



An Effective Regulator Ensuring Engineering Excellence

**Discipline-Specific Training Guide for Registration as a
Professional Engineer, Technologist, or Technician in Maritime
Engineering**

R-05-MAR-PEPTPN

REVISION No. 0: 19 August 2026

Document No.: R-05-MAR-PEPTPN	Revision No.: 0	Effective Date: 19/08/2026	 E C S A ENGINEERING COUNCIL OF SOUTH AFRICA
Subject: Discipline-Specific Training Guide for Registration as a Professional Engineer, Technologist or Technician in Maritime Engineering			
Compiled by: Assistant Manager	Approved by: Acting Executive RSIR	Next Review Date: 19/08/2030	Page 2 of 85
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DEFINITIONS

Applicant: A person applying to the Engineering Council of South Africa (ECSA) for registration in any of the categories as per Section 18 of the Engineering Professions Act, No. 46 of 2000.

Broadly defined engineering problems have several of the following characteristics:

- The scope of the practice area is linked to the technologies that are used and the changes that are due to the adoption of new technology into current practice.
- The practice area is located within a wider context; it requires teamwork and has interfaces with other parties and disciplines.
- The problems require the use of a variety of resources, including people, money, equipment, materials, and technologies.
- The problems are constrained by available technology, time, finance, infrastructure, resources, facilities, applicable laws, and standards and codes.
- The problems require the resolution of occasional problems arising from interactions between wide-ranging or conflicting issues such as technical and engineering issues.
- The problems have significant risks and consequences in the practice area and related areas.

Candidate: A person registered with the ECSA after completing the relevant accredited engineering undergraduate or postgraduate programme or qualifications assessed to be equivalent by the ECSA for the specific registration Category.

Certification: Formal recognition awarded to an education or training programme through a quality assurance procedure specifying that it meets the criteria laid down for the type of programme.

Competency Assessment: A summative assessment of an Applicant's competence against the prescribed standard based on evidence from the Applicant's work and other tests that include a Professional Review.

Competency Standard: Statement of competency required for a defined purpose.

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Complex engineering work:

This work is characterised by the following:

- The scope of activities may encompass entire complex engineering systems or complex sub-systems.
- The context is complex, varying, multidisciplinary, and unpredictable; it requires teamwork and may need to be identified.
- It requires diverse and significant resources, including people, money, equipment, materials, and technologies.
- Significant interactions exist among wide-ranging or conflicting technical, engineering, or other issues.
- It is constrained by time, finance, infrastructure, resources, facilities, standards and codes, and applicable laws.
- It has significant risks and consequences in a range of contexts.
- The solution is not readily apparent.
- The problem statement has many interrelated conditions and may require first-principle empirical judgement to create a solution within a set of originally undefined requirements or conditions.

Engineering problem: A problematic situation that is amenable to analysis and solution using engineering sciences and methods.

Engineering sciences: A body of knowledge that is based on the natural sciences and that uses mathematical formulation where necessary, extending knowledge and developing models and methods to support its application, to solve problems and to provide the knowledge base for engineering specialisations.

Ill-posed problem: Problems for which the requirements are not fully defined or may be defined erroneously by the requesting party.

Integrated performance: An overall satisfactory outcome of an activity requires several outcomes to be satisfactorily attained. For example, a design requires analysis, synthesis, analysis of impacts, checking of regulatory conformance, and judgement in decisions.

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Level descriptor: The measure of performance demands at which outcomes must be demonstrated.

Management of engineering works or activities: This involves the co-ordinated activities that are required to

- direct and control everything that is constructed or results from construction or manufacturing operations
- operate engineering works safely and in the manner intended
- return the engineering works, the plant, and the equipment to an acceptable condition by the renewal, replacement, or mending of worn, damaged or decayed parts
- direct and control the engineering processes, systems, commissioning, operation and decommissioning of equipment
- maintain engineering works or equipment in a state in which it can perform its required function

Marine Engineering and Naval Architecture (CESM 081801 – DHET Classification of Educational Subject Matter): An area of study that prepares individuals to apply mathematical and scientific principles to the design, development and operational evaluation of self-propelled stationary or towed vessels operating on or under the water (including inland, coastal and ocean environments) and the analysis of related engineering problems such as corrosion, power transfer, pressure, hull efficiency, stress factors, safety and life support, environmental hazards and factors, and specific use requirements.

Maritime: The branch of engineering concerned with the systems design, production, operation and maintenance of water-borne vessels and the services and discipline-specific infrastructure associated with the operation of such vessels.

Mentor: A professionally Registered Person who guides the competence development of a Candidate in a concomitant Category.

Outcome: A statement of the performance that a person must demonstrate to be judged competent at the professional level.

Over-determined problem: A problem for which the requirements are defined in excessive detail, making the required solution impossible to attain in all its aspects.

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Practice area: A generally recognised or distinctive area of knowledge and expertise developed by an engineering practitioner by virtue of the path of education, training, and experience followed.

Range statement: The required extent of or limitations on expected performance stated in terms of situations and circumstances in which outcomes are to be demonstrated.

Referee: A Registered Person who can attest to the competence of a person applying for professional registration in a concomitant Category by submitting a comprehensive referee report.

SAMSA Marine Engineer (Standards of Training, Certification and Watchkeeping [STCW] of the International Maritime Organization [IMO]): Registration as a Maritime Engineer as envisaged under these ECSA rules is not to be confused with IMO requirements for a Marine Engineer's Certificate of Competency (CoC) under the STCW Convention (Chief Engineer or 2nd Engineer). The South African Government, through the South African Maritime Safety Authority (SAMSA), has an IMO accredited protocol that verifies the academic and practical compliance requirements for the issue of a CoC as an Engineering Officer for seagoing vessels. The ECSA Registration of these Chief Engineers is addressed under the Pr Cert Eng registration pathway, as defined in document **R-05-ME-PCE** Sub-DSTG for Candidate Certificated Engineers (Marine Engineers).

Supervisor: A person who directs and oversees the work activities of an Applicant.

Testing: Includes the Factory Acceptance Test (FAT), Harbour Acceptance Test (HAT), and Sea Acceptance Test (SAT) and related Performance Testing and Evaluation of marine craft and systems.

