plans are followed in the event of a loss of shipboard electrical power caused by a failure or emergency associated with shipboard alternators, generators or control systems

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Required Skills and Knowledge

REQUIRED KNOWLEDGE

This describes the knowledge required for this unit.

- 1 National and international regulations, including AMSA Marine Orders applicable to the operation of electrical and electronic control equipment on vessels of unlimited propulsion power
- 2 Relevant OH&S legislation, policies and procedures
- 3 Procedures for the operation of marine electrical and electronic equipment, systems and equipment
- 4 Typical operational characteristics and performance specifications for the different types of shipboard electrical and electronic equipment usually found on a vessel of unlimited propulsion power
- 5 The nature and causes of typical shipboard electrical and electronic equipment operational problems and the appropriate preventative and remedial action to be taken in each case
- 6 A basic understanding of the power distribution and power generation systems typically used on board a vessel of unlimited propulsion power and their associated operational electrical and electronic equipment
- 7 Characteristics and application of shipboard electrical machines, including:
 - a AC and DC motors
 - b AC generators, including requirements for the parallel operation and the process of synchronisation
 - c three phase induction motors, including the various starting methods
 - d three phase motors
 - e three phase synchronous motors
 - f three phase alternators operating singly and in parallel

REQUIRED KNOWLEDGE

- g three phase transformers
- 8 Safety, environmental and hazard control precautions and procedures relevant to the operation of shipboard electrical power distribution systems and electrical and electronic equipment
- 9 Types of operations records that must be maintained on a vessel to meet the requirements of the company, survey requirements and regulatory authorities
- 10 Principles and procedures for electrical and electronic measurement, including the use of oscilloscopes and multimeters and insulation resistance measurement using a Megger
- 11 Procedures for taking electrical and electronic equipment performance readings and instrumentation
- 12 Purpose and content of Material Safety Data Sheets
- 13 Typical vessel and electrical and electronic equipment specifications, equipment drawings, operational manuals, and electrical and control circuit diagrams
- 14 Concepts of unmanned machinery spaces (UMS) and automated monitoring and control of machinery
- 15 Basic principles of electrotechnology, marine electrical practice and marine automation and control relevant to detection, identification and repair of faults, including:
 - a electromagnetism and electrostatics

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- b electrolytic action and cells
- c the electric circuit
- d AC and DC theory and electrical and electronic equipment
- e cabling, distribution and lighting systems
- f control and switch gear
- g deck electrical and electronic equipment

- b electrolytic action and cells
 - h basic principles of electronics, integrated circuits and microprocessors
 - i basic principles of electronic control, surveillance, measurement and recording systems
 - j process control principles
 - k instruments, calibration and testing
 - l telemetering devices
 - m alarm systems
 - n main and auxiliary electrical and related electronic control equipment
 - o fire and emergency alarm systems
- 16 Common active devices and their application in power electronic and electronic circuits typically used on vessels of unlimited propulsion power, including:
- a ability to identify the devices and their circuit symbols
 - b operating characteristics of common active devices
 - c applications of common active devices
- 17 Common integrated circuit devices and their application in shipboard electronic instrumentation and power supply circuits, including:
- a operational amplifiers
 - b voltage regulators
 - c multivibrators

- b electrolytic action and cells
- 18 Maritime communication techniques needed when operating electrical power distribution systems and electrical and electronic equipment
- 19 Safe procedures for the use of hand and power tools and instrumentation

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REQUIRED SKILLS

This describes the basic skills required for this unit.

- 1 Communicate effectively with other personnel when operating alternators, generators and control systems to supply shipboard electrical power
- 2 Communicate with multilingual crew where applicable using established techniques
- 3 Interpret and follow procedures for the operation of alternators, generators and control systems to supply shipboard electrical power
- 4 Read and interpret equipment performance readings and instrumentation
- 5 Interpret and follow all safety management procedures and precautions when operating alternators, generators and control systems to supply shipboard electrical power
- 6 Read and interpret material safety data sheets
- 7 Read and interpret vessel and machinery specifications, machinery design drawings, machine drawings, operational manuals, specifications and electrical and control circuit diagrams
- 8 Work collaboratively with other shipboard personnel when operating alternators, generators and control systems to supply shipboard electrical power
- 9 Identify problems that can occur during the operation of alternators, generators and control systems to supply shipboard electrical power
- 10 Carry out calculations required when operating alternators, generators and control systems to supply shipboard electrical power
- 11 Adapt to differing types of systems and associated equipment from one vessel to another and when equipment and systems are changed

REQUIRED SKILLS

- 12 Take appropriate precautions to prevent pollution of the marine environment
- 13 Select and use tools and equipment required when operating alternators, generators and control systems to supply shipboard electrical power

Evidence Guide

Evidence Guide

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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 Ensure a safe engineering watch during the operation of shipboard electrical power distribution systems and electrical power generation and associated electronic control equipment - b Operate shipboard electrical power distribution systems and electrical power generation and associated electronic control equipment within specifications on a vessel of unlimited propulsion power - c Prepare, start, synchronise and change-over alternators and generators - d Identify malfunctioning power distribution systems and electrical generation and electronic control equipment and components and, in consultation with a senior engineer, initiate appropriate action for repair or replacement - e Exercise all required safety, environmental and hazard control precautions and procedures when overseeing the operation of electrical power distribution systems and electrical and electronic equipment - f Identify typical power distribution and electrical and electronic control equipment operational problems and
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	hazards and take appropriate action g Communicate effectively with others during operation of power distribution systems and electrical and electronic control equipment h Ensure adherence to national and international regulations, IMO Conventions and Codes
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 shipboard power distribution systems and electrical power generation and associated electronic control equipment 2 assessing operational performance of shipboard power distribution systems and electrical power generation and associated control equipment 3 assisting in the identification of operational problems with shipboard power distribution systems and electrical power generation and associated electronic control equipment and taking remedial action 4 taking action in consultation with a senior engineer to minimise any damage and safety risk that could be caused by malfunctions in shipboard electrical power generation and associated electronic control equipment 5 applying safety precautions relevant to the operation of shipboard power distribution systems and power generation and associated electronic control equipment

