



Australian Government

MARL045 Apply basic principles of naval architecture

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 perform basic calculations related to the seaworthiness of commercial vessels, including those dealing with watertight integrity and vessel stability.

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

- Electro-Technical Officer (STCW Electro-Technical Officer Unlimited)
- Engineer Class 3 Near Coastal
- Engineer Watchkeeper (STCW Engineer Watchkeeper Unlimited).

Licensing/Regulatory Information

Legislative and regulatory requirements are applicable to this unit.

- 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.

Near Coastal Qualifications:

- This unit is one of the requirements to obtain Australian Maritime Safety Authority (AMSA) certification as an Engineer Class 3 Near Coastal as defined in the Marine Order 505 (Certificates of competency - National Law) 2013.

Blue Waters Qualifications:

- 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).

Pre-requisite Unit

Not applicable.

Competency Field

L - Engineering

Unit Sector

Not applicable.

Elements and Performance Criteria

ELEMENTS

Elements describe the essential outcomes.

1 Calculate shipboard areas and volumes

2 Calculate vessel displacement

3 Calculate ship dimensions

PERFORMANCE CRITERIA

Performance criteria describe the performance needed to demonstrate achievement of the element.

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| 1.1 | Basic principal structural members of ship and proper names of various parts are detailed |
| 1.2 | Simpson's Rules are applied to calculate shipboard areas |
| 1.3 | Simpson's Rules are applied to calculate shipboard volumes |
| 2.1 | Tonnes per centimetre (TPC) values and Simpson's Rules are applied to calculate vessel displacement |
| 2.2 | Calculations are performed using TPC values and Simpson's Rules to solve problems related to vessel displacement |
| 3.1 | Ship form dimensions are calculated using coefficients for areas |
| 3.2 | Ship form coefficients for underwater volumes are calculated |
| 3.3 | Influence of common hull modifications on hull form coefficients is explained |
| 3.4 | Calculations are performed to solve problems of ship form coefficients following change to vessel length resulting from mid-body insertion or removal |

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| 4 Explain position of centre of gravity (CG) of vessel in relation to its keel and midships | 4.1 | CG calculations for a vessel are performed |
| | 4.2 | How CG changes with redistribution, addition and/or removal of mass is explained |
| | 4.3 | How addition, removal or transfer of mass may cause overturning moments is identified |
| | 4.4 | Problems are solved involving addition, removal and vertical movement of mass by performing CG calculations for typical vessel loaded conditions |
| | 4.5 | Calculations are performed using results from inclining experiments to obtain initial stability characteristics |
| 5 Explain effects of water density and flooding of mid-length compartment on vessel draft | 5.1 | Relationship between changes in underwater volume and changes in water density is outlined |
| | 5.2 | Freshwater allowance of a vessel is determined |
| | 5.3 | Change in mean draft for vessel movement between waters of different densities is calculated |
| | 5.4 | Volume lost-volume gained relationship for flooded compartments is explained |
| | 5.5 | Calculations are performed to solve problems of mid-length compartment flooding in simple box-shaped hull forms |
| | 5.6 | Fundamental actions to be taken in the event of partial loss of intact buoyancy are identified |
| 6 Perform calculations related to propellers and vessel speed | 6.1 | Relationship between propellers and vessel speed is explained |
| | 6.2 | Problems related to vessel speed and propellers are solved by calculating theoretical, apparent and true speeds, apparent and true slips, wake speed and Taylor wake fraction |
| | 6.3 | Impact of fouling on vessel hull and propeller is outlined |

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| 7 Calculate voyage and daily fuel consumptions | 7.1 Fuel consumption is determined by applying admiralty coefficient for fuel consumption taking account of ship speed, shaft power and displacement |
| | 7.2 Calculations are performed to solve problems of vessel fuel consumption taking account of ship speed, shaft power and displacement |
| | 7.3 Impact of fouling on vessel fuel consumption is explained |
| 8 Calculate pressures and loads on surfaces due to hydrostatics | 8.1 Standard formula for hydrostatic pressure is defined |
| | 8.2 Hydrostatic load on vertical and horizontal surfaces is calculated |
| | 8.3 Method of calculating loads on typical tank structures for different filling rates is explained |

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 MARL002 Apply basic principles of naval architecture.

Links

Companion Volume implementation guide can be found in VetNet -

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