Well-defined engineering problems: Problems composed of interrelated conditions and requiring underpinning methods, procedures, and techniques to create a solution within a set of originally well-defined circumstances.

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ABBREVIATIONS

BDEA	Broadly defined engineering activities
BEng	Bachelor of Engineering
BEng Tech	Bachelor of Engineering Technology
BSc (Eng)	Bachelor of Science in Engineering
CEA	Complex engineering activities
CoC	Certificate of Competence
CoP	Code of Practice
CPD	Continuing Professional Development
DSTG	Discipline-Specific Training Guide
ECSA	Engineering Council of South Africa
FSS	Fire safety systems
IMO	International Maritime Organization
IPD	Initial Professional Development
LSA	Lifesaving appliances
MARPOL	Marine pollution
ND	National Diploma
PE	Professional Engineer
SAMSA	South African Maritime Safety Authority
SOLAS	Safety of Life at Sea
WDEA	Well-defined engineering activities

INTRODUCTION

All persons applying for registration as a Professional Engineer, Technologist, or Technician are expected to demonstrate the competencies specified in document **R-02-STA-PE/PT/PN** through work performed at the prescribed level of responsibility, irrespective of the Applicant's/trainee's discipline.

The Training and Mentoring Guide for Professional Categories (document **R-04-T&M-GUIDE-PC**) provides key aspects of training, which are as follows:

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- Duration of training and length of time working at level required for registration
- Principles of planning, training, and experience
- Progression of training programme
- Documenting training and experience
- Demonstrating responsibility

It is, therefore, important to standardise the framework for all engineering disciplines to ensure that all ECSA registration categories are aligned.

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BACKGROUND

The illustration below defines the documents that comprise the ECSA system for registration in professional categories. The illustration also locates the current document.

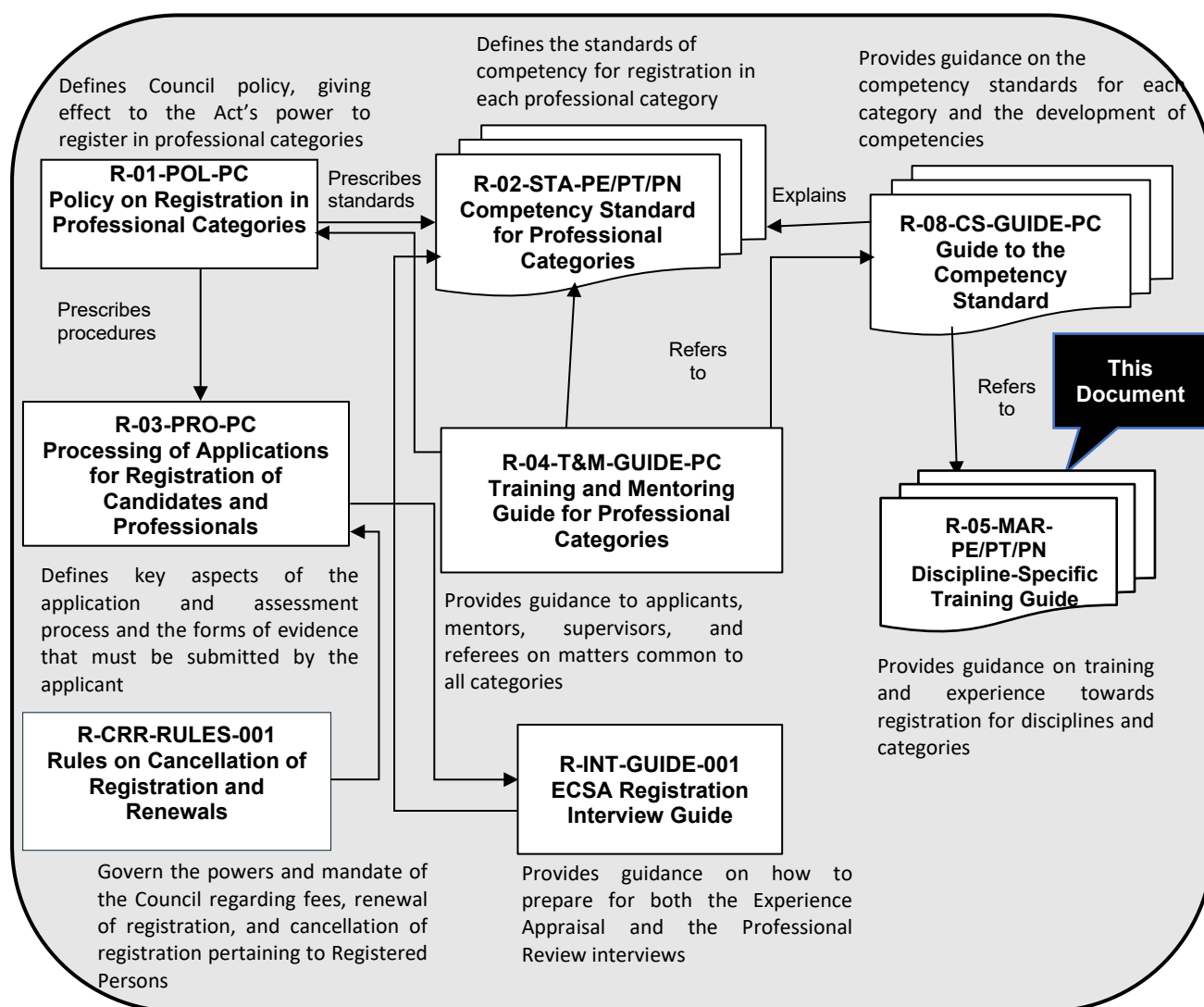


Figure 1: Documents defining the ECSA registration system

1. PURPOSE OF THIS DOCUMENT

All persons applying for registration as Professional Engineers are expected to demonstrate the competencies specified in the 'Competency Standard for Registration in Professional

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Categories' (document **R-02-STA-PE/PT/PCE/PN**) through work performed at the prescribed level of responsibility, irrespective of the trainee's discipline.

This document supplements the generic 'Training and Mentoring Guide for Professional Categories' (document **R-04-T&M-GUIDE-PC**) and the 'Guide to the Competency Standards for Registration in Professional Categories' (document **R-08-CS-GUIDE-PE/PT/PN**).

