



Australian Government

MARB014 Maintain and repair shipboard machinery and equipment

Release: 1

MARB014 Maintain and repair shipboard machinery and equipment

Modification History

Release 1. New unit of competency.

Application

This unit involves the skills and knowledge required to maintain and repair shipboard machinery and equipment on a vessel. This includes maintaining marine pumps, valves, air compressors, heat exchangers, diesel engines, turbochargers, marine lubricating systems and deck machinery as well as conducting inspections of marine boilers and marine refrigeration units.

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

This unit has links to legislative and certification requirements.

Pre-requisite Unit

Not applicable.

Competency Field

B – Equipment Checking and Maintenance

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.

1 Follow safe work practices

- 1.1 Work health and safety (WHS)/occupational health and safety (OHS) procedures relevant to maintaining shipboard machinery and equipment are complied with
- 1.2 Safety hazards are identified and reported according to safety and vessel procedures
- 1.3 Prior to use, tools, equipment and testing devices needed to carry out maintenance activities for correct operation and safety are checked according to safety and vessel procedures

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| | 1.4 | Before commencing maintenance activities, isolation precautions are implemented according to safety and vessel procedures |
| 2 Maintain marine pumps | 2.1 | Maintenance requirements for pump are determined according to safety, manufacturer and vessel procedures and documentation |
| | 2.2 | Appropriate procedures, materials, tools and equipment for maintaining pump are selected according to safety, manufacturer and vessel procedures |
| | 2.3 | Relevant information is extracted from drawings and technical specifications required to perform maintenance activities |
| | 2.4 | Pump is disassembled, inspected and serviced according to safety, manufacturer and vessel procedures |
| | 2.5 | Pump is reassembled and tested according to safety, manufacturer and vessel procedures |
| | 2.6 | Performance of pump is confirmed against recommended performance specifications according to safety, manufacturer and vessel procedures |
| 3 Maintain valves | 3.1 | Maintenance requirements for valve are determined according to safety, manufacturer and vessel procedures and documentation |
| | 3.2 | Appropriate procedures, materials, tools and equipment for maintaining valve are selected according to safety, manufacturer and vessel procedures |
| | 3.3 | Relevant information is extracted from drawings and technical specifications required to perform maintenance activities |
| | 3.4 | Valves are removed for maintenance according to safety, manufacturer and vessel procedures and documentation |
| | 3.5 | Valve is disassembled and valve maintenance is performed according to safety, manufacturer and vessel procedures and documentation |
| | 3.6 | Valves are reassembled and tested according to safety, manufacturer and vessel procedures and documentation |
| 4 Maintain air | 4.1 | Maintenance requirements for air compressor are determined |

compressors	according to safety, manufacturer and vessel procedures and documentation
4.2	Appropriate procedures, materials, tools and equipment for maintaining air compressor are selected according to safety, manufacturer and vessel procedures
4.3	Relevant information is extracted from drawings and technical specifications required to perform maintenance activities
4.4	Air compressor is disassembled and inspected according to safety, manufacturer and vessel procedures
4.5	Air compressor is reassembled, tested and adjusted according to safety, manufacturer and vessel procedures
4.6	Performance of air compressor is confirmed against recommended performance specifications according to safety, manufacturer and vessel procedures
5 Maintain heat exchangers	5.1 Maintenance requirements for heat exchanger are determined according to safety, manufacturer and vessel procedures and documentation
5.2	Appropriate procedures, materials, tools and equipment for maintaining heat exchanger are selected according to safety, manufacturer and vessel procedures
5.3	Relevant information is extracted from drawings and technical specifications required to perform maintenance activities
5.4	Heat exchanger is disassembled and inspected according to safety, manufacturer and vessel procedures
5.5	Heat exchanger is reassembled, tested and adjusted according to safety, manufacturer and vessel procedures
5.6	Performance of heat exchanger is confirmed against recommended performance specifications according to safety, manufacturer and vessel procedures
6 Maintain diesel engines	6.1 Maintenance requirements for diesel engine are determined according to safety, manufacturer and vessel procedures and documentation
6.2	Appropriate procedures, materials, tools, measuring instruments and equipment for maintaining diesel engine are selected according to safety, manufacturer and vessel

procedures

- 6.3 Relevant information is extracted from drawings and technical specifications required to perform maintenance activities
- 6.4 Diesel engine components are disassembled and inspected for wear and deterioration according to safety, manufacturer and vessel procedures
- 6.5 Routine maintenance on diesel engines is performed according to manufacturer and vessel procedures
- 6.6 Diesel engine components are refurbished, as required, according to manufacturer and vessel procedures
- 6.7 Specialised tools and measuring instruments are used to maintain and refurbish diesel engines/components according to safety, manufacturer and vessel procedures
- 6.8 Diesel engine is reassembled, tested and adjusted according to safety, manufacturer and vessel procedures
- 6.9 Performance of diesel engine is confirmed against recommended performance specifications according to safety, manufacturer and vessel procedures

