Australian Government

MARL036 Demonstrate advanced knowledge of ship operation and maintenance

Release: 1

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Modification History

Release 1. New unit of competency.

Application

This unit involves the skills and knowledge required to ensure that vessels comply with regulatory and survey requirements as well as implementing maintenance and repair procedures associated with satisfying maintenance of class. It includes analysing: regulatory framework impacting on commercial shipping operations; maintenance strategies relating to classification surveys; statutory survey requirements; and factors influencing vessel stability.

It also includes analysing repair and maintenance methods for hull work, pipe work and pumping systems, machinery, propellers and other items to satisfy maintenance of class position; international maritime dangerous goods code requirements; safe working practices in enclosed or confined spaces; dry docking procedures and responsibilities of engineering staff; and shipboard vibration.

This unit applies to the work of a Marine Engineer Class 1 on commercial vessels of unlimited propulsion power 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 Analyse regulatory framework	1.1 Functions of International Maritime Organization (IMO), its fields of influence, role of member states, adoption of

impacting on commercial shipping operations		recommendations through maritime legislation and exemptions are analysed
	1.2	Role of International Labour Organization (ILO) Convention in relation to shipboard practices is analysed
	1.3	Key provisions of Australian maritime legislation are analysed
	1.4	Role of AMSA in relation to maritime safety, protection of marine environment, and aviation and marine search and rescue is explained
	1.5	Role of Flag State administrations, Port State Control and other methods of implementation and enforcement of international agreements and conventions is analysed
	1.6	Role of insurance underwriters, Protection and Indemnity (P & I) Clubs and procedures for lodging claims following machinery failure and/or damage are analysed
	1.7	Role of classification societies, IACS and Memorandum of Agreement with Flag States is analysed
	1.8	Role of ship owners and ship management companies regarding ISM Code and ship management responsibilities regarding operation and maintenance is analysed
	1.9	Role of independent inspection agencies and adoption of inspection and maintenance guidelines for different ship types is analysed
	1.10	Standards of Training Certification and Watchkeeping (STCW) crew training requirements and implications for emergency response, administration, operation and maintenance are analysed
	1.11	Key provisions of the Code of Safe Working Practice for Australian Seafarers are analysed
2 Analyse maintenance strategies relating to classification surveys	2.1	Common areas covered by classification surveys are analysed
	2.2	Survey methods are analysed
	2.3	Terms of periodical, annual, renewal, intermediate and occasional surveys are identified
	2.4	Common defects identified in classification surveys and appropriate remedial actions are analysed

3	**Analyse statutory survey requirements**	3.1 Areas of vessel covered by statutory surveys are identified
		3.2 Statutory requirements for change of Flag, owner, and term expiry during layup are identified
		3.3 Records and documentation required for statutory surveys are identified
		3.4 Load line measurements and conditions of freeboard assignment are analysed
		3.5 Key areas of maintenance and testing of load line items and actions for addressing identified maintenance requirements and defects are identified
		3.6 Areas covered by safety construction surveys and associated faults, maintenance and repairs are identified
		3.7 Procedures for planning safety equipment surveys and actions for addressing identified maintenance requirements and defects are analysed
		3.8 Requirements for survey preparation under the International Convention for the Prevention of Pollution from Ships (MARPOL) are analysed
		3.9 Survey requirements for cargo ship safety construction, safety equipment and safety radio certificates; passenger ship safety certificates; chemical tanker and gas carrier certificates of fitness are analysed
		3.10 Application of Port State Control surveys, Flag State jurisdiction and IMO guidelines in relation to vessel detention and identification of substandard ships are analysed
4	**Analyse factors influencing vessel stability**	4.1 Loss of GM due to addition, removal or shift of mass on board is calculated
		4.2 Action to be taken with partial loss of intact buoyancy is specified
		4.3 Angle of Loll is explained
		4.4 Causes of vessel instability during ballasting, bunkering, cargo pumping and other daily routines and possible corrective and avoidance measures are assessed
		4.5 Risks associated with carrying thixotropic bulk cargo, deck cargo or grain and consequences of cargo movement or loss

