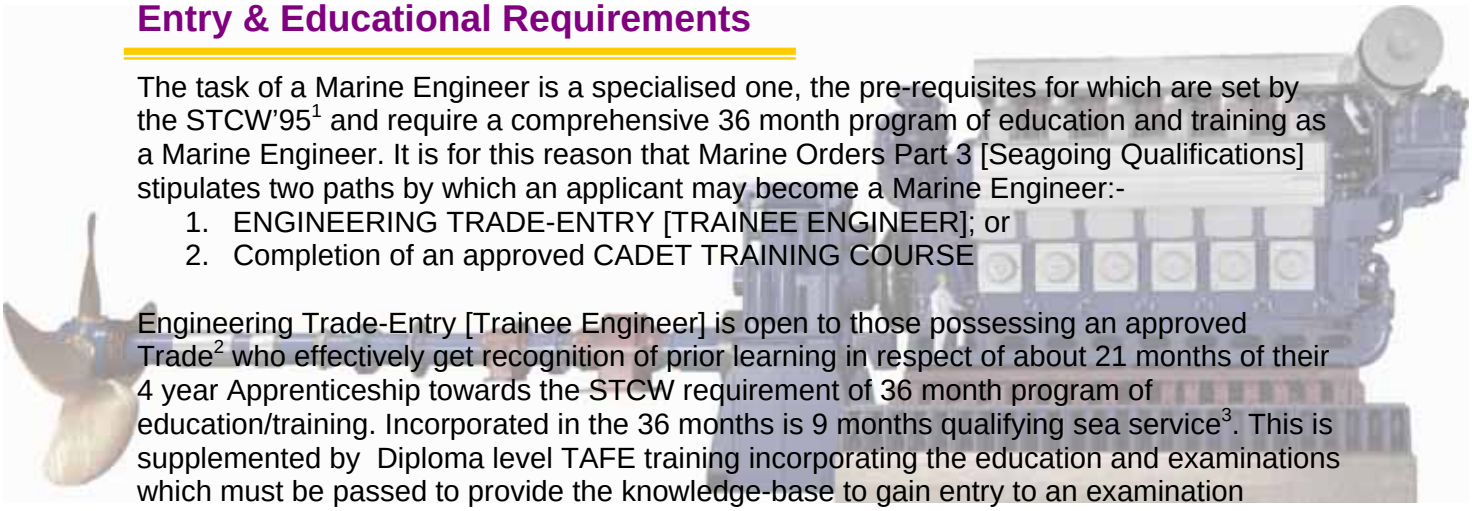
A CAREER AS A MARINE ENGINEER

Entry & Educational Requirements



The task of a Marine Engineer is a specialised one, the pre-requisites for which are set by the STCW'95[1] and require a comprehensive 36 month program of education and training as a Marine Engineer. It is for this reason that Marine Orders Part 3 [Seagoing Qualifications] stipulates two paths by which an applicant may become a Marine Engineer:-

1. ENGINEERING TRADE-ENTRY [TRAINEE ENGINEER]; or
2. Completion of an approved CADET TRAINING COURSE

Engineering Trade-Entry [Trainee Engineer] is open to those possessing an approved Trade[2] who effectively get recognition of prior learning in respect of about 21 months of their 4 year Apprenticeship towards the STCW requirement of 36 month program of education/training. Incorporated in the 36 months is 9 months qualifying sea service[3]. This is supplemented by Diploma level TAFE training incorporating the education and examinations which must be passed to provide the knowledge-base to gain entry to an examination conducted by the Australian Maritime Safety Authority ("AMSA") which if passed will lead to the issue by AMSA of the first of the series of escalating licences to perform the function of a Marine Engineer in escalating levels of Rank/responsibility. Before issue of the Certificate of Competency AMSA will require additional training in (1) Fire-Fighting (2) Survival at Sea and (3) First Aid.

In the alternative, an approved Engineer Cadet training course was available involving a Degree in Marine Engineering at the Australian Maritime College, Launceston.
This approach seeks to balance the lack of Trade-training and skills with a much higher emphasis on high academic level Engineering education, providing the STCW requirement of 36 month program of education/training through a 4-year Degree-course that incorporates all theoretical subjects towards [subject to sea-service and other Marine Orders 3 requirements as to timing/experience] issue of Watchkeeper/Class2/Class1 Marine Engineer Certificates of Competency.

