



**Australian Government**

**Department of Education, Employment and Workplace Relations**

# **TDMMB407B MAINTAIN SEAWORTHINESS OF VESSEL**

**Revision Number: 1**

## TDMMB407B MAINTAIN SEAWORTHINESS OF VESSEL

### Modification History

Not applicable.

### Unit Descriptor

UNIT DESCRIPTOR:

**This unit involves the skills and knowledge required to maintain the seaworthiness of a commercial vessel, including action to preserve the watertight integrity of the vessel and to ensure that stability conditions comply with the intact stability criteria of the International Maritime Organisation under all conditions of loading.**

### Application of the Unit

<b>Application of the unit</b>	The unit has application in the qualifications for an Engineer Watchkeeper on a vessel greater than 750 kW, i.e. Diploma of Transport&Distribution (Marine Engineering - Engineer Watchkeeper).
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### Licensing/Regulatory Information

<b>Licensing/legislative requirements</b>	The unit is consistent with the relevant sections of STCW 95 and Marine Orders under the Australian Navigation Act 1912, describing the role and responsibilities of an Engineer Watchkeeper.
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### Pre-Requisites

Not applicable.

## Employability Skills Information

Not applicable.

## Elements and Performance Criteria Pre-Content

<i>Elements describe the essential outcomes of a unit of competency.</i>	<i>Performance Criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the Evidence Guide.</i>
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
<b>1 Maintain watertight integrity of the vessel at all times</b>	<p>a Work to maintain seaworthiness of vessel is planned and carried out as per company procedures and established safety rules and regulations</p> <p>b Action is taken to ensure that coverage and frequency of checks and inspections on the vessel's seaworthiness complies with company procedures and established safety rules and MES and IMO regulations</p> <p>c Repairs and corrosion control are initiated and coordinated in accordance with company procedures and vessel and equipment manufacturer's instructions</p> <p>d Degree of vessel security is commensurate with anticipated weather and sea conditions and necessary vessel operations</p> <p>e Action taken in anticipation of environmental changes is timely and appropriate to the changes</p> <p>f Precautions are taken to ensure that vessel and on-board powered equipment is operated in accordance with manufacturer's instructions and codes of safe working practice</p> <p>g Action taken in emergency situations is appropriate to the significance of the situation and designed to maximise watertight integrity</p> <p>h Instructions to officers, crew and others are clear, concise and made at an appropriate time and place</p>

ELEMENT	PERFORMANCE CRITERIA
	<ul style="list-style-type: none"> <li>i Records of actions taken to carry out repairs and corrosion control and to ensure watertight integrity are complete, accurate and comply with statutory, commercial and enterprise requirements</li> </ul>
ELEMENT	PERFORMANCE CRITERIA
<p><b>2 Ensure the vessel's stress and stability for all stages of the voyage</b></p>	<ul style="list-style-type: none"> <li>a Stability calculations and weight distribution planning are conducted at a time, frequency and scope appropriate to the proposed nature of the voyage or operation</li> <li>b Weight distribution is designed to maintain the vessel within acceptable stability and stress limits for all stages of the voyage</li> <li>c Trim, draught and list are adjusted as required to safely and efficiently progress all vessel operations</li> <li>d Stability and stress monitoring is conducted in time and scope relevant to the nature and speed of vessel operations, and sufficient enough to ensure that stress and stability remain within acceptable limits at all times</li> <li>e Action taken where weight distribution is compromising vessel safety is prompt and designed to maximise safety</li> <li>f Tests and checks using computer-based stability programs or other appropriate methods are conducted at a frequency and scope that conform to manufacturer's instructions</li> <li>g Spurious or incorrect information from stress and stability calculations is promptly recognised and recalculated</li> <li>h Records of stress and stability calculations and action to maintain trim, stability and stress levels are maintained in accordance with company procedures and regulatory requirements</li> </ul>

