



**Australian Government**

# **MARL5006A Demonstrate basic knowledge of marine auxiliary 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 operate and maintain auxiliary machinery and associated systems on board a commercial vessel.

## **Application of the Unit**

This unit applies to the work of Marine Engineering Watchkeepers on commercial vessels greater than 750 kW forms part of the requirements for the Certificate of Competency Marine Engineer Watchkeeper 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

- 1 Outline layout of engine room and functions of auxiliary machinery in engine room**
  - 1.1 Layout of a typical engine room is outlined
  - 1.2 *Types and functions of auxiliary machinery* found in an engine room are explained
  - 1.3 Location, function and operation of all safety devices found on main and auxiliary machinery and within engine room, including shut downs and engine room escape routes is outlined
  - 1.4 Common operating pressures and temperatures of fluids within engine room are identified and how to respond to abnormal parameters is clarified
  
- 2 Explain duties and responsibilities of a watchkeeper engineer during a watch**
  - 2.1 Duties and responsibilities of a watchkeeper engineer with respect to safety of personnel and vessel, during and taking over the watch are clarified
  - 2.2 Importance of ensuring all events related to machinery are recorded in the log is explained
  - 2.3 Duties and responsibilities of a watchkeeper engineer in prevention and extinction of fire in machinery spaces are clarified
  - 2.4 Duties and responsibilities of a watchkeeper engineer in relation to prevention of flooding and avoidance of pollution are clarified
  - 2.5 Routine duties and responsibilities of a watchkeeper engineer with respect to safe operation of propulsion and auxiliary machinery are clarified
  - 2.6 Duties and responsibilities of a watchkeeper engineer on a unmanned machinery space (UMS) vessel are clarified
  - 2.7 Procedure for familiarising oneself on joining a new vessel is clarified

**3 Recognise key features, applications and treatment of fuels, lubricants and chemicals used on board vessels**

- 3.1 Types, properties, applications and treatments of various fuels used on board vessels are outlined
- 3.2 Procedures to be followed before and during fuel bunkering are clarified
- 3.3 Types, properties, applications and treatments of various lubricants used on board vessels are outlined
- 3.4 Uses and safe handling methods for various *types of chemicals* used on board vessels are outlined
- 3.5 Fuel system layout including fuel treatment method is detailed
- 3.6 Working principle, construction and safe operation of purifiers and clarifiers is explained

**4 Explain operation and maintenance of typical pumping systems used on board vessels**

- 4.1 Basic working principles, components and properties of different *types of pumps* are outlined
- 4.2 *Types of heat exchanges*, their basic working principles and applications are outlined
- 4.3 Correct operation and maintenance of pumps and heat exchangers is detailed
- 4.4 *Key features of bilge, cargo and ballast pumping systems* are outlined
- 4.5 Types, operating principles and requirements for oily-water separators or similar equipment are outlined
- 4.6 Other approved methods of disposing of oily water are identified
- 4.7 Procedure for completing oil record book is clarified

**5 Explain operation and maintenance of marine air compressors**

- 5.1 Types, characteristics, components and applications of various *compressors* used on board vessels are compared and contrasted
- 5.2 Correct pre-operational checks, starting procedure, safe operation and basic

maintenance required for air compressors are detailed

5.3 Potential safety hazards associated with compressed air are identified

5.4 Locations of all mountings, safety devices, alarms and shut downs on compressors, air receivers and compressed air systems are identified and their functions are outlined

5.5 Different requirements and production methods for control air, method of production and special requirements for a breathing apparatus compressor are clarified

