



Australian Government

MARL028 Demonstrate intermediate knowledge of marine electrical systems

Release: 1

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Modification History

Release 1. New unit of competency.

Application

This unit involves the skills and knowledge required to analyse complex switchboards, perform fault finding on electrical circuits, maintain circuit breakers, synchronise alternators and maintain emergency battery systems to ensure supply of shipboard electrical power on board a commercial vessel.

This unit applies to the work of a Marine Engineer Class 2 on commercial vessels greater than 3000 kW and forms part of the requirements for the Certificate of Competency Marine Engineer Class 2 issued by the Australian Maritime Safety Authority (AMSA).

No licensing, legislative or certification requirements apply to this unit at the time of publication.

Pre-requisite Unit

Not applicable.

Competency Field

L – Marine Engineering

Unit Sector

Not applicable.

Elements and Performance Criteria

Elements describe the essential outcomes.

Performance criteria describe the performance needed to demonstrate achievement of the element.

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| 1 Analyse common faults in shipboard electrical machinery | 1.1 Effects and ways of detecting earth on 3 wire insulated and 4 wire earthed neutral systems are explained |
| | 1.2 Effects of short circuits and operation of discrimination protection are explained |
| | 1.3 Symptoms and effects of ‘light’ and ‘heavy’ short circuits on components and circuits are compared |

- 1.4 Effects of open circuits on systems and components transformers are analysed
- 1.5 Causes and effects of 'hot spots' in circuits are identified
- 1.6 Cause and effects of static electricity on shafting and when cleaning tanks are identified
- 2 Perform fault-finding on electrical circuits**
 - 2.1 Safe procedure for determining insulation resistance of a 3-phase motor or alternator including protection of solid-state components and selection of suitable minimum insulation for the component is applied
 - 2.2 Procedure for safely drying out an electrical machine with a low IR is outlined
 - 2.3 Open circuit in a 3-phase motor is safely tested
 - 2.4 Procedure for testing internal short circuit in a 3-phase motor is clarified
- 3 Analyse complex shipboard switchboard layouts**
 - 3.1 Switchboard layouts are interpreted
 - 3.2 The effects and indications of earths on the system including intermittent and multi earths are explained
 - 3.3 Safe procedure for locating earths on main and low voltage circuits including 24 V system is outlined
 - 3.4 Operation of preferential tripping arrangements for overload protection is explained
 - 3.5 Relationship between main and emergency switchboards is explained
 - 3.6 Different methods of start up after black outs are outlined
- 4 Explain electrical safety procedures for ship and shore personnel**
 - 4.1 Potential problems associated with shore maintenance personnel working on ship electrical equipment are identified
 - 4.2 Safe procedure of isolating electrical machinery for repair or maintenance is applied
 - 4.3 Safe method of working on live electrical circuitry for purpose of repair or maintenance is explained
 - 4.4 Problems associated with shipboard electrical fires are explained
 - 4.5 Safe procedures for fighting shipboard electrical fires

- including fires in switchboards are clarified
- 5 Synchronise, parallel and load share alternators on manual and auto modes**
- 5.1 Process of manually synchronising alternator and sharing kW and kVAR loading under all loading conditions is explained
- 5.2 Process of starting, testing and where applicable, of transferring emergency generator power on to main board, is explained
- 5.3 Operation of synchronising lights, synchroscope and all meters associated with synchronising is outlined
- 5.4 Operation of AVR and prime mover governor with respect to synchronising is outlined and how these can be adjusted at set points is explained
- 6 Examine operation, construction and maintenance of circuit breakers**
- 6.1 Features and applications of different types of circuit breakers are differentiated
- 6.2 Closing and opening systems of circuit breakers are explained
- 6.3 Arc extinguishing systems are explained
- 6.4 Method for accessing an air circuit breaker for inspection is analysed
- 6.5 Function and operation of protection devices associated with air circuit breaker and molded case circuit breaker are examined
- 7 Analyse function of emergency battery systems**
- 7.1 Different types and characteristics of batteries used for emergency supplies are identified
- 7.2 Methods of battery charging and ways in which charge condition of the battery can be determined are explained
- 7.3 Requirements of emergency supply and how transfer can occur without adversely affecting solid state components are explained
- 7.4 Safety hazards associated with batteries, and procedures to be adopted to minimise explosion and short circuits are appraised
- 8 Explain hazards associated with marine high voltage**
- 8.1 Functional and operational requirements for a marine high voltage system are outlined
- 8.2 High voltage marine installations are identified

installations

- 8.3 Design features of high voltage installations are explained
- 8.4 Risks and safety procedures associated with working in high voltage environments are identified
- 8.5 Procedure for assisting suitably qualified personnel to carry out maintenance and repair of high voltage installation is outlined

Foundation Skills

Foundation skills essential to performance are explicit in the performance criteria of this unit of competency.

Range of Conditions

Range is restricted to essential operating conditions and any other variables essential to the work environment.

Systems and components include one or more of the following:

- motors
- transformers

Switchboard layouts include one or more of the following:

- DC systems
- dedicated power supplies
- dual supply for steering gear
- feed back and feed forward arrangements
- interconnection with low voltage

Problems include one or more of the following:

- electric shock
- enclosed space work
- noncompliance with safe working procedures
- unfamiliar with marine electrical systems
- using equipment beyond safe working limits
- working at heights

Unit Mapping Information

This unit replaces and is equivalent to MARL6015A Demonstrate intermediate knowledge of marine electrical systems.

Links

Companion Volume implementation guides are found in VETNet -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=772efb7b-4cce-47fe-9bbd-ee3b1d1eb4c2>