



**Australian Government**

# **MARB038 Maintain and repair marine electrical and electronic equipment**

**Release: 1**

# **MARB038 Maintain and repair marine electrical and electronic equipment**

## **Modification History**

Release 1. This is the first release of this unit of competency in the MAR Maritime Training Package.

## **Application**

This unit involves the skills and knowledge required to maintain and repair marine electrical and electronic equipment on a vessel. This includes carrying out routine maintenance of marine generators, switchboards, electric motors, motor starters, direct current (DC) electrical systems and electrical distribution systems; and identifying faults in automated control systems.

This unit applies to people working in the maritime industry in the capacity of:

- Electro-Technical Officer (STCW Electro-Technical Officer Unlimited)
- Engineer Watchkeeper (STCW Engineer Watchkeeper Unlimited).

## **Licensing/Regulatory Information**

Legislative and regulatory requirements are applicable to this unit.

- This unit is one of the requirements to obtain Australian Maritime Safety Authority (AMSA) certification as an Electro-Technical Officer (STCW Electro-Technical Officer Unlimited) or Engineer Watchkeeper (STCW Engineer Watchkeeper Unlimited) and to meet regulatory requirements this unit must be delivered consistent with Marine Orders and with the relevant sections of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW).
- Those regulatory requirements include STCW International Maritime Organization (IMO) model course competencies and areas of knowledge, understanding and proficiency, together with the estimated total hours required for lectures and practical exercises. Teaching staff should note that timings are suggestions only and should be adapted to suit individual groups of trainees depending on their experience, ability, equipment and staff available for training.

## **Pre-requisite Unit**

Not applicable.

## **Competency Field**

B – Equipment Checking and Maintenance

## Unit Sector

Not applicable.

## Elements and Performance Criteria

### ELEMENTS

Elements describe the essential outcomes.

### PERFORMANCE CRITERIA

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

#### **1 Maintain marine generators**

- 1.1** Safety requirements associated with working on marine electrical generation systems are complied with
- 1.2** Marine generators are inspected using appropriate manuals and drawings according to regulatory, organisational and manufacturer requirements
- 1.3** Routine maintenance and testing of marine generators is performed according to regulatory, organisational and manufacturer requirements
- 1.4** Alternators are synchronised according to organisational and manufacturer requirements
- 1.5** Testing and maintenance records are maintained according to regulatory, organisational and manufacturer requirements

#### **2 Maintain marine switchboards**

- 2.1** Safety requirements associated with handling circuit breakers are complied with
- 2.2** Routine maintenance is performed on main circuit breaker according to with regulatory, organisational and manufacturer requirements
- 2.3** Faults in circuit breakers are detected and corrected according to regulatory, organisational and manufacturer requirements
- 2.4** Testing and maintenance records are maintained according to regulatory, organisational and manufacturer requirements

#### **3 Maintain marine electrical motors**

- 3.1** Safety requirements associated with working on marine electrical motors are complied with
- 3.2** Equipment required for maintenance of electrical motors

- is selected and checked for serviceability
- 3.3** Routine maintenance procedures are applied on marine electrical motors according to regulatory, organisational and manufacturer requirements
- 4 Test marine electrical motor starters**
- 4.1** Safety requirements associated with working on marine electrical motor starters are complied with
- 4.2** Faults in electrical motor starters are detected and rectified according to regulatory, organisational and manufacturer requirements
- 4.3** Starting and running current load testing is performed on electrical motors according to regulatory, organisational and manufacturer requirements
- 4.4** Procedures for finding start and finish of electrical motor windings are applied according to regulatory, organisational and manufacturer requirements
- 4.5** Testing, repairs and maintenance records are maintained according to regulatory, organisational and manufacturer requirements
- 5 Maintain marine electrical distribution systems**
- 5.1** Safety requirements associated with working on marine electrical distribution systems are complied with
- 5.2** Causes and potential dangers associated with earth faults in multiple earthed neutral (MEN) and floating neutral systems are identified
- 5.3** Earth faults are detected and repaired using correct equipment according to regulatory, organisational and manufacturer requirements
- 5.4** Hazards associated with working on fluorescent lamp circuits are identified
- 5.5** Fluorescent lamp circuit is constructed using appropriate manuals and drawings according to regulatory, organisational and manufacturer requirements
- 5.6** Components, function and operation of watertight and flame proof fittings are identified
- 5.7** Reasons for earthing high voltage (HV) systems via a resistor are outlined

