



Australian Government

MARA023 Manage trim, stability and stress of a vessel

Release: 1

MARA023 Manage trim, stability and stress of a vessel

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 control trim, stability and stress within safe limits at all times on a vessel 500 gross tonnage (GT) or more.

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

- Master of a commercial vessel 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 a Master 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

A – Handling cargo and vessel stability

Unit Sector

Not applicable.

Elements and Performance Criteria

ELEMENTS

PERFORMANCE CRITERIA

Elements describe the essential outcomes.

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

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| 1 Manage vessel trim under normal operating conditions | 1.1 Stability analysis and weight distribution planning are conducted at a time frequency and scope appropriate to the proposed nature of the voyage and vessel operation

1.2 Weight distribution is arranged to maintain vessel within acceptable stability limits for the anticipated operational situations likely to be experienced during the voyage

1.3 Calculations are made to determine the draught and centre of gravity (CG) of vessel after adding, removing or shifting weight

1.4 Factors affecting the stability and trim of vessel are identified and allowances are made in calculations

1.5 Trim, draughts and list of vessel are controlled, as required, to ensure they are suitable to progress all anticipated vessel operations |
| 2 Control vessel stability when compartment is flooded | 2.1 Damage to vessel and nature of flooding of compartments is assessed

2.2 Effect upon vessel stability of flooded and flooding compartments is evaluated

2.3 Suitable strategy for maintaining or restoring trim and stability is devised

2.4 Where stress limits of the vessel are exceeded as a consequence of damage and/or flooding, appropriate action is initiated to ensure safety of personnel, including abandoning the vessel, as required |
| 3 Manage stress conditions of the vessel | 3.1 Stress levels of the vessel are assessed according to manufacturer specifications

3.2 Stability of the vessel is monitored at a frequency and scope relevant to vessel operations, sufficient to enable stress and stability to be maintained within acceptable limits at all times |

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| | 3.3 | Appropriate action is taken where weight distribution has or could exceed acceptable safety limits |
| 4 | Maintain records of stability management | |
| | 4.1 | Data and information related to stability management is accurately recorded |
| | 4.2 | Data and information related to stability management is filed and stored according to organisational procedures |

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 MARA009 Manage stability of a vessel 500 gross tonnage or more.

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 MARAO23 Manage trim, stability and stress of a vessel

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:

- applying International Maritime Organization (IMO) recommendations concerning vessel stability
- applying relevant work health and safety (WHS)/occupational health and safety (OHS) requirements and work practices
- attending to appropriate level of detail in recordkeeping
- determining stability and trim requirements for docking or slipping the vessel
- determining the effect on trim and stability of vessel in the event of damage to and consequent flooding of a compartment, and countermeasures to be taken
- identifying vessels trim and stability factors
- interpreting and applying information on the fundamental principles of vessel construction and the theories and factors affecting trim and stability, and measures necessary to preserve trim and stability
- maintaining stability and stress conditions within safe limits at all times
- producing accurate and reliable documentation
- undertaking stability calculations, including:
 - calculating required load distribution to achieve desired trim
 - calculations for change of draught, trim and heel when entering different water densities and to bilging of compartments
 - centre of gravity (CG) of a vessel using an inclining experiment and effect of suspended weights
 - changes to draught, trim and heel due to adding or removing fuel, ballast or cargo
 - determining required correction for height of CG for free surface effect
 - determining values of righting lever and construction of righting lever curves
 - displacement, wetted surface, form coefficients, tonne per centimetre (TPC) immersion, application of Simpson's Rules to first and second moments of area, centroids and centres of pressure
 - effect on stability of dry docking and grounding
 - hydrostatic stability of a vessel
 - moment of statistical stability at small angles of heel
 - permeability

- shear force and bending moment calculations
- transverse and longitudinal stability using hydrostatic data
- vessel CG, centre of buoyancy and metacentre
- using automatic data-based equipment.

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:

- causes and repercussions of a heeling vessel
- data and information related to stability management, including:
 - cargo handling equipment
 - instructions of relevant maritime authorities
 - manufacturer instructions and procedures
 - organisational cargo handling procedures
 - relevant Australian and international standards and regulatory requirements
 - relevant WHS/OHS legislation
 - vessel and shore safety checklists
 - vessel cargo securing manual
 - vessel log
 - vessel register of materials handling equipment
- effects of angle of loll, including centre of buoyancy, how a ship behaves at the angle of loll, inherent dangers, corrective action and the difference between a loll and a list
- effects of density of sea water on the draught and freeboard of a vessel
- effects of flooding on transverse stability and trim, including:
 - calculation of vessel after flooding
 - cargo vessels
 - passenger ships
- features of the load-line and draught marks of a vessel and procedures for carrying out related calculations
- fundamental theories and principles of ship construction and the theories and factors that impact on trim and stability, and measures necessary to preserve trim and stability
- IMO recommendations concerning vessel stability
- levelling arrangements for damaged side compartments
- nature of flooding, including:
 - flooding due to collision or grounding
 - ingress of sea water through hatch covers or ruptured pipes
- principle stresses that act on the structure of a vessel, including panting and pounding, shear force, bending moments and torsional stress
- principles of parametric rolling and control methods
- principles of synchronous rolling and methods for its control

- procedures for calculating the required load distribution to achieve the desired trim
- responsibilities under international conventions and codes, including:
 - IMO grain regulations and grain heeling moment information
 - minimum stability requirements required by Load Line Rules and Intact Stability Code
 - passenger ship stability after damage
 - use of weather criterion
- stability, including:
 - dynamical
 - intact, including grain
 - statical
- suitable strategies for stabilising vessels
- survey and dry dock requirements
- trim and list
- typical problems related to the control of trim and stability for vessels of 500 gross tonnage (GT) and more
- vessels trim and stability factors for:
 - dry docking
 - excessive trim
 - free surface of a liquid
 - grounding
 - handling of heavy weights
 - large swell conditions
 - shift of cargo
 - wind heel
- WHS/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 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
- tools, equipment, machinery, materials and relevant personal protective equipment (PPE) currently used in industry.

Links

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