## Required Skills and Knowledge

### REQUIRED KNOWLEDGE

*This describes the knowledge required for this unit.*

- 1 Sections of the IMO STCW 95 Code and AMSA Marine Orders dealing with the seaworthiness of vessels
- 2 ISM Code and associated vessel's safety management system and procedures
- 3 Relevant OH&S and pollution control legislation and policies
- 4 Procedures for the checking and inspecting a vessel's seaworthiness to ensure compliance with company procedures and established safety rules and regulations
- 5 Principles and procedures to ensure the watertight integrity of a vessel's hull in both normal and emergency situations
- 6 Damage control measures that may be required to maintain the integrity of the hull in a range of typical emergency situations that could occur on a vessel
- 7 Procedures for the initiation and coordination of repair and/or replacement procedures
- 8 Corrosion control measures, including surface preparation and painting and antifouling
- 9 Safety, environmental and hazard control precautions and procedures relevant to inspection and maintenance operations
- 10 Theory and calculations of vessel stability and dynamics, including:
  - a computation of hydrostatic stability data of a vessel
  - b calculation of a vessel's metacentre
  - c calculation of the transverse and longitudinal stability using hydrostatic data
  - d calculation of the moment of statical stability at small angles of heel
  - e determination of the centre of gravity of a vessel using an inclining experiment
  - f determining the required correction for the height of centre of gravity for the free surface effect
  - g determination of the values of the righting lever and construction of righting lever curves

## REQUIRED KNOWLEDGE

- h calculations for change of draught and trim when entering different water densities
- 11 Principal features of the structure of a vessel
- 12 A basic understanding of the properties and application of materials used in vessel construction
- 13 Construction, layout and subdivision requirements of a typical vessel, including an understanding of freeboard and bulkhead deck, watertight compartments, weathertight compartments, the bulkhead of the vessel and collision bulkhead
- 14 Typical construction features and stress characteristics for vessels of 500 gross tonnage or more or 3,000 kW propulsion power or more
- 15 The principal stresses which act on the structure of a vessel
  
- Effects of density of sea water on the draught and freeboard of a vessel
- 16
- 17 Features of the load-line and draught marks of a vessel and methods for performing related calculations
- 18 Maritime communication techniques needed
- 19 Problems related to the control of trim, stability and stresses of vessels and appropriate action and solutions
- 20 Records that must be maintained on the seaworthiness of a vessel

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## REQUIRED SKILLS

*This describes the basic skills required for this unit.*

- 1 Communicate effectively with other personnel when maintaining the seaworthiness of a vessel
- 2 Communicate with multilingual crew where applicable using established techniques

Effects of density of sea water on the draught and freeboard of a vessel

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- 3 Interpret and follow procedures for the maintenance of the seaworthiness of a vessel
- 4 Read and interpret vessel and machinery specifications, machinery design drawings, machine drawings, operational manuals, specifications, and electrical and control circuit diagrams
- 5 Interpret and follow all safety management procedures and precautions when maintaining the seaworthiness of a vessel
- 6 Read and interpret material safety data sheets
- 7 Work collaboratively with other shipboard personnel when maintaining the seaworthiness of a vessel
- 8 Prepare appropriate reports on the outcomes of inspection and maintenance activities to ensure the seaworthiness of the vessel
- 9 Identify problems that can occur during the maintenance of the seaworthiness of a vessel
- 10 Carry out calculations required when maintaining the seaworthiness of a vessel
- 11 Adapt to differing types of vessels and equipment
- 12 Take appropriate precautions to prevent pollution of the marine environment
- 13 Select and use materials, tools and equipment required when maintaining the seaworthiness of a vessel

## Evidence Guide

### Evidence Guide

### TDMMB407B MAINTAIN SEAWORTHINESS OF VESSEL

*The Evidence Guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for this Training Package.*

