



Australian Government

MARL6012A Demonstrate intermediate knowledge of marine auxiliary machinery and systems

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 operate and maintain auxiliary machinery and associated systems on board a commercial vessel.

Application of the Unit

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).

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

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| 1 Determine responsibilities of an Engineer Class 2 in relation to auxiliary machinery of a vessel | <p>1.1 Commonwealth, state/territory and local legislation and regulations, which relate to <i>auxiliary machines and systems</i> in terms of safety, repairs and pollution, including implementation, is identified</p> <p>1.2 Safe operating practices for all steam plant are examined and standing orders as to their operation are prepared or modified</p> <p>1.3 Procedures for establishing engine room staff who are fully conversant with safe practices for operation and maintenance of auxiliary machines and systems are outlined</p> |
| 2 Assess material properties and their application to engine room situations | <p>2.1 Properties of materials and how these can be determined by simple tests are explained</p> <p>2.2 Common methods for non-destructive <i>testing</i> (NDT) and their application to auxiliary machinery and components are outlined</p> <p>2.3 Common non-metallic materials used in the marine industry are assessed and their properties, applications and restrictions on usage are explained</p> <p>2.4 Common metallic materials used in marine industry, their applications, failure mechanisms and methods to limit or reduce failures are assessed</p> |
| 3 Outline procedure for sampling and carrying out onboard and laboratory tests on fuel and lubricants | <p>3.1 Importance and implications of continual monitoring of quality of fuel oils and lubricants in efficient operation of machinery are explained</p> <p>3.2 Procedures for onboard testing for fuels and lubricants are clarified</p> <p>3.3 Laboratory tests that may be conducted on fuels and lubricants and how results can be interpreted and utilised as part of a maintenance program are detailed</p> |

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| 4 Explain pre-treatment of residual fuel and servicing of contaminated fuel and lubricants | 4.1 Operation of centrifugal separators is outlined and factors that affect optimum separation are analysed |
| | 4.2 Procedures for dealing with contamination of oils by water, fuel or solid debris including recognition of dangerous levels and possible consequences, are clarified |
| | 4.3 Symptoms, causes, effects and methods of treatment of oils that have become infected by bacteria are identified |
| | 4.4 Function and operation for onboard fuel blender and alternative fuel treatments are explained |
| 5 Assess operational problems with pumps and pumping systems handling sea water | 5.1 Procedure for evaluating pump or pumping system, including heat exchangers and methods of locating cause of problems that affect output and performance, is clarified |
| | 5.2 Operation of a self-priming system used on bilge, ballast or cargo pumping arrangements is explained |
| | 5.3 Different types of distillation plants used on ships are compared and contrasted taking into account operation, performance, problems and applications |
| | 5.4 Main reasons for corrosion in sea water systems and regions most affected are explained |
| | 5.5 Operation of <i>corrosion prevention systems</i> fitted to pumping systems is assessed |
| 6 Apply fault-finding procedures for air compressors and compressed air systems | 6.1 Effects of <i>common faults</i> on operation of single and multi stage compressors are interpreted |
| | 6.2 Reasons for and effects of high levels of oil or water in compressed air are explained |
| | 6.3 Effects of operating air compressors on synthetic lubricating oils are explained with regards to carbon formation and water contamination of the oil |

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| | 6.4 | Procedures for inspecting and maintaining air receivers and associated fittings are clarified |
| 7 Outline construction, installation and operation of steering gears, stabilisers and bow thrusters | 7.1 | Construction, installation and operation of hydraulic steering gear is explained |
| | 7.2 | Construction and operation of stabilisers is explained |
| | 7.3 | Construction and operation of bow thrusters is explained |
| | 7.4 | Normal alarms and safety devices fitted to steering gears for all classes of vessel are identified |
| | 7.5 | Auto and manual changeover procedures are analysed in the event of faults occurring in a steering gear |
| | 7.6 | Oil changing and air purging procedures for a steering gear are clarified |
| | 7.7 | Fault finding procedures for steering gear are clarified |
| | 7.8 | Procedures for change over to alternative systems of power or control of steering gear are clarified |
| 8 Assess common faults in refrigeration and air conditioning systems | 8.1 | Symptoms, effects and remedial action for common faults in refrigeration and air conditioning systems are assessed |
| | 8.2 | Pumping down, leak test, gas charge and oil charge procedures are clarified |
| | 8.3 | Functions and operation of all <i>components of refrigeration and air conditioning plant</i> are analysed |
| | 8.4 | Correct procedures for recovery of refrigerants from refrigeration systems are implemented |

