



Australian Government

MARL057 Demonstrate basic knowledge of marine diesel engines and systems

Release: 2

MARL057 Demonstrate basic knowledge of marine diesel engines and systems

Modification History

Release 2. This is the second release of this qualification in the MAR Maritime Training Package with minor change to performance evidence.

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 operate and maintain marine diesel engines and systems on a commercial vessel.

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

- Electro-Technical Officer (STCW Electro-Technical Officer Unlimited)
- Engineer Class 3 Near Coastal
- Engineer Watchkeeper (STCW Engineer Watchkeeper Unlimited).

Licensing/Regulatory Information

Legislative and regulatory requirements are applicable to this unit.

- 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.

Near Coastal Qualifications:

- This unit is one of the requirements to obtain Australian Maritime Safety Authority (AMSA) certification as an Engineer Class 3 Near Coastal as defined in the Marine Order 505 (Certificates of competency - National Law) 2013.

Blue Waters Qualifications:

- This unit is one of the requirements to obtain Australian Maritime Safety Authority (AMSA) certification as an Electro-Technical Officer (STCW Electro-Technical Officer Unlimited) or Engineer Watchkeeper (STCW Engineer Watchkeeper 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).

Pre-requisite Unit

Not applicable.

Competency Field

L - Engineering

Unit Sector

Not applicable.

Elements and Performance Criteria

ELEMENTS

Elements describe the essential outcomes.

1 Outline stages of combustion in two-stroke and four-stroke cycle diesel engines

2 Explain means of pressure-charging diesel engines

3 Explain operation of diesel engine governors

PERFORMANCE CRITERIA

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

1.1 Two-stroke and four-stroke cycle diesel engines are compared and contrasted

1.2 Methods and diagnostic information used in determining engine combustion characteristics are specified

1.3 Diagnostic information is used to identify and interpret common combustion faults and to produce typical diagrams for analysing faults

2.1 Pressure-charging principles and their influence on engine design and waste heat recovery are explained

2.2 Different methods of pressure-charging diesel engines are clarified

2.3 Emergency isolation procedures used when pressure-charging diesel engines are clarified

3.1 Governing principles, common governor types and related controls are outlined

3.2 Different requirements for governing diesel engines for propulsion and power generation are explained

	3.3	Problems of mismatched engine sizes/prime mover types when sharing common loads are outlined
4 Explain properties of materials used in construction of engine components	4.1	Properties of materials used in construction of engine components are specified
	4.2	Dynamic stresses and loads, materials and service limitations of engine components are outlined
	4.3	Construction and operating cycle forces of diesel engine components are outlined
	4.4	Relationship between critical speed, use of detuners/dampers and materials in engine components is clarified
5 Explain safe working practices associated with diesel engines during maintenance, repair and operation	5.1	Safe practices for isolating propulsion and power generation diesel engines prior to work commencement are confirmed
	5.2	Personal protective (PPE) to be used during all aspects of diesel maintenance is identified
	5.3	Hazards associated with working on diesel engines and systems, including working in enclosed spaces, are identified
	5.4	Correct procedures for using hydraulic tools and high-pressure fuel injection test equipment are clarified
	5.5	Purpose, operation and maintenance of safety interlocks and protective cut-outs of engine manoeuvring systems is determined
6 Explain procedures for preventing and responding to crankcase and air-line explosions, and scavenge and uptake fires	6.1	Causes, symptoms and means of preventing and extinguishing uptake and economiser fires are outlined
	6.2	Risks of continued service with an isolated waste heat unit are assessed
	6.3	Causes, symptoms, methods of extinguishing and

prevention of scavenge fires are evaluated

- 6.4 Causes and hazards associated with starting air-line explosions are identified
- 6.5 Protective devices fitted to air starting systems to minimise risk of explosion, and routine inspection and maintenance required are detailed
- 6.6 Causes and ways of preventing crankcase explosions in both diesel and dual-fuel engines are outlined
- 6.7 Procedure to be taken in the event of an early warning of a hazardous crankcase atmosphere and required procedure to be followed after engine has stopped are clarified

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 MARL006 Demonstrate basic knowledge of marine diesel engines and systems.

Links

Companion Volume Implementation Guides are found in VETNet -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=772efb7b-4cce-47fe-9bbd-ee3b1d1eb4c2>

Assessment Requirements for MARL057 Demonstrate basic knowledge of marine diesel engines and systems

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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:

- accessing diagnostic information related to marine diesel engines and systems
- assessing own work outcomes and maintaining knowledge of current codes, standards, regulations and industry practices
- explaining basic operation of marine diesel engines and systems
- identifying and applying relevant solutions for addressing problems associated with marine diesel engines and systems
- identifying and interpreting diagnostic information, and performing mathematical calculations related to operating, maintaining and repairing marine diesel engines and systems
- identifying methods, procedures and materials needed for operating, maintaining and repairing marine diesel engines and systems
- imparting knowledge and ideas through verbal, written and visual means
- providing accurate and reliable information
- providing appropriate level of detail in responses
- reading and interpreting manuals, technical specifications, safety data sheets (SDS)/material safety data sheets (MSDS) and manufacturer guides related to operating, maintaining and repairing marine diesel engines and systems.

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:

- basic principles of diesel engine operation, including:
 - basic construction
 - engine principles
 - engine types
 - fuel atomisation and combustion

- heat-engine cycle
- ideal gas cycle
- common combustion faults, including:
 - engine cylinder fuel supply
 - lack of total combustion
- components of diesel engines
- crankcase and air-line explosions, scavenge and uptake fires
- diesel engine, including:
 - medium speed and high-speed diesel engine
 - slow-speed diesel engine
- diesel engine:
 - lubrication systems
 - propulsion and power generation
- diagnostic information, including:
 - engine efficiency
 - fuel consumption
 - temperature
- hazards, including:
 - acids
 - chemicals
 - defective or bypassed machinery protective devices
 - defective or inappropriately adjusted exhaust systems
 - enclosed spaces
 - flammable liquids under pressure
 - hydrocarbons
 - leaking oil and fuel
 - lifting heavy components both unaided and with lifting gear
- manoeuvring systems of diesel engines
- methods of pressure-charging diesel engines, including:
 - exhaust gas turbocharging
 - positive displacement engine-driven blowers
 - under-piston assistance
- pressure-charging diesel engines, including common service faults, actions to rectify faults, emergency operation and isolation procedures
- properties and characteristics of fires
- safe working practices associated with diesel engines during operation, maintenance and repair
- starting methods of diesel engines
- work health and safety (WHS)/occupational health and safety (OHS) legislation, policies and procedures.

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, including:
- diesel engine components:
 - camshafts
 - crankshafts
 - cross-heads
 - cylinder heads
 - exhaust valves
 - frames
 - fuel injectors
 - fuel pumps
 - liners
 - pistons
 - turbochargers
 - valves and rocker gear.

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