This document must be read in conjunction with the following documents:

- **R-01-POL-PC** – Policy on Registration in Professional Categories
- **R-02-STA-PE/PT/PN** – Competency Standard
- **R-02-COP-MAR** – Code of Practice for the Performance of Maritime Engineering Work
- **R-03-PRO-PC** – Processing of Applications for Registration of Applicants and Professionals
- **R-04-TM-GUIDE-PC** – Training and Mentoring Guide for Professional Categories
- **E-23-P** – Engineering Qualifications in the Higher Education Qualifications Sub-Framework

This guide and documents **R-04-T&M-GUIDE-PC** and **R-08-CS-GUIDE-PE/PT/PN** are subordinate to the policy **R-01-POL-PC** and the standards **R-02-STA-PE/PT/PN** and **R-03-PRO-PC**.

Document **R-05-ME-PCE Sub-DSTG** for Candidate Certificated Engineers (Marine Engineers) complements this document.

2. AUDIENCE

This Discipline-Specific Training Guide (DSTG) is directed towards Candidates and their Supervisors and Mentors in the discipline of Maritime Engineering (comprising Naval Architecture, Marine Mechanical Engineering, Marine Electrical Engineering, and related engineering specialist disciplines) and those who are undergoing in-service training as Maritime Engineers, Technologists, or Technicians.

The guide is also applicable to Engineers, Technologists, or Technicians who have studied other engineering disciplines but whose postgraduate specialisation is primarily in the

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maritime field and who wish to be assessed for professional registration based on their work in a maritime environment.

The guide is intended to support a programme of training and experience through incorporating elements of good practice.

The guide applies to persons who have

- completed the educational requirements for the Maritime Engineering qualifications prescribed for the Category,
- obtained qualifications recognised by the Washington, Sydney and Dublin Accords (for which the ECSA is a signatory thereof),
- registered with the ECSA as a Candidate Engineer, Technologist, or Technician, and
- embarked on a process of acceptable training under the supervision of an assigned Mentor (discipline-qualified professional), guiding the professional development process at each stage.

2.1 Persons registered as a Candidate with the ECSA

Candidate refers to a person registered with the ECSA after completing a relevant accredited engineering undergraduate or postgraduate programme or qualifications assessed to be equivalent by the ECSA for a specific registration Category. Candidates can carry out training through a Training Academy's programme as outlined in document **A-01-POL**.

The training through a Training Academy is structured to align with the ECSA's standard competency outcomes for the benefit of the Candidate. Professional Mentors, Supervisors, Coaches and Candidates must ensure that the training covers all developmental aspects aligned with the competency outcomes required for registration as a professional.

Mature Applicants for registration may apply the guide retrospectively to identify possible gaps in their development.

2.2 Persons not registered as a Candidate with the ECSA

Regardless of the developmental path followed, all Candidates for registration must present the same evidence of competence and be assessed against the same standards. Application

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for registration as a professional in a specific Category is permitted without being registered as a Candidate Engineer, Technologist, or Technician and without training under a Training Academy. Mentorship and adequate supervision during the period of training are, however, key factors in effective development to the level required for registration.

If the employer does not offer access to a Training Academy, the Applicant should establish the level of mentorship and supervision that the employer is able to provide. In the absence of an internal Mentor, the services of an external Mentor should be secured.

The Voluntary Association (VA) for the discipline may be consulted for assistance in locating an external Mentor. A mentorship programme can be developed and should keep abreast of all stages of the development process. Applicants in Maritime Engineering can consult the following ECSA-recognised VA:

- South African Institute of Marine Engineers and Naval Architects (SAIMENA) (Refer to the ECSA website regarding recognised VAs)

This guide is written for the recent graduate who is training and gaining experience towards registration. Mature Candidates for registration may apply the guide retrospectively to identify possible gaps in their development. Applicants who have not enjoyed mentorship are advised to request an experienced Mentor (internal or external) to act as an application adviser while they prepare their applications for registration.

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Maritime Engineering - Discipline Specific Training Pathway						
	NQF 7	NQF 8	First Step	Interim	Experience and Training	Registration
(Diploma then) Advanced Diploma in Marine Engineering	SAMSA accredited		Marine Engineering Cadetship	4th, 3rd, 2nd, Chief COC STCW standard	Candidate Certificated Engineer follow R-05-ME-PCE -Sub DSTG for Candidate Certificated Engineers (Marine Engineers)	Professional Certificated Engineer
Bachelor of Marine Engineering	SAMSA accredited		Marine Engineering Cadetship	4th, 3rd, 2nd, Chief COC STCW standard	Candidate Certificated Engineer follow R-05-ME-PCE -Sub DSTG for Candidate Certificated Engineers (Marine Engineers)	Professional Certificated Engineer
Bachelor of Engineering Technology in Marine Engineering	ECSA and SAMSA accredited		Marine Engineering Cadetship or Candidate Engineering Technologist	Marine related qualification in Marine, Electrical or Naval Architecture	APPENDIX B: Training Elements at PrTech level in Maritime Discipline	Professional Engineering Technologist
Mechanical or related Engineering programmes from ECSA accredited University		ECSA accredited	Maritime Candidate Engineer	Marine related qualification in Marine, Electrical or Naval Architecture	APPENDIX B: Training Elements at PrEng level in Maritime Discipline	Professional Engineer
Marine related education in Marine Engineering or Naval Architecture from local or international university		Get ECSA accredited	Maritime Candidate Engineer	Marine related qualification in Marine, Electrical or Naval Architecture	APPENDIX B: Training Elements at PrEng level in Maritime Discipline	Professional Engineer

Figure 2: Discipline-Specific Training Pathway for Maritime Engineering

3. TYPE OF ENGINEERING WORK

In terms of Section 27(1) of the Engineering Profession Act, the Council must draw up a Code of Conduct for Registered Persons and may draw up a Code of Practice (CoP) in consultation with the Council for the Built Environment, the VAs, and Registered Persons.

Maritime Engineering Professionals perform and supervise engineering work that is concerned with the design, development, manufacture, testing, operation, and maintenance and support of all types of maritime vessels and infrastructure based on the engineering sciences underlying marine dynamics, marine structures, propulsion systems, electronic systems in navigation, control and communication, marine electrical systems, naval weapons

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systems, vessel integration, marine support systems (onboard and ashore), and vessel infrastructure.

