



Australian Government

MARL5009A Demonstrate basic knowledge of marine electrical systems

Release 1

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Modification History

Release 1

This is the first release of this unit.

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.

Application of the Unit

This unit applies to the work of Marine Engineering Watchkeepers on commercial vessels greater than 750 kW and forms part of the requirements for the Certificate of Competency Marine Engineer Watchkeeper issued by the Australian Maritime Safety Authority (AMSA).

Licensing/Regulatory Information

Not applicable.

Pre-Requisites

Not applicable.

Employability Skills Information

This unit contains employability skills.

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

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| 1 Explain hazards and isolation procedures associated with live electrical components | 1.1 | Effects of electricity on the human body are outlined |
| | 1.2 | Procedure to be taken in the event of a person suffering an electric shock is clarified |
| | 1.3 | Correct procedure for isolating an electrical circuit is clarified |
| | 1.4 | Electrical hazards in a vessel at sea or port are identified |
| 2 Explain basic operation of and hazards associated with marine high voltage installations | 2.1 | Functional and operational requirements for a marine high voltage system are detailed |
| | 2.2 | Safety procedures required when working in high voltage environments are outlined |
| | 2.3 | Procedure for assisting suitably qualified personnel to carry out maintenance and repair of high voltage switchgear of various types is outlined |
| 3 Explain principles of power generation and transmission in AC and DC circuits | 3.1 | Excitation methods used to produce alternating current (AC) and direct current (DC) voltages are outlined |
| | 3.2 | Basic voltage control of generated AC voltages is outlined |
| 4 Outline key features of basic electrical diagrams used on vessels | 4.1 | Types of diagrams used to depict electrical systems on ships are outlined |
| | 4.2 | Electrical symbols used in basic electrical diagrams are identified |
| | 4.3 | Electrical devices used in basic electrical circuits are clarified |
| 5 Use common electrical measuring and testing instruments | 5.1 | Different types of multimeters are used appropriately |
| | 5.2 | Functions of insulation and 'tong' testers are explained |
| | 5.3 | Safety requirements when using test equipment are applied |
| 6 Rectify basic electrical faults | 6.1 | Fault situation is determined by appropriate questioning of client or operator |
| | 6.2 | Safe working practices are demonstrated when carrying out fault-finding work |
| | 6.3 | Basic common faults of equipment and techniques used to find faults are outlined |

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| | 6.4 | Knowledge of various types of basic common faults of circuits and techniques is used to find faults |
| | 6.5 | Basic common faults in electrical equipment are identified and rectified |
| 7 Outline basic components and layout of a marine electrical switchboard | 7.1 | Layout of a typical three wire insulated electrical system is sketched |
| | 7.2 | Interconnections between main switchboard, emergency switchboard and shore supply are explained |
| | 7.3 | Procedure for changing over to emergency switchboard for testing or during loss of mains power is outlined |
| | 7.4 | Safety features on a typical marine switchboard are identified |
| 8 Explain operation of shipboard alternators | 8.1 | Types and construction methods of alternators used on a marine vessel are outlined |
| | 8.2 | Principles of operation of a marine type alternator are outlined |
| | 8.3 | Relationship is shown between voltage and speed in regulation of alternator |
| | 8.4 | Operational characteristics of a marine alternator are outlined |
| | 8.5 | Excitation and automatic voltage regulation systems used with marine alternators are clarified |
| 9 Explain procedures for paralleling of alternators | 9.1 | Process of measuring voltage, frequency and phase angle is outlined |
| | 9.2 | Automatic and manual procedures for synchronising and paralleling marine alternators, including machines of different capacities are clarified |
| | 9.3 | How two machines can be adjusted to share kVAR and kW loads is confirmed |
| | 9.4 | Process of removing an alternator from the bus is outlined |

Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

Required Skills:

- Assess own work outcomes and maintain knowledge of current codes, standards, regulations and industry practices
- Explain basic principles of alternators, generators and control systems, and
- Identify and interpret numerical and graphical information in electrical diagrams and specifications for a commercial vessel
- Identify and suggest ways of rectifying electrical hazards and emergency situations on a vessel
- Identify methods, procedures and materials needed for operating, maintaining and repairing basic marine electrical systems
- Impart knowledge and ideas through verbal, written and visual means
- Read and interpret written information related to electrical circuitry and components on commercial vessels
- Use electrical measuring and testing instruments

Required Knowledge:

- AC/DC voltage
- Alternators – construction, characteristics, synchronised operation
- Electrical:
 - safe working practices
 - measuring and testing instruments
 - symbols, basic electrical diagrams/circuits
- Marine electrical systems – switchboards, instrumentation, earthing
- Phase angle, power factor and current flow
- Procedures for dealing with hazards and emergencies
- Resistance, inductance and capacitance
- Switchboards and protection – purpose, testing and maintenance, equipment removal
- Work health and safety (WHS)/occupational health and safety (OHS) legislation and policies

Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, the required skills and knowledge, the range statement and the Assessment

Guidelines for the Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit

The evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the Elements, Performance Criteria, Required Skills, Required Knowledge and include:

- providing accurate and reliable information
- providing appropriate level of detail in responses.

Context of and specific resources for assessment

Performance is demonstrated consistently over time and in a suitable range of contexts.

Resources for assessment include access to:

- industry-approved marine operations site where basic knowledge of marine electrical systems can be demonstrated
- technical reference library with current publications on marine electrical systems
- tools, equipment and personal protective equipment currently used in industry
- relevant regulatory and equipment documentation that impacts on work activities
- range of relevant exercises, case studies and/or other simulated practical and knowledge assessments
- appropriate range of relevant operational situations in the workplace.

In both real and simulated environments, access is required to:

- relevant and appropriate materials and equipment
- applicable documentation including workplace procedures, regulations, codes of practice and operation manuals.

Method of assessment

Practical assessment must occur in an:

- appropriately simulated workplace environment and/or
- appropriate range of situations in the workplace.

A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate to this unit:

- direct observation of the candidate demonstrating basic knowledge of marine electrical systems
- direct observation of the candidate applying relevant WHS/OHS requirements and work practices.

Guidance information for assessment

Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

In all cases where practical assessment is used it should be

combined with targeted questioning to assess Required Knowledge.

Assessment processes and techniques must be appropriate to the language and literacy requirements of the work being performed and the capacity of the candidate.

Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below.

- Electrical hazards may include:
- Electric shock
 - Electrical fire
 - Moving and rotating electrical equipment
 - Non-compliance with safe working procedures
 - Over-speed of electrical machinery
 - Poor housekeeping procedures
 - Using equipment beyond safe working limits

Unit Sector(s)

Not applicable.

Competency Field

Marine Engineering