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| <p>9 Outline pollution prevention regulations and operation of equipment used to handle oily bilge, sewage and other waste substances</p> | <p>9.1 International Convention for the Prevention of Pollution from Ships (MARPOL) regulations are identified and their implications for marine engineers and ship operators are explained</p> <p>9.2 Operation of modern oily water separators, oil content monitors and how they comply with MARPOL regulations are explained</p> <p>9.3 Operation of typical sewage plants and regulations controlling their usage are explained</p> <p>9.4 Operation of incinerators, material that may legally be burned and monitoring devices is explained</p> |
| <p>10 Explain basic operation of marine gas turbines</p> | <p>10.1 Basic flow of air and gas through a simple cycle marine gas turbine is outlined</p> <p>10.2 Materials and construction of compressor, combustion system and turbine in a single and two-shaft design turbine are outlined</p> <p>10.3 Basic controls required for control and protection of plant are outlined</p> <p>10.4 Accessories necessary for safe operation are identified</p> |
| <p>11 Explain shafting arrangement of vessel</p> | <p>11.1 Different shafting arrangements found on vessels from main engine to propeller are outlined</p> <p>11.2 Performance of different couplings and coupling bolts is assessed</p> <p>11.3 Arrangement of a stern tube is completed</p> <p>11.4 Procedure to mount and unmount propeller on tail shaft is clarified</p> <p>11.5 Different shaft bearings, couplings, sealing and lubrication arrangements of transmission system are identified</p> |

12 Explain types, operation, and maintenance requirements of steam turbine machinery found in larger vessels

- 12.1 Types of steam turbines, their location, and typical operating conditions of temperature and pressure are explained
- 12.2 Common operational problems associated with steam turbine plants, symptoms and effects of these problems and possible remedies are outlined
- 12.3 Process of warming-through and shutting down turbine plant is explained
- 12.4 Maintenance requirements for achieving optimum performance of an auxiliary steam turbine plant are outlined

Required Skills and Knowledge

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

Required Skills:

- Access information and sketch diagrams to interpret and explain testing requirements related to operating marine auxiliary machines
- Assess own work outcomes and maintain knowledge of current codes, standards, regulations and industry practices
- Explain principles of marine auxiliary machines
- Identify and interpret numerical and graphical information related to starting up and shutting down marine auxiliary machines on commercial vessels
- Identify and suggest ways of rectifying faults and malfunctions in marine auxiliary machines on commercial vessels
- Identify methods, procedures and materials needed for operating, maintaining and repairing marine auxiliary machines on commercial vessels
- Impart knowledge and ideas through verbal, written and visual means
- Read and interpret written information related to the operation, performance and maintenance of marine auxiliary machines, including machinery specifications, machinery design drawings, machine drawings, operational manuals, specifications, and electrical and control circuit diagrams

Required Knowledge:

- Corrosion causes and prevention
- Fuels and basic principles of fuel systems
- MARPOL
- Nature and causes of typical start up and shut down malfunctions of main and auxiliary machinery, and associated systems and available methods for their detection and rectification
- Non-destructive testing procedures and standards
- Operational characteristics and performance specifications for the different types of auxiliary machinery and associated systems usually found on a commercial vessel, including pumps, air compressors, steering gears, heat exchangers and evaporators
- Pollution prevention regulations
- Principles and procedures of machinery lubrication
- Procedures for carrying out the start up and shut down of main and auxiliary machinery and associated systems to ensure compliance with company and survey requirements and regulations
- Properties of metallic and non-metallic materials
- Purpose and content of safety data sheets/material safety data sheets
- Responsibilities of an Engineer Class 2 in relation to auxiliary machinery of a vessel
- Safety, environmental and hazard control precautions and procedures relevant to start up and

shut down of marine auxiliary machinery and associated systems

- Types of auxiliary machinery and components
- Work health and safety (WHS)/occupational health and safety (OHS) legislation and policies

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:

- providing accurate and reliable information
- providing appropriate level of detail in responses.

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 intermediate knowledge of marine auxiliary machinery and systems can be demonstrated
- technical reference library with current publications on marine auxiliary machinery and systems
- 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 demonstrating intermediate knowledge of marine auxiliary machinery and systems
- 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.

Auxiliary machines and systems may include:

- Boiler
- Cargo handling equipment
- Compressors
- Deck machinery
- Diesel generator
- Evaporators
- Pumps
- Refrigerating installation
- Separators

Testing may include:

- Density
- Fuel in lubricating oil
- Pour point
- Viscosity
- Water contamination

Corrosion prevention systems may include:

- Anodes
- Chemical injection
- Impressed current
- Marine growth inhibiting systems
- Special coatings

Common faults may include:

- Coolers
- Filters
- Rings
- Valves

Components of refrigeration and air conditioning plant may include:

- All fittings
- Safety devices

Accessories may include:

- Accessory gear
- Lube oil:
 - coolers
 - pump
 - filter

Arrangement of a stern tube may include:

- Starting device
- Lubrication circuit
- Shaft sealing
- Tail shaft bearing

Unit Sector(s)

Not applicable.

Competency Field

Marine Engineering