**Evidence Guide****TDMMB407B MAINTAIN SEAWORTHINESS OF VESSEL**

<p><b>1 Critical aspects of evidence required to demonstrate competency in this unit</b></p>	<p>Assessment must confirm appropriate knowledge and skills to:</p> <ul style="list-style-type: none"> <li>a Monitor and evaluate the seaworthiness of the vessel under normal and emergency situations</li> <li>b Take appropriate action to maintain trim, stability and stresses of the vessel within safe limits</li> <li>c Take appropriate preventative and remedial action to maintain the security and watertight integrity of the vessel's hull</li> <li>d Initiate and coordinate maintenance required to ensure the seaworthiness of a vessel</li> <li>e Identify typical problems related to trim stability and stress of a vessel and the watertight integrity of the hull, and take appropriate action in conjunction with other officers and crew</li> <li>f Exercise all required safety, environmental and hazard control precautions and procedures during inspection and maintenance operations</li> <li>g Communicate effectively with others when taking action to maintain the seaworthiness of the vessel</li> </ul>
<p><b>2 Evidence required for demonstration of consistent performance</b></p>	<ul style="list-style-type: none"> <li>a Performance is demonstrated consistently over a period of time and in a suitable range of contexts</li> <li>b Consistently applies underpinning knowledge and skills when: <ul style="list-style-type: none"> <li>1 carrying out routine and emergency checks and inspections of a vessel's seaworthiness</li> <li>2 identifying and evaluating problems concerning the trim, heel, stability and stresses on a vessel and the integrity of its hull and determining appropriate courses of action</li> <li>3 initiating and coordinating maintenance activities required to ensure the seaworthiness of a vessel</li> </ul> </li> </ul>



**Evidence Guide****TDMMB407B MAINTAIN SEAWORTHINESS OF VESSEL**

- 4 applying safety precautions relevant to maintenance operations
- 5 identifying and implementing improvements to procedures for maintaining the seaworthiness of a vessel
- c Shows evidence of application of relevant workplace procedures, including:
  - 1 relevant sections of IMO Conventions and AMSA Marine Orders

**Evidence Guide (continued)****TDMMB407B MAINTAIN SEAWORTHINESS OF VESSEL**

**2 Evidence required for demonstration of consistent performance (continued)**

- 2 OH&S regulations and hazard prevention policies and procedures
- 3 job procedures and work instructions
- 4 relevant vessel manufacturer's guidelines relating to the trim, stability and stress limits of the vessel
- 5 procedures to protect the integrity and security of the vessel's hull
- 6 environmental protection procedures when pumping ballast water
- d Action is taken promptly to report and/or rectify out-of-limit trim, stability and stresses of the vessel or problems with the integrity of the vessel's hull in accordance with manufacturer's instructions, statutory requirements and company procedures
- e Work is completed systematically with required attention to detail
- f Recognises and adapts appropriately to cultural differences in the workplace, including modes of behaviour and interactions between crew and others

<b>Evidence Guide (continued)</b> <b>TDMMB407B MAINTAIN SEAWORTHINESS OF VESSEL</b>	
<b>3 Context of assessment</b>	<ul style="list-style-type: none"> <li>a Assessment of competency must comply with the assessment requirements of the relevant maritime regulations</li> <li>b Assessment of this unit must be undertaken within relevant marine authority approved and audited arrangements by a registered training organisation:               <ul style="list-style-type: none"> <li>1 As a minimum, assessment of knowledge must be conducted through appropriate written/oral examinations, and</li> <li>2 Appropriate practical assessment must occur:                   <ul style="list-style-type: none"> <li>i at the registered training organisation; and/or</li> <li>ii on an appropriate working or training vessel</li> </ul> </li> </ul> </li> </ul>
<b>4 Specific resources required for assessment</b>	<p>Access is required to opportunities to:</p> <ul style="list-style-type: none"> <li>a participate in a range of exercises, case studies and other simulated practical and knowledge assessments that demonstrate the skills and knowledge to maintain the seaworthiness of a vessel in a range of operational situations; and/or</li> </ul>

<b>Evidence Guide (continued)</b> <b>TDMMB407B MAINTAIN SEAWORTHINESS OF VESSEL</b>	
<b>4 Specific resources required for assessment</b>  <b>(continued)</b>	<ul style="list-style-type: none"> <li>b assist in maintaining the seaworthiness of a vessel in a range of operational situations either:               <ul style="list-style-type: none"> <li>i using a simulator, meeting the requirements of Section A I/12 of the IMO STCW 95 Code, over an appropriate range of simulated loading and operational situations</li> <li>ii in appropriate practical situations on an operational commercial or training vessel</li> </ul> </li> </ul>

