



Australian Government

Department of Education, Employment and Workplace Relations

TDMMB1307B CARRY OUT SHIPBOARD FABRICATION AND REPAIR OPERATIONS

Revision Number: 1

TDMMB1307B CARRY OUT SHIPBOARD FABRICATION AND REPAIR OPERATIONS

Modification History

Not applicable.

Unit Descriptor

UNIT DESCRIPTOR:

This unit involves the skills and knowledge required to carry out shipboard fabrication and repair operations on a commercial vessel of unlimited propulsion power. This includes working with a senior engineer on the analysis of fabrication and repair requirements and carrying out established engineering fabrication and repair tasks.

Application of the Unit

Application of the unit	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

Licensing/legislative requirements	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
1 Detect, identify and investigate faulty and deteriorated structures and components	a Inspections of vessel structures and components are carried out as per vessel's survey requirements and manufacturer's instructions and specifications b Damaged, faulty or deteriorated structures and components are investigated in accordance with marine engineering practice and manufacturer's instructions and appropriate action is initiated to rectify the identified problem c Damaged or faulty equipment and components are identified and are reported and action is initiated as required for isolation, tagging and fabrication, repair or replacement as per company procedures and established marine engineering practice d Appropriate action is taken in consultation with the responsible engineer to prevent further damage in accordance with vessel's planned maintenance system or procedures, established marine engineering practice, safety regulations and manufacturer's instructions e Decisions are made in consultation with the senior engineer to carry out temporary or permanent repairs depending on the vessel's position and circumstances

ELEMENT	PERFORMANCE CRITERIA
1 Detect, identify and investigate faulty and deteriorated structures and components (continued)	f Appropriate consultation is undertaken with classification society and marine administration concerning the nature of the fabrication and repairs and any contingency or emergency action required g Engine room personnel are organised and controlled to facilitate fabrication and repairs in accordance with company procedures and established marine engineering practice
2 Fabricate and repair faulty and deteriorated structures and components	a In consultation with the responsible engineer, a plan for the fabrication and repair of damaged, faulty or deteriorated vessel structures and components is established in accordance with company planned maintenance system or procedures, manufacturer's instructions and established marine engineering practice b Required tools and materials to carry out the fabrication and repair tasks are selected and obtained in accordance with vessel's procedures c Appropriate personnel are given timely advice of the fabrication and repair activities d Where relevant, the repair area is isolated and safety and warning signs are erected prior to commencing fabrication and repair activities in accordance with safety regulations and vessel's procedures e Fabrication and repair of damaged, faulty or deteriorated vessel structures and components are carried out in consultation with the responsible engineer using appropriate tools and materials in accordance with manufacturer's instructions and established marine engineering practice f Repaired structures and components are checked against specifications in accordance with vessel's survey and regulatory requirements and manufacturer's instructions and specifications

ELEMENT	PERFORMANCE CRITERIA
3 Follow safety and hazard control procedures	- a Fabrication and repairs of vessel structures, components and fittings are conducted in accordance with safety regulations and company procedures in consultation with the responsible engineer - b Fabrication and repair hazards are identified and action is taken to minimise or eliminate risk to personnel, vessel and the environment - c Personal protection clothing and equipment are used in accordance with safety regulations and established engineering practice - d Safety, hazard minimisation and pollution control procedures and national and international regulations are followed at all times during fabrication and repair operations

ELEMENT	PERFORMANCE CRITERIA
3 Follow safety and hazard control procedures (continued)	- e In consultation with a senior engineer, where relevant, procedures and precautions necessary for entry into a pump room, fuel tanks or other confined spaces on a vessel are correctly followed - f Action is taken in the event of a serious failure or deterioration of the vessel's structures or components to secure the structures and the vessel, and maintain the safety of the vessel and persons involved - g Vessel's emergency and contingency plans are correctly followed in the event of a serious failure or deterioration of the vessel's structures or components
4 Complete maintenance and repair documentation	- a Correct records are kept concerning any identified structural or component faults or deterioration and related fabrication and repair operations - b All planned maintenance system and repair documentation is completed in accordance with survey and company requirements and regulations

Required Skills and Knowledge

REQUIRED KNOWLEDGE

This describes the knowledge required for this unit.

