



Australian Government

Department of Education, Employment and Workplace Relations

TDMMR1607B PLAN AND SCHEDULE OPERATIONS ON VESSELS OVER 750KW PROPULSION POWER

Revision Number: 1

TDMMR1607B PLAN AND SCHEDULE OPERATIONS ON VESSELS OVER 750KW PROPULSION POWER

Modification History

Not applicable.

Unit Descriptor

UNIT DESCRIPTOR:

This unit involves the skills and knowledge required to plan and schedule operations within the limits of responsibility of a Marine Engineer Class 2 on a commercial vessel powered by main propulsion machinery of 750 kW propulsion power or above. This covers the knowledge and skills required to work as:

- **Chief Engineer on vessels between 750 kW and 3,000 kW propulsion power**
- **First Engineer (Second Engineer for STCW 95 Code) on vessels over 750 kW propulsion power.**

This includes the management and coordination of relevant operational activities and the application of advanced diagnostic and problem solving techniques to operational difficulties.

Application of the Unit

Application of the unit	
	The unit has application in qualifications for Chief Engineer on a vessel between 750 kW and 3,000 kW propulsion power operating in international waters. It is usually packaged within the Advanced Diploma of Transport&Distribution(Marine Engineering Class 2).

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 requirements for a Chief Engineer on a vessel between 750 kW and 3,000 kW propulsion power operating in international waters.
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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 Plan operations of vessel's power installation and auxiliary machinery	- a Bridge orders and operational instructions for the proposed voyage are correctly interpreted in accordance with established procedures - b Capacity and technical specifications of engines, propulsion plant and auxiliary machinery are reviewed and confirmed - c Operational plans for the vessel's power installation and auxiliary machinery are prepared that suit the design parameters of the installation and machinery and the requirements of the proposed voyage in accordance established procedures - d Contingency and emergency plans are prepared based on a risk assessment of potential engine room operational problems and hazards that could occur during the voyage in

ELEMENT	PERFORMANCE CRITERIA
	accordance with established procedures

ELEMENT	PERFORMANCE CRITERIA
2 Schedule operations of vessel's power installation and auxiliary machinery	- a Operational schedules for the vessel's power installation and auxiliary machinery are prepared based on the confirmed operational plan using established project planning techniques - b Operational schedules are documented as per vessel and company procedures - c Operational schedules are distributed to relevant personnel on board vessel

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 the planning and scheduling of the operations of the power installations and auxiliary machinery on vessels between 750 kW and 3,000 kW propulsion power
- 2 Relevant OH&S legislation, policies and procedures
- 3 Established engineering practice for the planning and scheduling of the operations of the power installations and auxiliary machinery on vessels between 750 kW and 3,000 kW propulsion power
- 4 Engineering project scheduling and planning methods, including the use of GANTT charts and CPM/PERT network techniques
- 5 Operational characteristics and performance specifications for the types of engines, propulsion plant and auxiliary machinery usually found on a vessel between 750 kW and 3,000 kW propulsion power
- 6 Procedures for the planning and scheduling of the operation of the power installations and auxiliary machinery on vessels between 750 kW and 3,000 kW propulsion power ensure compliance with the operational instructions for the voyage, bridge orders, technical specifications, survey requirements and established safety rules and regulations
- 7 The nature and causes of typical potential malfunctions and/or poor performance of engines, propulsion plant and auxiliary machinery
- 8 Hazards and problems that can occur with power installations and auxiliary machinery during voyages of vessels between 750 kW and 3,000 kW propulsion power and appropriate preventative and remedial action and solutions
- 9 Safety, environmental and hazard control precautions and procedures relevant to the operation of the power installations and auxiliary machinery on vessels between 750 kW and 3,000 kW propulsion power
- 10 Operational and performance evaluation records that must be maintained on a vessel to meet the requirements of the company, survey requirements and regulatory authorities
- 11 Maritime communication techniques needed when planning and scheduling of the operation of the power installation and auxiliary machinery on a vessel between 750 kW and 3,000 kW propulsion power