**6 Explain different types, safe operation and testing of steering gear commonly used on board vessels**

6.1 Essential statutory regulations covering operation of steering gear are established

6.2 Operation of different *types of steering gear* used on board vessels is clarified

6.3 Working principle of variable delivery pumps used in *steering gear* is explained

6.4 Location of all alarms and safety devices associated with steering gear is identify and their functions are outlined

6.5 Process for testing steering gear and monitoring its performance is explained

**7 Explain operation of an evaporator**

7.1 Why 'fresh water' may have to be produced from seawater is explained

7.2 Function, construction and operation of evaporators is explained

7.3 Correct starting procedure, safe operation and basic maintenance required for an evaporator is clarified

7.4 Process for testing the evaporator and monitoring performance is explained

7.5 Treatment of distillate for domestic purposes is outlined

7.6 Quality necessary if water being produced by a distiller is to be used for human consumption is

- outlined
- 8 Explain basic operation of marine refrigeration systems**
- 8.1 Properties of an ideal refrigerant are listed
  - 8.2 Refrigerants commonly used on board are listed and reason for their use is clarified
  - 8.3 Basic construction and operation of a marine refrigeration system is explained
  - 8.4 Preparation, operation, fault detection and necessary actions to prevent damage in marine refrigeration systems is confirmed
  - 8.5 Personal safety and environmental hazards associated with CFCs and ozone depleting substances are identified
- 9 Explain basic operation of marine air-conditioning and ventilation systems**
- 9.1 Basic construction and operation of marine air-conditioning and ventilation systems in routine and emergency situations is explained
  - 9.2 Preparation, operation, fault detection and necessary actions to prevent damage in marine air-conditioning and ventilation systems is confirmed
- 10 Explain basic operation of marine gas turbines**
- 10.1 Basic flow of air and gas through a simple cycle marine gas turbine is outlined
  - 10.2 Materials and construction of compressor, combustion system and turbine in a single and two-shaft design turbine are detailed
  - 10.3 Basic controls required for the control and protection of the plant are outlined
  - 10.4 *Accessories* necessary for safe operation are listed
- 11 Explain types, safe operation and maintenance of deck machinery**
- 11.1 Types, basic construction and operation of *deck machinery* are outlined
  - 11.2 Preparation, operation, fault detection and necessary actions to prevent damage in deck machinery is confirmed

## 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 the operation of marine auxiliary machines
- Assess own work outcomes and maintain knowledge of current codes, standards, regulations and industry practices
- Explain basic 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:

- Fuels and basic principles of fuel systems
- 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
- Operational characteristics and performance specifications for different types of auxiliary machinery and associated systems usually found on a commercial vessel, including pumps, air compressors, steering gears, heat exchangers and evaporators
- Principles and procedures of machinery lubrication
- Procedures for carrying out start up and shut down of main and auxiliary machinery and associated systems to ensure compliance with company and survey requirements and regulations
- Purpose and content of safety data sheets/material safety data sheets
- 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 basic knowledge of marine auxiliary machinery and systems can be demonstrated
- technical reference library with current publications on auxiliary machinery
- 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 basic knowledge of marine auxiliary machinery and systems
- 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.

- Types of auxiliary machinery may include:
- Boiler
  - Compressors
  - Diesel generator
  - Evaporators
  - Pumps
  - Refrigerating installation
  - Separators
- Functions of auxiliary machines may include:
- Applying main power of engines for propulsion and manoeuvring
  - Keeping ship dry and trimmed
  - Mooring ship and handling cargo
  - Providing for safety
  - Supplying domestic needs such as fresh water
  - Supplying needs of main engines and boilers
  - Supplying ship with electric power and lighting
- Types of chemicals may include:
- Cleaning fluids
  - Fuel additives
  - Solvents
- Types of pumps may include:
- Axial flow
  - Centrifugal
  - Gear
  - Reciprocating
  - Screw
  - Vane
- Types of heat exchanges may include:
- Plate
  - Shell and tube
- Features of bilge, cargo and ballast pumping systems may include:
- Safety fittings
  - Sensing devices
  - Types of valves
- Compressors may include:
- Breathing apparatus compressor
  - Lubricated reciprocating air compressors
  - Non-lubricated reciprocating air compressors
  - Oil free air compressors
  - Rotary screw compressors
- Types of steering gear may include:
- Electrical
  - Ram

Steering gear may include:

- Rotary vane
- Oscillating steering
- Hunting gear
- Telemotor

Accessories may include:

- Accessory gear
- Lube oil coolers
- Lube oil drive
- Lube oil filter
- Starting device

Deck machinery may include:

- Accommodation ladders
- Anchor winch
- Cranes
- Davits
- Mooring winch

## **Unit Sector(s)**

Not applicable.

## **Competency Field**

Marine Engineering