Please note: an applicant who does not possess an approved Trade and does not complete the previously-available Degree-course Cadetship **can not currently become a Marine Engineer.**

Colleges, Shipowners and others in the industry should be aware that an applicant who does not possess an approved Trade can not simply do the short-path available to a Tradesperson because **AMSA can not issue that applicant with a Certificate** as the STCW requirements for a comprehensive 36-month program of education and training have not been met.

The Institute is striving to re-establish either the Degree-course Cadetship or an alternative high-academic-standard Cadetship; in the lack of shipowner support for the NMITC we are having to take this up in industrial negotiations. We hope for an outcome by late 2004, in

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[1] I.M.O.'s Convention on Standards of Training Certification and Watchkeeping 1995 requirements include Regulation III/1: completion of at least 36 months "…approved education and training…" including training in mechanical and electrical workshop skills relevant to the duties of an engineer officer; [and see 3 below]

[2] Approved under Marine Orders Part 3 [Seagoing Qualifications]. As at July 2004 these are Fitter & Turner/Machinist or Diesel Fitter or Electrical Fitter or an equivalent tradesman's rights certificate or an engineering trade with approved program of workshop service.

[3] Qualifying sea service is governed by STCW95 Section A-III/1 requiring that the approved program of on-board training involves systematic practical training and experience in the tasks, duties and responsibilities of an officer in charge of an engine-room watch, is closely supervised and monitored by a qualified and certificated Engineer Officer and is adequately documented in a training record book.

time for the 2005 academic year if possible. The Institute is also asking shipoperators to employ greater numbers of new entrants as a condition of our industrial agreements.

Certificates of Competency

A Marine Engineer must not only be qualified, but is required under the Navigation Act to be assessed/tested by AMSA for issue of a licence which must be valid at all times in order to be permitted to work as a Marine Engineer in Australia or internationally.

The first of these licences is the "Engineer Watchkeeper" Certificate of Competency which would permit the holder to sail as Third Engineer on an Australian or international vessel world-wide. To work on any kind of specialised vessel [e.g. a Steamship, a Tanker, a Chemical Tanker, or a Gas-Carrier] would require additional experience/training and a specific 'endorsement' of the Certificate of Competency to permit the holder to work on that specialist vessel.

After further experience/training the holder of an "Engineer Watchkeeper" Certificate of Competency may apply to AMSA to undergo the examination for issue of a Class 2 Marine Engineer Certificate of Competency. Such Certificate should permit the holder to sail as Second Engineer or even as First Engineer on an Australian or international vessel world-wide, however it is the practice of many companies to insist (above the legislated standards, in case of accident/injury to the Chief Engineer) that they will not appoint as First Engineer unless the person holds the next higher Certificate.

After further experience/training the Engineer may apply to AMSA to undergo the examination for issue of a Class 1 Marine Engineer Certificate of Competency. Such Certificate would permit the holder to sail as Chief Engineer on an Australian or international vessel world-wide.

Note that all these examinations conducted by AMSA are thorough and extensive: the pass rate is frequently less than 40% of those who qualify for the examination.

To go to sea you must also hold a valid certificate of Fitness from an AMSA-approved Doctor who will test your vision (including colour), hearing and general health.[4]

Note also that these Certificates of Competency are issued pursuant to the *Navigation Act 1912* and related regulations called *Marine Orders* to give effect to Australia's obligations under STCW95 and therefore have relevance to, or recognition in, limited employment sectors ashore.

Work Environment

Every activity described herein is performed on an unstable deck/platform that pitches, rolls, yaws according to the condition of the sea and the actions taken by the helmsman; neither of which you can see or predict.
In addition the deck/platforms within the (approximately) 10-storey high space that is the engine-room are vibrating/oscillating as a result of the percussive effect of each explosion in each massive cylinder of the ship's Slow-speed main engine in which the cylinder is half a metre to 1 metre wide and has a stroke approaching six foot long and operates at only ninety (90) revolutions per minute. Added to this is an ambient air temperature of 40 to 50 degrees Celsius and the turbo-charger whine which at 1 metre measures over 110 dBA.

[4] To a standard set under Marine Orders Part 9 [Health-Medical Fitness]. Aids to vision are permitted but colour blindness can be a problem. If in doubt go undertake the AMSA-Medical before you commence this career.

