

A Career as a MARINE ENGINEER

also known as a SHIP'S ENGINEER

Document produced December 2012
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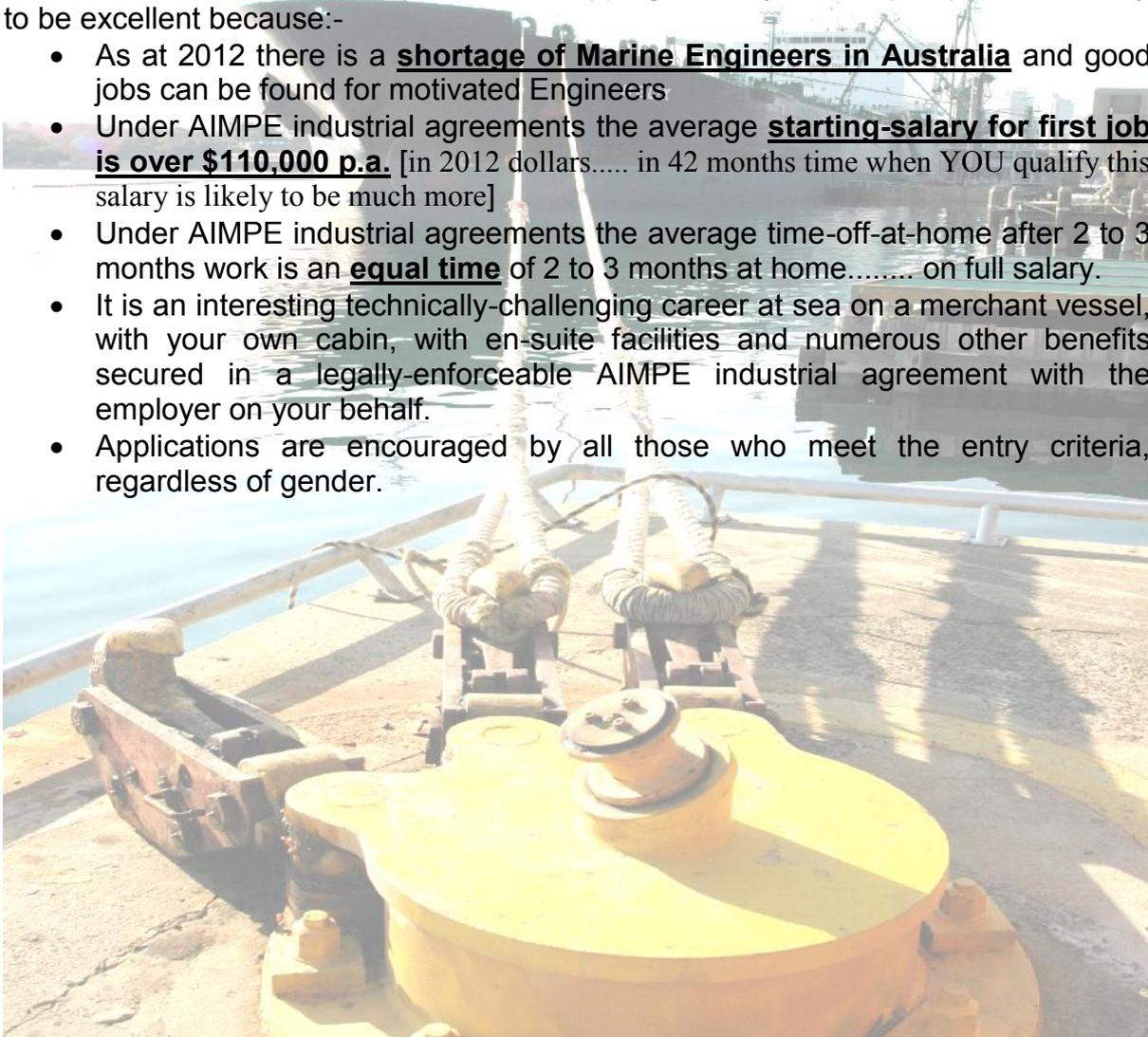
Do you want to be a MARINE ENGINEER who sails on commercial cargo ships, oil tankers, dredging vessels or offshore oil & gas vessels and operates and repairs all the ships machinery and related systems?

NOTE: this career is NOT about the Navy or armed forces.

ADVANTAGES

When you qualify, and pass your Australian Maritime Safety Authority exams for issue of a Marine Engineer Watchkeeper Certificate of Competency, you will need to look for work in the Australian merchant shipping industry but the prospects are likely to be excellent because:-

- As at 2012 there is a **shortage of Marine Engineers in Australia** and good jobs can be found for motivated Engineers
- Under AIMPE industrial agreements the average **starting-salary for first job is over \$110,000 p.a.** [in 2012 dollars..... in 42 months time when YOU qualify this salary is likely to be much more]
- Under AIMPE industrial agreements the average time-off-at-home after 2 to 3 months work is an **equal time** of 2 to 3 months at home..... on full salary.
- It is an interesting technically-challenging career at sea on a merchant vessel, with your own cabin, with en-suite facilities and numerous other benefits secured in a legally-enforceable AIMPE industrial agreement with the employer on your behalf.
- Applications are encouraged by all those who meet the entry criteria, regardless of gender.