Evidence Guide (continued)

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2 Evidence required for demonstration	6 completing operations documentation and records c Shows evidence of application of relevant workplace
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performance (continued)	procedures, including: 1 relevant sections of maritime regulations 2 OH&S regulations and hazard prevention policies and procedures 3 safety management system and quality procedures and work instructions 4 following on-board housekeeping processes d Action is taken promptly to report and assist in the rectification of electrical and electronic equipment malfunctions, non-conformities, accidents, hazardous occurrences and safety incidents in accordance with statutory requirements, company procedures and the ISM Code 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 between 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 operational

situations and other assessments that demonstrate the skills and knowledge to operate electrical power distribution systems and electrical power generation and control equipment typically found on a vessel of unlimited propulsion power; and/or

Evidence Guide (continued)

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4 Specific resources required for assessment (continued)

- b maintain a safe engineering watch and operate shipboard electrical power distribution systems and electrical power generation and control equipment in a range of operational situations on a commercial or training vessel of unlimited propulsion power

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 mandatory rules and regulations and IMO Conventions and Codes, including the relevant sections of the AMSA Marine Orders and ensuring that applicable codes, guidelines and standards recommended by IMO, the classification societies and maritime industry organisations are taken into account

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

b. Work is performed:	1 in consultation with a senior engineer, relatively independently within broad operational requirements, with limited accountability and responsibility for self and others in achieving the prescribed outcomes
c. Work involves:	1 the application of marine engineering practice to the operation of shipboard alternators, generators and control systems typically found on a vessel of unlimited propulsion power across a wide and often unpredictable variety of operational contexts. Monitoring and supervising the implementation of a broad plan or strategy for the operation of shipboard alternators, generators and control systems is required. Defined accountability and responsibility for self and others in achieving the outcomes is involved
d. Work requires:	1 some responsibility for overseeing the operation of alternators, generators and control systems to supply shipboard power. This includes supervision and control of personnel, hazard minimisation, analysis of performance and operational situations, and related decision making

2. WORKSITE ENVIRONMENT

a Shipboard alternators, generators and control systems may include:	1 those typically found on any Australian or international commercial vessel of unlimited propulsion power
b Operation of electrical equipment and related control equipment 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 anchored or moored

Range Statement (continued)

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VARIABLE	SCOPE
b Operation of electrical equipment and related control equipment may be carried out (continued)	6 in dry dock 7 when bunkering 8 during cargo operations
c Types of electrical and electronic control equipment may include:	1 Main switchboard and shipboard power distribution systems, including: - i distribution circuits and wiring - ii protection devices - iii circuit breakers 2 three phase alternators and AC generators 3 three phase transformers 4 AC and DC motors, including: - i three phase induction motors such as squirrel cage, double cage, wound rotor and slip ring, TEFC, splash proof and submersible - ii three phase synchronous motors 6 emergency supply systems, including emergency generators, emergency switchboard and battery banks 7 electrical and electronic equipment space monitoring alarm and control systems 8 electronic instrumentation and power supply circuits

VARIABLE	SCOPE
	9 electronic governors 10 deck electrical machinery
d Operational hazards may include:	1 moving and rotating electrical equipment 2 using equipment beyond safe working limits 3 poor housekeeping procedures 4 non-compliance with safe working procedures 5 hot pipes and valves (steam, fuel oil, lubricating oil) 6 cold pipes and valves (refrigeration and liquefied gas cargoes) 7 working at heights and in confined spaces 8 dangerous atmosphere

Range Statement (continued)

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VARIABLE	SCOPE
d Operational hazards may include: (continued)	9 overspeed of electrical machinery, emergency trips 10 noxious and dangerous cargoes 11 electric shock
e 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 engine room

VARIABLE	SCOPE
	5 fire or explosion in engine room 6 failure of emergency alarm and control systems 7 loss of refrigeration 8 overloading of electrical systems 9 electric shock
f Documentation /records may include:	1 ISM Code safety management system plans, procedures, checklists and instructions 2 vessel and company's planned maintenance system, repair procedures and instructions 3 electrical and electronic equipment and vessel manufacturer's specifications, instructions and recommended procedures 4 power distribution system and electrical generation and control equipment running sheets, operations logs and other operational records, including computer database of running information, where relevant 5 vessel's survey procedures and instructions as they relate to shipboard electrical and electronic equipment 6 relevant sections of national and international regulations, IMO Conventions and Codes, including AMSA Marine Orders and class society rules dealing with shipboard electrical power distribution systems and electrical and electronic control equipment operation 7 instructions of relevant maritime authorities and class societies concerning shipboard electrical power distribution systems and electrical and electronic control equipment operation

Range Statement (continued)

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VARIABLE	SCOPE
g Applicable procedures and codes may include:	1 sections of national and international regulations, IMO Conventions and Codes, including AMSA Marine Orders and class society rules related to shipboard electrical power distribution systems and electrical power generation and electronic control equipment operation on vessels of unlimited propulsion power 2 relevant international, Commonwealth, State and Territory OH&S legislation 3 relevant international, Commonwealth, State and Territory electrical and electronic engineering practice standards

Unit Sector(s)

Not applicable.

Field

Field E Communications

Relationship to other units

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