Australian Government

Assessment Requirements for MARB039 Maintain and repair shipboard machinery and equipment

Release: 1

Assessment Requirements for MARB039 Maintain and repair shipboard machinery and equipment

Modification History

Release 1. This is the first release of this unit of competency in the MAR Maritime Training Package.

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:

- explaining principles of shipboard machinery and equipment and imparting knowledge and ideas verbally and in writing
- initiating timely action in response to defects or damage
- performing calculations and interpreting graphical information used in maintaining shipboard machinery and equipment
- reading and interpreting written information related to the operation, performance and maintenance of shipboard machinery and equipment, including machinery specifications and operational manuals
- scheduling maintenance of shipboard machinery and equipment
- using testing equipment and explaining test and performance results relevant to shipboard machinery and equipment.

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:
  - causes of crankcase and air-line explosions, and scavenge and uptake fires
  - common faults and appropriate action to be taken with cooling of diesel engines
  - crankshafts
  - cylinder liners and heads
  - different methods of cooling marine diesel engines, including common requirements of cooling
  - exhaust valves
  - materials used to construct diesel engine major parts
  - means of pressure charging diesel engines, including common service faults, appropriate actions to rectify these faults, and emergency operation and isolation procedures
  - operating principles and adjustments of diesel engine fuel injection equipment, including common service faults, symptoms and causes of diesel fuel injection problems, and

appropriate actions to be taken
    - typical diesel engine lubrication systems, including:
    - typical starting air and manoeuvring systems of diesel engines, including all components normally found therein
- basic principles of electrotechnology, marine electrical practice and marine automation and control relevant to detection, fault finding and repair of faults in electrical and electronic equipment, including:
    - alternating current (AC) and direct current (DC) theory and plant and equipment
    - basic cabling, distribution and lighting systems
    - basic control and switchgear
    - basic electrical circuit theory
    - basic theory of electromagnetism and electrostatics
    - electrolytic action and cells
    - instruments, calibration and testing
- basic principles of mechanics as they relate to forces, pressures, stress and strains in shipboard dynamic machinery
- basic principles of operating and maintaining:
    - fluid power control systems
    - machinery lubrication systems
    - marine boilers and materials used to construct boiler major parts
    - refrigeration systems:
        - furnace
        - steam and water drum
        - superheaters
        - water tubes
- basic thermodynamics, including:
    - advantages of multi-staging and inter-cooling
    - air/fuel ratio and significance of excess air on combustion
    - basic steam plant cycles and function of each component
    - basic thermodynamic properties of common working fluids
    - clearance volume, its effect on volumetric efficiency and methods of calculating volumetric efficiency
    - combustion process and calorific value of fuels
    - elementary principles of steam plants
    - meaning of gauge and absolute pressure
    - methods of heat transfer and related problems
    - operating cycle of single stage reciprocating air conditioners, including methods for the mass of air delivered
    - principles of heat transfer by conduction, convection and radiation and their application to marine systems
    - International System of Units (SI) and common thermodynamic terms and principles

- temperature and temperature scales
- deck machinery, including:
  - cranes
  - lifeboat davits and gear
  - mooring winch
  - winch
  - windlass
- diesel engine routine maintenance, including:
  - air intake system:
    - inspecting and changing air filters
    - inspecting turbocharger to make sure there is no fouling of compressor blades from crankcase gases
  - cooling system:
    - coolant sampling for trending analysis
    - draining, flushing and refilling system when required
    - fluid level checks
  - emissions systems:
    - inspecting crankcase ventilation systems, selective catalytic reduction (SCR) systems and diesel particulate filters (if so equipped)
  - exhaust system:
    - inspecting for leaks, corrosion and wet stacking
  - fuel system:
    - changing fuel filters and fuel injectors
    - checking water separators
  - lubrication:
    - changing oil and oil filters
    - checking levels
    - taking oil samples for trending analysis to optimise oil change intervals and to detect engine wear
  - mechanical systems:
    - generally inspecting for leaks, wear or deterioration
    - inspecting resilient engine mounts and torsional couplings
  - operating systems:
    - downloading data from digital engine management system to note and review alarm conditions
  - valves and heads:
    - inspecting and recording cylinder head wear for trending analysis
    - inspecting, adjusting and recording valve train wear for trending analysis
- inspection and disassembling, including:
  - air compressors:

