



The following pages contain the competencies listed in Annex B of Part D of the National Standard for Commercial Vessels.

These competencies form the basis of the orals examinations conducted by NSW Maritime. Reference should also be made with those listed in the Maritime Industry Training Package Units of Competency and the NSW Record of Service (RoS) Book.

**TABLE B6.1 — Competencies For A Certificate Of Competency As A Marine Engine Driver Grade 3
Function: Marine Engineering at the Operational Level
Marine Engine Driver Grade 3**

Outcome	Content	Standards for evaluating competence
Explain the construction, operation and service of marine internal combustion engines	<p>Basic cycles of operation and component identification of:</p> <ul style="list-style-type: none"> • Marine 2 and 4 stroke diesel engines • Marine 2 and 4 stroke petrol engines • Basic timing diagrams • Fuel systems including: <ul style="list-style-type: none"> ▪ Petrol/diesel ▪ Carburettors/fuel injectors ▪ Fuel storage and management ▪ Injection pumps ▪ Basic governor operation ▪ Fuel system maintenance ▪ Fuel system fault finding and possible emergency operation • Basic combustion process • Air filters • Turbo/Supercharging 	<p>The major parts of marine internal combustion engines are identified.</p> <p>The main differences between 2 & 4 Stroke Cycles of operation are identified.</p> <p>Fuel systems are managed safely in accordance with regulations, manufacturer's instructions and vessel procedures and so as to prevent pollution of the marine environment.</p> <p>Marine internal combustion engines are operated within the technical specifications.</p> <p>Operation & surveillance of main propulsion plant and auxiliary systems is sufficient to maintain safe operating conditions.</p> <p>Basic operational faults are recognised and repair or maintenance assistance is organised.</p>
	<ul style="list-style-type: none"> • Cooling systems including: <ul style="list-style-type: none"> ▪ Keel cooling/heat exchangers ▪ Circulating pumps ▪ Ship's side valves ▪ Coolant circulation and thermostats ▪ Corrosion ▪ Maintenance ▪ Instrumentation ▪ Emergency procedures 	<p>Cooling systems are operated in accordance with established procedures and so as to prevent pollution of the marine environment.</p>
	<ul style="list-style-type: none"> • Lubricating systems including: <ul style="list-style-type: none"> ▪ Lube oil circulating systems ▪ Lube oil system components ▪ General lubrication and cooling effects ▪ Lubrication system problems ▪ Lube oil contamination Lube oil system management and maintenance • Lube oil system instrumentation 	<p>Lubricating systems are operated in accordance with established procedures and so as to prevent pollution of the marine environment.</p>

(Continued...)

**TABLE B6.1 — Function: Marine Engineering at the Operational Level
Marine Engine Driver Grade 3 (continued)**

Outcome	Content	Standards for evaluating competence
<p>Outline the workings of marine propulsion systems</p> <p>Recognise and takes steps to rectify basic operational faults</p>	<p>Power transmission including:</p> <ul style="list-style-type: none"> • Basic reverse/reduction gearbox operation • Types of gear trains • Lubrication and cooling of gearboxes including filters and strainers. • Fault identification • Emergency operation • Propeller and intermediate shafting alignment • Bearing types, materials, installation, lubrication • Shaft seals and glands, packing's • Couplings types, fitting, keys and keyways • Propeller types, fitting, keys and keyways, securing nuts, locking • Controllable pitch propellers • Sterndrive and water jet drive units • Maintenance and inspection • Causes of vibration and undue wear 	<p>Marine propulsion systems components are identified and functions explained in simple terms.</p> <p>Describe the operation and servicing of propulsion system within the technical specifications.</p> <p>Basic operational faults are recognised and repair or maintenance assistance is organised.</p>
<p>Prepare a vessel's machinery for Sea</p>	<ul style="list-style-type: none"> • Refuelling • Inspection and checks of main and auxiliary machinery and associated spaces. • Start up procedures • Instrumentation • Running checks • Keeping of running and maintenance logs • Shut down procedures 	<p>Safety precautions and pollution prevention measures during refuelling are applied according to legislative requirements, provider's requirements and vessel operating procedures.</p> <p>The methods of preparing for start-up and of making available fuel, lubricants, cooling water and air comply with vessel operating procedures and manufacturers recommendations.</p> <p>Checks of pressures, temperatures and revolutions during the start-up and warm-up periods are in accordance with the technical specifications.</p> <p>The methods of preparing the shut-down and supervising the cooling down of the engine are in accordance with vessel operating procedures and manufacturers recommendations.</p>
<p>Identify and operate components of auxiliary systems.</p>	<p>Steering Systems including:</p> <ul style="list-style-type: none"> ▪ Rudder construction and rudder types ▪ Rudder and stock support bearings ▪ Glands, packing, seals ▪ Tiller arm attachment ▪ Steering operation of hydraulic, cable, rod and gear, etc. <i>(Continued...)</i> ▪ Testing of steering and hydraulic systems 	<p>The steering arrangements are operated in accordance with manufacturer's instructions, operational procedures and regulations.</p> <p>Maintenance is arranged in accordance with the technical specifications.</p>

TABLE B6.1 — Function: Marine Engineering at the Operational Level
Marine Engine Driver Grade 3 (continued)

Outcome	Content	Standards for evaluating competence
	<p>Pumping Systems including:</p> <ul style="list-style-type: none"> ▪ Fire/bilge/tank circulating systems ▪ Fault identification, maintenance, prevention of corrosion ▪ Valve types – construction and routine servicing ▪ Back flooding prevention ▪ Strainers, mudboxes, foot valves ▪ Dual duty systems/cross connection. Use of flexible materials, hoses, etc. ▪ Drive systems, belts, clutches, motors, etc. ▪ Environmental responsibilities. Regulations and legislative requirements. 	<p>Pumping systems are operated in accordance with manufacturer's instructions, operational procedures and regulations to ensure safety of operation and prevention of pollution of the marine environment.</p> <p>Maintenance is arranged in accordance with the technical specifications.</p>
	<p>Refrigeration systems including:</p> <ul style="list-style-type: none"> ▪ Hazards of refrigerant gases ▪ Identification of components ▪ Environmental responsibilities 	<p>The refrigeration system is operated in accordance with manufacturer's recommendations, regulations and vessel operating procedures to ensure safety of operation and prevention of pollution of the environment.</p> <p>Maintenance is arranged in accordance with the technical specifications.</p>
Operate electrical systems	<p>Direct Current Systems (DC) (not exceeding 32 volts D.C.) including:</p> <ul style="list-style-type: none"> ▪ Batteries - types, care and maintenance, hazards ▪ Basic care of electrical systems in general - fault recognition ▪ Charging systems - regulators, alarms/indicators ▪ Uses of fuses and circuit breakers - selection of correct capacity ▪ Connecting Batteries • Starter motors, alternators and associated equipment - operation maintenance 	<p>DC systems are operated and operator preventative maintenance in accordance with manufacturer's recommendations, regulations and vessel operating procedures to ensure safe operation.</p> <p>WARNING: RELEVANT STATE/TERRITORY ELECTRICAL LICENSING REQUIREMENTS NEED TO BE FULFILLED BY ANY PERSONS CARRYING OUT INSTALLATION, MAINTENANCE AND REPAIR OF ELECTRICAL CIRCUITS OR SYSTEMS THAT ARE 50V AC OR ABOVE, OR 120V DC OR ABOVE, ON A VESSEL.</p>

(Continued...)

