



Australian Government

MARL059 Demonstrate basic knowledge of marine steam turbines and main boilers

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 main steam propulsion plant and associated control systems on a commercial vessel.

This unit applies to people working in the maritime industry in the capacity of:

- Electro-Technical Officer (STCW Electro-Technical Officer Unlimited)
- Engineer Watchkeeper (STCW Engineer Watchkeeper 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 Electro-Technical Officer (STCW Electro-Technical Officer Unlimited) or Engineer Watchkeeper (STCW Engineer Watchkeeper 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 Interpret an energy balance diagram for a shipboard steam plant

- 1.1 Ideal theoretical thermodynamic cycle for the operation of a steam plant is outlined
- 1.2 Why actual expansion of steam through a turbine differs from ideal cycle is explained
- 1.3 Typical heat losses around a steam plant are identified
- 1.4 Effect of air pre-heating, feed heating and economisation upon energy balance of steam plant's thermodynamic cycle are explained
- 1.5 Typical heat (and/or mass) balance diagram for a ship's steam plant is interpreted

2 Explain construction and operation of marine high-pressure water boilers

- 2.1 Advantages of water tube boiler over fire tube boiler for shipboard applications are outlined
- 2.2 Construction and operation of a 'D' type membrane furnace boiler with superheater, economiser and air pre-heater is explained
- 2.3 External fittings required by classification society rules on any large boiler are identified
- 2.4 Internal fittings of a boiler's main steam drum are identified
- 2.5 How automation is applied to boiler control is clarified
- 2.6 Start-up, operation and shutdown of a main propulsion steam boiler are outlined

3 Explain construction and operation of a main propulsion steam plant

- 3.1 How common forms of blading and rotor construction are manufactured is clarified
- 3.2 How casings of common marine steam turbines are fitted out is clarified

- 3.3 Principles of thermodynamics are applied to explain expansion of steam in a typical marine turbine
 - 3.4 Importance of start-up and warming-through procedures for a steam turbine set is conveyed
 - 3.5 Checks required during routine turbine operation are explained
 - 3.6 Safety devices for a steam turbine set are identified and normal emergency shutdown (ESD) procedures are identified
 - 3.7 Operation of turbines under normal and emergency conditions is outlined
- 4 **Explain auxiliary machinery required to support operation of main propulsion steam turbines and boilers**
 - 4.1 Construction and operation of different types of auxiliary machinery needed to support main propulsion steam turbines and boilers is outlined
 - 4.2 Construction and operation of steam and electric motor prime movers required for driving auxiliary machinery are outlined
- 5 **Explain configuration and operating principles of different steam distribution systems used in steam-powered vessels**
 - 5.1 Configuration and operating principles of different steam distribution systems is outlined
 - 5.2 Typical pressure reducing and pressure control valves suitable for steam service are outlined and illustrated
- 6 **Explain operation principles of close feed systems used by boiler/turbine sets**
 - 6.1 Difference between an open and a closed feed system is clarified
 - 6.2 Closed feed system is outlined
 - 6.3 Pressure feed heaters are outlined
 - 6.4 Chemical injection equipment suitable for use on any ship's main feed system is explained
- 7 **Explain feed and boiler water treatment**
 - 7.1 Recommended limits of characteristics for boiler water and recommended intervals at which tests are

- undertaken are clarified
- 7.2** Reasons for treating boiler water are outlined
- 7.3** Different types of hardness in water, consequences if left untreated, and ways of minimising their effect are explained
- 7.4** How corrosion within a boiler is minimised by treating boiler water is explained
- 7.5** Causes and ways of avoiding carry-over and caustic embrittlement are explained
- 7.6** Safety requirements for handling feed water and boiler water treatment chemicals are explained
- 8 Explain transmission of power from the steam turbine main engine to the propeller**
- 8.1** Why reduction gearing is required between steam turbines and propeller is clarified
- 8.2** Generation of tooth form is outlined
- 8.3** Double helical gearing and difference between single and double reduction gearing are explained
- 8.4** Applications of epicyclic gearing are explained
- 8.5** Function of flexible couplings in a turbine/gearing set is clarified
- 8.6** Components of a driveline from main wheel connection, aft, to propeller are listed
- 8.7** Methods and mechanisms for lubricating a driveline are detailed
- 9 Explain procedures for preventing and responding to fires and explosions specific to steam propulsion plant**
- 9.1** Causes, symptoms and means of preventing and extinguishing fires associated with steam propulsion plant are detailed
- 9.2** Protective devices associated with boilers to minimise risk of fires, explosions and water shortages are identified
- 9.3** Routine inspection and maintenance requirements to prevent fires, explosions and water shortages are

outlined

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 equivalent to MARL013 Demonstrate basic knowledge of marine steam turbines and main boilers.

Links

Companion Volume implementation guide can be found in VetNet -

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