Maritime Engineering Professionals must have a strong understanding of mathematics, physics, and sciences in addition to excellent problem-solving skills and attention to detail. They work in a variety of industries, including manufacturing, vessel maintenance, research and development, military, maritime authorities, and academic manufacturing. Their education, training, experience and exposure determine the Category in which Candidates can register and the types of engineering problems that they can solve.

The levels of engineering problems for the different levels of registration are as follows:

- **Professional Engineer:** Solves complex engineering problems and performs complex engineering activities.
- **Professional Engineering Technologist:** Solves broadly defined engineering problems and performs broadly defined engineering activities.
- **Professional Engineering Technician:** Solves well-defined engineering problems and performs well-defined engineering activities.

The characteristics and details of each level descriptor can be found in the Competency Standard for Registration, document **R-02-STA-PE/PT/PN**, which defines the competencies required for each Category.

Refer to **APPENDIX E** of this document for detailed information on the type of activities performed by Maritime Engineering Professionals that are generally appointed in one or more of the following positions, all of which fall under the term **Maritime Engineer**:

- a. Marine Mechanical Engineer
- b. Naval Architect
- c. Marine Electrical Engineer

A Maritime Engineer performs and supervises engineering work that is concerned with the design, development, manufacture, operation, and maintenance of all types of ships, vessels, and marine craft based on the engineering sciences underlying hydrodynamics, marine structures, and propulsion and auxiliary systems.

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Many Engineers in the maritime industry, particularly those working in a highly technical environment, tend to become specialists. Those working in areas such as manufacture, maintenance, and project management tend to be generalists.

Specialists, through their interaction on projects with those working in other specialist areas, should consequently gain practical experience in other areas of expertise.

Those Maritime Engineers whose training has been more general should demonstrate that they have acceptable experience in a number of specialist areas (typically five) for a minimum period of three years. Specialist Maritime Engineers, however, should demonstrate that they have in-depth experience, typically five years, in at least one area of Naval Architecture or Marine Engineering and acceptable experience in a number of other areas.

Maritime Engineers are generally appointed in one or more of the following positions (although these exact titles are seldom used):

- Maritime Design Engineer
- Maritime Systems Engineer
- Maritime Certification Engineer
- Maritime Test Engineer
- Maritime Research Engineer
- Maritime Engineering Academic
- Naval Architect (Engineer)

3.1 Typical practice areas

Required to have a working knowledge of the following regulations and audits and how they affect their working environment:

- a. Engineering Council of South Africa – its Rules and the Code of Conduct
- b. International Maritime Organization (IMO) and International Association of Classification Societies (IACS) Rules and Guidelines and Codes of Practice
- c. SAMSA Codes and Regulations
- d. International Safety Management (ISM)
- e. Maritime Labour Convention (MLC)

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- f. Safety of Life at Sea (SOLAS)
- g. Marine Pollution (MARPOL)
- h. Fire Safety Systems (FSS) Code
- i. Life Saving Appliances (LSA)
- j. Industry-Specific Work Instructions
- k. Applicable South African National Standard (SANS) and other international standards such as ISO, EN, DIN or US Federal Standards
- l. Applicable Classification Society rules and regulations
- m. Flag State rules and regulations
- n. Marine Pollution (Prevention of Pollution from Ships) Act, No. 1986.

Other Acts not listed here may also be pertinent to a trainee's work environment. Candidates are expected to have a basic knowledge of the applicable Acts and to investigate whether any Acts are applicable in their particular work environment.

The DSTG initially presents information that is relevant to all Candidate Engineers whose areas are in the broad field of Maritime Engineering. Information specific to sub-disciplines is provided in the subsequent sections. Special considerations regarding training in different environments are also given, for example, for consulting or contracting.

3.2 Research and development

This type of work may be performed in research and product-development centres of business organisations or at academic institutions. Applicants must undertake research and developmental work that is predominantly Maritime Engineering in nature, and this work should include an in-depth application of the various aspects of Maritime Engineering, including product or system testing under controlled experimental conditions.

4. DEVELOPING ENGINEERING COMPETENCIES

Maritime Engineering offers a wide spectrum of specialist areas as listed in section 3.1, and this document underscores the crucial competencies required for individuals aspiring to register as Maritime Engineering Professionals.

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Regardless of the work sector, these competencies are essential for success in the field. The 11 outcomes specified in document **R-08-CS-GUIDE-PE/PT/PN** are the pillars of these competencies. In some instances, these competencies may not be readily available within an individual's current role, project, or position. In such cases, secondment to another department or employer or seeking guidance from an external Mentor is recommended.

Progression throughout the Candidacy period presented in document **R-04-T&M-GUIDE-PC** and Table 2 (see section 5) refers to the gradual increase in the Degree of Responsibility that Applicants are exposed to during their professional training. The required level of responsibility is included in brackets under each subheading for ease of reference.

Applicants and Mentors who are unsure whether the engineering work they are considering is complex, broadly defined or well-defined should refer to document **R-02-STA-PE/PT/PN**, the Competency Standard for Registration. Document **R-02-STA-PE/PT/PN** provides detailed information about the characteristics and requirements of each level descriptor, defining the competencies needed for each Category.

The VAs applicable to Maritime Engineering Professionals and their functions and services to members provide a broad range of contextual knowledge for Candidate Engineers, Technologists, and Technicians that continues through the full career path of the registered professional.

The balance of this section provides a set of guidelines for each competency (as per the competency standard) for each registration Category.

4.1 Training for registration as a Professional Engineer

4.1.1 Outcome 1: Define, investigate, and analyse complex engineering problems

In line with the ECSA outcomes, Engineers are expected to be able to define, investigate and analyse complex engineering problems (Responsibility Level E):

- a. Defining the engineering problems and the procedures for solving the problems.
- b. Investigating and evaluating pertinent information and identifying systems and sub-systems of complex problems, including collecting, organising, and evaluating

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information from all applicable sources, including in-situ investigations where appropriate.

- c. Analysing relevant assumptions, inputs, and required outputs of a complex engineering problem.