**TABLE B6.1 — Function: Marine Engineering at the Operational Level
Marine Engine Driver Grade 3 (continued)**

Outcome	Content	Standards for evaluating competence
Operate electrical systems (continued)	<p>Electric Systems (above 32 volts DC and up to 415 volts AC) including:</p> <ul style="list-style-type: none"> ▪ Protective devices on switchboards ▪ Personal safety ▪ Shore power connection ▪ Fault identification, location, and safety implications. 	<p>Electrical systems are operated in accordance manufacturer's recommendations, regulations and vessel operating procedures to ensure safe operation.</p> <p>Electrical systems are operated in accordance with vessel procedures.</p> <p>Electrical system faults are recognised and where necessary steps are taken to make them immediately safe.</p> <p>WARNING: RELEVANT STATE/TERRITORY ELECTRICAL LICENSING REQUIREMENTS NEED TO BE FULFILLED BY ANY PERSONS CARRYING OUT INSTALLATION, MAINTENANCE AND REPAIR OF ELECTRICAL CIRCUITS OR SYSTEMS THAT ARE 50V AC OR ABOVE, OR 120V DC OR ABOVE, ON A VESSEL.</p>
Use deck machinery.	<ul style="list-style-type: none"> • Lifting equipment • Winches, capstans • Safe working procedures • Basic hydraulic systems, their operation and user-maintenance • Legislation affecting lifting equipment 	Lifting equipment and deck machinery is operated and user-maintenance is carried out in accordance with manufacturer's recommendations, regulations and vessel operating and procedures.
Describe the basic techniques of hull maintenance	<ul style="list-style-type: none"> • Basic hull inspection and maintenance • Use of sacrificial anodes 	Maintenance procedures and techniques for hulls are explained in accordance with regulations and vessel operating procedures.
Demonstrate the actions to be taken in the event of fire or explosion Describe actions for the operation and maintenance of fire fighting equipment in the engine space	<ul style="list-style-type: none"> • Fire/explosion, corrosion • Fire Triangle • Minimisation of hazards • Identification and maintenance of fire fighting equipment • Use of fire fighting equipment • Management /control of fires • Personnel safety • Emergency shut offs and closures • Fire alarm systems - heat/smoke detectors • Alarm panels • Fixed fire fighting installations • Control of passengers/crew • Communications, instructions, etc. 	<p>Fire control is implemented in accordance with maritime safety and vessel operating procedures whilst maintaining crew safety, vessel stability and operational capability.</p> <p>Actions taken to control fires are based on full and accurate assessment of the incident, using all available sources of information.</p> <p>The priority, timing and sequence of actions are appropriate to the overall requirements of the incident and to minimise damage and potential damage to the vessel, injuries to personnel and impairment of the operational effectiveness of the vessel.</p> <p>Maintenance of fire fighting appliances is in accordance with manufacturer's specifications.</p> <p>Alarms are actioned, recorded and reported according to vessel procedures and marine safety requirements.</p>

(Continued...)

TABLE B6.1 — Function: Marine Engineering at the Operational Level
Marine Engine Driver Grade 3 (continued)

Outcome	Content	Standards for evaluating competence
Explain the principles of the stowage and management of explosive and flammable materials	<ul style="list-style-type: none"> • Stowage and management of flammable/ explosive liquids, gases, solids and other materials normally carried on board. (spare fuel, lubricants, LPG cooking gas, flares) • Dangers inherent with the above materials 	Explanations of the stowage of flammable/explosive materials and their management, is in accordance with established rules and procedures.
Maintain running log including fuel calculations and written reports	<ul style="list-style-type: none"> • Writing of simple reports • Keeping of running and maintenance logs • Working out simple calculations for fuel • capacity, consumption and voyage duration 	<p>Running and maintenance logs are completed according to vessel and maritime procedures including regular reports.</p> <p>Calculations for fuels capacity, consumption and voyage duration.</p>
<p>Methods and conditions for demonstrating competence (To be applied to all outcomes in this table)</p>		
<p>Assessment by an accredited assessor in a—</p> <ul style="list-style-type: none"> • working vessel; • training vessel; • simulator; or • approved training facility. <p>Using a combination of practical demonstration or practical exercises and theoretical explanation as appropriate to the subject and supported by oral or written questions.</p> <p>The process can be a part of—</p> <ul style="list-style-type: none"> • employment; • an approved training program; or • recognition of prior learning. 		

**TABLE B8.1 — COMPETENCIES FOR A CERTIFICATE OF
COMPETENCY AS A MARINE ENGINE DRIVER GRADE 2
ADDITIONAL TO THOSE REQUIRED FOR AN MED3
Function: Marine engineering at the operational level — Marine
Engine Driver Grade 2**

Outcome	Content	Standards for evaluating competence
Operate and carry out basic user maintenance of marine internal combustion engines	<ul style="list-style-type: none"> • Diesel engine construction • Diesel engine operation and routine maintenance • Turbo charging arrangements • Diesel engine fuel injection, timing and control equipment • Engine protection arrangements • Engine performance and reasons for lack of performance (fault finding procedures) • Planned maintenance • Operational practice 	<p>Constructional parts of marine internal combustion engines are identified in accordance with manufacturers manuals.</p> <p>Two & four stroke cycles of operation are explained in compliance with manufacturer's specifications.</p> <p>Marine internal combustion engines are operated within the technical specifications.</p> <p>Surveillance and operation of main propulsion plant and auxiliary systems is within the operating limits specified by vessel procedures or manufacturers recommendations.</p> <p>Operational faults are recognised and rectified in accordance with manufacturer's specifications and fault-finding procedures.</p>
Operate and carryout basic user maintenance of lubricating oil and cooling-water systems	<ul style="list-style-type: none"> • Dry sump and wet sump lubrication systems • Correct pressure and flow conditions • Oil quality monitoring • Oil filter changing procedures • Heat exchanger, keel cooler, and raw water cooling systems • Construction and maintenance of heat exchangers • Corrosion prevention 	<p>Lubricating systems are managed in accordance with established Regulations, manufacturers instructions and vessel operating procedures and so as to prevent pollution of the marine environment.</p> <p>Cooling systems are managed in accordance with manufacturer's recommendations and established procedures.</p>
Operate and carry out basic user maintenance of pumps, bilge and sea-water systems	<ul style="list-style-type: none"> • Types of pumps and safety devices required • Pump capabilities and requirements for priming • Bilge pumping arrangements for vessels with several compartments • Dangers associated with backflooding and methods to prevent backflooding • Sea water circulating systems • Cross connections between sea water systems and bilge systems • Cross connections between bilge/ballast/sea water systems and fire main 	<p>Pumping systems are managed in accordance with established rules and procedures to ensure safety of operation and prevention of pollution of the marine environment.</p>

(Continued...)

