



Australian Government

MARL031 Demonstrate advanced knowledge of marine auxiliary machinery and systems

Release: 1

MARL031 Demonstrate advanced knowledge of marine auxiliary machinery and systems

Modification History

Release 1. New unit of competency.

Application

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.

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).

No licensing, legislative or certification requirements apply to this unit at the time of publication.

Pre-requisite Unit

Not applicable.

Competency Field

L – Marine Engineering

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 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

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| | 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 and evaluated |
| | 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

Foundation Skills

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

Range of Conditions

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

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| Auxiliary machinery includes one or more of the following: | <ul style="list-style-type: none">• boiler• compressors• deck machinery• diesel generator• evaporators• pumps• refrigerating installation• separators• turbo alternators |
| Constraints include one or more of the following: | <ul style="list-style-type: none">• class requirements• location• reliability• time |
| Factors influencing good lubrication include one or more of the following: | <ul style="list-style-type: none">• alignment• condition of bearing surfaces• flow rate• load• purity of lubricant• running clearances• speed• temperature• viscosity |
| Contaminants include one or more of the following: | <ul style="list-style-type: none">• air entrainment• incompatible fluids• moisture• particulate |
| Protections include one or more of the following: | <ul style="list-style-type: none">• axial displacement• condenser condition• expansion• high air temperature• high oil temperature• loss of vacuum• low oil pressure• overspeed:• electrical• mechanical |

- pressure
- steam
- steam condition
- temperature
- vibration

Unit Mapping Information

This unit replaces and is equivalent to MARL6018A Demonstrate advanced knowledge of marine auxiliary machinery and systems.

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 MARL031 Demonstrate advanced knowledge of marine auxiliary machinery and systems

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Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements, performance criteria and range of conditions on at least one occasion and include:

- accessing information and sketch diagrams to interpret and explain testing requirements related to the operation of marine auxiliary machines
- applying relevant work health and safety/occupational health and safety (WHS/OHS) requirements and work practices
- assessing own work outcomes and maintaining knowledge of current codes, standards, regulations and industry practices
- explaining principles of marine auxiliary machines
- identifying and interpreting complex numerical and graphical information related to operating, maintaining and repairing marine auxiliary machines on commercial vessels
- identifying and rectifying faults and malfunctions in marine auxiliary machines on commercial vessels
- identifying methods, procedures and materials needed for operating, maintaining and repairing marine auxiliary machines on commercial vessels
- imparting knowledge and ideas through verbal, written and visual means
- reading and interpreting 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.

Knowledge Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements, performance criteria and range of conditions and include knowledge of:

- 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
- turbo alternators
- types of auxiliary machinery and components
- WHS/OHS legislation and policies.

Assessment Conditions

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

Assessment must satisfy the National Vocational Education and Training Regulator (NVR)/Australian Quality Training Framework (AQTF) standards.

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.

Assessment must occur in workplace operational situations or where these are not available, in simulated workplace operational situations or an industry-approved marine operations site that replicates workplace conditions where advanced knowledge of marine auxiliary machinery and systems can be demonstrated.

Resources for assessment include access to:

- applicable documentation including workplace procedures, regulations, codes of practice and operation manuals
- appropriate range of relevant operational situations in the workplace
- relevant regulatory and equipment documentation that impacts on work activities
- technical reference library with current publications on auxiliary machinery
- tools, equipment, materials and personal protective equipment currently used in industry.

Performance should be demonstrated consistently over time and in a suitable range of contexts.

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