7 Maintain turbochargers

- 7.1 Maintenance requirements for turbocharger are determined according to safety, manufacturer and vessel procedures and documentation
- 7.2 Appropriate procedures, materials, tools and equipment for maintaining turbocharger are selected according to safety, manufacturer and vessel procedures
- 7.3 Relevant information is extracted from drawings and technical specifications required to perform maintenance activities
- 7.4 All components of turbocharger are disassembled and inspected for wear and deterioration according to safety, manufacturer and vessel procedures
- 7.5 Turbocharger is reassembled, tested and adjusted according to safety, manufacturer and vessel procedures
- 7.6 Performance of turbocharger is confirmed against recommended performance specifications according to safety, manufacturer and vessel procedures

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| 8 Inspect marine boilers | <p>8.1 Inspection requirements for marine boiler are determined according to safety, manufacturer and vessel procedures and documentation</p> <p>8.2 Appropriate procedures for inspecting marine boiler are selected according to safety, manufacturer and vessel procedures</p> <p>8.3 Relevant information is extracted from drawings and technical specifications required to perform inspection activities</p> <p>8.4 Marine boiler is inspected for repair or general maintenance according to safety, manufacturer and vessel procedures</p> <p>8.5 Performance of marine boiler is confirmed against recommended performance specifications according to safety, manufacturer and vessel procedures</p> |
| 9 Inspect marine refrigeration units | <p>9.1 Inspection requirements for marine refrigeration unit are determined according to safety, manufacturer and vessel procedures and documentation</p> <p>9.2 Appropriate procedures for inspecting marine refrigeration unit are selected according to safety, manufacturer and vessel procedures</p> <p>9.3 Relevant information is extracted from drawings and technical specifications required to perform inspection activities</p> <p>9.4 Marine refrigeration unit is inspected for repair or general maintenance according to safety, manufacturer and vessel procedures</p> <p>9.5 Performance of marine refrigeration unit is confirmed against recommended performance specifications according to safety, manufacturer and vessel procedures</p> |
| 10 Maintain marine lubricating systems | <p>10.1 Inspection and maintenance requirements for lubricating systems are determined according to safety, manufacturer and vessel procedures and documentation</p> <p>10.2 Relevant information is extracted from drawings and technical specifications required to perform inspection and maintenance activities</p> <p>10.3 Purifier maintenance procedures are applied according to safety, manufacturer and vessel procedures</p> |

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| | 10.4 | Components of lubricating system are inspected according to safety, manufacturer and vessel procedures |
| 11 Maintain and repair deck machinery | 11.1 | Maintenance and/or repair requirements for deck machinery are determined according to safety, manufacturer and vessel procedures and documentation |
| | 11.2 | Appropriate procedures, materials, tools and equipment for maintaining and/or repairing deck machinery are selected according to safety, manufacturer and vessel procedures |
| | 11.3 | Relevant information is extracted from drawings and technical specifications required to perform maintenance activities |
| | 11.4 | Deck machinery maintenance and/or repair procedures are implemented according to safety, manufacturer and vessel procedures |
| | 11.5 | Deck machinery is tested and adjusted according to safety, manufacturer and vessel procedures |
| | 11.6 | Performance of deck machinery is confirmed against recommended performance specifications according to safety, manufacturer and vessel procedures |

Foundation Skills

This section describes those language, literacy, numeracy and employment skills that are essential to performance.

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

Range of Conditions

Specifies different work environments and conditions that may affect performance. Essential operating conditions that may be present (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) are included.