TABLE B8.1 — Function: Marine engineering at the operational level — Marine Engine Driver Grade 2 (continued)

Outcome	Content	Standards for evaluating competence
Operate and carry out basic user maintenance of steering gear	<ul style="list-style-type: none"> • Electro-hydraulic steering gear • Common faults in steering gear • Testing of steering gear • Routine maintenance on steering systems • Emergency steering 	The steering arrangements are operated and maintained in accordance with the technical specifications.
Operate and manage fuel and fuel oil systems	<ul style="list-style-type: none"> • Arrangement of fuel oil systems and filters • Fuel oil tank components • Methods of fuel oil tank content measurement • Fuel tank filling • Condensation in fuel tanks • The effect of slack tanks on vessel stability 	Fuel systems are managed in accordance with established rules and procedures to ensure safety of operation and avoid pollution of the marine environment.
Explain the principles of oil and grease lubrication systems	<ul style="list-style-type: none"> • Functions of lubricating oil • Functions of grease 	The basic principles of lubrication are described in accordance with engineering principles.
Safely operate and carry out simple maintenance of electrical systems	<ul style="list-style-type: none"> • Main faults that can occur in electrical systems • Earth indicating devices • Maintenance and operation of batteries • Connecting batteries in series and parallel • Electrical distribution systems • Single and three phase AC power • Isolation of electrical circuits • Connection to shore power • Use of multi-meter to test voltage and continuity • Protection devices 	Electrical systems are operated and maintained in accordance with electrical regulations. WARNING: RELEVANT STATE/TERRITORY ELECTRICAL LICENSING REQUIREMENTS NEED TO BE FULFILLED BY ANY PERSONS CARRYING OUT INSTALLATION, MAINTENANCE AND REPAIR OF ELECTRICAL CIRCUITS OR SYSTEMS THAT ARE 50V AC OR ABOVE, OR 120V DC OR ABOVE, ON A VESSEL.
Explain the safe handling of LPG, liquid fuels and refrigerant gases	<ul style="list-style-type: none"> • Dangers associated with LPG and petrol vapour • Storage of LPG cylinders • Testing of LPG detectors • Safety procedures for vessel re-fuelling • Dangers of refrigerant gas leaks in confined spaces 	Flammable/explosive materials are stowed and managed in accordance with regulations and established rules and procedures. Refrigerant gases are stowed and managed in accordance with regulations and Australian Standards.

(Continued...)

TABLE B8.1 — Function: Marine engineering at the operational level — Marine Engine Driver Grade 2 (continued)

Outcome	Content	Standards for evaluating competence
<p>Explain the precautions against fire and explosion</p> <p>Demonstrate the methods of dealing with fires</p>	<ul style="list-style-type: none"> • Major causes of fire and explosion on board • Recognition and uses of different types of portable fire extinguishers • Fire pumps and fire main systems • Use of hoses and nozzles • Fixed installations, closing appliances and remote shut-offs • Safety precautions to be observed during a watch and immediate actions to be taken in the event of a fire or accident 	<p>Fire control is implemented in accordance with maritime safety and vessel operating procedures whilst maintaining crew safety, vessel stability and operational capability.</p> <p>Actions taken to control fires are based on full and accurate assessment of the incident, using all available sources of information.</p> <p>The order of priority, timing and sequence of actions are appropriate to the overall requirements of the incident and to minimise damage and potential damage to the vessel, injuries to personnel and impairment of the operational effectiveness of the vessel.</p> <p>Maintenance of fire fighting appliances is in accordance with maker's specifications.</p> <p>Alarms are actioned, recorded and reported according to vessel procedures and marine safety requirements.</p>
<p>Recognise and correct deteriorated fittings and machinery</p>	<ul style="list-style-type: none"> • Corrosion and means of prevention • Pipework repairs • Recognition and measurement of tailshaft wear • Machinery log keeping 	<p>Maintenance activities are planned in accordance with technical, legislative, safety and procedural specifications.</p> <p>Maintenance is carried out in compliance with manufacturer's specifications.</p>
<p>Prepare a vessel for sea and secure a vessel after a voyage</p>	<ul style="list-style-type: none"> • Spares and stores required for proposed voyage • Preparations and checks necessary before sailing • Shutting down machinery • Securing vessel after voyage 	<p>Vessel and machinery are prepared for sea and secured after voyage in accordance with ship and manufacturer's procedures.</p>
<p>Explain the methods of propulsion reversal</p>	<ul style="list-style-type: none"> • Construction and operation of: <ul style="list-style-type: none"> • reverse-reduction gearboxes; and • controllable pitch propellers 	<p>The method of propulsion reversal, and the operation of marine gearboxes are explained in accordance with technical specifications.</p>
<p>Calculate consumption of fuel, speed and range of vessels</p>	<ul style="list-style-type: none"> • Calculation of volumes • Conversion of volumes to litres • Specific gravity • Specific fuel consumption • Calculations involving specific fuel consumption, speed and range 	<p>Calculations dealing with bunkering capacity, consumption of fuel, speed and the range of a vessel are carried out and accurate to accepted working tolerances.</p>
<p>Ensure compliance with pollution prevention requirements</p>	<ul style="list-style-type: none"> • Prevention of pollution of the marine environment • Knowledge of the precautions to be taken to prevent pollution of the marine environment • Anti-pollution procedures and all associated equipment 	<p>The systems and equipment are managed safely so as to avoid pollution of the marine environment.</p>

(Continued...)

TABLE B8.1 — Function: Marine engineering at the operational level — Marine Engine Driver Grade 2 *(continued)*

Methods and conditions for demonstrating competence (To be applied to all outcomes in this table)
Assessment by an accredited assessor in a— <ul style="list-style-type: none">• working vessel;• training vessel;• simulator; or• approved training facility. Using a combination of practical demonstration or practical exercises and theoretical explanation as appropriate to the subject and supported by oral or written questions. The process can be a part of— <ul style="list-style-type: none">• employment;• an approved training program; or• recognition of prior learning.

**TABLE B10.1 — COMPETENCIES FOR A CERTIFICATE OF
COMPETENCY AS A MARINE ENGINE DRIVER GRADE 1
ADDITIONAL TO THOSE REQUIRED FOR MED 2
Function: Marine engineering at the operational level
Section 1: Practical Mathematics—Marine Engine Driver Grade1**

Outcome	Content	Standards for evaluating competence
Calculate fuel consumption and storage	<ul style="list-style-type: none"> • Consumption of fuel and lubricating oil for a particular voyage, using quantity in litres and mass in tonnes and specified regular shaped tanks • Hourly fuel consumption • Remaining steaming times • Requirements for replenishing lubricating oil in oil tanks • The area and circumference of a circle • The volumes of regular shaped tanks • Tank capacities and pumping capacities for tank filling and emptying • Relationship between theoretical vessel speed, propeller pitch and R.P.M. Calculations involving specific fuel consumption, power, speed and range • Calibration tables 	Calculations as per the “content statement” are carried out and conform to accepted engineering tolerances.
Carry out engineering calculations	<ul style="list-style-type: none"> • Common SI units such as: kilogram, tonne, Newton, Newton metre, Pascal, joule, watt, and metre • Conversion of units to multiples of base units. Convert fractions to decimals. Calculations to determine the area and circumference of a circle • Calculations involving the volume and capacity of regular shaped tanks. Use calibration tables to measure quantities in tanks • Use of relative density/specific gravity to convert quantity in litres and volume to mass. Calculations involving pumping capacities for tank filling and emptying • Calculations involving the consumption of fuel and lubricating oil, hourly fuel consumption, theoretical steaming times and distances covered • Calculations involving the relationship between theoretical vessel speed, propeller pitch and engine speed • Calculations involving specific fuel consumption, power, speed and range 	Calculations as per the “content statement” are carried out and conform to accepted engineering tolerances.

