



Australian Government

MARL029 Demonstrate intermediate knowledge of marine steam turbines and main boilers

Release: 1

MARL029 Demonstrate intermediate knowledge of marine steam turbines and main boilers

Modification History

Release 1. New unit of competency.

Application

This unit involves the skills and knowledge required to operate and maintain main steam propulsion plant and associated control systems on a commercial vessel.

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).

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 energy balance of steam turbine plant

- 1.1 Heat losses in a turbine and turbine system are analysed
- 1.2 An enthalpy/entropy diagram is used to show how steam properties change through a turbine
- 1.3 The affect air heaters and economisers have on turbine plant efficiency is explained
- 1.4 Practical methods of verifying energy losses are detailed

2 Explain construction

- 2.1 Operation and components of the complete feed system are

and operation of feed system		outlined
	2.2	Construction, operating principles and maintenance requirements of a regenerative condenser are explained
	2.3	Causes of loss of vacuum are identified
	2.4	Construction and operation of air ejectors, vacuums and extraction pumps are explained
	2.5	Construction and operation of gland condensers, low-pressure heaters, drain coolers and high-pressure heaters are explained
	2.6	General arrangement and construction of turbo-feed pumps is outlined
	2.7	Governor control is explained
	2.8	Operating principles and construction details of de-aerators are explained
3 Explain construction, operation and repair of high-pressure water tube boilers	3.1	Operating principles of high-pressure boilers, including water and gas flow circulation are explained
	3.2	Drum, internal fittings and support and expansion arrangements are outlined
	3.3	Procedures for repairing a membrane wall furnace are clarified
	3.4	Operating principles and construction methods of integral and external superheaters are explained
	3.5	Construction and operation of economisers and air heaters is explained
	3.6	Chemistry of combustion is explained
	3.7	Typical burner register arrangements are outlined
	3.8	Construction, operation and maintenance of boiler gauge glasses and safety valves is explained
	3.9	Operation of boiler control and soot blowing system is detailed
	3.10	Blow-down procedure for a high pressure boiler is prepared
4 Explain requirements for	4.1	How salts are precipitated and how metal is corroded in the boiler and feed system is explained and method of prevention

feed water treatment for high-pressure water tube boilers		is outlined
	4.2	How oxygen is eliminated in high-pressure boilers is shown
	4.3	How pH is measured and controlled is explained
	4.4	Normal and maximum operating limits for boiler feed water treatment are identified and procedure to follow if these limits are exceeded is clarified
	4.5	Purpose and procedure for different types of tests of boiler water chemistry are explained
5 Explain construction and operation of high-pressure turbines	5.1	Flow of steam through nozzles is analysed, and pressure and velocity compounding are illustrated
	5.2	Construction of blades, bearings, glands, rotors and casings is explained
	5.3	Warming-through procedure prior to start up is explained
	5.4	Routine checks during operation are detailed
	5.5	Emergency operation of plant with one turbine inoperative is outlined
	5.6	Turbine shutdown procedure is clarified
	5.7	Routine checks carried out at a turbine plant survey are detailed
	5.8	Precautions necessary when turbine and gearing casings are open are explained and any repairs or adjustments that may be required are identified
	5.9	Performance of steam plant by routine observations of pressure temperature speed and vibration of turbine, gearing and associated systems is analysed
6 Explain turbine gearing arrangements	6.1	Single and double reduction gearing systems are outlined
	6.2	Use of double helical involute gear teeth is explained
	6.3	Advantages and disadvantages of single and double locked tandem gearboxes are detailed
	6.4	Purpose of fitting a nodal drive in gearing system is clarified
	6.5	Construction and reason for installing flexible couplings in gearing system is explained

	6.6	Layout of a turbo-electric drive is detailed
7 Analyse flow of air and gas through a simple cycle marine gas turbine	7.1	Construction of compressor, combustion system and single and two shaft turbines is explained
	7.2	Necessary controls required for control and protection of plant are confirmed
	7.3	Accessories necessary for safe operation of simple cycle marine gas turbines are listed

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.

Accessories must include:

- accessory gear
- lube oil:
 - coolers
 - filters
 - pumps
- starting devices

Unit Mapping Information

This unit replaces and is equivalent to MARL6016A Demonstrate intermediate knowledge of marine steam turbines and main boilers.

MARL6016A replaces and is equivalent to TDMMR5807A Manage the operation, monitoring and evaluation of the performance of steam propulsion plant on vessels over 750 kW propulsion power.

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 MARL029 Demonstrate intermediate knowledge of marine steam turbines and main boilers

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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 diagnostic information related to marine steam turbines
- 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
- identifying and applying relevant solutions to problems that can occur during operation of steam propulsion plant and associated systems on a steam vessel
- identifying and interpreting diagnostic information, and perform mathematical calculations related to operating, maintaining and repairing marine steam turbines
- identifying methods, procedures and materials needed for operating, maintaining and repairing marine steam turbines
- imparting knowledge and ideas through verbal, written and visual means
- reading and interpreting manuals, technical specifications, safety data sheets/material safety data sheets and manufacturer guides related to operating, maintaining and repairing marine steam turbines.

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:

- basic principles of operation of main steam propulsion and auxiliary systems on a steam vessel, including:
 - methods of turbine control, including safety devices
 - symptoms, causes and effects of defects of auxiliary steam turbines and actions to be taken
 - construction and operation of main and auxiliary steam turbines
 - procedures for emergency operation of a steam turbine

- construction and operation of feed system
- construction and operation of high-pressure turbines
- construction, operation and repair of high-pressure water tube boilers
- energy balance for a steam turbine plant
- established engineering practice and procedures for operation of shipboard steam propulsion plant and associated systems in warm-through, manoeuvring, start up, normal running, emergency and shut down situations
- fundamental principles of steam propulsion systems and boilers
- hazards and problems that can occur during operation of steam propulsion plant and associated systems, and appropriate preventative and remedial action
- methods of lubricating principal components of a marine steam propulsion turbine and its associated gearing, and evaluating common faults, including common lubrication faults, symptoms, causes, and actions to be taken with such faults
- operational characteristics and performance specifications for different types of steam propulsion plant and associated systems on a steam vessel of unlimited propulsion power
- procedures for reading and interpreting readings and indications of performance of steam propulsion plant and associated systems
- requirements for feed water treatment for high-pressure water tube boilers
- simple cycle marine gas turbine
- turbine gearing arrangements
- types, properties, tests, applications and treatment of fuels, lubricants and solvents/chemicals used on board a steam vessel, including working principles, construction, maintenance and safe operation of centrifuges, filters, and other treatment devices
- typical operating precautions for steam propulsion plant and associated systems to ensure operational performance complies with bridge orders, technical specifications, survey requirements, and established safety and anti-pollution rules and regulations
- units of measurement
- 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 an industry-approved marine operations site where intermediate knowledge of marine steam turbines and main boilers can be demonstrated.

Resources for assessment include access to:

- applicable documentation including workplace procedures, regulations, codes of practice and operation manuals
- diagrams, specifications and other information related to marine steam turbines
- technical reference library with current publications on basic marine steam turbines
- 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.

Links

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<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=772efb7b-4cce-47fe-9bbd-ee3b1d1eb4c2>