The complex engineering problem may be a design requirement, an applied research and development requirement, or a problematic situation in an existing component, system, or process. According to the ECSA, the definition of 'complex' in complex engineering problems can be defined as follows:

Composed of many interrelated conditions requiring first-principle empirical judgement to create a solution within a set of originally undefined circumstances.

Marine Engineering forms an integral part of broader engineering systems and infrastructure in technologically complex designs, manufacturing and processing techniques, Maritime Craft product development, and research environments.

All Applicants are, therefore, required to demonstrate their ability to solve complex maritime problems, as explained in document **R-08-CS-GUIDE-PE/PT/PN**. Solving such problems typically requires the application of Maritime Engineering sciences and engineering judgement.

4.1.2 Outcome 2: Design or develop solutions to complex engineering problems

The engineering design or development of solutions to complex engineering problems includes the identification and/or development of clear requirements or needs. Based on these needs, an appropriate approach for the design process is chosen to resolve the complex problem. The preferred option or way forward is influenced by factors that best fit the solution, taking into consideration cost, practicability, innovation, and any impact outside the requirements. Depending on the problem tackled and the chosen approach, the design process should include the following:

- a. Advanced application of theoretical knowledge with respect to these systems. Applicants must incorporate calculations with clearly defined inputs of the formulae used and detailed interpretation of the results obtained.

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- b. Applicants must demonstrate how the calculated results were used to provide the solution to the problem at hand and indicate the economic benefit to the project or the operating work environment (e.g. improved efficiency, reduced environmental footprint, capacity enhancement, or simplification of the system).
- c. A complete and final solution with relevant documentation should be made available, including sufficient detail to show that the complex problem was solved and a presentation of the implementation plan.

4.1.3 Outcome 3: Comprehend and apply advanced and local knowledge of the widely applied principles underpinning good practice that is specific to the jurisdiction in which the Engineer practises

Evidence should be provided to demonstrate that individuals have a thorough understanding and mastery of the engineering principles and technologies relevant to their areas of practice. Furthermore, they should be able to apply first-principle analytical thinking to address and solve complex problems within their domain effectively.

In demonstrating advanced application of theoretical knowledge with respect to these systems, Applicants must incorporate calculations with clearly defined inputs of the formulae used and detailed interpretation of the results obtained.

Applicants must demonstrate how the calculated results have been used to provide the solution to the problem at hand and indicate the economic benefit to the project or the operating work environment (e.g. improved efficiency, reduced environmental footprint, capacity enhancement, or simplification of the system).

In applying technical and scientific knowledge gained through academic training, Applicants must also demonstrate the financial and economic benefits of engineered solutions synthesised from scientific and engineering principles at a sufficiently advanced level.

4.1.4 Outcome 4: Manage part or all of one or more complex engineering activities

Engineers are very often given the responsibilities to lead and manage multidisciplinary teams. Hence, the work done by a Maritime Engineer may frequently cross the boundaries between engineering disciplines and specialist areas or at least be influenced by interfaces with other

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disciplines. To this effect, special consideration must be given to the competency of Management and Communication.

The display of personal and work-process management abilities in the competence area is typified by the following:

- a. managing self, people, work priorities, processes, and resources when performing complex engineering activities
- b. planning, organising, leading, and controlling complex engineering activities
- c. managing contracts and other agreements and possessing the ability to establish and maintain professional and business relationships

4.1.5 Outcome 5: Communicate clearly using multiple media and collaborate inclusively with a broad range of stakeholders in the course of engineering activities

In the field of Maritime Engineering, effective communication and inclusive collaboration are critical to the success of complex engineering projects. Maritime Engineers consistently demonstrate their ability to convey technical concepts clearly across multiple media, ranging from detailed design reports and digital simulations to oral presentations and collaborative digital platforms.

These professionals engage with a wide array of stakeholders, including multidisciplinary engineering teams, regulatory bodies, industry partners, and end-users. Their capacity to communicate precisely and inclusively ensure that project objectives are clearly understood, risks are effectively managed, and innovative solutions are developed and implemented efficiently.

Competency indicators: Effective and clear communication is typified by the following:

- a. Accurate technical documentation: Ability to create precise and comprehensive reports, specifications, and manuals that are essential for design validation and certification and maintenance procedures.
- b. Effective use of visual aids and tools: Skilled in using engineering drawings, system diagrams, simulations, and 3D models to represent complex systems and data visually for clear understanding.

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- c. Tailoring communication to the audience: Demonstrates the ability to adapt messaging, both written and verbal, based on the technical expertise and needs of diverse stakeholders.
- d. Clear oral communication in multidisciplinary teams: Communicates effectively in team settings, ensuring that all members, from software developers to flight crews, understand the technical goals and constraints.
- e. Active listening and feedback integration: Listens attentively to input from others and integrates feedback into engineering processes, showing respect for team collaboration and continual improvement.
- f. Concise presentation of technical data: Presents complex data and engineering decisions in a concise and understandable manner during reviews, audits, or client meetings.
- g. Use of collaborative communication platforms: Proficient in using digital platforms (e.g. project management tools, shared documents, messaging apps) to ensure smooth and transparent communication across teams.
- h. Documentation for certification and compliance: Prepares clear and regulatory-compliant documentation required by marine authorities, ensuring that all engineering activities meet legal and safety standards.
- i. Cross-cultural and international communication skills: Communicates effectively with global partners and suppliers, showing cultural awareness and language sensitivity in international projects.
- j. Crisis and risk communication: Provides clear, timely and calm communication in high-pressure or emergency situations, enabling rapid and effective decision-making that prioritises safety and compliance.

4.1.6 Outcome 6: Recognise the reasonably foreseeable economic, social, cultural, and environmental effects of complex engineering activities seeking to achieve sustainability

Maritime Engineers play a vital role in shaping the future of a sustainable maritime industry by recognising and addressing the broader impacts of their work. In the course of complex engineering activities, they are trained to consider not only technical performance and safety but also the economic, social, cultural, and environmental consequences of their decisions.