- 1 National and international regulations, IMO Conventions and Codes, including AMSA Marine Orders applicable to maintenance and repair operations on vessels of unlimited propulsion power
- 2 Relevant OH&S and pollution control legislation, policies and procedures
- 3 Established engineering practice for the checking, fabrication and repair of marine structures, components, fittings and equipment
- 4 Operational characteristics and performance specifications for the different types of shipboard machinery usually found on a vessel of unlimited propulsion power
- 5 Procedures for carrying out shipboard machinery testing, troubleshooting and repair as part of routine maintenance procedures to ensure compliance with the company and survey requirements and established safety rules and regulations
- 6 Planned maintenance systems and procedures for the condition monitoring of structures, fittings and components, including responsibilities and requirements covered by various forms of vessel survey
- 7 The nature and causes of typical deterioration and damage to vessel structures, components and fittings and the available methods for its detection and related fabrication and repair
- 8 Fabrication and repair hazards and problems and appropriate preventative and remedial action and solutions
- 9 Safe procedures for handling heavy structures and component parts during fabrication and repair
- 10 Safe procedures for the use of hand and power tools, welding and other maintenance equipment during maintenance and repair of shipboard structures, components and fittings
- 11 Procedures for the initiation and coordination of temporary and permanent repair and/or replacement procedures on board vessels at sea, alongside and in dry dock
- 12 Safety, environmental and hazard control precautions and procedures relevant to shipboard inspection and maintenance operations
- 13 Principal features of vessel construction, including the layouts and the structural

REQUIRED KNOWLEDGE

- strength of different types of vessels
- 14 A basic understanding of the properties and application of materials and structures typically used in the construction of a vessel of unlimited propulsion power and its associated operational machinery
- 15 Maintenance and repair records that must be maintained on a vessel to meet the requirements of the company, survey requirements and regulatory authorities
- 16 Maritime communication techniques needed during maintenance and repair operations
- 17 Purpose and content of material safety data sheets
- 18 Procedures for the reading and interpretation of machinery performance readings and indications
- 19 Typical vessel and machinery specifications, machinery design drawings, machine drawings, operational manuals and specifications
- 20 A basic understanding of the components and materials used within various types of vessel's equipment, including:
 - a pumps and pumping systems
 - b heat exchangers
 - c valves and safety fittings
 - d marine air compressors
 - e refrigeration and air-conditioning plants
 - f transmission systems, including design, manufacture and materials of gear teeth
 - g auxiliary boilers and waste heat units
 - h feed systems for boilers
 - i auxiliary steam turbines
 - j construction of diesel engines, including the materials used
 - k fuel pumps used in diesel engines

- 20 A basic understanding of the components and materials used within various types of vessel's equipment, including:
- 21 Basic principles of mechanics as they relate to fabrication and repair activities, including:
- a stress and strain caused by axial loads
 - b mechanical advantage, velocity ratio and efficiency of lifting and geared marine machinery
 - c effects on stress and stability caused by a change or shift in the mass in a vessel
 - d statics, force as a vector, triangle and polygon of forces, the principle of moments, application to simply supported beams and cranked levers, moments of force, couples, centroids and centres of gravity limited to geometrical shapes. resultant and equilibrant of a system of concurrent coplanar forces
 - e laws of friction for dry surfaces, coefficient of friction (horizontal plane only), lubrication of bearings and plain surfaces
 - f linear displacement, time speed, velocity and acceleration, angular motion
 - g problems with constant force or force with linear variation. torque, work, energy, power. conservation of energy, potential and kinematic energy, Newton's laws of motion, momentum, rate of change of momentum, centrifugal force
 - h simple lifting machines, graphs of load-effort and load-efficiency, linear law, velocity ratio
 - i mechanical advantage and efficiency of the following machines: wheel and axle, differential pulley blocks, screw jack, Warwick screw, hydraulic jack, worm driven chain blocks and single and double purchase crab winches, reduction gearing
 - j direct stress and strain, Hooke's law, modulus of elasticity, elastic limit, ultimate tensile strength, yield stress, limit of proportionality, safety factor, shear stress
 - k circumferential and longitudinal stress in thin cylindrical and spherical shells subject to internal pressure

