



Australian Government

MARB5002A Maintain and repair shipboard machinery and 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 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.

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 Follow safe work practices | <ul style="list-style-type: none">1.1 Work health and safety (WHS)/occupational health and safety (OHS) procedures relevant to maintaining shipboard machinery and equipment are complied with1.2 Safety hazards are identified and reported according to safety and vessel procedures1.3 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 procedures1.4 Before commencing maintenance activities, isolation precautions are implemented according to safety and vessel procedures |
| 2 Maintain marine pumps | <ul style="list-style-type: none">2.1 Maintenance requirements for pump are determined according to safety, manufacturer and vessel procedures and documentation2.2 Appropriate procedures, materials, tools and equipment for maintaining pump are selected according to safety, manufacturer and vessel procedures2.3 Relevant information is extracted from drawings and technical specifications required to perform maintenance activities2.4 Pump is disassembled, inspected and serviced according to safety, manufacturer and vessel procedures2.5 Pump is reassembled and tested according to safety, manufacturer and vessel procedures2.6 Performance of pump is confirmed against recommended performance specifications according to safety, manufacturer and vessel procedures |
| 3 Maintain valves | <ul style="list-style-type: none">3.1 Maintenance requirements for valve are determined according to safety, manufacturer and vessel procedures and documentation3.2 Appropriate procedures, materials, tools and equipment for maintaining valve are selected according to safety, manufacturer and vessel procedures3.3 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 compressors

- 4.1 Maintenance requirements for air compressor are determined 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

8 Inspect marine boilers

- 8.1 **Inspection requirements for marine boiler** are determined according to safety, manufacturer and vessel procedures and documentation
- 8.2 Appropriate procedures for inspecting marine boiler are selected according to safety, manufacturer and vessel procedures
- 8.3 Relevant information is extracted from drawings and technical specifications required to perform inspection activities
- 8.4 Marine boiler is inspected for repair or general maintenance according to safety, manufacturer and vessel procedures
- 8.5 Performance of marine boiler is confirmed against recommended performance specifications according to safety, manufacturer and vessel procedures

9 Inspect marine refrigeration units

- 9.1 Inspection requirements for marine refrigeration unit are determined according to safety, manufacturer and vessel procedures and documentation
- 9.2 Appropriate procedures for inspecting marine refrigeration unit are selected according to safety, manufacturer and vessel procedures
- 9.3 Relevant information is extracted from drawings and technical specifications required to perform inspection activities
- 9.4 Marine refrigeration unit is inspected for repair or general maintenance according to safety, manufacturer and vessel procedures
- 9.5 Performance of marine refrigeration unit is confirmed against recommended performance specifications according to safety,

manufacturer and vessel procedures

10 Maintain marine lubricating systems

- 10.1 Inspection and maintenance requirements for lubricating systems are determined according to safety, manufacturer and vessel procedures and documentation
- 10.2 Relevant information is extracted from drawings and technical specifications required to perform inspection and maintenance activities
- 10.3 Purifier maintenance procedures are applied according to safety, manufacturer and vessel procedures
- 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

Required Skills and Knowledge

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

Required Skills:

- Carry out cargo operations according to cargo plan or other documents and established safety rule/regulations, equipment operating instructions and shipboard stowage limitations
- Establish and maintain effective communications during loading and unloading
- Handle dangerous, hazardous and harmful cargo to comply with international regulations, recognised standards and codes of safe practice
- Identify and solve problems associated with loading, unloading, stowage and care of cargo
- Monitor and anticipate problems and risks associated with loading, unloading, stowage and care of cargo
- Monitor use of equipment in loading, unloading, stowage and care of cargo
- Read, interpret and apply instructions, regulations, procedures and information associated with loading, unloading, stowage and care of cargo

Required Knowledge:

- Ballast management issues and procedures
- Cargo handling documentation requirements
- Cargo lifting equipment and safe working loads
- Container position numbering
- Effect of cargo, including heavy lifts, on the seaworthiness and stability of the vessel
- Effects of different types of cargo operations on vessel trim and stability
- Effects on cargo handling of sea conditions, wind and weather
- Effects on stability during loading and discharging operations including heeling moments from gear and loads
- Methods of caring for various types of cargo
- Methods of handling various types of cargo
- Operational characteristics of different types of shipboard and terminal-based cargo handling equipment and facilities
- Principles of cargo care
- Procedures for carrying out calculations involving weights, capacities, stowage factors
- Relevant sections of applicable maritime regulations
- Relevant work health and safety (WHS)/occupational health and safety (OHS) and cargo handling legislation, codes of practice, policies and procedures
- Safe handling, stowage and securing of cargo including dangerous, hazardous and harmful cargo, and their effect on the safety of life and the vessel
- Standard stowage position numbering systems used on container vessels
- Typical cargo handling problems and hazards, and appropriate preventative and remedial actions and solutions

- Typical types and sizes of shipping containers
- Usual methods of container packing, loading and discharging, stowage, dunnaging
- Various types of cargo likely to be carried; their peculiar characteristics, liability to damage, decay or deterioration; their measurements, hazards and problems; appropriate preventative and remedial action and solutions
- Ways of restricting vessel stress levels within permitted levels within permitted limits during loading/discharging cargo

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 currency of relevant WHS/OHS skills and knowledge
- ensuring currency of relevant legislative and regulatory 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 shipboard machinery and 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 shipboard machinery and equipment
- direct observation of the candidate applying relevant

Guidance information for assessment

WHS/OHS requirements and work practices.

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.

- | | |
|---|--|
| Pumps may include: | <ul style="list-style-type: none"> • Axial • Centrifugal • Gear • Reciprocating • Screw |
| Serviced may include: | <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • gland packing • studs, intact and broken • Replacing and adjusting seals |
| Valves may include: | <ul style="list-style-type: none"> • Ball • Butterfly • Check • Diaphragm • Gate • Globe: <ul style="list-style-type: none"> • screw down non return • screw lift |
| Valve maintenance may include: | <ul style="list-style-type: none"> • Examining seats, valves, spindles and glands • Gland packing: <ul style="list-style-type: none"> • selection • removal • repacking • Lapping valves and seats • Machining valves and seats |
| Air compressor is disassembled and inspected may include: | <ul style="list-style-type: none"> • Coolers and cooling passages • Lubricating systems • Piston and rings • Suction and delivery valves and seats |
| Heat exchanger is disassembled and inspected may include: | <ul style="list-style-type: none"> • Corrosion • Erosion • Fouling |

Diesel engine components are disassembled and inspected may include

- Leakage
- Provision for tube expansion
- Bearings
- Cooling system
- Crankshaft alignment
- Liners
- Lubrication system
- Pistons
- Rings
- Valves

Routine maintenance on diesel engines may include:

- 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
Diesel engine components are refurbished may include:	• inspecting and recording cylinder head wear for trending analysis • Air start valves • Cylinder heads • Exhaust valves • Fuel injectors • Relief valves
Components of turbocharger may include:	• Air casing • Air filters • Bearings • Diffuser • Gas inlet grid • Impeller • Inducer • Nozzle ring • Rotor • Volute
Inspection requirements for marine boiler may include:	• Fire side • Water side
Inspection requirements for marine refrigeration unit may include:	• Compressors • Condensers • Evaporators • Expansion valves • Oil separators
Components of lubricating system may include:	• Settling tank • System bearings • System filters
Deck machinery may include:	• Cranes • Lifeboat davits and gear • Mooring winch • Winch • Windlass

Unit Sector(s)

Not applicable.

Competency Field

Equipment Checking and Maintenance