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Whether designing more fuel-efficient vessels, developing quieter propulsion systems or selecting environmentally responsible materials, Maritime Engineers strive to minimise negative impacts and promote long-term sustainability. Their ability to anticipate foreseeable outcomes and integrate sustainable practices into engineering solutions reflects a deep commitment to responsible innovation and global stewardship:

- Social effects: Impacts on communities and individuals such as improved connectivity, job creation, and public safety and concerns such as noise pollution or displacement due to airport expansion.
- Environmental effects: Consequences for the natural environment, including emissions, fuel consumption, noise pollution, and resource use, with efforts focused on reducing the ecological footprint of ships and maritime systems.
- Cultural effects: Influence on local and global cultural values such as respecting indigenous land during infrastructure development or ensuring that maritime technologies align with cultural expectations and practices in diverse regions.

4.1.7 Outcome 7: Meet all legal and regulatory requirements and protect the health and safety of persons during all complex engineering activities

Applicants are expected to have a working knowledge of the following regulations and Acts and how the legislation affects their working environment:

- Engineering Profession Act, No. 46 of 2000 (EPA)
- The ECSA Code of Conduct
- Occupation Health and Safety Act as amended by the Occupation Health and Safety Act, No. 181 of 1993 (OHS Act)

The Applicant is expected to have a basic knowledge of the Acts that are applicable to their area of practice. This list is not exhaustive.

Other Acts not listed here may also be pertinent to an Applicant's specific work environment. Candidates are expected to have a basic knowledge of the relevant Acts and to investigate whether any Acts are applicable to their specific work environment.

Note: International and other applicable standards that are acceptable after proper justification.

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4.1.8 Outcome 8: Conduct engineering activities ethically

Maritime Engineers are entrusted with responsibilities that have far-reaching implications for safety, security, and public trust. As such, they must conduct all engineering activities with the highest ethical standards. This involves making decisions with honesty, integrity, and transparency while prioritising the well-being of society, the environment, and future generations. Whether dealing with safety-critical systems, managing confidential information, or navigating complex regulatory environments, Maritime Engineers must uphold professional codes of conduct and ensure their actions align with ethical principles. Ethical practice is essential not only for compliance but also for sustaining the credibility and accountability of the engineering profession.

The ECSA has developed the Code of Practice for the Performance of Maritime Engineering Work to supplement the Code of Conduct for Registered Persons: Engineering Profession Act, No. 46 of 2000.

Section 27 of the Engineering Profession Act, No. 46 of 2000, empowers the ECSA to draw up codes of practice in addition to codes of conduct and requires all Registered Persons to comply with such codes. While codes of conduct regulate behaviour, codes of practice regulate engineering practice.

The CoP also details the ethical values and professional standards that the ECSA expects all Registered Persons to adhere to as prescribed under the Code of Conduct for Registered Persons in terms of the Act.

Registered Persons must abide by the Ethical Rules of Conduct as listed in the Code of Conduct:

- a. Competency
- b. Integrity
- c. Public Interest
- d. Environment
- e. Dignity of the Profession

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It is expected that in the execution of their engineering work, Registered Persons will conduct their work with integrity and according to generally accepted norms of professional conduct without prejudice to public health and safety.

4.1.9 Outcome 9: Exercise sound judgement by evaluating the outcomes, impacts, and alternatives in the course of complex engineering activities

Maritime Engineers are frequently required to exercise sound judgement when navigating complex engineering activities in which the stakes are high and the consequences far reaching. This involves critically evaluating potential outcomes while considering both technical performance and broader impacts such as safety, cost, environmental effects, and regulatory compliance. By systematically weighing alternatives and anticipating risks, Maritime Engineers ensure that the decisions made throughout the design, testing, and operational phases support both mission success and public safety. Their ability to make informed, ethical, and forward-thinking choices is fundamental to the advancement of maritime technology and reliability.

Sound engineering judgement involves the following aspects:

- Critical evaluation of alternatives** to compare multiple design or solution options by assessing trade-offs involving performance, cost, sustainability, feasibility and long-term implications.
- Risk assessment and mitigation** to identify, analyse, and mitigate technical and operational risks while considering safety, reliability, and regulatory requirements.
- Ethical and professional responsibility** by demonstrating integrity and accountability by considering the societal, environmental, and legal impacts of engineering decisions.

Applicants must, therefore, demonstrate evidence of this professional judgement when evaluating the interactions between conflicting technical, engineering, social, and other considerations and pay careful attention to their broader impacts on all affected stakeholders when formulating recommendations.

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4.1.10 Outcome 10: Be responsible for making decisions on part or all of complex engineering activities

In the field of Maritime Engineering, decision-making during complex engineering activities carries a high level of responsibility, as the outcomes directly influence the safety, performance, and regulatory compliance of maritime systems.

Maritime Engineers are entrusted with making informed decisions that account for a wide range of technical parameters, operational constraints, and stakeholder expectations. This responsibility extends beyond technical proficiency to include ethical considerations, sustainability, cost-effectiveness, and long-term system integrity.

Sound decision-making requires a disciplined approach that integrates rigorous analysis, multidisciplinary collaboration and a commitment to professional standards to ensure that each choice contributes to the success and safety of the engineering solution.

4.1.11 Outcome 11: Undertake sufficient professional developmental activities to maintain and extend competence and enhance the ability to adapt to emerging technologies and the ever-changing nature of work

Professional development is a critical aspect of a Maritime Engineer's career, ensuring sustained competence in a rapidly evolving and highly technical field. It involves taking personal ownership of one's growth by independently planning, selecting, undertaking, and recording activities that enhance knowledge, skills, and professional capability.

Given the pace of technological advancements and the stringent safety and regulatory standards in Maritime Engineering, continual learning is essential. By pro-actively engaging in professional development, Maritime Engineers not only maintain relevance in their discipline but also uphold the highest standards of engineering excellence and public trust.

Professional development is essential for Engineers to improve their skills continually and advance their careers. To facilitate this key professional development, Applicants can consider the following list of useful courses that present such learning activities:

- a. Project management
- b. Standards and Regulations development and writing

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- c. Microsoft Office tools (MS Excel, MS Word, MS PowerPoint, MS Project, etc.)
- d. Occupational health and safety

Note: The above list is by no means extensive or comprehensive and may carry ECSA Continuing Professional Development (CPD) points.