(Continued...)

TABLE B10.1 — Function: Marine engineering at the operational level
Section 1: Practical Mathematics—Marine Engine Driver Grade1 *(continued)*

Outcome	Content	Standards for evaluating competence
Carry out engineering calculations <i>(Continued)</i>	<ul style="list-style-type: none"> • Terminology of simple levers • Calculations involving mechanical advantage, load, effort, moments • Understanding of terminology of material technology • Calculations involving stress, strain and safe working load 	(see previous page)
<p>Methods and conditions for demonstrating competence (To be applied to all outcomes in this table)</p>		
<p>Assessment by an accredited assessor in a—</p> <ul style="list-style-type: none"> • working vessel; • training vessel; • simulator; or • approved training facility. <p>Using a combination of practical demonstration or practical exercises and theoretical explanation as appropriate to the subject and supported by oral or written questions.</p> <p>The process can be a part of—</p> <ul style="list-style-type: none"> • employment; • an approved training program; or • recognition of prior learning. 		

**TABLE B10.2 — COMPETENCIES FOR A CERTIFICATE OF
COMPETENCY AS A MARINE ENGINE DRIVER GRADE 1
ADDITIONAL TO THOSE REQUIRED FOR MED 2
Function: Marine engineering at the operational level
Section 2: Engineering — Marine Engine Driver Grade 2**

Outcome	Content	Standards for evaluating competence
Operate and maintain marine internal combustion engines and propulsion transmission systems	<ul style="list-style-type: none"> • Simple constructional details • Cycles and timing diagrams for two and four stroke diesel engines • Care and management of two and four stroke diesel engines • Safety devices fitted to propulsion engines • Engine fuel systems • Engine and gearbox lubricating systems • Engine and gearbox cooling systems • Transmission systems from engine output shaft to propeller • Engine malfunctions and corrective action 	<p>Marine internal combustion engines and transmission systems are operated and maintained within technical specifications and in accordance with accepted practices and procedures.</p> <p>The causes of machinery malfunctions are identified (fault finding) and any resultant restrictions applied to operations are justified and conveyed to the vessel Master. Actions are to ensure the overall safety of the ship and plant having due regard to the prevailing circumstances and conditions.</p>
Operate and maintain auxiliary machinery systems, including steering gear and refrigeration systems	<ul style="list-style-type: none"> • Pumps and pumping systems for bilge, fuel oil, freshwater and seawater systems • Types of pumps and associated safety devices • Hydraulic systems including steering gear • Electro-hydraulic steering gear • Emergency operation in the event of electrical or hydraulic failure • Simple hydraulic circuits • Maintenance of hydraulic systems • Refrigeration plant and its operation • Identification of refrigeration system components • The refrigeration cycle • Types of refrigerant • Identification of faults in refrigeration systems 	<p>Auxiliary machinery systems are operated and maintained within technical specifications, in accordance with accepted practices and vessel procedures to ensure safety of operation and avoid pollution of the marine environment.</p> <p>Hydraulic systems and steering gear are operated and maintained in accordance with technical specifications to ensure safety of operation and avoid pollution of the marine environment.</p> <p>Refrigeration systems are operated in accordance with technical specifications to ensure safety of operation and avoid pollution.</p>

(Continued...)

TABLE B10.2 — Function: Marine engineering at the operational level
Section 2: Engineering — Marine Engine Driver Grade 2 *(continued)*

Outcome	Content	Standards for evaluating competence
Operate, test and maintain electrical and control equipment	<ul style="list-style-type: none"> • DC equipment • Electrical principles and circuits. • Operate and manage in a safe manner, the AC generation, protective devices and shore power arrangements 	<p>Electrical and control equipment is operated and maintained within technical specifications, in accordance with regulations, accepted practices and procedures and with regard to safety.</p> <p>WARNING: RELEVANT STATE/TERRITORY ELECTRICAL LICENSING REQUIREMENTS NEED TO BE FULFILLED BY ANY PERSONS CARRYING OUT INSTALLATION, MAINTENANCE AND REPAIR OF ELECTRICAL CIRCUITS OR SYSTEMS THAT ARE 50V AC OR ABOVE, OR 120V DC OR ABOVE, ON A VESSEL.</p>
Maintain deck equipment and machinery	<ul style="list-style-type: none"> • Operation and maintenance of deck machinery • Winches and windlass • Safeguards/protective devices for winches • Causes and rectification of problems • Safe operating practices 	<p>Deck equipment and machinery is maintained in accordance with technical specifications and with regard to safety.</p> <p>The causes of machinery malfunctions are identified (fault finding) and any resultant restrictions applied to operations are justified and conveyed to the vessel Master. Actions are to ensure the overall safety of the ship and plant having due regard to the prevailing circumstances and conditions.</p>
Organise maintenance and repairs	<ul style="list-style-type: none"> • Identification and use of manufacturer's manuals • Planning and preparation for maintenance including systematic isolation, dismantling and reassembly of plant • Inspections undertaken on a vessel's hull during slipping or dry-docking 	<p>Maintenance and repair procedures are organised within technical specifications, accepted practices and vessel procedures.</p> <p>The organisation and preparation of operations is suited to the design parameters of the power installation and to the requirements of the voyage.</p>

(Continued...)

TABLE B10.2 — Function: Marine engineering at the operational level
Section 2: Engineering — Marine Engine Driver Grade 2 (continued)

Outcome	Content	Standards for evaluating competence
Explain methods of fire protection, detection and extinction	<ul style="list-style-type: none"> • Operation and maintenance of fire protection, detection and extinguishing equipment • Operation of machinery in such a way as to minimise fire risk • Causes if fire on board a vessel • Fire hazards aboard a vessel during operation and maintenance periods • Causes and methods of prevention of fires/explosion associated with LPG • Classes of fires • Types of fire extinguishers for marine use, including portable, non-portable and fixed fire fighting installations • Requirements for particular types of portable extinguishers for different classes of fire • Fire detection and alarms • Closing devices and remote shut-offs, gas/foam flooding systems. • Control and extinguishment of large compartment fires. • Hazards associated with the use of gas flooding systems. 	<p>Operational effectiveness of all fire detection and extinguishing systems is maintained at all times in accordance with performance specifications and legislative requirements.</p> <p>Fire control is implemented in accordance with maritime safety and vessel operating procedures whilst maintaining crew safety, vessel stability and operational capability.</p> <p>Actions taken to control fires are based on full and accurate assessment of the incident, using all available sources of information.</p> <p>The order of priority, timing and sequence of actions are appropriate to the overall requirements of the incident and to minimise damage and potential damage to the vessel, injuries to personnel and impairment of the operational effectiveness of the vessel.</p> <p>Alarms are actioned, recorded and reported according to vessel procedures and marine safety requirements.</p>
Apply regulations to be observed regarding operational or accidental pollution of the marine environment and methods to prevent such pollution	<ul style="list-style-type: none"> • Marine pollution regulations. • Operation of equipment in such a way as to minimise environmental pollution. • Causes of pollution particularly relating to discharges from engine compartments and vessel operation. • Statutory requirements regarding the discharge of oil, galley waste, garbage and plastics overboard. • Methods of prevention of pollution. • Requirements for reporting incidents. • Procedures for dealing with an oil spill. 	<p>Legislative requirements relating to protection of the marine environment are correctly identified.</p> <p>Procedures for monitoring shipboard operations and ensuring compliance with legislative requirements relating to protection of the marine environment are observed.</p>
Identify the lifesaving appliances required and explain their maintenance and use life saving appliances.	<ul style="list-style-type: none"> • Lifesaving appliances. • Launching arrangements for inflatable liferafts including hydrostatic releases. • Maintenance and checks necessary to keep lifesaving appliances in correct operating condition 	<p>Actions in responding to abandon ship and survival situations are appropriate to the prevailing circumstances and conditions and comply with accepted safety practices and standards.</p> <p>Maintenance procedures for Lifesaving appliances meet legislative requirements.</p>

(Continued...)

