



Australian Government

MARL044 Apply basic principles of marine mechanics

Release: 1

MARL044 Apply basic principles of marine mechanics

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 apply the basic principles of marine mechanics and to perform associated calculations needed to operate and maintain marine machinery.

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

- 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 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

Elements describe the essential outcomes.

1 Use vector diagrams to calculate the resultant and equilibrant of up to four coplanar forces

PERFORMANCE CRITERIA

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

- 1.1** Meaning of force as a vector, moment of a force, resultant and equilibrant are explained
- 1.2** Forces using the triangle and polygon of forces are determined
- 1.3** Moments and couples applied to beams and levers are explained
- 1.4** Centroid of an area is calculated
- 1.5** Centre of gravity (CG) of regular geometrical shapes is calculated
- 1.6** Resultant and equilibrant of a system of concurrent coplanar-planer forces are calculated

2 Solve problems involving friction

- 2.1** Nature of friction and the laws of dry sliding friction are explained
- 2.2** Influence of lubrication on bearings and plain surfaces is outlined
- 2.3** Coefficient of friction is derived
- 2.4** Laws of friction are applied to movement in a horizontal plane and the force to overcome friction on horizontal surfaces
- 2.5** Effect of lubricating two surfaces in contact with each other is outlined

3 Apply laws of motion

- 3.1** Laws of motion are explained
- 3.2** Velocity/time and acceleration/displacement graphs are sketched and adapted to derive the standard velocity formula for both linear and angular motion

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| | 3.3 | Formula and/or graphs are applied to solve problems of linear and angular velocity |
| | 3.4 | Linear motion is converted to angular motion and revolutions to radians |
| 4 | Solve problems in dynamics related to marine machinery | |
| | 4.1 | Relationship between torque, work, energy and power in marine engines and compressors is explained |
| | 4.2 | Conservation of energy theorem is used to calculate energy and power during linear and angular motion |
| | 4.3 | Meaning of momentum is explained |
| | 4.4 | Calculations are performed associated with the collision of rigid bodies |
| | 4.5 | Centrifugal force is distinguished from centripetal force |
| | 4.6 | Centrifugal and centripetal force in relation to marine machinery is calculated |
| 5 | Determine efficiency of lifting and geared marine machinery | |
| | 5.1 | Velocity ratio, mechanical advantage and efficiency of simple machines is calculated |
| | 5.2 | Calculations are performed to solve problems related to the operation of simple machines |
| 6 | Calculate stress and strain due to axial loads | |
| | 6.1 | Normal stress is distinguished from strain |
| | 6.2 | Hooke's Law for stress and strain is explained |
| | 6.3 | Meaning of elastic limit, ultimate tensile strength, yield stress, limit of proportionality and factor of safety is explained |
| | 6.4 | Normal stress and strain caused by axial loads is calculated |
| 7 | Determine shear stress and strain in coupling bolts and simple bolted | |
| | 7.1 | Shear stress in simple bolted connections is determined |

connections

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| | 7.2 | Torque theory is applied to calculate shear stress in coupling bolts |
| 8 Determine stresses in thin walled pressure vessels | 8.1 | Factor of safety and joint efficiency factor for pressure vessels is calculated |
| | 8.2 | Hoop and longitudinal stress in thin walled pressure vessels is calculated |

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 MARL012 Apply basic principles of marine mechanics

Links

Companion Volume implementation guide can be found in VetNet -

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

Assessment Requirements for MARL044 Apply basic principles of marine mechanics

Modification History

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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
- identifying and applying relevant mathematical formulas and techniques to solve basic problems related to marine mechanics
- identifying and interpreting numerical and graphical information, and performing mathematical calculations to determine resultant and equilibrant of coplanar forces, linear and angular velocity, and hoop and longitudinal stress in thin walled pressure vessels
- identifying, collating and processing information required to perform basic calculations related to marine mechanics
- performing accurate and reliable mathematical calculations using a calculator
- reading and interpreting written information needed to perform basic calculations in marine mechanics
- solving problems using appropriate laws and principles.

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:

- centre of gravity (CG)
- conservation of energy theorem
- dynamics, including:
 - relationship between speed, acceleration, mass, force and resistance
 - velocity and the effect of change of direction
- effective verbal, written and visual communication strategies
- factor of safety
- fluids, including effects of pressure and its relationship to depth of liquid and force
- force
- hydraulics
- hydrostatics
- joint efficiency factor

- laws of motion
- mass and volume
- momentum
- nature and laws of friction
- pressure vessels, including:
 - deformation of flat surfaces
 - strengths of dished or spherical end-plates in comparison to flat end-plates
- principles of marine mechanics
- reasons for:
 - using dished or spherical end-plates to give a higher strength than flat end-plates of similar thickness
 - using stays on flat surfaces
- simple machines, including:
 - hydraulic jack
 - pulley blocks
 - reduction gears
 - screw jack
 - single and double purchase crab winches
 - warwick screw
 - wheel and axle
 - worm driven chain blocks
- statics
- stress and strain
- thin cylinder theory
- types and uses of simple machines
- work health and safety (WHS)/occupational health and safety (OHS) requirements and work practices.

Assessment Conditions

Assessors must hold credentials specified within the Standards for Registered Training Organisations current at the time of assessment.

Assessment must satisfy the Principles of Assessment and Rules of Evidence and all regulatory requirements included within the Standards for Registered Training Organisations current at the time of assessment.

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.

Practical assessment must occur in a workplace, or realistic industry approved marine operations site or simulated workplace, under the normal range of workplace conditions.

Simulations and scenarios may be used where situations cannot be provided in the workplace or may occur only rarely, in particular for situations relating to emergency procedures and adverse

weather conditions where assessment would be unsafe, impractical or may lead to environmental damage.

Resources for assessment must include access to:

- applicable documentation, such as legislation, regulations, codes of practice, workplace procedures and operational manuals
- diagrams, specifications and other information required for performing basic calculations related to marine mechanics
- tools, equipment, machinery, materials and relevant personal protective equipment (PPE) currently used in industry.

Links

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