Competence in self-development is demonstrated through a proactive and strategic approach to continuing professional growth. This includes the following:

- a. **Articulating a clear awareness of the need for ongoing development** together with a well-defined strategy for independently enhancing professional knowledge, skills, and capabilities in alignment with evolving industry demands and personal career goals.
- b. **Providing verifiable evidence of sustained self-development**, both within the Engineer's primary area of expertise and in new or emerging domains. This may include formal learning, practical experience, mentorship activities, or engagement in professional networks, reflecting a commitment to lifelong learning and adaptability in a dynamic engineering environment.

Note: Refer to **Appendix D** for various levels of developmental activities.

4.2 Training for registration as a Professional Engineering Technologist

A Maritime Engineering Technologist performs and supervises broadly defined (as defined under the abbreviations section and in document **R-02-STA-PE/PT/PN**) engineering work concerned with the design, development, manufacture, operation, and maintenance of Maritime Craft of all types based on the engineering sciences underlying flight dynamics, maritime structures, and propulsion systems.

The following outcomes are to be read with document **R-02-STA-PE/PT/PN**, the Competency Standard for Registration, which provides key competency indicators for each outcome.

4.2.1 Outcome 1: Define, investigate, and analyse broadly defined engineering problems

This outcome defines the skills needed for a Maritime Engineering Technologist to address broadly defined engineering problems. These problems may arise from design requirements,

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Research and Development needs or issues in existing systems and must be solvable using known technologies.

Broadly defined engineering problems often demand in-depth technical expertise and a structured analytical approach to address them effectively. These problems are frequently ill-defined, requiring thorough interpretation and clarification before a viable solution can be developed. They may be embedded within complex systems or call for innovative adaptations to meet unique requirements. While such challenges can deviate from established standards, any proposed solution must be rigorously justified.

Additionally, Maritime Engineering Technologists may need to navigate incomplete data, conflicting constraints, and multidisciplinary impacts that influence the problem-solving process. The consequences of these challenges can be significant, sometimes extending beyond the immediate scope of the project. Furthermore, solutions must account for broader implications, as they may lead to multiple outcomes with far-reaching effects.

In essence, the Maritime Engineering Technologist ensures that a systematic process is adopted in solving broadly defined engineering problems with sound judgement.

4.2.2 Outcome 2: Design or develop solutions to broadly engineering problems

This outcome outlines the processing of a systematic approach that a Maritime Engineering Technologist may follow to develop and implement solutions for broadly defined engineering problems, typically after the initial analysis as performed in Outcome 1. Processing of a systematic approach to a broadly defined engineering problem may be typified by the following activities:

a. Processing of a systematic approach to a broadly defined engineering problem:

It is essential to develop multiple viable solutions, each supported by detailed costings, impact assessments, and/or theoretical calculations. This approach ensures a comprehensive evaluation of different strategies, allowing for an optimal balance between feasibility, cost-effectiveness, and performance. All proposed alternatives must meet the specified requirements, ensuring that no solution compromises its essential criteria (the main priority being safety).

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- b. **Determination of the optimal solutions:** Each design must be rigorously analysed against key criteria, including technical requirements, cost implications, and broader external impacts. In cases where full theoretical validation is unavailable, consultation with an experienced Engineer ensures that assumptions are sound and solutions are feasible.
- c. **Detailing the required specifications:** Engineering drawings and all necessary supporting documentation to ensure accurate execution must be detailed. Every specification of the chosen solution must be validated to confirm it fully meets the requirements such as safety, functionality, and economic viability.

In essence, Maritime Engineering Technologists establish that the process followed ensures that solutions to the broadly defined engineering problems are well-researched, justified, and ready for a realistic application in meeting the requirements.

4.2.3 Outcome 3: Comprehend and apply knowledge that is embodied in established engineering practices and that is specific to the jurisdiction in which the Engineering Technologist practises

This outcome outlines the essential knowledge area/s required for the Maritime Engineering Technologist to practice effectively and emphasise established and emerging technologies within a multidisciplinary team to ensure compliance with the necessary regulatory framework.

Applicable knowledge areas may require the application of well-established engineering principles while adapting to local conditions (e.g. environmental) or specific unique factors that the designed solutions must account for. This knowledge area may also require the assessment of emerging, new technologies, or materials that may require rigorous testing and validation before implementation. Decisions and justifications may be based on education, experience, and analysis of systems, materials, and client needs.

A working knowledge and an understanding of the interrelated disciplines (e.g. Naval Architecture, Mechanical Engineering, Electrical Engineering) are required when forming part of a multidisciplinary team. The Maritime Engineering Technologist may also be expected to lead multidisciplinary teams while taking responsibility for project outcomes.

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In effect, there must be a sound indication of knowledge, ensuring that regulatory compliance with the necessary legal, safety, and industry standards (e.g. OHS Act, environmental laws) is achieved. Other regulatory knowledge areas may include elements such as contract law, risk management, quality control, and Project/Construction Management.

4.2.4 Outcome 4: Manage part or all of one or more broadly defined engineering activities

This outcome outlines the responsibilities for the Maritime Engineering Technologist to ensure the effective management and application of management principles to the solution of the broadly defined engineering problem in terms of emphasising planning, organising, leading, and controlling activities.

Moreover, these key responsibilities may additionally emphasise managing self, teams, processes and resources while providing the engineering solution/s and adhering to the required levels of quality, safety, and environmental standards.

4.2.5 Outcome 5: Communicate clearly using multiple media and collaborate inclusively with a broad range of stakeholders in the course of engineering activities

This outcome outlines the professional communication that the Maritime Engineering Technologist requires to be capable of ensuring precise information flow for the successful execution of the broadly defined engineering solution/s.

This outcome ensures that the Maritime Engineering Technologist is adequately capable of combining essential technical knowledge with unique communication skills to bridge the gap between engineering concepts and realistic implementation. The key role will be indicated by the reported technical documentation, reporting, and stakeholder communication to ensure such key communication can facilitate the necessary decision-making, safety compliance, cost control, and continual improvement regarding proposed engineering problem solutions.