TABLE B10.2 — Function: Marine engineering at the operational level
Section 2: Engineering — Marine Engine Driver Grade 2 (continued)

Outcome	Content	Standards for evaluating competence
Employ Damage Control techniques for Hull damage.	<ul style="list-style-type: none"> • Practice of correct damage control procedures following hull damage. • Methods of damage control with specific reference to action to be taken in the event of flooding. 	Emergency procedures are in accordance with the established plans for emergency situations.
Maintain a safe working environment.	<ul style="list-style-type: none"> • Causes of accidents with marine mechanical; equipment • Methods of prevention. • Operating procedures for use of winches and other rotating/moving machinery. • Hazards associated with and the procedures for safe entry into confined spaces. • Hazards associated with and the procedures for the safe operation of lifting devices • Hazards associated with radio and radar transmitters 	Working practices are in accordance with legislative requirements, codes of practice, permits to work and environmental concerns.
<p>Methods and conditions for demonstrating competence (To be applied to all outcomes in this table)</p>		
<p>Assessment by an accredited assessor in a—</p> <ul style="list-style-type: none"> • working vessel; • training vessel; • simulator; or • approved training facility. <p>Using a combination of practical demonstration or practical exercises and theoretical explanation as appropriate to the subject and supported by oral or written questions.</p> <p>The process can be a part of—</p> <ul style="list-style-type: none"> • employment; • an approved training program; or • recognition of prior learning. 		

**TABLE B12.1 — COMPETENCIES FOR A CERTIFICATE OF
COMPETENCY AS AN ENGINEER CLASS 3**

Function: Marine Engineering at the operational level

Section: Practical mathematics — Engineer Class 3

Outcome	Content	Standards for evaluating competence
Use mathematical techniques to solve engineering problems	<ul style="list-style-type: none"> • Areas of geometric figures • Volumes of geometric solids • Relationship between relative density/specific gravity and volumes • Representation of a force as a vector. Resolution of vectors to a resultant thrust obtained from tangential forces in simple structures and lifting apparatus • Basic laws of friction • Force to overcome friction • Friction losses in simple slides • Simple lifting machines • First moments as applied to levers • Velocity ratio • mechanical advantage • efficiency of simple machines • levers, rope blocks, screw and hydraulic jacks 	Calculations from content column are carried out with results in accordance with makers or design specifications, product data sheet.
Carry out mathematical calculations relative to: <ul style="list-style-type: none"> • Vessel stress and stability • Heat value of fuel • Heat transference and expansion rates • Fluid pressures 	<ul style="list-style-type: none"> • Stress, strain and elastic limit • Working stress and safe working load • Relationship between circumferential and longitudinal stress in thin cylinders and spherical shells • Equilibrium of floating bodies • Linear expansion due to heating • Units of heat • Specific heat • Sensible heat (enthalpy) • Latent heat (enthalpy) • Higher and lower calorific values of fuel • Relationship between power and mean effective pressure • Turning moment applied to a shaft • Calorific value • Specific fuel consumption • Variation in fuel consumption with vessel speed 	Calculation results conform to engineering practices and/or case study results.

(Continued...)

TABLE B12.1 — Function: Marine Engineering at the operational level
Section: Practical mathematics — Engineer Class 3 *(continued)*

Methods and conditions for demonstrating competence (To be applied to all outcomes in this table)
<p>Assessment by an accredited assessor in a—</p> <ul style="list-style-type: none">• working vessel;• training vessel;• simulator; or• approved training facility. <p>Using a combination of practical demonstration or practical exercises and theoretical explanation as appropriate to the subject and supported by oral or written questions.</p> <p>The process can be a part of—</p> <ul style="list-style-type: none">• employment;• an approved training program; or• recognition of prior learning.

**TABLE B12.2 — COMPETENCIES FOR A CERTIFICATE OF
COMPETENCY AS AN ENGINEER CLASS 3**

Function: Marine Engineering at the operational level

Section: Engineering — Engineer Class 3

Outcome	Content	Standards for evaluating competence
Identify properties of common marine engineering materials and methods of joining Manufacture simple components Apply simple heat treatment	<ul style="list-style-type: none"> • Characteristics and limitations of materials used in construction and repair of ships and equipment • Characteristics and limitations of processes used for fabrication and repair • Properties and parameters considered in the fabrication and repair of systems and components 	Identification of important parameters for fabrication of typical ship related components are appropriate. Selection of material conforms to vessel design. Use of equipment and machine tools are according to engineering workshop practices. Identify common marine engineering materials. List the properties as per material specifications. Fabricate the following: <ul style="list-style-type: none"> • Fit male and female finger joint. • Machine and make threads to demonstrate use of lathe. Join two sections of— <ol style="list-style-type: none"> a) the same material; and b) different material, in conformance with welding and mechanical techniques, to engineering tolerances.
Explain the Properties of liquids and gases commonly used aboard vessels	<ul style="list-style-type: none"> • Properties of liquids and gases commonly used on board ship 	Monitor and control vessel fluids and gases to ensure compliance with legislative requirements and measures to ensure safety of life at sea and protection of the marine environment.
Explain precautions against fire or explosion	<ul style="list-style-type: none"> • Principles of fire • Methods of fire prevention • Detection and alarm systems • Common causes • Advantages of cleanliness and good housekeeping practices • Oil mist detectors • Storage and use of LPG and petrol • Bunkering and transfer of fuel • Safety devices to prevent fire or explosion; Dangers of accumulation of oil or gas in enclosed spaces 	Identify and explain the causes of fires and explosions and the means of prevention in accordance with maritime safety regulations and vessel Procedures. Procedures for monitoring fire detection and safety systems ensure that all alarms are detected promptly and acted upon in accordance with established ship procedures.

(Continued...)

