



**Australian Government**

# **MARC2007A Operate marine internal combustion engines, and propulsion and auxiliary systems**

**Release 1**

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## **Modification History**

Release 1

This is the first release of this unit.

## **Unit Descriptor**

This unit involves the skills and knowledge required to safely operate marine internal combustion engines, and propulsion and auxiliary systems on a vessel.

## **Application of the Unit**

This unit applies to engine workers in the maritime industry working as a Marine Engine Driver Grade 3 on vessels up to 500 kW or as a Marine Engine Driver Grade 2 on vessels up to 750 kW or as a Marine Engine Driver Grade 1 on vessels up to 1500 kW.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.

## **Employability Skills Information**

This unit contains employability skills.

## **Elements and Performance Criteria Pre-Content**

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- 1 **Prepare engine, and propulsion and auxiliary systems for use**
  - 1.1 Appropriate *personal protective equipment* is selected, used, maintained and stored according to work health and safety (WHS)/occupational health and safety (OHS) requirements
  - 1.2 Routine *pre-operational checks* are carried out on *equipment* according to manufacturer specifications and workplace requirements
  - 1.3 Engine is started according to manufacturer specifications and organisational requirements
  - 1.4 Deviations from the norm are promptly identified and rectified
  - 1.5 Adjustments are made to achieve a safe and efficient operation
  - 1.6 Inability to start equipment is reported, and logged promptly and accurately to appropriate personnel
- 2 **Operate engine, and propulsion and auxiliary systems**
  - 2.1 Engine, and propulsion and auxiliary systems are operated in a safe and controlled manner
  - 2.2 Performance and efficiency of engine, and propulsion and auxiliary systems are monitored according manufacturer instructions
  - 2.3 Engine, and propulsion and auxiliary systems are operated within defined operating limits when running, to achieve optimum safety and efficiency
  - 2.4 *Environmental implications* associated with operation of engine, and propulsion and auxiliary systems are identified and controlled
  - 2.5 Deviations from normal operations are promptly identified
  - 2.6 Action is taken to identify and rectify *basic operational faults* to maintain optimum safety and efficiency
  - 2.7 Appropriate action is taken in the event of a malfunction or *emergency*
- 3 **Complete operations**
  - 3.1 Equipment shut-down procedures are carried out according to manufacturer specifications and workplace procedures
  - 3.2 Engine, propulsion and auxiliary system *operational records* are maintained according to workplace procedures
  - 3.3 Equipment damage, malfunctions or irregular performance is recorded and reported according to workplace procedures

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required Skills:

- Arrange maintenance according to technical specifications
- Check pressures, temperatures and revolutions during start-up and warm-up periods according to technical specifications
- Comply with vessel operating procedures and manufacturer recommendations for start-up and making available fuel, lubricants, cooling water and air
- Identify:
  - main difference between two- and four-stroke cycles of operation
  - major parts of marine internal combustion engines
  - marine propulsion systems components and explain their functions
- Implement safe and environmentally responsible work practices
- Manage fuel systems safely according to regulations, manufacturer instructions and vessel procedures and so as to prevent pollution of the marine environment
- Operate:
  - lubricating systems according to established procedures and so as to prevent pollution of the marine environment
  - main propulsion plant auxiliary systems to ensure safe operating conditions
  - marine internal combustion engines within technical specifications
  - pumping systems according to manufacturer instructions, operational procedures and regulations to ensure safety of operation and prevention of pollution of the marine environment
  - refrigeration system according to manufacturer instructions, operational procedures and regulations to ensure safety of operation and prevention of pollution of the marine environment
- Outline operation and servicing of propulsion system within the technical specifications
- Prepare shut-down and supervise cooling down of engine according to vessel operating procedures and manufacturer recommendations
- Read and interpret manufacturer specifications
- Recognise and repair basic operational faults or organise maintenance assistance
- Test steering arrangements according to manufacturer instructions, operational procedures and regulations

### Required Knowledge:

- Air filters
- Back-flooding prevention
- Basic:

- combustion process
- governor operation
- timing diagrams
- Bearing types, materials, installation, lubrication
- Causes of vibration and undue wear
- Circulating pumps
- Controllable pitch propellers
- Cooling systems including keel cooling/heat exchangers, circulating pumps, ship's side valves, coolant circulation and thermostats
- Corrosion
- Couplings types, fittings, keys and keyways
- Drive systems, belts, clutches, motors, etc. of pumping systems
- Dual duty systems/cross connection
- Emergency procedures
- Engine watchkeeping
- Fault identification, maintenance, prevention of corrosion
- Fuel system fault-finding and possible emergency operation
- Fuel systems including petrol/diesel, carburettors/fuel injectors, common rail
- Gear box fault identification and emergency operation
- Glands, packing, seals
- Identification of components of refrigeration systems
- Injection pumps
- Inspection and checks of main and auxiliary machinery and associated spaces
- Instrumentation
- Keeping running and maintenance logs
- Lubricating systems including lube oil circulating systems, lube oil system components, general lubrication , cooling effects and lubrication system problems
- Main differences between two- and four-stroke cycles of operation
- Maintenance and inspection
- Marine two- and four-stroke:
  - diesel engines
  - petrol engines
- Major parts of marine internal combustion engines
- Operation of firefighting equipment in engine space
- Power transmission operation
- Propeller and intermediate shafting alignment
- Pumping systems including fire/bilge/tank circulating systems
- Refrigeration systems including hazards of refrigerant gases

- Relevant environmental responsibilities, regulations and legislative requirements
- Rudder and stock support bearings
- Running checks
- Shaft seals and glands, packings
- Start-up and shut-down procedures
- Steering operation of hydraulic, cable, rod and gear
- Steering systems including rudder construction and rudder types
- Sterndrive and water jet drive units
- Strainers, mudboxes, foot valves
- Testing of steering and hydraulic systems
- Tiller arm attachment
- Turbo/supercharging
- Use of flexible materials, hoses
- Valve types:
  - construction and routine servicing
- WHS/OHS requirements and work practices

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, the required skills and knowledge, the range statement and the Assessment Guidelines for the Training Package.

### **Critical aspects for assessment and evidence required to demonstrate competency in this unit**

The evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the Elements, Performance Criteria, Required Skills, Required Knowledge and include:

- being aware of own ability and limits to rectify irregularities
- initiating timely action in response to defects or damage
- attention to appropriate level of detail in recordkeeping.

### **Context of and specific resources for assessment**

Performance is demonstrated consistently over time and in a suitable range of contexts.

Resources for assessment include access to:

- industry-approved marine operations site where operating engine, and propulsion and auxiliary systems on a vessel can be conducted
- tools, equipment and personal protective equipment currently used in industry
- relevant regulatory and equipment documentation that impacts on work activities
- range of relevant exercises, case studies and/or other simulated practical and knowledge assessments
- appropriate range of relevant operational situations in the workplace.

In both real and simulated environments, access is required to:

- relevant and appropriate materials and equipment
- applicable documentation including workplace procedures, regulations, codes of practice and operation manuals.

### **Method of assessment**

Practical assessment must occur in an:

- appropriately simulated workplace environment and/or
- appropriate range of situations in the workplace.

A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate to this unit:

- direct observation of the candidate operating engine, and propulsion and auxiliary systems on a vessel
- direct observation of the candidate applying relevant WHS/OHS requirements and work practices.

**Guidance information for assessment**

Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

In all cases where practical assessment is used it should be combined with targeted questioning to assess Required Knowledge.

Assessment processes and techniques must be appropriate to the language and literacy requirements of the work being performed and the capacity of the candidate.



## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below.

- Personal protective equipment may include:
- Boots
  - Gloves
  - Hard hat
  - Hearing protection
  - Overalls
  - Protective eyewear
  - Respirator or face mask
- Pre-operational checks may include:
- Checking coolants levels
  - Checking:
    - filters
    - fuel level
    - starting system
    - there is enough power available on switchboard and close isolator
  - Confirming correct pressures of auxiliary systems
  - Connections
  - Dip oil
  - Inspecting batteries and turning on isolator
  - Inspecting for leaks and faults
  - Inspecting safety guards, power take off stubs and shafts
  - Leads
  - Lines
  - Opening valves as appropriate
- Equipment may include:
- Auxiliary equipment and associated spaces
  - Cooling systems
  - Firefighting equipment
  - Fuel systems
  - Gearbox
  - Lubricating systems
  - Marine two- and four-stroke:
    - diesel engines
    - petrol engines
  - Propeller and immediate shafting alignment
  - Pumping systems
  - Refrigeration systems
  - Steering systems

- Environmental implications may include:
- Sterndrive and water jet drive units
  - Excessive noise and exhaust emissions
  - Loss of fuel and oil overside
- Basic operational faults may include:
- Starting faults
  - Failure of:
    - cooling systems
    - fuel system
    - lubrication systems
  - Gearbox faults
  - Pumping systems failure
  - Refrigeration systems failure
  - Steering failure
- Emergencies may include:
- Failure of main engine
  - Fire
  - Flooding
  - Loss of steering
- Operational records may include:
- Maintenance logs
  - Running logs

## **Unit Sector(s)**

Not applicable.

## **Competency Field**

Equipment Operations