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|----------|-----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          | <b>5.8</b>                                          | Routine maintenance, inspection and testing of marine electrical distribution systems is performed according to regulatory, organisational and manufacturer requirements |
|          | <b>5.9</b>                                          | Temporary repairs to insulation are performed according to regulatory, organisational and manufacturer requirements                                                      |
|          | <b>5.10</b>                                         | Limitation of temporary repairs to insulation in terms of survey requirements are identified                                                                             |
| <b>6</b> | <b>Maintain DC electrical systems</b>               |                                                                                                                                                                          |
|          | <b>6.1</b>                                          | Safety requirements associated with working on marine DC electrical systems are complied with                                                                            |
|          | <b>6.2</b>                                          | Operation of a rectifier is identified                                                                                                                                   |
|          | <b>6.3</b>                                          | Single-phase full wave rectifier fitted with filters is built and operated                                                                                               |
|          | <b>6.4</b>                                          | Routine battery maintenance is carried out according to organisational and manufacturer requirements                                                                     |
|          | <b>6.5</b>                                          | Correct procedures for checking specific gravity of electrolyte in lead acid and alkaline batteries are applied according to manufacturer requirements                   |
|          | <b>6.6</b>                                          | Methods for supplying back-up power for remote/automatic control equipment are identified                                                                                |
|          | <b>6.7</b>                                          | Procedure for testing back-up power is identified and applied                                                                                                            |
| <b>7</b> | <b>Identify faults in automated control systems</b> |                                                                                                                                                                          |
|          | <b>7.1</b>                                          | Pneumatic, hydraulic, electronic/electrical control systems are compared and contrasted                                                                                  |
|          | <b>7.2</b>                                          | Function and operation of main components of automated control systems are outlined                                                                                      |
|          | <b>7.3</b>                                          | Faults in automated control systems are detected and rectified using standard fault-finding procedures                                                                   |
|          | <b>7.4</b>                                          | Testing procedures for identifying function and performance of automatic control systems in vessel operating systems are identified and applied                          |
| <b>8</b> | <b>Operate electrical testing and measuring</b>     |                                                                                                                                                                          |
|          | <b>8.1</b>                                          | Insulation tester is operated safely according to manufacturer procedures                                                                                                |

## equipment

- |          |                                       |                                                                                                                |
|----------|---------------------------------------|----------------------------------------------------------------------------------------------------------------|
|          | <b>8.2</b>                            | Continuity testing on electrical circuits is performed according to organisational and manufacturer procedures |
|          | <b>8.3</b>                            | Clamp meter is operated safely according to manufacturer procedures                                            |
|          | <b>8.4</b>                            | Multimeter is operated safely according to manufacturer procedures                                             |
| <b>9</b> | <b>Test automatic control devices</b> |                                                                                                                |
|          | <b>9.1</b>                            | Operational functions are performed on a monitor                                                               |
|          | <b>9.2</b>                            | Different types and operation of control valves are identified                                                 |
|          | <b>9.3</b>                            | Control system control functions are applied using different control devices                                   |

## 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.

## Unit Mapping Information

This unit replaces and is equivalent to MARB013 Maintain and repair marine electrical and electronic equipment.

## Links

Companion Volume implementation guide can be found in VetNet - <https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=772efb7b-4cce-47fe-9bbd-ee3b1d1eb4c2>

# Assessment Requirements for MARB038 Maintain and repair marine electrical and electronic equipment

## Modification History

Release 1. This is the first release of this unit of competency in the MAR Maritime Training Package.

## Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria on at least one occasion and include:

- applying relevant procedures
- communicating procedures associated with maintaining and repairing marine electrical and electronic equipment verbally and in writing
- conducting risk assessment on task to be performed
- extracting information from basic electrical and electronic diagrams required to build electrical and electronic circuits
- identifying and interpreting numerical and graphical information in vessel electrical diagrams and specifications
- identifying and suggesting ways of rectifying faults and malfunctions in marine electrical and electronic systems
- identifying methods, procedures and materials needed for operating, maintaining and repairing marine electrical and electronic systems
- initiating timely action in response to defects or damage
- reading and interpreting written information related to operating and maintaining marine electrical and electronic systems, including specifications, drawings, technical manuals, and electrical and electronic circuit diagrams
- using testing equipment to gather information on function and performance of marine electrical and electronic systems.