TABLE B12.2 — Function: Marine Engineering at the operational level
Section: Engineering — Engineer Class 3 (continued)

Outcome	Content	Standards for evaluating competence
Operate and maintain fire protection, detection and extinguishing equipment and operate machinery in such a way as to minimise fire risk	<ul style="list-style-type: none"> • Methods of dealing with fire on board vessels • Construction, testing and use of various portable and fixed fire extinguishers • Remote shut-offs and closing appliances 	The type and potential risk of the fire is identified, explained and initial actions conform to emergency procedures and contingency plans.
Implement safety precautions before entering tanks or confined spaces	<ul style="list-style-type: none"> • Dangers encountered in tanks and confined spaces • Precautions before entering tanks or confined spaces 	Maintenance activities are planned and carried out in accordance with technical, legislative, safety, and procedural specifications.
Explain the construction features of a ship that impact on its watertight integrity and stability	<ul style="list-style-type: none"> • Common terms associated with vessel construction • Interpret plans • Rudder details • Oil and water lubricated stern tube details • Propeller types and fitting • Underwater fittings • Free surface effect • Management of tanks to maintain trim and stability 	<p>Structural components of a vessel are identified and information from vessel technical drawings is interpreted in accordance with design.</p> <p>Explain how the procedures ensure and maintain the watertight integrity and stability of the ship are in accordance with accepted practice.</p>
<p>Explain elementary principles, care and management of auxiliary power sources (steam and motor), including boilers and their fittings</p> <p>Operate auxiliary power sources</p>	<ul style="list-style-type: none"> • Waste heat boilers and economisers and their fittings • Auxiliary oil fired boilers and their fittings • Boiler water treatment and testing • Correct use of gauge glasses • Danger of water hammer • Maintenance of boiler water density • Diesel generators • Shaft generators 	<p>Auxiliary power sources are maintained and operated within maker's specifications and vessel maintenance schedules.</p> <p>Assessment of boiler condition is based on relevant information available from local and remote indicators and physical inspection and is in compliance with manufacturer's operating instructions and procedures.</p> <p>Malfunctions and deviations from the operating specifications are identified and rectification procedures comply with vessel procedures and manufacturers recommendations.</p> <p>Incidents are reported the vessel Master detailing the operational restrictions necessary.</p>

(Continued...)

TABLE B12.2 — Function: Marine Engineering at the operational level
Section: Engineering — Engineer Class 3 (continued)

Outcome	Content	Standards for evaluating competence
Explain elementary principles and care and management of the various types of auxiliary pumps and pumping, and piping systems, and other shipboard auxiliaries	<ul style="list-style-type: none"> • Types of pumps and principles of operation • Pumping systems for fuel oil, fresh-water, sea-water, lubricating oil, and bilge-water • Centrifugal separators • Oily water separators • Sewage systems 	<p>Operation of auxiliary equipment is planned and carried out in accordance with established rules and procedures to ensure safety of operations and avoid pollution of the marine environment.</p> <p>Auxiliary equipment is maintained and operated within maker's specifications and vessel maintenance schedules.</p> <p>Malfunctions and deviations from the specifications are identified and rectification procedures comply with vessel procedures and manufacturers recommendations. Incidents are reported the vessel Master detailing any operational restrictions necessary.</p>
Describe the alignment of machinery and machinery parts Dismantle, inspect, repair and reassemble vessel machinery	<ul style="list-style-type: none"> • The importance of correct alignment • The effects of incorrect alignment • Achieving correct alignment 	<p>Dismantling, inspecting, repairing and reassembling equipment is in accordance with manuals and good practice.</p>
Use gauges and meters to monitor and measure	<ul style="list-style-type: none"> • Construction and use of the various gauges and meters 	<p>The electrical, pressure and measuring gauges and meters are used in accordance with the technical specifications and parameter.</p>
Maintain engineering records including oil pollution	<ul style="list-style-type: none"> • Maintenance of records and machinery logs • Organisation of planned maintenance • Maintenance of spare parts and consumable stores • Knowledge of statutory and survey requirements • Knowledge of pollution legislation 	<p>A record is maintained of the movements and activities relating to the ship's engineering systems in accordance with vessel procedures and maritime engineering and safety procedures.</p> <p>Maintenance activities are planned and carried out in accordance with technical, legislative, safety, and procedural specifications.</p> <p>Plans, specifications, materials, spare parts and equipment are available according to vessel contingency plans for maintenance and repair.</p> <p>Procedures for monitoring operations and maintenance comply with legislative requirements.</p> <p>Potential non-compliance is promptly identified and action taken to prevent actual occurrence.</p> <p>Requirements for renewal and extension of certificates ensure continued validity of survey items and equipment.</p>

(Continued...)

TABLE B12.2 — Function: Marine Engineering at the operational level
Section: Engineering — Engineer Class 3 (continued)

Outcome	Content	Standards for evaluating competence
Demonstrate use of lifesaving appliances Abandon ship	<ul style="list-style-type: none"> • The operation of survival craft and rescue boats • Survival craft launching appliances and arrangements and their equipment, including EPIRBs 	Actions in responding to abandon ship and survival situations are appropriate to the prevailing circumstances and comply with accepted safety practices and standards.
Operate and maintain refrigeration systems	<ul style="list-style-type: none"> • Principles of refrigeration • Properties of common refrigerants • Operating temperature and pressures • Methods of temperature control • Care and management of refrigeration equipment, recognition of defects 	Explain the operating principles of a refrigeration system in accordance with maker's specifications. Refrigeration and air conditioning systems are operated and maintained within technical specifications and in accordance with accepted practices and procedures to ensure safety of operation and avoid pollution of the marine environment.
Methods and conditions for demonstrating competence (To be applied to all outcomes in this table)		
Assessment by an accredited assessor in a— <ul style="list-style-type: none"> • working vessel; • training vessel; • simulator; or • approved training facility. Using a combination of practical demonstration or practical exercises and theoretical explanation as appropriate to the subject and supported by oral or written questions. The process can be a part of— <ul style="list-style-type: none"> • employment; • an approved training program; or • recognition of prior learning. 		

**TABLE B12.3 — COMPETENCIES FOR A CERTIFICATE OF
COMPETENCY AS AN ENGINEER CLASS 3
Function: Marine Engineering at the operational level
Section: Engineering — Engineer Class 3 Motor candidates only**

Outcome	Content	Standards for evaluating competence
Operate and maintain two and four stroke machinery Operate and maintain compressed ignition engines	<ul style="list-style-type: none"> • Simple constructional details • Care and management of two stroke and four stroke main propulsion internal combustion engines • Care and management of compressed ignition internal combustion engines • Two and four stroke cycles and timing • Scavenging and supercharging • Engine cooling and lubrication • Tuning • Overloading • Safety devices • Engine governors and trips • Starting, reversing and operational procedures • Engine bearings • Detection of defects • Crankcase explosions 	<p>Identify and explain the function of internal combustion engine components.</p> <p>The methods of preparing for start-up and making available fuels, lubricants, cooling water and air are in accordance with vessel procedures or maker's specification.</p> <p>Checks of pressures, temperatures and revolutions during the start-up and warm-up period are in accordance with the technical specifications.</p> <p>Watchkeeping (or bridge monitoring) schedules ensure the main propulsion plant is operated within maker's specifications.</p> <p>Malfunctions and deviations from the operating specifications are identified promptly and accurately and rectification procedures comply with the vessel procedures and manufacturers recommendations and are reported to the vessel Master detailing any operational restrictions necessary.</p> <p>Arrangements for ensuring the safe and efficient operation and condition of the machinery installation are in compliance with vessel operating procedures.</p>
Explain the principles of engine cooling, fuel and lubricating systems	<ul style="list-style-type: none"> • Cooling systems for diesel engines • Relationship between temperature and efficiency • Cooling water testing • Fuel systems for diesel engines • Safety devices • Centrifugal separators • Fuel filters • Lubricating systems for diesel engines • Boundary & full fluid film • Viscosity • Additives & total base numbers • On board tests of lubricating oil 	<p>Engine cooling, fuel and lubricating systems are operated and maintained in accordance with technical specifications to ensure safety of operation and avoid pollution of the marine environment.</p>
Outline the principles of air compressors, their care and maintenance	<ul style="list-style-type: none"> • Reciprocating air compressors • Cooling and intercooling • Compressor defects • Relief valves • Air receivers and their mountings • Oil contamination of air start systems 	<p>Air compressors and ancillary equipment are operated and maintained in accordance with technical specifications and accepted procedures to ensure safety of operation.</p>

(Continued...)