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

Pumps include one or more of the following:

- axial
- centrifugal
- gear
- reciprocating
- screw

Serviced includes one or more of the following:

- dismantling rod and gears, seals, bearings and relief valve
- identifying wear and deterioration
- measuring wear in cylinders, neck rings and rods
- protecting finished surfaces
- removing:
- gland packing
- studs, intact and broken
- replacing and adjusting seals

Valves include one or more of the following:

- ball
- butterfly
- check
- diaphragm
- gate
- globe:
- screw down non return
- screw lift

Valve maintenance include one or more of the following :

- examining seats, valves, spindles and glands
- gland packing:
- selection
- removal
- repacking
- lapping valves and seats
- machining valves and seats

Air compressor is disassembled and inspected include one or more of the following:

- coolers and cooling passages
- lubricating systems
- piston and rings
- suction and delivery valves and seats

Heat exchanger is

- corrosion

disassembled and inspected include one or more of the following:

- erosion
- fouling
- leakage
- provision for tube expansion

Diesel engine components are disassembled and inspected include one or more of the following:

- bearings
- cooling system
- crankshaft alignment
- liners
- lubrication system
- pistons
- rings
- valves

Routine maintenance on diesel engines include one or more of the following:

- air intake system:
 - inspecting and changing air filters
 - inspecting turbocharger to make sure there is no fouling of compressor blades from crankcase gases
- cooling system
 - fluid level checks
 - coolant sampling for trending analysis
 - draining, flushing and refilling system when required
- emissions systems:
 - inspecting crankcase ventilation systems, selective catalytic reduction (SCR) systems and diesel particulate filters (if so equipped)
- exhaust system:
 - inspecting for leaks, corrosion, wet stacking
- fuel system:
 - changing fuel filters, fuel injectors
 - checking water separators
- lubrication:
 - checking levels
 - changing oil, oil filters
 - taking oil samples for trending analysis to optimise oil change intervals and to detect engine wear
- mechanical systems:
 - inspecting resilient engine mounts and torsional couplings
 - generally inspecting for leaks, wear or deterioration
- operating systems:

- downloading data from digital engine management system to note and review alarm conditions
- valves and heads:
 - inspecting, adjusting and recording valve train wear for trending analysis
 - inspecting and recording cylinder head wear for trending analysis

Diesel engine components are refurbished include one or more of the following:

- air start valves
- cylinder heads
- exhaust valves
- fuel injectors
- relief valves

Components of turbocharger include one or more of the following:

- air casing
- air filters
- bearings
- diffuser
- gas inlet grid
- impeller
- inducer
- nozzle ring
- rotor
- volute

Inspection requirements for marine boiler include one or more of the following:

- fire side
- water side

Inspection requirements for marine refrigeration unit include one or more of the following:

- compressors
- condensers
- evaporators
- expansion valves
- oil separators

Components of lubricating system include one or

- settling tank
- system bearings

more of the following:

- system filters

Deck machinery includes
one or more of the
following:

- cranes
- lifeboat davits and gear
- mooring winch
- winch
- windlass

Unit Mapping Information

This is a new unit. This unit is equivalent to MARB5002A Maintain and repair shipboard machinery and equipment.

Links

Companion Volume implementation guides are found in VETNet -

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

Assessment Requirements for MARB014 Maintain and repair shipboard machinery and equipment

Modification History

Release 1. New unit of competency.

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:

- assessing own work outcomes and maintaining knowledge of current codes, standards, regulations and industry practices
- explaining principles of shipboard machinery and equipment and imparting knowledge and ideas verbally and in writing
- initiating timely action in response to defects or damage
- performing calculations and interpreting graphical information used in maintaining shipboard machinery and equipment
- reading and interpreting written information related to the operation, performance and maintenance of shipboard machinery and equipment, including machinery specifications and operational manuals
- scheduling maintenance of shipboard machinery and equipment
- using testing equipment and explaining test and performance results relevant to shipboard machinery and equipment.

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:

- basic principles of diesel engine operation including:
 - typical starting air and manoeuvring systems of diesel engines, including all components normally found therein
 - typical diesel engine lubrication systems, including:
 - operating principles and adjustments of diesel engine fuel injection equipment, including common service faults, symptoms and causes of diesel fuel injection problems, explaining appropriate actions to be taken
 - means of pressure charging diesel engines, including common service faults, appropriate actions to rectify these faults, and emergency operation and isolation procedures
 - different methods of cooling marine diesel engines, including common requirements of cooling
 - common faults and appropriate action to be taken with cooling of diesel engines