REQUIRED KNOWLEDGE

- 12 Typical vessel and machinery specifications, machinery design drawings, machine drawings, operational manuals, specifications and electrical and control circuit diagrams
- 13 Purpose and content of material safety data sheets
- 14 Principles and operational characteristics of internal combustion engines, including:
 - a two stroke and four stroke cycles
 - b optimum combustion parameters and their control
 - c diesel engine scavenging systems both in normal and emergency operation
 - d atmospheric pollution caused by diesel engine combustion and ways in which it can be minimised
 - e determination of shaft power
 - f irregularities in the performance of machinery and plant

Methods of providing air for combustion

- 15
- 16 Theory and preventative strategies for scavenge and uptake fires, and starting air-line, crankcase and gearbox explosions, including:
 - a plans for hazard reduction
 - b procedures for extinguishment of scavenge fires and dealing with crankcase mist detector alarm
 - c regaining of control after starting air-line, crankcase and gearbox explosions
- 17 Basic principles of fuel systems, including:
 - a typical injection pressures and viscosities for different grades of fuel
 - b alterations to fuel pumps, camshafts and injectors for varying fuel types
 - c differences between constant and variable injection timing of fuel
 - d injection requirements for different speeds of diesel engine
 - e common service faults, symptoms and causes of combustion problems and

- Methods of providing air for combustion
- 15 related solutions
- f fuel line pulsation damping devices and leakage protection
 - g fuel valve cooling arrangements
 - h uni-fuel and dual fuel systems
- 18 Basic principles of engine cooling and lubrication, including:
- a different methods of diesel engine cooling
 - b need for treatment of engine cooling water
 - c methods of treating engine cooling water
 - d diesel engine lubrication requirements
 - e methods of lubricating diesel engine components
 - f theory and types of lubrication
 - g relative characteristics, and applications of mineral and synthetic oils
 - h contaminants that may affect lubricants, their effect on machinery performance, and action that can be taken to avoid and remedy contamination of lubricants
 - i common lubrication problems and their solution
- 19 Basic principles of marine control systems, including
- a common sensors and their associated transmitters
 - b analysis of control loops
 - c temperature and pressure control systems used on board vessel
 - d methods of load-dependent cooling of diesel alternators on heavy fuel oils
 - e analysis of typical level control systems used on board vessel
 - f operation and application of electronic PID controllers

- f operation and application of electronic PID controllers
- 20 Procedures for the testing of boiler water, machinery cooling water and lubricating oil
- 21 Principles of operation of hydraulic and electronic overspeed governors
- 22 Basic principles and functions of machinery space monitoring and alarm systems, including:
 - a central cooling and load-dependent cooling control systems
 - b main engine control arrangements for fixed pitch and controllable pitch propeller systems requiring sequential control
 - c alarm and monitoring systems involving data loggers, alarm loggers and trend analysis
- 23 Basic principles of air-conditioning and refrigeration systems, including:
 - a principles of operation
 - b performance indicators
 - c characteristics, hazards and handling requirements of CFCs and HCFCs
 - d safety and environmental requirements associated with air-conditioning and refrigeration systems
- 24 Basic principles of thermodynamics and heat and heat engines, including:
 - a heat transfer, including log mean temperature and circular pressure vessels
 - b gases
 - c gas cycles
 - d properties and expansion of steam
 - e steam cycles
 - f boilers and evaporators
 - g steam turbines
 - h combustion with a specific understanding of volumetric analysis
 - i refrigeration and air-conditioning

- f operation and application of electronic PID controllers
- 25 Principles and operational characteristics of steam turbines, gearing and associated equipment, including:
- a lubrication
 - b gear configurations
 - c thrust blocks
 - d air ejectors
 - e determination of shaft power
 - f irregularities in the performance of machinery and plant
- 26 Basic principles and operational characteristics of boilers and associated equipment, including:
- a boiler water tests and treatment
 - b corrosion
 - c superheaters
 - d de-aerators
 - e open and closed feed systems
 - f uptake fires

c superheaters

REQUIRED SKILLS

This describes the basic skills required for this unit.