Machinery and plant is found at all levels within the engineroom and access is via engineroom ‘ladders’; these ladders have steel treads about 100mm wide and are usually inclined at about 30 degrees away from the vertical. Tools in hand, and in a sea-way, the Engineer must access all levels of the engineroom to perform adjustments and repairs and monitor gas and fluid levels/temperatures/pressures and respond to alarms from the 2000-point alarm system.
Even when you reach the peak of your career as Chief Engineer, and your role becomes increasingly technical/administrative/supervisory your responsibilities still require you to respond day or night to take charge of the engineroom should the situation get beyond the capacity/experience of the Duty Engineer.

Duties & Physical Requirements

Marine Engineers are responsible for the operation, and for the maintenance, of all propulsion systems whether steam, gas-turbine or marine-diesel and for all the cooling systems, heat-exchangers, lubricating systems, fuel-systems, water-treatment-systems, as well as electrical power [415Volt multi-alternator systems] generation and distribution on the ship, for all the diesel engines or steam-turbines that drive such alternators, for all hydraulic power systems, pneumatic systems, control systems, alarm systems and emergency systems. We cannot begin to describe all the duties of the marine engineer, we may as well reproduce STCW95, Marine Orders 28 Operating Procedures and Standards, the ISM Code but the simple truth is that the marine engineer must in any situation rely on him/herself to do what it takes to ensure the safety of personnel, machinery and ship; there is no one else to turn to at sea.

Large merchant cargo ships [say 10,000 tonnes and larger] commonly are manned by four Marine Engineers; A Chief Engineer, First Engineer, Second Engineer and Third Engineer. The lower 3 engineers take turns in being the ‘Duty-Engineer’ responsible for a 24 hour period for all alarms and isolations. The engineer may be asleep or in the shower but must respond immediately to such alarms and if the alarm is not cancelled within the first few minutes it will default to the Chief Engineer’s cabin and wake him/her up.
As well, these three engineers are allocated specific machinery/systems for which they take primary responsibility for all maintenance; this is not simply a case of waiting for something to breakdown, instead there are 2 important methods of determining maintenance-needs: (1) observation and diagnosis and (2) “Planned Maintenance” a system in which according to operational running-hours the machine is taken out of service and dismantled by the engineer so that its condition can be measured, parts machined/refurbished or spare parts fitted as required, then re-built. The pump/engine/compressor/centrifuge/heat-exchanger etc can be taken out of service after the ‘standby’ machine in the system is started and operated in the stead of the machine to be overhauled. It should be noted that this is heavy physical work which the Engineer does him/herself; you dismantle the machinery, you lump the heads of the diesel-alternator out to where you can get a sling on to it for access to any crane or overhead rail to raise it up several levels to the workshop, you re-condition it and return it to the engine and rebuild it, torque the bolts to manufacturers specifications. When this same task is done on a main engine bolt of about 100 mm diameter, you may have to use ‘flogging-spanners’ and a sledgehammer to apply the correct torque or on more modern ships use hydraulic bolt-tensioning equipment to do so. Within the crankcase of the main engine you climb on top of the oil-coated crankshaft and lift heavy hydraulic equipment into place to torque the nut holding each piston rod to the engine cross-head so that you can remove the piston to change the (half a metre to 1 metre wide) cast-iron piston-rings then stand inside the cylinder using an angle-grinder to smooth score-marks on the cylinder-liner. Many tasks, including changing a broken piston-ring, may at times have to be performed as an emergency break-down repair at sea with the vessel entirely at the mercy of the waves as you work to repair the propulsion machinery.

Your duties are performed all over the ship and will include the following examples:-

- From the Forecastle:

Inspect/operate/maintain emergency diesel-driven fire pump, deck-air compressor, hydraulic power systems for anchor-windlass and deck-winches and climb down vertical ladders to bow-thruster room (immediately under the bow) to inspect/repair the bow-thruster machinery as required.

- To the main deck

Work on deck to take fuel and water 'soundings' using a steel tape down the pipe for each of the many tanks Port and Starboard for Ballast Water, drinking water, light diesel fuel and heavy fuel. Also work on deck to repair hydraulic systems for winches cargo hatches & hydraulic systems or electrical systems for deck-cranes [depending on type of vessel]

Work beneath the deck when Ballast and other tanks are opened up for inspection or to gain access to deep-well pumps which are submerged inside the tanks. Climb vertical ladders to the bottom of the cargo holds to overhaul hold-bilge pipes and valves and (on dry-cargo self-discharger ships) inspect/adjust/maintain/repair in-hold cargo-conveyor-systems and cargo-bucket/scraper systems as well as all associated machinery.