## Range Statement

### Range Statement

### TDMMB407B MAINTAIN SEAWORTHINESS OF VESSEL

*The Range Statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance.*

#### VARIABLE

#### SCOPE

### 1. GENERAL CONTEXT

<b>a. Work must be carried out:</b>	1 in compliance with the relevant sections of the AMSA Marine Orders and IMO STCW Conventions and Codes
<b>b. Work is performed:</b>	1 relatively independently within broad operational requirements, with limited accountability and responsibility for self and others in achieving the prescribed outcomes
<b>c. Work involves:</b>	1 the application of vessel construction principles and stability and stress techniques to the management of the seaworthiness of a vessel across a wide and often unpredictable variety of operational contexts. Monitoring and supervising the implementation of a broad plan or strategy for the maintenance of the seaworthiness of a vessel is required. Defined accountability and responsibility for self and others in achieving the outcomes is involved
<b>d. Work requires:</b>	1 responsibility in the management of the maintenance of the seaworthiness of a vessel

### 2. WORKSITE ENVIRONMENT

**Range Statement****TDMMB407B MAINTAIN SEAWORTHINESS OF VESSEL**

<b>a Vessel may include:</b>	1 any Australian or international commercial vessel.
<b>b Seaworthiness of a vessel must be maintained:</b>	1 by day or night in both normal and emergency situations 2 under any possible conditions of sea, weather and loading 3 while underway 4 during berthing and unberthing operations 5 while anchoring or mooring 6 when bunkering 7 when loading/unloading cargo

**Range Statement (continued)****TDMMB407B MAINTAIN SEAWORTHINESS OF VESSEL**

<b>VARIABLE</b>	<b>SCOPE</b>
<b>c Action taken to check the seaworthiness of a vessel may include:</b>	1 routine inspections 2 checks prior to departure 3 checks on completion of a voyage 4 checks on completion of maintenance activities 5 checks in anticipation of a change in sea and weather conditions 6 checks during an emergency which may have caused damage or changes to the stability and stresses of the vessel

**Range Statement (continued)****TDMMB407B MAINTAIN SEAWORTHINESS OF VESSEL**

<b>d Means of maintaining the security and stability of a vessel include:</b>	<ol style="list-style-type: none"> <li>1 closing openings</li> <li>2 taking precautions when using lifting equipment and associated equipment</li> <li>3 position, stowage and lashing of cargo, stores and equipment</li> <li>4 action to avoid or minimise cargo shift during a voyage</li> <li>5 distribution of load on vessel</li> <li>6 ballast management</li> <li>7 measures to avoid corrosion and metal fatigue on the hull</li> <li>8 damage control measures to maintain, stabilise or restore the watertight integrity of the hull</li> </ol>
<b>e Maintenance may include:</b>	<ol style="list-style-type: none"> <li>1 repairs to equipment, components and vessel's structure and appliances</li> <li>2 surface preparation and painting</li> <li>3 antifouling</li> <li>4 lubrication</li> <li>5 replacement of faulty equipment or components</li> </ol>
<b>f Stability and stress parameters may include:</b>	<ol style="list-style-type: none"> <li>1 transverse stability - both dynamic and static</li> <li>2 longitudinal stability</li> <li>3 free surface effect</li> <li>4 torsion</li> <li>5 bending moments</li> </ol>

**Range Statement (continued)****TDMMB407B MAINTAIN SEAWORTHINESS OF VESSEL**

<b>VARIABLE</b>	<b>SCOPE</b>
<b>g Documentation /records may include</b>	<ol style="list-style-type: none"> <li>1 ISM Code safety management system plans, procedures, checklists and instructions</li> <li>2 operational orders</li> <li>3 IMO Conventions and Class Rules</li> <li>4 AMSA Marine Orders</li> <li>5 'Trim and Stability Booklet'</li> <li>6 company procedures</li> <li>7 maintenance schedules and records</li> <li>8 vessel and equipment manufacturer's instructions, specifications and recommended procedures</li> <li>9 instructions of relevant maritime authorities related to the seaworthiness of vessels</li> <li>10 relevant Australian and international standards</li> </ol>
<b>h Applicable procedures and codes may include</b>	<ol style="list-style-type: none"> <li>1 IMO Conventions related to the seaworthiness of vessels</li> <li>2 ISM Code</li> <li>3 relevant sections of AMSA Marine Orders related to the seaworthiness of vessels</li> <li>4 relevant international, Commonwealth, State and Territory OH&amp;S legislation</li> </ol>

## Unit Sector(s)

Not applicable.

## Field

Field B Equipment Checking and Maintenance

## Relationship to other units

<b>Relationship to other units</b>	The unit must be assessed in conjunction with other units that relate to the functions of the occupation(s) concerned.
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