- 1 Communicate effectively with other personnel when planning and scheduling operations on vessels between 750 kW and 3,000 kW propulsion power
- 2 Interpret and follow procedures for the planning and scheduling of operations on vessels between 750 kW and 3,000 kW propulsion power
- 3 Read and interpret equipment performance readings and instrumentation
- 4 Read and interpret material safety data sheets
- 5 Read and interpret vessel and machinery specifications, machinery design drawings, machine drawings, operational manuals, specifications and electrical and control circuit diagrams
- 6 Work collaboratively with other shipboard personnel when planning and scheduling operations on vessels between 750 kW and 3,000 kW propulsion power
- 7 Identify problems that can occur during the planning and scheduling operations on vessels between 750 kW and 3,000 kW propulsion power
- 8 Carry out calculations required when planning and scheduling
- 9 Adapt to differing types of operational systems, policies and procedures from one vessel to another and when equipment and systems are changed
- 10 Select and use any computing and other equipment and resources required when planning and scheduling operations on vessels between 750 kW and 3,000 kW propulsion power

Evidence Guide

Evidence Guide TDMMR1607B PLAN AND SCHEDULE OPERATIONS ON VESSELS OVER 750 KW PROPULSION POWER
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The Evidence Guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement

Evidence Guide TDMMR1607B PLAN AND SCHEDULE OPERATIONS ON VESSELS OVER 750 KW PROPULSION POWER

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 Plan and schedule the operations of vessel's power installation and auxiliary machinery for the voyage of a vessel between 750 kW and 3,000 kW propulsion power - b Comply with all required safety, environmental and hazard control precautions and procedures when planning the operations of vessel's power installation and auxiliary machinery - c Identify potential operational problems and hazards and develop appropriate contingency plans within the scope of responsibility of an Engineer Class 1 - d Document and disseminate operational plans and schedules - e 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 planning and scheduling the operation of the power installation and auxiliary machinery for the voyage of a vessel 2 complying with required safety, environmental and hazard control precautions and procedures when planning the operation of a vessel's power installation and auxiliary machinery 3 identifying typical potential operational problems and hazards and developing appropriate contingency plans 4 documenting and disseminating operational plans and schedules 5 identifying and implementing improvements to procedures for the planning and scheduling of the

Evidence Guide

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- operations on a vessel
- c Shows evidence of application of relevant workplace procedures, including:
 - 1 relevant sections of applicable maritime regulations
 - 2 OH&S regulations and hazard prevention policies and procedures
 - 3 safety management system procedures and work instructions on the operation of a vessel's power installation and auxiliary machinery,
 - 4 waste, pollution and recycling management processes

Evidence Guide (continued)

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2 Evidence required for demonstration of consistent performance (continued)

- d Action is taken promptly to report and/or address any problems that may arise when planning and scheduling operations on a vessel 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 among 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,

Evidence Guide (continued)

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	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 plan and schedule the operations on a vessel between 750 kW and 3,000 kW propulsion power; and/or b plan and schedule the operations of vessel's power installation and auxiliary machinery on a commercial or training vessel between 750 kW and 3,000 kW propulsion power

Range Statement

Range Statement

TDMMR1607B PLAN AND SCHEDULE OPERATIONS ON VESSELS OVER 750 KW PROPULSION POWER

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

Range Statement

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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 ensuring 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 independently under broad operational requirements, with accountability for self and others in achieving the prescribed outcomes
c. Work involves:	1 the application of marine engineering management practice to the planning and scheduling of the operation of the vessel's power installation and auxiliary machinery on a vessel between 750 kW and 3,000 kW propulsion power over the range of operational situations during a voyage. Contribution to the development and implementation of a broad plan or strategy for the operation of the vessel's power installation and auxiliary machinery is required and accountability and responsibility for self and others in achieving the outcomes is involved
d. Work requires:	1 significant judgement in planning, engineering and leadership functions related to planning and scheduling the operation of the vessel's power installation and auxiliary machinery. This includes management and analysis of the power installation capacity and voyage requirements, problem solving, decision making and contingency planning

