Australian Government

MARL017 Apply intermediate principles of naval architecture

Release: 1

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Modification History

Release 1. New unit of competency.

Application

This unit involves the skills and knowledge required to perform intermediate calculations related to the seaworthiness of commercial vessels, including those dealing with vessel stability, fuel consumption, power and symmetrical flooding.

This unit applies to the work of a Marine Engineers Class 2 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 Calculate shipboard areas, volumes and displacement	1.1 Simpson's Rules are applied to find typical and non-conforming shipboard areas
	1.2 Simpson's Rules are applied to calculate water plane areas or transverse sectional areas to determine underwater volumes
	1.3 Simpson's Rules are applied to immersed tonnes per centimetre values to determine displacement
	1.4 Tonnes per centimetre is applied to determine change in mean draught due to addition or removal of mass

2	**Calculate coefficients of form and changes in draught associated with fluid density**	2.1 Application of coefficients of form are identified and explained
		2.2 Problems are solved involving coefficients of form
		2.3 Impact of hull modification on hull form coefficients is explained
		2.4 Problems of coefficients of form are solved following change in length by mid body insertion/removal
		2.5 Relationship between underwater volume/draught and fluid density is explained
		2.6 Application of freeboard markings for Load Line Rules is explained
		2.7 Density correction formula is defined
		2.8 Change in mean draught due to change in density is calculated
3	**Solve stability problems**	3.1 Effects of adding, removing and transferring mass on board or from a vessel are explained
		3.2 Calculations are performed to solve problems involving suspended masses
		3.3 Positive, neutral and negative stability are distinguish from each other
		3.4 How centre of gravity is calculated for redistribution, addition and/or removal of masses is explained, including the use of derricks
		3.5 Problems are solved involving vertical and horizontal movement of masses to calculate KG and GM for typical vessel loaded conditions, together with true shift in vessel centre of gravity between specified conditions and small angle transverse stability
		3.6 Vessel righting moment and GZ are explained
		3.7 Calculations are performed to solve problems of small angle transverse stability
		3.8 Purpose of an Inclining Experiment is explained
		3.9 Formula for determining initial stability characteristics is

			applied
		3.10	Calculations are performed to solve problems using Inclining Experiments
4	**Calculate loss of transverse stability due to fluid free surface**	4.1	Principles of liquid free surface are explained
		4.2	Principles of metacentric height are explained
		4.3	Centre of gravity solid is distinguished from centre of gravity fluid
		4.4	Application of the second moment of area using parallel axis theorem to obtain free surface moment of inertia and use of density correction between vessel and free surface fluids is explained
		4.5	Calculations are performed to solve problems of liquid free surface for simple compartments, including correction for free surface on metacentric height [GM] and fluid mass on centre of gravity [KG]
5	**Calculate centroids and solve problems of hydrostatics**	5.1	Importance of area and volume centroids and methods of determining KG, LCF, LCB and bulkhead area centroids is explained
		5.2	Calculations are performed to solve problems related to area and volume centroids
		5.3	Methods of calculating pressures and loads on typical tank structures for different filling rates, accidental flooding or tank testing are explained
		5.4	Use of flat panel stiffeners and shear force reactions applicable to vertical bulkheads is explained
		5.5	Calculations are performed to solve problems in hydrostatics relating to pressure and loads on ship structures, including bulkheads, stiffeners and shear forces
6	**Solve problems involving propellers and powering**	6.1	Factors that influence the speed of advance are explained
		6.2	Calculations are performed to solve problems of single screw vessels
		6.3	Relationships between propulsive coefficient, quasi propulsive coefficient and related powers together with typical values of losses for transmission, hull and propeller are explained

	6.4	Components of hull resistance are explained
	6.5	Calculations are performed to show impact of resistance augmentation and thrust deduction factors on powering of full size vessels
	6.6	Causes, effects and methods of reducing cavitation are explained
7 Calculate voyage and daily fuel consumptions	7.1	Admiralty coefficient for fuel consumption is stated taking account of values for ship speed, shaft power and displacement
	7.2	Vessel fuel consumption is calculated using admiralty coefficient
	7.3	Calculations are performed to show relationship between fuel consumption and displacement
	7.4	Calculations are performed to show relationship between daily fuel consumption and speed
	7.5	Calculations are performed to show relationship between voyage consumption, speed and distance travelled
	7.6	Voyage and daily fuel consumption are calculated taking into account propulsion, domestic loads and fuel reserve requirements
8 Solve problems related to symmetrical flooding	8.1	Volume lost-volume gained relationship for flooded compartments is explained
	8.2	Modified volume lost by compartment subdivision is explained using a horizontal flat
	8.3	Modified volume lost by compartment permeability is explained, including consideration of cargo stowage factor and relative density details
	8.4	Problems of symmetrical flooding of simple box-shaped and standard hull forms involving flooding above and below horizontal subdivisions and different permeabilities are solved

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.

Shipboard areas include one or more of the following:	• bulkheads • elemental areas • water planes
Coefficients of form include one or more of the following:	• block coefficient • midship section area coefficient • prismatic coefficient • waterplane area coefficient
Centre of gravity must include:	• centre of gravity (KG) • longitundal centre of gravity (LCG) • vertical centre of gravity (VCG)
Speed of advance must include:	• apparent and true slips • Taylor wake fraction • theoretical, apparent and true speeds • wake speed
Related powers must include:	• delivered • effective • indicated • shaft • thrust
Hull resistance must include:	• frictional • residuary • total
Shipboard areas include one or more of the following:	• bulkheads • elemental areas • water planes

Unit Mapping Information

This unit replaces and is equivalent to MARL6004A Apply intermediate 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