22 Basic thermodynamics as it relates to the responsibilities of an officer in charge of an engineering watch, including:

- a basic thermodynamic properties of common working fluids
- b methods of heat transfer and related problems
- c principles of heat transfer by conduction, convection and radiation and their application to marine systems
- d elementary principles of steam plants
- e saturated dry and wet steam, dryness fraction, superheated steam, enthalpy, steam tables, evaporation
- f basic steam plant cycles and explain the function of each component
- g the combustion process and the calorific value of fuels
- h air/fuel ratio and the significance of excess air on combustion
- i the operating cycle of single stage reciprocating air-conditioners, including methods for calculating the mass of air delivered
- j clearance volume, its effect on volumetric efficiency and methods of calculating the volumetric efficiency
- k advantages of multistaging and intercooling
- l meaning of gauge and absolute pressure
- m temperature and temperature scales
- n SI units and common thermodynamic terms and principles.
- o gases and gas cycles
- p boilers and evaporators
- q refrigeration and air-conditioning
- r the use and advantages of insulation

TDMMB1307B CARRY OUT SHIPBOARD FABRICATION AND REPAIR OPERATIONS

22 Basic thermodynamics as it relates to the responsibilities of an officer in charge of an engineering watch, including:

REQUIRED SKILLS

This describes the basic skills required for this unit.

- 1 Communicate effectively with other personnel when carrying out shipboard fabrication and repair operations
- 2 Communicate with multilingual crew, where applicable, using established techniques
- 3 Interpret and follow procedures for shipboard fabrication and repair operations
- 4 Interpret and follow all safety management procedures and precautions when carrying out shipboard fabrication and repair operations
- 5 Read and interpret material safety data sheets
- 6 Read and interpret vessel and machinery specifications, machinery design drawings, machine drawings, operational manuals, specifications and electrical and control circuit diagrams
- 7 Work collaboratively with other shipboard personnel when carrying out shipboard fabrication and repair operations
- 8 Identify problems that can occur during shipboard fabrication and repair operations and take appropriate action to report and rectify problems identified
- 9 Carry out calculations required when carrying out shipboard fabrication and repair operations
- 10 Adapt to differing types of equipment and materials from one vessel to another and when equipment is changed
- 11 Take appropriate precautions to prevent pollution of the marine environment
- 12 Select and use tools and equipment required for shipboard fabrication and repair operations

Evidence Guide

Evidence Guide

TDMMB1307B CARRY OUT SHIPBOARD FABRICATION AND REPAIR OPERATIONS

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.

1 Critical aspects of evidence required to demonstrate competency in this unit	Assessment must confirm appropriate knowledge and skills to: - a Inspect shipboard structures and components for damage, faults and deterioration against specifications on a vessel of unlimited propulsion power - b Identify damaged, faulty, worn and deteriorated structures and components and in consultation with the responsible engineer, initiate appropriate action for repair or replacement - c Plan and carry out required fabrication and repairs in consultation with the senior engineer in accordance with established marine engineering practice - d Exercise all required safety, environmental and hazard control precautions and procedures when carrying out fabrication and repair activities - e Identify typical maintenance and repair problems and hazards and take appropriate action - f Communicate effectively with others during fabrication and repair operations - g Ensure adherence to national and international regulations, IMO Conventions and Codes
2 Evidence required for demonstration of consistent performance	- a Performance is demonstrated consistently over a period of time and in a suitable range of contexts - b Consistently applies underpinning knowledge and skills when: 1 inspecting shipboard structures, components and fittings for damage, faults and deterioration against