		are outlined
	4.6	Damage and intact stability requirements for merchant ships, countermeasures for ro-ro vessels and damage control assessment following collision or grounding is assessed
	4.7	Operational procedures to minimise and control flooding are prepared
	4.8	Stability requirements for routine and emergency dry docking, including stability assessment for the docking duration, are specified
	4.9	Factors causing ship squat and other influences on vessel manoeuvrability are assessed
5 Maintain class certification	5.1	Methods for repair and maintenance are analysed
	5.2	Properties of ordinary and high tensile hull grades of steel are analysed
	5.3	Processes and materials used in underwater hull repairs are assessed
	5.4	Methods of minimising and controlling internal and external hull corrosion, including bacterial corrosion of bilges and fuel tanks, are evaluated
	5.5	Examination and repair techniques for fixed pitch and controllable propellers are assessed
	5.6	Dismantling, inspection, repair and re-assembly of thrusters and rudders is explained
	5.7	Methods of performance testing shipboard pumping systems are evaluated
	5.8	Causes of common faults and methods of assessment of shipboard pumping systems are identified
	5.9	Condition monitoring of machinery is compared with planned maintenance systems
	5.10	Causes of damage to and losses of bulk ships and tankers, and appropriate remedies are explained
	5.11	Types and purpose of special and enhanced surveys are outlined
6 Analyse	6.1	Key principles of IMDG Code are analysed

	International Maritime Dangerous Goods (IMDG) Code requirements	6.2	Action plans for managing emergency situations on board a vessel involving dangerous goods are developed
		6.3	Criteria for evaluating effectiveness of action plans for managing emergency situations on board a vessel involving dangerous goods are established
7	**Analyse safe working practices in enclosed spaces**	7.1	Hazards of shipboard enclosed spaces are analysed
		7.2	Methods and regulatory requirements for testing atmosphere in enclosed spaces are outlined and evaluated
		7.3	Function, status and limitations of chemist certificate of compliance is explained
		7.4	Limits of exposure to common atmospheric hazards are stated
		7.5	Typical safe entry permit for enclosed spaces, covering hot work and cleaning, evacuation procedures, training and contingency evaluation is prepared
		7.6	Dangers of using cleaning solvents and painting in enclosed spaces using product safety data sheets/material safety data sheets and work health and safety/occupational health and safety (WHS/OHS) guidelines are assessed
8	**Analyse dry docking procedures and responsibilities of engineering staff**	8.1	Dockyard contract, docking specifications and survey requirements are used to plan preparation of vessel for docking, explaining variations required for emergency docking
		8.2	Dock work schedules, responsibilities for engineering personnel and procedures for dock entry, duration and refloating are prepared
		8.3	Inspection and maintenance procedures for hull and machinery items in dock are explained
		8.4	In-water hull cleaning methods and preparation essential for in-water surveys is evaluated
		8.5	Types and application procedures of coatings used to protect ship hulls and tanks are identified
		8.6	Procedures for vessel layup to satisfy class, insurance, owner and statutory requirements are prepared
		8.7	Inspection and reactivation processes after prolonged layup

		are outlined
9	**Analyse shipboard vibration**	9.1 Appropriate terms are applied when describing vibration
		9.2 Influence of materials, construction, loading patterns and ship type on natural hull vibration patterns is assessed
		9.3 Significance of hull response to excitation by sea state, machinery and propulsion systems is explained
		9.4 Methods of prediction and in service assessment of resonant vibration are evaluated
		9.5 Vibration related structural and equipment damage and failure is identified
		9.6 Solutions to troublesome vibration are proposed
		9.7 Acceptable vibration limits using relevant standards are established
10	**Analyse vessel bunkering requirements**	10.1 Requirements for bunkering orders are analysed
		10.2 Procedures for taking bunkers are analysed
		10.3 Bunkering guidelines for spills and fire are analysed
		10.4 Methods and requirements for sampling fuels are analysed
		10.5 Procedures for assessing the quality and quantity of fuels are explained
		10.6 Communication requirements and procedures during bunkering operations are analysed
		10.7 Methods for monitoring levels and facilitating changeover of tanks 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.