Entry & Educational Requirements

The task of a Marine Engineer in the merchant shipping industry is a specialised one, the pre-requisites for which are set by the STCW Convention¹ plus the requirements of Australia's Marine Orders which stipulate *two* paths by which an applicant may become a Marine Engineer:-

1. Completion of an approved CADET-Engineer Training Course;
or
2. TRAINEE-Engineer [i.e. Engineering TRADE-entry]

[Note: AIMPE is also promoting discussion with AMSA for Class 3 Engineers with NO Trade, to have their maintenance experience since obtaining Class 3 evaluated by AMSA, on case-by-case basis, as Trade-Equivalent for entry to the Marine Engineer Watchkeeper course. As at November 2012 this is not yet implemented.]

The Australian Institute of Marine and Power Engineers ["AIMPE"] is the professional organisation and trade union for Marine Engineers in Australia, a role it has fulfilled since engineers banded together to protect themselves and their profession in 1881.

AIMPE and Teekay Shipping (Australia) Pty Ltd ["TEEKAY"] have reached agreement on the **AIMPE/TEEKAY-SPONSORED MARINE ENGINEER CADET PROGRAM** to give effect to the first of the above options.

If you are an Australian citizen or Resident and you hold HSC [year 12 or equivalent] passes in at least Mathematics, English and Science (Physics preferred) then you can apply for ***sponsorship*** for the 42 month program as an AIMPE/Teekay-Sponsored Marine Engineer Cadet.



The successful applicant is sponsored as a student [i.e. is *not* an employee] by being funded in relation to educational expenses, accommodation and



airfares as necessary to complete the 42 month AIMPE/Teekay-sponsored program, subject to signing the related Cadet-Agreement and fulfilling the obligations of that agreement. The college component will be at Newcastle's Hunter TAFE and the at-sea work-experience component in a learning-role on a commercial cargo ship operated by Teekay Shipping (Australia) Pty Ltd. Visit www.aimpe.asn.au to download details

of the Cadet Program and a copy of the AIMPE/Teekay Sponsored Cadet Agreement which sets out in detail both the obligations and the entitlements which apply to the successful applicants.

¹ I.M.O.'s Convention on Standards of Training Certification and Watchkeeping 1995 requirements plus the requirements of Australia's Marine Orders Part 3 include 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]

In the alternative, Engineering Trade-Entry [Trainee Engineer] is open to those possessing an approved Trade² who effectively get recognition of prior learning in respect of about 21 months of their 4 year Apprenticeship towards the required program of education/training. Incorporated in this is a requirement for the Trade-qualified Trainee Engineer to obtain at least 9 months qualifying sea service³. 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 Fire-Fighting, Survival at Sea and First Aid.

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 **Marine 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 a **Marine 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 a large 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 (Class 1) 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 any Australian or international vessel world-wide.

² Approved under Marine Orders Part 3 [Seagoing Qualifications]. As at November 2012 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 plus the requirements of Australia’s Marine Orders Part 3 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.

Living Environment

A large ocean-going cargo ship will have a complement of Chief Engineer and 3 other engineer officers, Captain and 3 other deck officers, a Cook and possibly an additional Caterer, and a number of Integrated Ratings [i.e. a rating who works in either the engineroom or on deck as required] and a Chief Integrated Rating. As a Marine Engineer



Officer you are entitled to your own cabin, with bed, wardrobe and desk and usually also with a couch and sometimes an armchair. Most have an en-suite (shower + toilet). A large ocean-going cargo ship will have a Duty-Mess for eating meals when in working clothes and a 'restaurant' for when the meal is in your off-duty time. There is an Officer's Recreation Lounge [which may or may not have a

Bar depending on the type of trade the vessel is in] with audio-visual entertainment equipment and a similar Ratings Recreation Lounge elsewhere in the ship. There will be a small Library and there may be a TV Room and a gymnasium.



Hours of Work & LEAVE

Most sectors of the industry work a 10 to 12 hour day, 7 days per week.... you may think that is a lot but you are away at sea and wont get home for many weeks so it is good to be kept busy. More importantly as you have worked about 80 hours per week whilst at sea you have earned the equal-time leave: for each day you have worked you have accrued a day of leave which keeps you on full salary when your 'duty-swing' is complete and you go home for a similar number of weeks of leave.

Some ships are never far from home, have telephone and email contact most of the time, and the 'duty-swing' is as short as 5 to 6 weeks. Other ships trade all around the Australian coast and overseas and the 'duty-swing' is 10 to 12 weeks. Some of the oil-producing ships [called FPSOs] work 3 weeks on duty, 3 weeks off duty, 3 weeks on duty, 6 weeks on duty.... naturally these jobs are sought-after.