Evidence Guide

TDMMB1307B CARRY OUT SHIPBOARD FABRICATION AND REPAIR OPERATIONS

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| | <p>specifications</p> <ol style="list-style-type: none"> 2 identifying damaged, faulty, worn and deteriorated structures and components and initiating appropriate action for repair or replacement 3 planning and carrying out required fabrication and repairs in consultation with the senior engineer 4 identifying and evaluating fabrication and repair problems and determining appropriate courses of action 5 applying safety precautions relevant to mechanical and electrical machinery and equipment maintenance and repair operations 6 completing mechanical and electrical machinery and equipment maintenance and repair documentation and records <p>c Shows evidence of application of relevant workplace procedures, including:</p> |
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Evidence Guide (continued)

TDMMB1307B CARRY OUT SHIPBOARD FABRICATION AND REPAIR OPERATIONS

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| <p>Evidence required for demonstration of consistent performance (continued)</p> <p>2</p> | <ol style="list-style-type: none"> 1 relevant sections of international Conventions and Codes and AMSA Marine Orders 2 OH&S regulations and hazard prevention policies and procedures 3 ISM Code safety management system procedures and work instructions on fabrication and repair of structures, components and fittings, including specifications and directions on equipment capability and limitations 4 following on-board housekeeping processes 5 waste, pollution and recycling management processes <p>d Action is taken promptly to report and/or rectify damaged</p> |
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Evidence Guide (continued)

TDMMB1307B CARRY OUT SHIPBOARD FABRICATION AND REPAIR OPERATIONS

	and worn structures, components and fittings, in accordance with statutory requirements, company procedures and the ISM Code e Work is managed, controlled and 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
3 Context of assessment	a Assessment of competency must comply with the assessment requirements of the relevant maritime regulations b Assessment of this unit must be undertaken within relevant marine authority approved and audited arrangements by a registered training organisation: 1 As a minimum, assessment of knowledge must be conducted through appropriate written/oral examinations, and 2 Appropriate practical assessment must occur: - i at the registered training organisation; and/or - ii on an appropriate working or training vessel
4 Specific resources required for assessment	Access is required to opportunities to: a participate in a range of practical and theoretical assignments, exercises, case studies and other assessments that demonstrate the skills and knowledge to fabricate and repair structures, components and fittings typically found on a vessel of unlimited propulsion power; and/or b fabricate and repair structures, components and fittings in consultation with the responsible engineer on a commercial or training vessel of unlimited propulsion power

Range Statement

Range Statement

TDMMB1307B CARRY OUT SHIPBOARD FABRICATION AND REPAIR OPERATIONS

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

a. Work must be carried out:	1 in compliance with mandatory rules and regulations and IMO Conventions and Codes, including the relevant sections of the AMSA Marine Orders and to ensure that applicable codes, guidelines and standards recommended by IMO, the classification societies and maritime industry organisations are taken into account
b. Work is performed:	1 relatively independently in consultation with a senior engineer under broad operational requirements, with accountability and responsibility for self and others in achieving the prescribed outcomes
c. Work involves:	1 the application of marine engineering practice to the fabrication and repair of structures and components typically found on a vessel of unlimited propulsion power. Implementation of a broad plan or strategy for shipboard maintenance and repair is required and accountability and responsibility for self and others in achieving the outcomes is involved

Range Statement

TDMMB1307B CARRY OUT SHIPBOARD FABRICATION AND REPAIR OPERATIONS

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| d. Work requires: | 1 some judgement in engineering functions related to fabrication and repair operations and procedures. This includes working with a senior engineer on the analysis of fabrication and repair requirements and carrying out established engineering fabrication and repair tasks |
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2. WORKSITE ENVIRONMENT