- causes of crankcase and air-line explosions, and scavenge and uptake fires
- materials used to construct following diesel engine major parts:
 - crank shafts
 - cylinder liners and heads
 - exhaust valves
- basic principles of electrotechnology, marine electrical practice and marine automation and control relevant to detection, fault finding and repair of faults in electrical and electronic equipment, including:
 - basic electrical circuit theory
 - basic theory of electromagnetism and electrostatics
 - electrolytic action and cells
 - AC and DC theory and plant and equipment
 - basic cabling, distribution and lighting systems
 - basic control and switch gear
 - instruments, calibration and testing
- basic principles of mechanics as they relate to forces, pressures, stress and strains in shipboard dynamic machinery
- basic principles of operating and maintaining:
 - fluid power control systems
 - refrigeration systems
 - machinery lubrication systems
 - marine boilers and materials used to construct following boiler major parts:
 - water tubes
 - furnace
 - steam and water drum
 - superheaters
- basic thermodynamics, including:
 - basic thermodynamic properties of common working fluids
 - methods of heat transfer and related problems
 - principles of heat transfer by conduction, convection and radiation and their application to marine systems
 - elementary principles of steam plants
 - basic steam plant cycles and function of each component
 - combustion process and calorific value of fuels
 - air/fuel ratio and significance of excess air on combustion
 - operating cycle of single stage reciprocating air-conditioners, including methods for the mass of air delivered
 - clearance volume, its effect on volumetric efficiency and methods of calculating volumetric efficiency
 - advantages of multi-staging and inter-cooling
 - meaning of gauge and absolute pressure

- temperature and temperature scales
- system international (SI) units and common thermodynamic terms and principles
- maintenance and repair hazards and problems, and appropriate preventative and remedial action and solutions during maintaining and repairing shipboard plant and equipment
- maritime communication techniques needed during maintenance and repair operations
- materials used to construct the following gas turbine major parts:
 - turbine casing
 - rotors
 - compressors
 - gas generators
- materials used to construct the following steam turbine major parts:
 - turbine casings
 - • rotors
 - • blades
 - • nozzles
 - • reduction gears
- national and international regulations, International Maritime Organization (IMO) Conventions and Codes, including Australian Maritime Safety Authority (AMSA) Marine Orders applicable to managing shipboard plant and equipment maintenance and repair operations
- nature and causes of typical shipboard plant and equipment malfunctions and available methods for their detection and repair, including established fault finding techniques
- operating principles and performance specifications for different types of shipboard plant and equipment usually found on a vessel of unlimited propulsion power
- operating principles of unmanned machinery spaces (UMS) and automated monitoring and control of machinery
- planned maintenance systems and procedures for condition monitoring of plant and equipment, including responsibilities and requirements covered by various forms of vessel survey
- plant and equipment typically found on board a vessel of unlimited propulsion power
- procedures for:
 - carrying out shipboard plant and equipment fault finding and repair as part of routine maintenance procedures to ensure compliance with company and survey requirements, and established safety rules and regulations
 - completing temporary and permanent repair and/or replacement procedures for plant and equipment on board vessels at sea, alongside and in dry dock
 - reading and interpreting plant and equipment performance readings and instrumentation
- purpose and content of safety data sheets (SDS)/material safety data sheets (MSDS)
- safe procedures for:
 - handling heavy plant, equipment and component parts during maintenance and repair of shipboard plant and equipment
 - using hand and power tools and maintenance equipment

- safety, environmental and hazard control precautions and procedures relevant to shipboard plant and equipment inspection and maintenance operations
- types of vessel maintenance and repair records to be maintained to meet requirements of company, survey and regulatory authorities
- typical vessel and plant and equipment specifications, equipment drawings, operational manuals, and electrical and control circuit diagrams
- work health and safety (WHS)/occupational health and safety (OHS) legislation, policies and procedures.

Assessment Conditions

Assessors must satisfy National Vocational Education and Training Regulator (NVR)/Australian Quality Training Framework (AQTF) assessor requirements.

Assessment must occur in workplace operational situations where it is appropriate to do so; where this is not appropriate, assessment must occur in simulated workplace operational situations that reflect workplace conditions.

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.

Resources for assessment must include access to:

- tools, equipment, machinery, materials and personal protective equipment currently used in industry
- applicable documentation such as legislation, regulations, codes of practice, workplace procedures and operational manuals
- range of relevant exercises, case studies and/or simulations.

Links

Companion Volume implementation guides are found in VETNet -

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