TABLE B12.3 — Function: Marine Engineering at the operational level
Section: Engineering — Engineer Class 3 Motor candidates only *(continued)*

Methods and conditions for demonstrating competence (To be applied to all outcomes in this table)
<p>Assessment by an accredited assessor in a—</p> <ul style="list-style-type: none">• working vessel;• training vessel;• simulator; or• approved training facility. <p>Using a combination of practical demonstration or practical exercises and theoretical explanation as appropriate to the subject and supported by oral or written questions.</p> <p>The process can be a part of—</p> <ul style="list-style-type: none">• employment;• an approved training program; or• recognition of prior learning.

**TABLE B12.4 — COMPETENCIES FOR A CERTIFICATE OF
COMPETENCY AS AN ENGINEER CLASS 3
Function: Marine Engineering at the operational level
Section: Engineering — Engineer Class 3 Steam candidates only**

Outcome	Content	Standards for evaluating competence
Explain the operation and safety of boilers, steam and feed systems, steam engines and turbines	<ul style="list-style-type: none"> • Simple constructional details and the care and management of main propulsion steam engines and boilers, their fittings and mountings, with particular reference to safety devices • Preparing for sea • Detection of defects 	<p>The methods of preparing the start-up of boilers, steam engines and turbines are in accordance with vessel and manufacturer's operating procedures.</p> <p>Assessment of boiler condition is based on relevant information available from local and remote indicators and physical inspection and physical inspection and is in accordance with manufacturer's operating instructions and procedures.</p> <p>Checks of pressures, temperatures and revolutions during the start-up and warm-up period are in accordance with the technical specifications.</p> <p>Watchkeeping is sufficient to ensure the main propulsion plant is maintained within safe operating specifications. Performance levels are in accordance with the technical specifications.</p> <p>Malfunctions and deviations from the operating specifications are identified promptly and accurately and rectification procedures comply with vessel procedures and manufacturers recommendations. Incidents are reported the vessel Master detailing any operational restrictions necessary.</p> <p>The methods of measuring the load capacity of the engines are in accordance with the technical specifications and performance is checked against bridge orders.</p> <p>Arrangements for ensuring the safe and efficient operation and condition of the machinery installation are in accordance with vessel operating procedures.</p>
Conduct boiler water tests and water treatment	<ul style="list-style-type: none"> • Causes and effects of boiler water contamination • Methods of detection of boiler water contamination • Boiler water treatment • Explain preventative and remedial actions 	<p>Boiler fuel, air and feed systems are operated and maintained in accordance with technical specifications to ensure safety of operation, optimum efficiency and to avoid pollution of the marine environment.</p>

(Continued...)

TABLE B12.4 — Function: Marine Engineering at the operational level
Section: Engineering — Engineer Class 3 Steam candidates only *(continued)*

Outcome	Content	Standards for evaluating competence
Manage boiler fuel, air and feed systems	<ul style="list-style-type: none"> • Principles of operation of common types of fuel oil burners • “Turn down ratio” • Application of flue gas analysis to good combustion • Importance of excess air • Importance of correct air register maintenance • Typical closed feed system with associated fittings • Function and operation of condensers, air ejectors, extraction pumps, feed controller and feed heaters 	Boiler water tests are carried out and water treatment undertaken in accordance with technical specifications to ensure safety of operation and optimum efficiency.
<p>Methods and conditions for demonstrating competence (To be applied to all outcomes in this table)</p>		
<p>Assessment by an accredited assessor in a—</p> <ul style="list-style-type: none"> • working vessel; • training vessel; • simulator; or • approved training facility. <p>Using a combination of practical demonstration or practical exercises and theoretical explanation as appropriate to the subject and supported by oral or written questions.</p> <p>The process can be a part of—</p> <ul style="list-style-type: none"> • employment; • an approved training program; or • recognition of prior learning. 		

**TABLE B12.5 — COMPETENCIES FOR A CERTIFICATE OF
COMPETENCY AS AN ENGINEER CLASS 3**

Function: Marine Engineering at the operational level

Section: Electrical — Engineer Class 3 All candidates

Outcome	Content	Standards for evaluating competence
Define electrical terms and solve basic electrical problems using mathematics	<ul style="list-style-type: none"> • S.I. Units, Amperes, Volts, Ohms • Ohms law • Resistance in series and parallel • Batteries in series and parallel • Heating effect of electric current • Calculation of electrical power given a network of resistance and applied voltage 	Terms are defined in accordance with electrical trade handbooks and calculations conform to principles of electricity.
Demonstrate electrical safety during repair and inspection of electrical circuitry and equipment	<ul style="list-style-type: none"> • Procedures for safe isolation of electrical and other types of plant and equipment • Supervision and management of electrical work • Safe working procedures on electrical plant and equipment 	Isolation, dismantling and reassembly of plant and equipment is in accordance with electrical trade practices and procedures. WARNING: RELEVANT STATE/TERRITORY ELECTRICAL LICENSING REQUIREMENTS NEED TO BE FULFILLED BY ANY PERSONS CARRYING OUT INSTALLATION, MAINTENANCE AND REPAIR OF ELECTRICAL CIRCUITS OR SYSTEMS THAT ARE 50V AC OR ABOVE, OR 120V DC OR ABOVE, ON A VESSEL.
Explain and use the colour coding system for electric conductors	<ul style="list-style-type: none"> • Colour coding system 	Earth active and neutral conductors are defined and wiring is connected in accordance with design diagrams and electrical trade practices and procedures.
Operate and maintain electric starter motors	<ul style="list-style-type: none"> • Types of AC and DC motor starters • Circuit protection devices for over and under loading 	Operation and maintenance requirements are explained in accordance with vessel procedures and manufacturer's manuals. AC and DC motors, starters and protection devices are operated and maintained in accordance with technical specifications and established procedures to ensure safety of operation WARNING: RELEVANT STATE/TERRITORY ELECTRICAL LICENSING REQUIREMENTS NEED TO BE FULFILLED BY ANY PERSONS CARRYING OUT INSTALLATION, MAINTENANCE AND REPAIR OF ELECTRICAL CIRCUITS OR SYSTEMS THAT ARE 50V AC OR ABOVE, OR 120V DC OR ABOVE, ON A VESSEL.

(Continued...)