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| a Structures and components to be fabricated or repaired may include: | 1 those typically found on any Australian or international commercial vessel of unlimited propulsion power |
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| b Fabrication and repair activities may include: | 1 routine maintenance inspections of vessel's structures, components and fittings
2 identification of any deterioration of a vessel's structure, fittings and components |
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Range Statement (continued)

TDMMB1307B CARRY OUT SHIPBOARD FABRICATION AND REPAIR OPERATIONS

VARIABLE	SCOPE
b Fabrication and repair activities may include: (continued)	3 identification of faulty structures or fittings and arranging for repair or replacement 4 fabrication of metal and wooden structures and components to specification 5 preparation of marine surfaces prior to the application of the prescribed marine coating

Range Statement (continued)

TDMMB1307B CARRY OUT SHIPBOARD FABRICATION AND REPAIR OPERATIONS

	6 selection and application of appropriate marine preservatives or finishes for particular surfaces
c Damage or deterioration of vessel's structure, components and fittings may include:	1 corrosion of structures, components, hull fittings and equipment 2 damage caused through an accident 3 deterioration caused by wear or metal fatigue
d Maintenance tools and equipment may include:	1 hand tools, including spanners, wrenches, screwdrivers, hacksaws, chipping hammers and scrapers, etc. 2 electric power tools such as grinders, sanders and drills 3 welding equipment 4 milling machines, bench drills and lathes 5 pneumatic power tools such as grinders, sanders and drills 6 marine preservative finish application equipment such as brushes, spay guns, rollers 7 greasing and lubrication tools 8 rinsing and storage equipment 9 protective clothing and equipment such as: - i eye and ear protection - ii safety boots and helmet - iii dust and fume masks

Range Statement (continued)

TDMMB1307B CARRY OUT SHIPBOARD FABRICATION AND REPAIR OPERATIONS

e Fabrication and repair hazards may include:	1	moving heavy loads using unsafe lifting procedures
	2	unsecured machinery, components or repair equipment
	3	slippery deck
	4	welding equipment

Range Statement (continued)

TDMMB1307B CARRY OUT SHIPBOARD FABRICATION AND REPAIR OPERATIONS

VARIABLE	SCOPE
e Fabrication and repair hazards may include: (continued)	5 sharp tools and implements
	6 power tools
	7 moving and rotating machinery
	8 flammable liquids, vapours and fuel
	9 faulty machinery equipment handling equipment and lifting gear
	10 using equipment beyond safe working limits
	11 poor housekeeping procedures
	12 non-compliance with safe working procedures
	13 electrical wiring and systems
	14 hot pipes and valves (steam, fuel oil, lubricating oil)
	15 cold pipes and valves (refrigeration and liquefied gas cargoes)
	16 working at heights and in confined spaces

Range Statement (continued)

TDMMB1307B CARRY OUT SHIPBOARD FABRICATION AND REPAIR OPERATIONS

f Documentation and records may include	1 ISM Code safety management system plans, procedures, checklists and instructions 2 vessel's and company's planned maintenance system, repair procedures and instructions 3 machinery and vessel manufacturer's specifications, instructions and recommended procedures 4 maintenance log, running sheets and records, including computer database of maintenance records, where relevant 5 vessel's survey as it relates to shipboard structures and components 6 relevant sections of national and international regulations, IMO Conventions and Codes, including AMSA Marine Orders and classification society rules dealing with shipboard maintenance and repair 7 instructions of relevant maritime authorities and classification societies concerning shipboard maintenance and repair
g Applicable legislation, regulations and codes may include:	1 sections of national and international regulations, IMO Conventions and Codes, including AMSA Marine Orders and classification society rules related to shipboard maintenance and repair on vessels of unlimited propulsion power 2 relevant international, Commonwealth, State and Territory OH&S legislation 3 relevant international, Commonwealth, State and Territory engineering practice standards

Unit Sector(s)

Not applicable.

Field

Field B Equipment Checking and Maintenance

Relationship to other units

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