



Australian Government

MARB5001A Maintain and repair marine electrical and electronic equipment

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 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.

Application of the Unit

This unit applies to the work of a Marine Engineer Class 3.

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

- | | |
|--|--|
| 1 Maintain marine generators | <p>1.1 Safety requirements associated with working on marine electrical generation systems are complied with</p> <p>1.2 Marine generators are inspect using appropriate manuals and drawings according to regulatory, organisational and manufacturer requirements</p> <p>1.3 Routine maintenance and testing of marine generators is performed according to regulatory, organisational and manufacturer requirements</p> <p>1.4 Alternators are synchronised according to organisational and manufacturer requirements</p> <p>1.5 Testing and maintenance records are maintained according to regulatory, organisational and manufacturer requirements</p> |
| 2 Maintain marine switchboards | <p>2.1 Safety requirements associated with handling circuit breakers are complied with</p> <p>2.2 Routine maintenance is performed on main circuit breaker according to with regulatory, organisational and manufacturer requirements</p> <p>2.3 Faults in circuit breakers are detected and corrected according to regulatory, organisational and manufacturer requirements</p> <p>2.4 Testing and maintenance records are maintained according to regulatory, organisational and manufacturer requirements</p> |
| 3 Maintain marine electrical motors | <p>3.1 Safety requirements associated with working on marine electrical motors are complied with</p> <p>3.2 Equipment required for maintenance of electrical motors is selected and checked for serviceability</p> <p>3.3 Routine maintenance procedures are applied on marine electrical motors according to regulatory, organisational and manufacturer requirements</p> <p>3.4 Maintenance records are maintained according to regulatory, organisational and manufacturer requirements</p> |
| 4 Test marine electrical motor starters | <p>4.1 Safety requirements associated with working on marine electrical motor starters are complied with</p> <p>4.2 Faults in electrical motor starters are detected and rectified according to regulatory, organisational and manufacturer</p> |

- 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 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 multi earth neutral 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 using appropriate manuals and drawings is constructed 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 systems via a resistor are outlined
 - 5.8 Routine maintenance, inspection and testing of marine electrical distribution systems is performed according to regulatory, organisational and manufacturer requirements
 - 5.9 Temporary repairs to insulation are performed according to regulatory, organisational and manufacturer requirements
 - 5.10 Limitation of temporary repairs to insulation in terms of survey requirements are identified
- 6 Maintain DC electrical systems**
- 6.1 Safety requirements associated with working on marine DC electrical systems are complied with
 - 6.2 Operation of a rectifier is identified

- 6.3 Single-phase full wave rectifier fitted with filters is built and operated
- 6.4 Routine battery maintenance is carried out according to organisational and manufacturer requirements
- 6.5 Correct procedures for checking specific gravity of electrolyte in lead acid and alkaline batteries are applied according to manufacturer requirements
- 6.6 Methods for supplying back up power for remote/automatic control equipment are identified
- 6.7 Procedure for testing back up power is identified and applied
- 7 **Identify faults in automated control systems**
 - 7.1 Pneumatic, hydraulic, electronic/electrical control systems are compared and contrasted
 - 7.2 Function and operation of **main components of automated control systems** is outlined
 - 7.3 **Faults in automated control systems** are detected and rectified using standard fault finding procedures
 - 7.4 Testing procedures for identifying function and performance of automatic control systems in **vessel operating systems** are identified and applied
- 8 **Operate electrical testing and measuring equipment**
 - 8.1 Insulation tester is operated safely according to manufacturer procedures
 - 8.2 Continuity testing on electrical circuits is performed according to organisational and manufacturer procedures
 - 8.3 Clamp meter is operated safely according to manufacturer procedures
 - 8.4 Multimeter is operated safely according to manufacturer procedures
- 9 **Test automatic control devices**
 - 9.1 Operational functions are performed on a monitor
 - 9.2 Different types and **operation of control valves** are identified
 - 9.3 Control system control functions are applied using different control devices

Required Skills and Knowledge

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

Required Skills:

- Apply relevant procedures
- Assess own work outcomes and maintain knowledge of current codes, standards, regulations and industry practices
- Communicate procedures associated with maintaining and repairing marine electrical and electronic equipment verbally and in writing
- Extract information from basic electrical and electronic diagrams required to build electrical and electronic circuits
- Identify and interpret numerical and graphical information in vessel electrical diagrams and specifications
- Identify and suggest ways of rectifying faults and malfunctions in marine electrical and electronic systems on vessels
- Identify methods, procedures and materials needed for operating, maintaining and repairing marine electrical and electronic systems on vessels
- Read and interpret written information related to operating and maintaining marine electrical and electronic systems, including specifications, drawings, technical manuals, and electrical and electronic circuit diagrams
- Use testing equipment to gather information on function and performance of marine electrical and electronic systems

Required Knowledge:

- Alternating current (AC)/DC voltage
- Batteries
- Circuit breakers and interlocks fitted to circuit breakers
- Circuits
- Current protection relays:
 - 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
- Fault protection equipment:
 - differential protection device
 - fuses
 - over voltage devices

- over current 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
- Nature and causes of typical start up and shut down malfunctions of main and auxiliary electrical and associated systems and available methods for their detection and rectification
- Operation of:
 - boiler, purifier and generator shut down systems
 - main engine shut down protective devices
 - protective devices found on board 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 shut down 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, 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 environments
- Safety, environmental and hazard control precautions and procedures relevant to start up and shut down 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 safety management systems
- Work health and safety (WHS)/occupational health and safety (OHS) legislation and policies
- Working safely with electricity:
 - 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

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:

- ensuring behaviour reflects relevant current legislative and regulatory requirements
- ensuring currency of relevant WHS/OHS skills and knowledge
- initiating timely action in response to defects or damage.

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 maintaining and repairing marine electrical and electronic equipment can be conducted
- 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 maintaining and repairing marine electrical and electronic equipment
- 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.

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|---|---|
| Testing of marine generators may include: | <ul style="list-style-type: none">• Functional test of AVR• Insulation• Reading of alternator:<ul style="list-style-type: none">• excitation circuit• stator |
| Faults in circuit breakers may include: | <ul style="list-style-type: none">• Alignment of contactors• Condition of:<ul style="list-style-type: none">• closing and opening mechanisms• insulation barriers• Wear and tear on linkages |
| Faults in electrical motor starters may include: | <ul style="list-style-type: none">• Earthing• Open circuit |
| Main components of automated control systems may include: | <ul style="list-style-type: none">• Actuator• Control valve• Controller• Positioner• Regulator• Relay• Sensor• Servomotor• Transducer |
| Faults in automated control systems may include: | <ul style="list-style-type: none">• Failure of components• Intermittent functional faults |
| Vessel operating systems may include | <ul style="list-style-type: none">• Auxiliary machinery• Boilers• Main engine• Power generation and distribution |
| Operation of control valves may include: | <ul style="list-style-type: none">• Electrical• Hydraulic• Manual• Pneumatic |

Unit Sector(s)

Not applicable.

Competency Field

Equipment Checking and Maintenance