



**Australian Government**

# **MARL002 Apply basic principles of naval architecture**

**Release: 1**

# MARL002 Apply basic principles of naval architecture

## Modification History

Release 1. New unit of competency.

## 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 as a Marine Engineering Watchkeeper on commercial vessels greater than 750 kW or as an Engineer Class 3 Near Coastal.

This unit has links to legislative and certification requirements.

## 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.

|                                                |     |                                                                                                                  |
|------------------------------------------------|-----|------------------------------------------------------------------------------------------------------------------|
| <b>1 Calculate shipboard areas and volumes</b> | 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                                                       |
| <b>2 Calculate vessel displacement</b>         | 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 |

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| <b>3 Calculate ship dimensions</b>                                                               | <p>3.1 Ship form dimensions are calculated using coefficients for areas</p> <p>3.2 Ship form coefficients for underwater volumes are calculated</p> <p>3.3 Influence of common hull modifications on hull form coefficients is explained</p> <p>3.4 Calculations are performed to solve problems of ship form coefficients following change to vessel length resulting from mid body insertion or removal</p>                                                                                                                                                                                         |
| <b>4 Explain position of centre of gravity of vessel in relation to its keel and midships</b>    | <p>4.1 Centre of gravity calculations for a vessel are performed</p> <p>4.2 How centre of gravity changes with redistribution, addition and/or removal of mass is explained</p> <p>4.3 How addition, removal or transfer of mass may cause overturning moments is identified</p> <p>4.4 Problems are solved involving addition, removal and vertical movement of mass by performing centre of gravity calculations for typical vessel loaded conditions</p> <p>4.5 Calculations are performed using results from inclining experiments to obtain initial stability characteristics</p>                |
| <b>5 Explain effects of water density and flooding of mid-length compartment on vessel draft</b> | <p>5.1 Relationship between changes in underwater volume and changes in water density is outlined</p> <p>5.2 Fresh water allowance of a vessel is determined</p> <p>5.3 Change in mean draft for vessel movement between waters of different densities is calculated</p> <p>5.4 Volume lost-volume gained relationship for flooded compartments is explained</p> <p>5.5 Calculations are performed to solve problems of mid-length compartment flooding in simple box-shaped hull forms</p> <p>5.6 Fundamental actions to be taken in the event of partial loss of intact buoyancy are identified</p> |
| <b>6 Perform calculations related to propellers and vessel speed</b>                             | <p>6.1 Relationship between propellers and vessel speed is explained</p> <p>6.2 Problems related to vessel speed and propellers are solved by calculating theoretical, apparent and true speeds, apparent</p>                                                                                                                                                                                                                                                                                                                                                                                         |

|                                                                        |     |                                                                                                                                                  |
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|                                                                        |     | and true slips, wake speed and Taylor wake fraction                                                                                              |
|                                                                        | 6.3 | Impact of fouling on vessel hull and propeller is outlined                                                                                       |
| <b>7 Calculate voyage and daily fuel consumptions</b>                  | 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                                                                                        |
| <b>8 Calculate pressures and loads on surfaces due to hydrostatics</b> | 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

This section describes those language, literacy, numeracy and employment skills that are essential to performance.

Foundation skills essential to performance are explicit in the performance criteria of this unit of competency.

## Range of Conditions

Specifies different work environments and conditions that may affect performance. Essential operating conditions that may be present (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) are included.

Range is restricted to essential operating conditions and any other variables essential to the work environment.

Shipboard areas include one or more of the following:

- bulkheads
- elemental areas
- water planes

Shipboard volumes include one of the following:

- transverse sectional areas
- water plane areas

Problems related to vessel displacement include one of the following:

- addition of mass
- removal of mass

Coefficients for areas include one of the following:

- midships (CM)
- waterplane (CW)

Coefficients for underwater volumes include one of the following:

- block (Cb)
- prismatic (Cp)

Centre of gravity includes one or more of the following:

- centre of gravity (CG)
- longitudinal centre of gravity (LCG)
- vertical centre of gravity (VCG)

Mass includes one or more of the following:

- ballast
- cargo
- fuel
- passengers

Filling rates include one or more of the following:

- accidental flooding
- tank testing

## Unit Mapping Information

This is a new unit. This unit is equivalent to MARL5004A Apply basic principles of naval architecture.

## 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 MARL002 Apply basic principles of naval architecture

## Modification History

Release 1. New unit of competency.

## Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria on at least one occasion and include:

- assessing own work outcomes and maintaining knowledge of current codes, standards, regulations and industry practices
- explaining basic principles of naval architecture
- identifying and applying relevant mathematical formulas and techniques to solve basic problems related to speed, fuel consumption and stability of commercial vessels
- identifying and interpreting numerical and graphical information, and performing mathematical calculations related to shipboard areas and volumes, vessel displacement, ship dimensions, centre of gravity, vessel speed, fuel consumption and hydrostatic pressure
- identifying, collating and processing information required to perform calculations related to speed, fuel consumption and stability of commercial vessels
- imparting knowledge and ideas through verbal, written and visual means
- performing accurate and reliable calculations
- reading and interpreting written information needed to perform calculations related to the seaworthiness of commercial vessels
- solving problems using appropriate laws and principles
- using calculators to perform mathematical calculations.

## Knowledge Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria and include knowledge of:

- basic structural members of a ship and the proper names of the various parts
- buoyancy
  - centre of gravity:
  - centre of gravity (CG), longitudinal centre of gravity (LCG), vertical centre of gravity (VCG)
  - calculations
- density correction formula
- fuel consumption calculations
- hydrostatic pressure

- principle of displacement
- ship:
  - stability
  - stability calculations
  - measurements
  - displacement
- shipboard:
  - areas
  - volumes
- Simpson's Rules
- Tonnes per centimetre (TPC) immersion
- trim and stress tables, diagrams and stress calculating equipment
- vessel speed calculations
- watertight integrity.

## Assessment Conditions

Assessors must satisfy National Vocational Education and Training Regulator (NVR)/Australian Quality Training Framework (AQTF) assessor requirements.

Assessment must occur in workplace operational situations where it is appropriate to do so; where this is not appropriate, assessment must occur in simulated workplace operational situations that reflect workplace conditions.

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.

Resources for assessment must include access to:

- tools, equipment, machinery, materials and personal protective equipment currently used in industry
- applicable documentation such as legislation, regulations, codes of practice, workplace procedures and operational manuals
- range of relevant exercises, case studies and/or simulations.

## Links

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