Work Environment

Every activity described herein is performed on an unstable deck/platform that pitches, rolls, and yaws or heaves, sways and surges according to the condition of



the sea and the actions taken by the helmsman; neither of which you can see or predict. Many seafarers on their first-trip get very seasick. Most adapt within a few days and have little trouble thereafter. Some hardy souls get seasick for the first day or so of every voyage no matter how many years they work at sea.

(there are many other types of commercial vessels of different sizes and engine-capacity but the following description is typical of the largest ocean-going cargo vessels).

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 in the hotter parts of the engineroom of 35 to 45 degrees Celsius and the turbo-charger whine which at 1 metre commonly measures over 110 dBA.

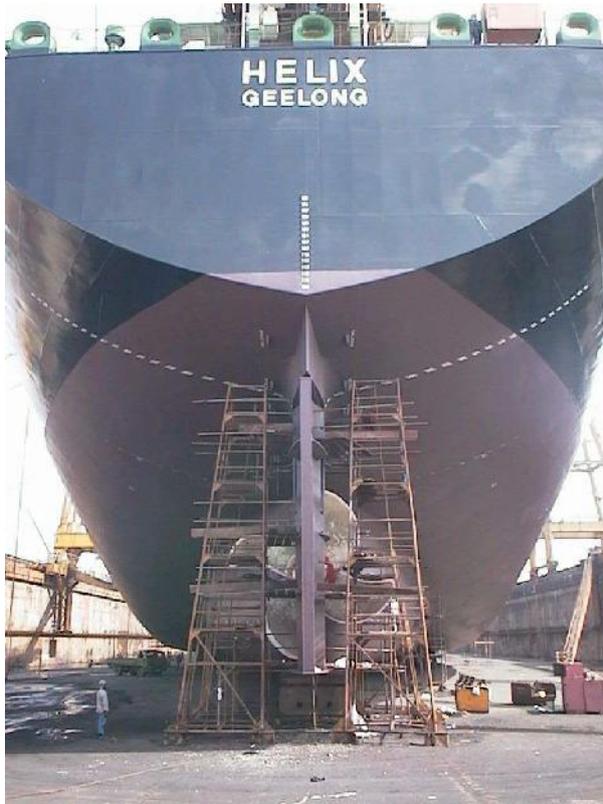
Machinery and plant is found at all levels within the engineroom and access is via engineroom 'ladders'; these ladders have steel treads about 100mm wide and are usually inclined at about 30 degrees away from the vertical. Tools in hand, and in a sea-way, the Engineer must access all levels of the engineroom to perform adjustments and repairs and monitor gas and fluid levels/temperatures/pressures and respond to alarms from the 2000-point machinery-alarm system which the duty Engineer monitors from the Engine Control Room [see photo].



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 and some use 6kV 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: to try would be to reproduce STCW95, Marine Orders 28 [Operating Procedures and Standards] and the International Safety Management Code. In short, however, 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 too.

These three engineers are also 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 the manufacturer's 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-winch 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 tank 'soundings' using a steel tape down the pipe for each of the many tanks Port and Starboard for light diesel fuel and heavy fuel oil. 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/scrapper 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. Nearby will be the sewage treatment plant and usually on this level that the fresh-water-generator [for producing drinking water from seawater] is located. This is also the level of the main-engine 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 engine room; 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 engine room 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.

Other Requirements

A seafarer must be able to pass the Medical-examination for issue of a certificate of Fitness from an AMSA-approved Doctor who will test your general health⁴, vision (including colour), and hearing.

A seafarer will have unrestricted access to port and ship 'security-zones' and therefore must also be able to pass the AFP/ASIO assessment for issue of a Maritime Security Identification Card.

Rewards

- Training; and someone will pay for it.
- Travel; and someone will pay to for it.
- High degree of job-control and job satisfaction
- After 'duty-swing' at sea the employer repatriates the Engineer home anywhere in Australia
- High salary and conditions have been negotiated by Engineers acting collectively through their union, the Australian Institute of Marine & Power Engineers.

You want to know more?

If you meet the Trade-entry requirements and want to know more about becoming a Trainee Engineer see our website www.aimpe.asn.au and contact one of our Branch offices.

If you have read all the material on our website www.aimpe.asn.au and you meet the Cadet-entry requirements and want to know more about becoming an **AIMPE/TEEKAY-SPONSORED MARINE ENGINEER CADET** please contact one of our Branch offices and ask for application forms.

Career Advisers seeking a briefing on this program please contact:-

- Mr Jim Mallows, AIMPE Director Professional Standards, on 0417 042 760 ; or
- Mr Henning Christiansen, AIMPE Federal Secretary, on 0419 400 324



*Australian Institute of
Marine & Power
Engineers*

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.