- To the ship's Accommodation

Supply/maintain electricity, hot and cold water, sewerage treatment, heating and air-conditioning to the ship's living areas, all ship's refrigeration plant and cold-rooms, plumbing, bathrooms, toilets, ventilation system, washing machines, drying machines, galley equipment [similar to a large commercial kitchen] and services to all cabins and public rooms.

- To the engine-spaces:

These extend from the main deck downwards about 5 or 6 storeys [to the bottom of the ship] and from the main deck rise 4 or 5 storeys [surrounded by accommodation levels]. At the bottom of the ship you will be checking the condition of the stern-tube-seals on the propeller-shaft at the rear of the bottom-most depths of the engine-room, then lifting hatches in steel bottom-plates [1 to 2 square-metre sections of steel chequer-plate flooring] to access fuel/ballast/bilge pipes and pumps to inspect/tighten pump-glandseals and use hand-operated-valves. This is also the level of the crank-case doors which are opened in port to allow you to perform maintenance such as inspecting all fasteners within the crankcase, climbing over the crankshaft to take readings of crankshaft – deflections, changing bearings, removing piston-nuts to permit piston-removal and overhaul etc.

Up the next engine-room ladder you will find the engine-side manual-control station which you would use to operate the main engine under local-control should all forms of remote-control fail. Pumps, heat exchangers, lubrication systems and cooling water systems are all around you.

Up the next engine-room ladder you will find the engine-tops where each cylinder has a separate head fastened on with 8 to 12 large bolts (bolt-diameter up to about 100mm) which you will need to remove to gain access to that cylinder to remove the piston, change rings,etc. The Engine Control Room will likely be adjacent and have a window looking out onto this level of the engineroom; this is your first stop when answering an Alarm as the Duty Engineer and you will silence the Alarm, identify the hazard, determine and take corrective action and when safe operation has been restored, cancel the Alarm. Some manual 'Logging' of these events will be required, no matter how well the control systems make an electronic log of events.

Up the next engine-room ladder you will usually find 3 diesel-alternators, each diesel about 3 metres long and typically outputting about 800 to 1200kW , a workshop and storerooms for spare-parts and engineers equipment and tools.

On these and ever-higher levels within the engineroom spaces you will also be responsible for an oil-fired Boiler, exhaust-gas waste-heat boiler/economiser, fuel heating and centrifuge systems, lubricating oil centrifuge systems, cooling water [Freshwater] systems, cooling water [Seawater] systems, boiler-water systems and the like. This description is illustrative, not exhaustive.

Technology.

Most of the technology is in the design/construction of the machinery for which you are responsible plus in your knowledge that will [in time] permit you to take readings and make adjustments to the operation of machinery to optimise its operation.
The rest of the technology is in your head; it is the engineering knowledge that will allow you to look at the systems around you and understand them so well that you will know when a noise/smell/temperature/pressure indicates a fault and you will have the skills to deduce where in the system corrective adjustment or maintenance is required.
If you want to become a Marine Engineer because you see yourself tapping the keys of a computer operating high tech equipment in air-conditioned comfort and spotless white overalls then be aware that there is only one place in the Engine Room that is air-conditioned, and that is the Control Room, a place that you will spend only a small proportion of your time. The Marine Engineer is not merely an 'operator', he/she is the Maintainer of all machinery/plant/equipment on the vessel, hence the greater proportion of your time is spent in the engine spaces doing maintenance.

Rewards

- Training; and someone will pay you to do it.
- Travel; and someone will pay you to do it.
- High degree of job-control and job satisfaction
- High salary and conditions have been negotiated by Engineers acting collectively through their union, the **Australian Institute of Marine & Power Engineers**.

We suggest you print this for future reference and re-visit our web site for updates.

www.aimpe.asn.au

For further information contact one of our Branch offices.

Head Office: 02 9698 3999
Queensland: 07 3252 2900
Newcastle: 02 4961 6064
Melbourne: 03 9699 1488
Adelaide: 08 8341 0779
Perth: 08 9430 7782