Key provisions of Australian maritime legislation must include:	• AMSA legislation • levy legislation • marine pollution legislation • navigation legislation • shipping industry legislation • shipping registration legislation • other relevant legislation
Key provisions of the Code of Safe Working Practice for Australian Seafarers must include:	• anchoring, docking and mooring • carriage of dangerous goods • entering and working in enclosed or confined spaces • general duties and responsibilities • general provisions • manual lifting and carrying • painting • permit to work systems • reporting of accidents • safe access to ship • safe movement about the ship • safety in living accommodation • shipboard: • emergencies and emergency equipment • health and safety • specific vessel types • tools and materials • upkeep of wire and fibre ropes • welding flame cutting and other hot work • working: • aloft and over the side • with electricity and electrical equipment • with dangerous and irritating substances and radiations • in machinery spaces • in galleys, pantries and other food handling areas
Areas covered by classification must include:	• specific notations for cargo pumping arrangements for tankers
Areas covered by	• automation

classification include one or more of the following:	• boilers/pressure vessels • cargo gear • hull • machinery • tailshaft
Ship types include one or more of the following	• bulk carrier • container • general dry cargo • passenger • ro-ro • tanker or gas carrier
Survey methods include one or more of the following:	• alternative • continuous • special surveys
Classification surveys must include:	• hull work • machinery • pipe work • pumping systems • propellers
Areas of vessel covered by statutory surveys must include:	• links with classification society requirements for endorsement of class certificates
Loss of GM must include:	• derrick hook loads • free surface effect
Operational procedures to minimise and control flooding must include:	• action to ensure watertight integrity of ship • rules relating to watertight doors
Stability requirements for routine and emergency dry docking must include:	• stability assessment for docking duration
Properties must include:	• repair techniques and limitations • weld ability • welder qualification tests
Methods of minimising	• bacterial corrosion of bilges and fuel tanks

and controlling internal and external hull corrosion must include:	
Methods of performance testing shipboard pumping systems must include:	• bilge and ballast systems • hydraulic deck machinery
Shipboard pumping systems must include:	• bilge and ballast systems, including predictive health monitoring • hydraulic deck machinery
Planned maintenance systems must include:	• guidelines for classification society approval of substitution for continuous machinery surveys
Principles of IMDG Code include:	• contains dangerous goods packagings/tanks which are of appropriate strength and which will prevent goods escaping • groups dangerous goods together based on hazards they present in transport (classification) • lays down principles for ensuring dangerous goods that will react dangerously together are kept apart • lays down principles for where to place dangerous goods on board ship to ensure safe transport • provides emergency response advice for dangerous goods involved in a fire or spillage on board ship • requires standard documentation to be provided when dangerous goods are being transported • uses hazard warning labels and other identifying marks to identify dangerous goods in transport
Emergency situations include one or more of the following:	• dangerous goods • disposal of dangerous/toxic materials • firefighting • first aid • hazard reduction • reporting
Hazards of shipboard enclosed spaces must include:	• re-entry of compartments after a major fire • release of a fixed firefighting medium
Hazards of shipboard enclosed spaces must	• engulfment • explosion

include one or more of the following:	• fire • lack of oxygen • toxic gases
Inspection and maintenance procedures for hull and machinery items in dock must include:	• hull coating systems • measurement and evaluation of clearances
Terms must include:	• amplitude • anti-node • frequency • mode • node • resonance
Solutions include one or more of the following:	• damping • detuning • modification of ship: • design • operation
Communication includes one or more of the following:	• checklist • rate • safety • stock method • two-way radio

Unit Mapping Information

This unit replaces and is equivalent to MARL6023A Demonstrate advanced knowledge of ship operation and maintenance

Links

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