## Knowledge Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria and include knowledge of:

- alternating current (AC)/direct current (DC) voltage
- batteries
- circuit breakers and interlocks fitted to circuit breakers
- circuits
- current protection relays, including:
  - operate on fault and request
  - operate on fault and request and demand

- operate on fault and request and under voltage
- earthing
- electrical measuring and testing instruments
- electrical symbols, basic electrical and electronic diagrams and circuits
- faults in circuit breakers, including:
  - alignment of contactors
  - condition of:
    - closing and opening mechanisms
    - insulation barriers
  - wear and tear on linkages
- faults in electrical motor starters, including:
  - earthing
  - open circuit
- faults in automated control systems
- fault protection equipment, including:
  - differential protection device
  - fuses
  - over current devices
  - over voltage devices
  - reverse power devices
  - thermal overload devices
  - thermistor protection devices
  - under voltage devices
- function and performance testing of system monitoring devices, including:
  - alarm printer
  - data logger
- current codes, standards, regulations and industry practices
- main components of automated control systems, including:
  - actuator
  - control valve
  - controller
  - positioner
  - regulator
  - relay
  - sensor
  - servomotor
  - transducer
- marine generator testing, including:
  - testing an alternator
- nature and causes of typical start-up and shutdown malfunctions of main and auxiliary

electrical and associated systems and available methods for their detection and rectification

- operation of:
  - boiler, purifier and generator shutdown systems
  - main engine shutdown protective devices
  - protective devices found onboard vessels
- operational characteristics and performance specifications for different types of electrical and electronic systems found on vessels
- principles and procedures of electrical maintenance
- purpose and content of safety data sheets (SDS)/material safety data sheets (MSDS)
- relevant procedures such as those relating to:
  - adjusting, testing and maintaining fault protection devices on switchboards
  - carrying out start-up and shutdown of electrical machinery and associated systems to ensure compliance with company and survey requirements and regulations
  - changing alarm-setting values in monitoring systems
  - confirming the accuracy of measuring monitoring
  - detecting electrical malfunctions and preventing damage
  - electrical safety and isolation
  - fault finding
  - marine maintenance, including difference between breakdown repair, planned maintenance and condition monitoring, purpose of maintenance recording and reporting procedures
  - routine maintenance on marine electrical motors (cleaning, inspection, deterioration of insulation, removal of dust and oil, and renewal of bearings)
  - safety and emergency
  - testing function and performance of protection devices as part of vessel statutory survey
- risks and safety procedures associated with working in high voltage (HV) environments
- safety, environmental and hazard control precautions and procedures relevant to start-up and shutdown of marine electrical machinery and associated systems
- safety requirements associated with working on marine electrical systems, including:
  - dangers associated with the spaces in the vicinity of busbars
  - potential dangers associated with instrument voltage/current transformer circuits
  - protection normally provided on doors of switchboard cubicles
- types of electrical and electronic equipment and components
- vessel operating systems
- vessel safety management systems (SMS)
- work health and safety (WHS)/occupational health and safety (OHS) legislation and policies
- working safely with electricity, including:
  - appropriate method of removing an electric shock victim from a live electrical situation
  - common causes of electrical accidents
  - effects of electric shock on the human body
  - electrical safe working practices

- need for ensuring safe isolation of an electrical supply
- precautions that can minimise chance of electric shock.

## Assessment Conditions

Assessors must hold credentials specified within the Standards for Registered Training Organisations current at the time of assessment.

Assessment must satisfy the Principles of Assessment and Rules of Evidence and all regulatory requirements included within the Standards for Registered Training Organisations current at the time of assessment.

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

Practical assessment must occur in a workplace or realistic simulated workplace, under the normal range of workplace conditions.

Simulations and scenarios may be used where situations cannot be provided in the workplace or may occur only rarely, in particular for situations relating to emergency procedures and adverse weather conditions where assessment would be unsafe, impractical or may lead to environmental damage.

Resources for assessment must include access to:

- applicable documentation, such as legislation, regulations, codes of practice, workplace procedures and operational manuals
- tools, equipment, machinery, materials and relevant personal protective equipment (PPE) currently used in industry.

## Links

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