    - coolers and cooling passages
    - lubricating systems
    - piston and rings
    - suction and delivery valves and seats
  - diesel engine components:
    - bearings
    - cooling system
    - crankshaft alignment
    - liners
    - lubrication system
    - pistons
    - rings
    - valves
  - heat exchangers:
    - corrosion
    - erosion
    - fouling
    - leakage
    - provision for tube expansion
- inspection requirements for:
  - marine refrigeration:
    - compressors
    - condensers
    - evaporators
    - expansion valves
    - oil separators
  - marine boiler:
    - fire side
    - water side
- lubricating system components, including:
  - settling tank
  - system bearings
  - system filters
- maintenance and repair hazards and problems, and appropriate preventative and remedial action and solutions during maintaining and repairing shipboard plant and equipment
- maritime communication techniques needed during maintenance and repair operations
- materials used to construct the following gas turbine major parts:
  - compressors
  - gas generators
  - rotors

    - turbine casing
- materials used to construct the following steam turbine major parts:
    - blades
    - nozzles
    - reduction gears
    - rotors
    - turbine casings
- national and international regulations, International Maritime Organization (IMO) conventions and codes, including Australian Maritime Safety Authority (AMSA) Marine Orders applicable to managing shipboard plant and equipment maintenance and repair operations
- nature and causes of typical shipboard plant and equipment malfunctions and available methods for their detection and repair, including established fault-finding techniques
- operating principles and performance specifications for different types of shipboard plant and equipment usually found on a vessel of unlimited propulsion power
- operating principles of unmanned machinery spaces (UMS) and automated monitoring and control of machinery
- planned maintenance systems and procedures for condition monitoring of plant and equipment, including responsibilities and requirements covered by various forms of vessel survey
- plant and equipment typically found onboard a vessel of unlimited propulsion power
- procedures for:
    - carrying out shipboard plant and equipment fault finding and repair as part of routine maintenance procedures to ensure compliance with company and survey requirements, and established safety rules and regulations
    - completing temporary and permanent repair and/or replacement procedures for plant and equipment on board vessels at sea, alongside and in dry dock
    - reading and interpreting plant and equipment performance readings and instrumentation
- pumps, including:
    - axial
    - centrifugal
    - gear
    - reciprocating
    - screw
- purpose and content of safety data sheets (SDS)/material safety data sheets (MSDS)
- refurbished diesel engine components, including:
    - air start valves
    - cylinder heads
    - exhaust valves
    - fuel injectors
    - relief valves
- safety procedures for:

  - handling heavy plant, equipment and component parts during maintenance and repair of shipboard plant and equipment
  - using hand and power tools and maintenance equipment
- safety, environmental and hazard control precautions and procedures relevant to shipboard plant and equipment inspection and maintenance operations
- servicing, including:
  - dismantling rod and gears, seals, bearings and relief valve
  - gland packing
  - identifying wear and deterioration
  - measuring wear in cylinders, neck rings and rods
  - protecting finished surfaces
  - replacing and adjusting seals
  - removing studs: intact and broken
- turbocharger components, including:
  - air casing
  - air filters
  - bearings
  - diffuser
  - gas inlet grid
  - impeller
  - inducer
  - nozzle ring
  - rotor
  - volute
- types of vessel maintenance and repair records to be maintained to meet requirements of company, survey and regulatory authorities
- typical vessel and plant and equipment specifications, equipment drawings, operational manuals, and electrical and control circuit diagrams
- valves, including:
  - ball
  - butterfly
  - check
  - diaphragm
  - gate
  - globe:
  - screw down non return
  - screw lift
- valve maintenance, including:
  - examining seats, valves, spindles and glands
  - gland packing

- lapping valves and seats
- machining valves and seats
- removal
- repacking
- selection

- work health and safety (WHS)/occupational health and safety (WHS/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.

Links

Companion Volume implementation guide can be found in VetNet - https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=772efb7b-4cce-47fe-9bbd-ee3b1d1eb4c2