TABLE B12.5 — Function: Marine Engineering at the operational level
Section: Electrical — Engineer Class 3 All candidates *(continued)*

Outcome	Content	Standards for evaluating competence
Explain the principles of operation and operating procedures for AC and DC generators	<ul style="list-style-type: none"> • Preparing, starting coupling and changing over alternators or generators. • Management of load sharing • Location of common faults and action to prevent damage 	The operation of AC & DC generators is explained in accordance with manufacturer's manuals and operating procedures comply with manufacturer's instructions and vessel procedures.
Manage and maintain batteries and accumulators	<ul style="list-style-type: none"> • Types of accumulators and storage batteries • Accumulators and storage battery construction • Accumulator and storage battery charging • Accumulator and storage battery maintenance and safety. 	Accumulators and storage batteries are managed and maintained within technical specifications and in accordance with established procedures to ensure safety of operation. WARNING: RELEVANT STATE/TERRITORY ELECTRICAL LICENSING REQUIREMENTS NEED TO BE FULFILLED BY ANY PERSONS CARRYING OUT INSTALLATION, MAINTENANCE AND REPAIR OF ELECTRICAL CIRCUITS OR SYSTEMS THAT ARE 50V AC OR ABOVE, OR 120V DC OR ABOVE, ON A VESSEL.
Repair, maintain and manage power distribution of single and three phase electrical power	<ul style="list-style-type: none"> • Single phase distribution systems • Three phase distribution systems • Circuit protection • Earth fault detection and rectification • Electrical safety procedures 	Distribution systems are managed and operated within technical specifications and in accordance with established rules of the electrical trade. WARNING: RELEVANT STATE/TERRITORY ELECTRICAL LICENSING REQUIREMENTS NEED TO BE FULFILLED BY ANY PERSONS CARRYING OUT INSTALLATION, MAINTENANCE AND REPAIR OF ELECTRICAL CIRCUITS OR SYSTEMS THAT ARE 50V AC OR ABOVE, OR 120V DC OR ABOVE, ON A VESSEL.
Methods and conditions for demonstrating competence (To be applied to all outcomes in this table)		
Assessment by an accredited assessor in a— <ul style="list-style-type: none"> • working vessel; • training vessel; • simulator; or • approved training facility. Using a combination of practical demonstration or practical exercises and theoretical explanation as appropriate to the subject and supported by oral or written questions. The process can be a part of— <ul style="list-style-type: none"> • employment; • an approved training program; or • recognition of prior learning. 		

**TABLE B12.6 — COMPETENCIES FOR A CERTIFICATE OF
COMPETENCY AS AN ENGINEER CLASS 3
Function: Marine Engineering at the operational level
Section: Engineering — Engineer Class 3 (For the steam
endorsement of a ME3 certificate limited to motor only)**

Outcome	Content	Standards for evaluating competence
Prepare a steam boiler for sea going operations and establish engine room watchkeeping procedures	<ul style="list-style-type: none"> • Boiler construction and the care and management of main propulsion steam engines and boilers, their fittings and mountings • Safety devices fitted to boilers • Preparing for sea • Detection of defects 	<p>The methods of preparing the start-up of boilers, steam engines and turbines conform to manufacturer's specification and vessel operating procedures.</p> <p>Assessment of boiler condition is based on relevant information available from local and remote indicators and physical inspection and is in accordance with manufacturer's operating instructions and procedures.</p> <p>Checks of conditions during the warm through and start-up periods are in accordance with the manufacturer's operating instructions and procedures.</p> <p>Watchkeeping procedures ensure performance levels are in accordance with the technical specifications and vessel procedures.</p> <p>Malfunctions and deviations from the operating specifications are identified promptly and accurately and rectification procedures comply with vessel procedures and manufacturers recommendations. Incidents are reported to the vessel Master detailing any operational restrictions necessary.</p>
Describe the causes, effects of, and methods of detection of boiler water contamination Explain preventative and remedial actions	<ul style="list-style-type: none"> • Causes and effects of boiler water contamination • Methods of detection of boiler water contamination • Boiler water treatment 	Boiler water tests are carried out and appropriate water treatment undertaken in accordance with technical specifications to ensure safety of operation and optimum efficiency.
Describe the care and management of boiler, fuel, air and feed systems	<ul style="list-style-type: none"> • Principles of operation of common types of fuel oil burners. • "Turn down ratio" • Application of flue gas analysis to good combustion • Importance of excess air • Importance of correct air register maintenance. Typical closed feed system with associated fittings • Functions & operation of condensers, air ejectors, extraction pumps, feed controllers and feed heaters 	Boiler fuel, air and feed systems are operated and maintained in accordance with the technical specifications to ensure safety of operation, optimum efficiency and avoid pollution of the marine environment.

(Continued...)

TABLE B12.6 — Function: Marine Engineering at the operational level
Section: Engineering — Engineer Class 3 (For the steam endorsement of a ME3 certificate limited to motor only) (continued)

Outcome	Content	Standards for evaluating competence
<p>Explain the operation and maintenance of two and four stroke compression ignition engines</p>	<ul style="list-style-type: none"> • Simple constructional details • Care and management of two and four stroke main propulsion internal combustion engines • Two and four stroke cycles and timing. • Scavenging and supercharging • Engine cooling and lubrication • Tuning • Overloading • Safety devices • Engine governors and trips • Starting, reversing and operational procedures • Engine bearings • Detection of defects • Crankcase explosions 	<p>The methods of preparing for start-up and making available fuels, lubricants, cooling water and air are the most appropriate.</p> <p>Checks of pressures, temperatures and revolutions during the star-up and warm up period are in accordance with the technical specifications.</p> <p>Watchkeeping schedules ensure the main propulsion plant is operated within manufacturer's specifications.</p> <p>Malfunctions and deviations from the operating specifications are identified promptly and accurately and rectification procedures comply with vessel procedures and manufacturers recommendations. Incidents are reported the vessel Master detailing any operational restrictions necessary.</p>
<p>Explain the principles of engine cooling, fuel and lubricating systems.</p> <p>Outline the principles of air compressors, their care and maintenance</p>	<ul style="list-style-type: none"> • Cooling systems for diesel engines • Relationship between temperature and efficiency • Cooling water testing • Fuel systems for diesel engines • Safety Devices • Centrifugal separators • Fuel filters • Lubricating systems for diesel engines • Boundary and full fluid film lubrication • Viscosity • Additives and Total Base Number • On board tests of lubricating oil • Reciprocating air compressors • Cooling and intercooling • Compressor defects • Relief valves • Air receivers and their mountings • Oil contamination of air start systems 	<p>Engine cooling, fuel and lubricating systems are operated and maintained in accordance with the technical specifications to ensure safety of operation and avoid pollution of the marine environment.</p> <p>Air compressors and ancillary equipment are operated and maintained in accordance with technical specifications and accepted principles to ensure safety of operation.</p>

(Continued...)

TABLE B12.6 — Function: Marine Engineering at the operational level
Section: Engineering — Engineer Class 3 (For the steam endorsement of a ME3 certificate limited to motor only) (continued)

Methods and conditions for demonstrating competence (To be applied to all outcomes in this table)
Assessment by an accredited assessor in a— <ul style="list-style-type: none">• working vessel;• training vessel;• simulator; or• approved training facility. Using a combination of practical demonstration or practical exercises and theoretical explanation as appropriate to the subject and supported by oral or written questions. The process can be a part of— <ul style="list-style-type: none">• employment;• an approved training program; or• recognition of prior learning.