2. WORKSITE ENVIRONMENT

a Planning and scheduling of the operation of power installation and auxiliary	1 for an Australian or international commercial vessel between 750 kW and 3,000 kW propulsion power
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Range Statement

TDMMR1607B PLAN AND SCHEDULE OPERATIONS ON VESSELS OVER 750 KW PROPULSION POWER

machinery may
be undertaken

Range Statement (continued)

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VARIABLE	SCOPE
b Operational scheduling and planning methods may include the use of:	1 GANTT charts 2 CPM/PERT network techniques 3 Other project planning techniques
c Propulsion plant configurations may include:	1 low speed, medium and high speed diesel propulsion 2 stern tube bearing 3 CPP 4 direct drive shaft 5 diesel electric 6 steam turbine plant and boiler 7 gas turbine 8 reduction gears 9 thrust blocks, detuners and shaft bearings
d Types of engines, propulsion equipment and	1 steam turbine, diesel, diesel electric and gas turbine propulsion systems and controls 2 steering gear, stabilisers, bow thrusters, rudders

Range Statement (continued)
TDMMR1607B PLAN AND SCHEDULE OPERATIONS ON VESSELS
OVER 750 KW PROPULSION POWER

auxiliary machinery may include:	3	fluid power systems and controls
	4	pumps and pumping systems
	5	auxiliary systems and controls, including
	i	fresh and salt water cooling systems
	ii	lubricating oil cooling systems
	iii	fuel, oil, gas, coal systems and centrifuges
	iv	air compressor and air starting systems
	v	lubrication
	vi	bilge and ballast system, oily water separator
	vii	refrigeration and air-conditioning plant and equipment
	viii	on-board air compressors and compressed air and control air systems
	ix	waste management and pollution control systems
	x	fresh water evaporators reverse osmosis systems
	xi	inert gas generator

Range Statement (continued)
TDMMR1607B PLAN AND SCHEDULE OPERATIONS ON VESSELS
OVER 750 KW PROPULSION POWER

VARIABLE	SCOPE
d Types of engines, propulsion equipment and related auxiliary	xii cargo pumps, tank washing machines and associated systems xiii purifiers and clarifiers xiv heaters

Range Statement (continued)
TDMMR1607B PLAN AND SCHEDULE OPERATIONS ON VESSELS
OVER 750 KW PROPULSION POWER

include: (continued)	- xv sewage plant - xvi fixed firefighting installations and fire control systems - xvii auxiliary boilers and waste heat generators - xvii lifesaving appliances - i - xix maintenance to hull and vessel side valves
e Potential emergencies may include:	1 loss of propulsion 2 loss of electrical power 3 loss of steering 4 flooding of engine room 5 fire or explosion in engine room 6 fuel oil, lubrication oil, steam and gas leaks 7 overheating and overspeed of machinery, governors, emergency trips
f Documentation /records may include:	1 details of scheduled voyage 2 ISM Code safety management system plans, procedures, checklists and instructions 3 vessel and company's operational procedures and instructions 4 engines, propulsion plant and auxiliary machinery manufacturer's specifications, instructions and recommended procedures 5 vessel's survey as it relates to engines, propulsion plant and auxiliary machinery 6 relevant sections of national and international regulations, IMO Conventions and Codes, including AMSA Marine

Range Statement (continued)

TDMMR1607B PLAN AND SCHEDULE OPERATIONS ON VESSELS OVER 750 KW PROPULSION POWER

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| | Orders and class society rules dealing with the operation and performance evaluation of engines, propulsion plant and auxiliary machinery |
| 7 | instructions of relevant maritime authorities and class societies concerning the operation of engines, propulsion plant and auxiliary machinery |

Range Statement (continued)

TDMMR1607B PLAN AND SCHEDULE OPERATIONS ON VESSELS OVER 750 KW PROPULSION POWER

VARIABLE	SCOPE
g Applicable procedures and codes may include:	1 sections of national and international regulations, IMO Conventions and Codes, including AMSA Marine Orders and class society rules related to the operation of engines, propulsion plant and auxiliary machinery on vessels between 750 kW and 3,000 kW 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 R Carry Out Operations on Equipment and Systems

Relationship to other units

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