



Australian Government

MARL6018A Demonstrate advanced 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. This includes evaluating ship systems, assessing lubricants and lubricant contamination, and analysing the operation of major items of marine auxiliary machinery.

Application of the Unit

This unit applies to the work of a Marine Engineer Class 1 and forms part of the requirements for the Certificate of Competency Marine Engineer Class 1 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 Evaluate ship systems

- 1.1 Conventional systems are analysed from ship layout drawings and performance data
- 1.2 Viability and potential problems of new systems and advanced specialist vessels are evaluated
- 1.3 Suitable modifications are devised for systems that are not performing satisfactorily or recommendations are made on alternative systems
- 1.4 Manufacturer claims about new products and their suitability for use in existing conditions are evaluated
- 1.5 Performance of different pumps and heat exchangers is assessed and their applications are compared for different purposes
- 1.6 Performance of shipboard pollution control equipment is evaluated

2 Assess materials failure

- 2.1 Type of materials failure that impact on marine auxiliary components is analysed
- 2.2 Type and properties of metallic and non-metallic materials used in the marine field are evaluated
- 2.3 Ideal properties of materials required for components of **auxiliary machinery** are analysed
- 2.4 Repair methods used for auxiliary machines and **constraints** on engineering staff engaged in repairing auxiliary machinery are analysed
- 2.5 Type and purpose of destructive and non-destructive testing of materials are compared

3 Analyse lubrication

- 3.1 Mechanism of lubrication between two surfaces is explained
- 3.2 **Factors influencing good lubrication** are identified
- 3.3 Different types of lubrication applied to marine

- machinery are compared and contrasted
- 3.4 Relative advantages of synthetic lubricants and mineral oils are assessed
 - 3.5 Methods of assuring quality of lubrication are identified
- 4 Analyse fuel and lubricating oil contaminants**
- 4.1 Symptoms, effects and possible remedial actions for different types of contaminants in fuel are evaluated
 - 4.2 Types of **contaminants** that affect lubricants and remedial actions required for different forms of contamination are identified
 - 4.3 Products used to counter poor quality fuels and to improve properties of lubricating oils are assessed
 - 4.4 Safety measures to be applied when fuels are found to be outside class requirements are identified
- 5 Analyse shafting systems, bearings, couplings, clutches and shaft seals that form transmission system**
- 5.1 Different types and methods of checking alignment and wear of shafting, shaft bearings and thrust blocks are identified
 - 5.2 Assembly and dismantling procedures for muff and flange type couplings are compared and contrasted
 - 5.3 Different types, methods of operation and maintenance requirements of clutches are compared
 - 5.4 Different types, maintenance requirements and operation of stern tubes, tail shaft seals and stern bearing lubrication systems under adverse conditions are evaluated
- 6 Analyse steering gears and controllable pitch propeller systems**
- 6.1 Regulatory requirements for steering gears of different types of vessels are identified
 - 6.2 Operation of various types of steering gear arrangements are analysed
 - 6.3 Operation and performance of controllable pitch propeller (CPP) and fixed pitch systems are

- compared and contrasted
- 6.4 Modes of operation of CPP systems are explained
- 6.5 Effects and countermeasures, in the event of failure in the control system or seals of a CPP system, are identified
- 7 Analyse marine transmission systems**
- 7.1 Operation and performance of different marine transmission systems are compared and contrasted
- 7.2 Procedure for inspecting a set of reduction gears from a propulsion system is analysed
- 7.3 Types and locations of faults that may occur in gearing systems and repair options available are analysed
- 8 Analyse marine air compressors**
- 8.1 Procedures for assessing performance of reciprocating and rotary compressors by output and condition monitoring techniques are explained
- 8.2 Effects of multi staging, inter-cooling and clearance volume are explained
- 8.3 Importance of all fittings and safety devices in compressed air system is explained
- 8.4 Full automatic operation of starting air compressors is explained
- 9 Evaluate shipboard refrigeration and air conditioning systems**
- 9.1 Principle of air conditioning systems is explained and how ideal conditions are achieved in conditioned space is analysed
- 9.2 Automatic operation of a typical marine provision fridge plant capable of maintaining different temperatures in different cold rooms is analysed
- 9.3 Hazards associated with CFCs and HCFCs, and regulations controlling their production and usage are analysed
- 9.4 Procedure for evacuation and recovery of refrigerants from the system is outlined

10 Evaluate operation of inert gas systems on crude oil tankers

- 10.1 Location and functions of all components, fittings and safety devices in an inert gas system are identified
- 10.2 Operation of a typical inert gas system found on crude oil tankers is analysed
- 10.3 Operation and maintenance requirements of inert gas systems are explained

11 Evaluate plant efficiency and relate problems in a turbo alternator

- 11.1 Operating parameters and associated **protections** for turbo alternator systems are analysed
- 11.2 Procedure for assessing efficiency of auxiliary steam turbines is explained by analysing measured parameters
- 11.3 Methods of steam and air leak detection in turbo alternator systems are compared
- 11.4 Effects of fouling of condenser and changes in sea water temperature in turbo alternator systems are analysed

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 principles of marine auxiliary machines
- Identify and interpret complex numerical and graphical information related to operating, maintaining and repairing marine auxiliary machines on commercial vessels
- Identify and rectify 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 complex 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:

- Fuel and lubricating oil contaminants
- Fuels and basic principles of fuel systems
- Inert gas systems
- Lubrication
- Marine air compressors
- Marine transmission systems
- Materials failure
- 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 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
- Plant efficiency
- 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
- Shafting systems, bearings, couplings, clutches and shaft seals that form the transmission system
- Ship systems
- Shipboard refrigeration and air conditioning systems
- Steering gears and controllable pitch propeller systems
- Types of auxiliary machinery and components
- Turbo alternators
- 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 advanced 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 advanced 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 machinery may include:

- Boiler
- Compressors
- Deck machinery
- Diesel generator
- Evaporators
- Pumps
- Refrigerating installation
- Separators
- Turbo alternators

Constraints may include:

- Class requirements
- Location
- Reliability
- Time

Factors influencing good lubrication may include:

- Alignment
- Condition of bearing surfaces
- Flow rate
- Load
- Purity of lubricant
- Running clearances
- Speed
- Temperature
- Viscosity

Contaminants may include:

- Air entrainment
- Incompatible fluids
- Moisture
- Particulate

Protections may include:

- Atrial displacement
- Condenser condition
- Expansion
- High air temperature
- High oil temperature
- Loss of vacuum
- Low oil pressure
- Overspeed:
 - mechanical
 - electrical

- Pressure
- Steam
- Steam condition
- Temperature
- Vibration

Unit Sector(s)

Not applicable.

Competency Field

Marine Engineering