



Australian Government

MARL5008A Demonstrate basic knowledge of marine diesel engines and 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 knowledge required to operate and maintain marine diesel engines and systems on a commercial vessel.

Application of the Unit

This unit applies to the work of Marine Engineering Watchkeepers on commercial vessels greater than 750 kW and forms part of the requirements for the Certificate of Competency Marine Engineer Watchkeeper issued by the Australian Maritime Safety Authority (AMSA).

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

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| 1 Outline stages of combustion in two-stroke and four-stroke cycle diesel engines | 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 Explain means of pressure-charging diesel engines | 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 Explain operation of diesel engine governors | 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 | 5.1 Safe practices for isolating propulsion and power generation diesel engines prior to work commencement are confirmed
5.2 Safety protective clothing 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 |

- operation**
- 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 airline 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 airline 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

Required Skills and Knowledge

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

Required Skills:

- Access diagnostic information related to marine diesel engines and systems
- Assess own work outcomes and maintain knowledge of current codes, standards, regulations and industry practices
- Explain basic operation of marine diesel engines and systems, and
- Identify and apply relevant solutions for addressing problems associated with marine diesel engines and systems
- Identify and interpret diagnostic information, and perform mathematical calculations related to operating, maintaining and repairing marine diesel engines and systems
- Identify methods, procedures and materials needed for operating, maintaining and repairing marine diesel engines and systems
- Impart knowledge and ideas through verbal, written and visual means
- Read and interpret manuals, technical specifications, safety data sheets/material safety data sheets and manufacturer guides related to operating, maintaining and repairing marine diesel engines and systems

Required Knowledge:

- Basic principles of diesel engine operation
- Components of diesel engines
- Crankcase and air-line explosions, scavenge and uptake fires
- Diesel engine:
 - lubrication systems
 - propulsion and power generation
- Diesel engine
- Manoeuvring systems of diesel engines
- 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

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:

- providing accurate and reliable information
- providing appropriate level of detail in responses.

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 basic knowledge of marine diesel engines and systems can be demonstrated
- diagrams, specifications and other information required for performing basic calculations related to marine diesel engines and systems
- technical reference library with current publications on basic marine diesel engines and systems
- 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 demonstrating basic

knowledge of marine diesel engines and systems

- 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.

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| Diagnostic information may include: | <ul style="list-style-type: none">• Engine efficiency• Fuel consumption• Temperature |
| Common combustion faults may include: | <ul style="list-style-type: none">• Engine cylinder fuel supply• Lack of total combustion |
| Methods of pressure-charging diesel engines may include: | <ul style="list-style-type: none">• Exhaust gas turbo charging• Positive displacement engine-driven blowers• Under-piston assistance |
| Diesel engine components may include: | <ul style="list-style-type: none">• Bedplates• Camshafts• Crankshafts• Cross-heads• Cylinder heads• Exhaust valves• Frames• Fuel injectors• Fuel pumps• Liners• Pistons• Tie-rods for two- or four-stroke engines• Turbochargers• Valves and rocker gear |
| Hazards may include: | <ul style="list-style-type: none">• Acids• Chemicals• Defective or bypassed machinery protective devices• Defective or inappropriately adjusted exhaust systems• Enclosed spaces• Flammable liquids under pressure• Hydrocarbons• Lifting heavy components both unaided and with lifting gear• Leaking oil and fuel |
| Causes may include: | <ul style="list-style-type: none">• Airlock in feed water system• Cleanliness of economiser tubes |

- Failure of economiser feed pump
- Loss of feed-water supply

Unit Sector(s)

Not applicable.

Competency Field

Marine Engineering