Australian Government

MARL048 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 of competency in the MAR Maritime Training Package.

Application

This unit involves the skills and knowledge required to operate and maintain auxiliary machinery and associated systems onboard 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 people working in the maritime industry in the capacity of:

- Engineer Class 1 (STCW Chief Engineer Unlimited)
- Engineer Class 2 (STCW Second Engineer Unlimited).

Licensing/Regulatory Information

Legislative and regulatory requirements are applicable to this unit.

- This unit is one of the requirements to obtain Australian Maritime Safety Authority (AMSA) certification as an Engineer Class 1 (STCW Chief Engineer Unlimited) or Engineer Class 2 (STCW Second Engineer Unlimited) and to meet regulatory requirements this unit must be delivered consistent with Marine Orders and with the relevant sections of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW).

- Those regulatory requirements include STCW International Maritime Organization (IMO) model course competencies and areas of knowledge, understanding and proficiency, together with the estimated total hours required for lectures and practical exercises. Teaching staff should note that timings are suggestions only and should be adapted to suit individual groups of trainees depending on their experience, ability, equipment and staff available for training.

Pre-requisite Unit

Not applicable.

Competency Field

L – Engineering

Unit Sector

Not applicable.

Elements and Performance Criteria

ELEMENTS		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	Performance of different pumps and heat exchangers is assessed, and their applications are compared for different purposes
		1.4	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, including metallic and non-metallic
		2.2	Ideal properties of materials required for components of auxiliary machinery are analysed
		2.3	Repair methods used for auxiliary machines and constraints on engineering staff engaged in repairing auxiliary machinery are analysed
		2.4	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
		3.6	Procedures for onboard testing for fuels and lubricants are clarified
		3.7	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
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, including bacterial infections
		4.3	Methods 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
		4.5	Operation of centrifugal separators is outlined and factors that affect optimum separation are analysed
		4.6	Procedures for dealing with contamination of oils by water, fuel or solid debris, including recognition of dangerous levels and possible consequences, are determined
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
		5.5	Mounting and unmounting propeller to tail shaft is clarified
6	**Analyse steering gears and controllable pitch propeller (CPP)**	**6.1**	Regulatory requirements for steering gears of different types of vessels are identified

	systems		
		6.2	Operation of various types of steering gear arrangements are analysed
		6.3	Operation and performance of 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
		6.6	Construction, installation and operation of hydraulic gear, stabilisers and bow thrusters are identified
		6.7	Normal alarms and safety devices fitted to steering gears for all classes of vessels are identified, including analysis of auto and manual changeover procedures
		6.8	Construction, installation and operation of hydraulic steering gear is explained
		6.9	Construction and operation of stabilisers is explained
		6.10	Construction and operation of bow thrusters is explained
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
		8.5	Air receivers are inspected and maintained
9	**Evaluate shipboard refrigeration and air conditioning (RAC) systems**	**9.1**	Principle of air conditioning systems is explained and how ideal conditions are achieved in air 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 chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs), and regulations controlling their production and usage are analysed
		9.4	Procedures for evacuation and recovery of refrigerants from the

			system are outlined
		9.5	Symptoms, effects and remedial action for common faults in RAC systems are assessed
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
		11.5	Process of warming-through and shutting down turbine plant is explained
		11.6	Maintenance requirements for achieving optimum performance of an auxiliary steam turbine plant are outlined
12	**Assess operational**	**12.1**	Procedure for evaluating pump or pumping system, including

	problems with pumps and pumping systems handling sea water		heat exchangers and methods of locating cause of problems that affect output and performance, is clarified
		12.2	Operation of a self-priming system used on bilge, ballast or cargo pumping arrangements is explained
		12.3	Different types of distillation plants used on ships are compared and contrasted taking into account operation, performance, problems and applications
		12.4	Main reasons for corrosion in seawater systems and regions most affected are explained
		12.5	Operation of corrosion prevention systems fitted to pumping systems is assessed
13	**Outline pollution prevention regulations and operation of equipment**	**13.1**	International Convention for the Prevention of Pollution from Ships (MARPOL) regulations are identified and their implications for Engineers and ship operators are explained
		13.2	Operation of modern oily water separators, oil content monitors and how they comply with MARPOL regulations are explained
		13.3	Operation of typical sewage plants and regulations controlling their usage are explained
		13.4	Operation of incinerators, material that may legally be burned and monitoring devices

			is explained
14	**Explain basic operation of marine gas turbines**	**14.1**	Basic flow of air and gas through a simple cycle marine gas turbine is outlined
		14.2	Materials and construction of compressor, combustion system and turbine in a single and two-shaft design turbine are outlined
		14.3	Basic controls required for control and protection of plant are outlined
		14.4	Accessories necessary for safe operation are identified

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.

Unit Mapping Information

This unit replaces and is not equivalent to MARL025 Demonstrate intermediate knowledge of marine auxiliary machinery and systems.

This unit replaces and is equivalent to MARL031 Demonstrate advanced knowledge of marine auxiliary machinery and systems.

Links

Companion Volume implementation guide can be found in VetNet - https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=772efb7b-4cce-47fe-9bbd-ee3b1d1eb4c2