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4.2.6 Outcome 6: Recognise the reasonably foreseeable economic, social, cultural, and environmental effects of broadly defined engineering activities seeking to achieve sustainability

Engineering solutions exist within a social and ecological context and require careful consideration of their broader implications beyond technical solutions. The proposed engineering solutions to the broadly defined engineering problems may negatively or positively affect the social, environmental and cultural spheres in which they may be implemented. It is, therefore, necessary that the Maritime Engineering Technologist is capable of recognising and addressing these effects:

- a. Social effects encompass all issues that affect people and their livelihoods, directly or indirectly, positively or negatively. Engineering solutions and activities may affect people's way of life, political system, health and well-being, and personal and property rights.
- b. Environmental effects include large ecosystems and people's environment, namely air and water quality, exposure to dust and noise, and adequacy of sanitation. This may include disruption of ecosystems and fauna and flora, increased land temperatures and the impact on historical buildings.
- c. Cultural effects include people's customary beliefs, religion, language, and norms, for example, ceremonies and customs of a particular group or society.

Overall, the engineering solutions should demonstrate a holistic approach that ensures such solutions provide value while respecting the social fabric and natural systems that they may affect. Therefore, a careful equilibrium between progress and preservation must be observed and analysed.

4.2.7 Outcome 7: Meet all legal and regulatory requirements and protect the health and safety of persons during all broadly defined engineering activities

This outcome requires that the Maritime Engineering Technologist identifies the legal and regulatory requirements, including health and safety standards, for their engineering activities. This is achieved by demonstrating awareness in selecting safe (e.g. occupational health and safety laws), sustainable materials, components, and systems while managing associated risks.

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The associated regulations of the specific aspects of the broadly defined engineering solutions must be carefully identified and applied by the Maritime Engineering Technologist. This can be done by attending a Risk Management course and/or adopting the organisational safety processes and procedures. This awareness will ensure the Engineering Technologist is capable of identifying, analysing and managing the long-term risks of their broadly defined engineering solutions.

Maritime Engineering Technologists are expected to have a working knowledge of the regulations and Acts and of how the legislation affects their working environment.

In effect, Maritime Engineering Technologists are expected to have a working knowledge of the Acts that are applicable to their areas of practice. The list of International and Applicable Standards is provided under section 4.1.7 of this document. This list is not exhaustive.

Other Acts may also be pertinent to an Applicant's specific work environment. Candidates are expected to have a basic knowledge of the relevant Acts and to investigate whether any other Acts are applicable to their specific work environment.

Note: International and Applicable Standards are acceptable after proper justification.

4.2.8 Outcome 8: Conduct engineering activities ethically

This outcome ensures that when encountering any ethical challenges in conducting engineering activities, the Maritime Engineering Technologist is firstly, capable to identify such ethical issues and affected parties and secondly, is capable of appropriately addressing such ethical issues systematically, thus demonstrating legal compliance, fairness and adherence to organisational policies to ensure that their integrity and accountability, as well as that of their organisation, are upheld.

In effect, Maritime Engineering Technologists must uphold professional codes of conduct and ensure that their actions align with ethical principles. They must ensure conversance and act in compliance with the ECSA's Rules of Conduct for Registered Persons and adhere to the ECSA's Code of Conduct.

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4.2.9 Outcome 9: Exercise sound judgement by evaluating the outcomes, impacts, and alternatives in the course of broadly defined engineering activities

Engineering practice demands interdisciplinary collaboration where technical decisions must integrate with other fields of practice while adhering to best professional standards. The Maritime Engineering Technologist will manage projects with broadly defined parameters, exercising judgement within their expertise but seeking guidance from the respective specialists when encountering complex or unfamiliar challenges.

Exercising this required judgement ensures that the encountered critical aspects can be rigorously evaluated in terms of risk and consequence. This evaluation can be achieved through decision-making tools and analysis and must be supported by appropriate calculations, established standards and/or thorough risk assessments.

This process highlights the critical thinking, professional accountability and adaptive problem-solving that are essential to the roles of the Maritime Engineering Technologist.

4.2.10 Outcome 10: Be responsible for making decisions on part or all of broadly defined engineering activities

Maritime Engineering Technologists should clearly demonstrate the accountability that they discharged for significant parts of one or more of the engineering activities in which they were involved. This responsibility entails the legal and moral accountability of the broadly defined engineering solutions that were being developed.

It requires holistic decision-making that balances technical, social, environmental and sustainability factors. As part of this decision-making process, respective codes, specifications, and industry best practices should be consulted, with sound justification being provided.

Maritime Engineering Technologists must recognise their competency limits and consult experts for specialised issues while independently managing tasks within their scope. Maritime Engineering Technologists must prioritise safety, sustainability, and ethical standards while managing their engineering activities.

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This framework of accountability, the alignment with competence, and collaboration when needed ensures reliable solutions can be provided and upholds the profession's integrity.

4.2.11 Outcome 11: Undertake sufficient professional developmental activities to maintain and extend competence and enhance the ability to adapt to emerging technologies and the ever-changing nature of work

Professional development is the continual education and training that Maritime Engineering Technologists undertake to enhance skills, stay updated with industry trends, and advance their careers.

When applying for professional registration, the Maritime Engineering Technologist should provide evidence of Initial Professional Development (IPD) achieved during training, including engineering, management, or computer courses.

Professional development is essential for Engineers to improve their skills continually and advance their careers; to facilitate this key professional development, the Applicant can consider the list of useful courses that present such learning activities in section 4.1.11 of this document.

For registered Professional Maritime Engineering Technologists, maintaining competency through CPD is mandatory to retain registration. Ensuring effective professional development before and after registration can be achieved with a personal strategy and selection of relevant developmental activities together with demonstrating independent learning and ensuring a maintained and detailed record of such activities. This requires structured learning, including courses and postgraduate studies, personal initiative in planning developmental activities, and meticulous record-keeping. By taking ownership of their growth while understanding employer policies, professionals ensure they stay current with industry trends and remain competent in their field. In essence, continual learning enables career progression and sustains technical relevance in a changing industry.

Note: Refer to **Appendix D** for the various levels of developmental activities.

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4.3 Training for registration as a Professional Engineering Technician

4.3.1 Outcome 1: Define, investigate, and analyse well-defined engineering problems

During training, Applicant Engineering Technicians should be exposed to the technical investigation of equipment, plant, and product failure. The intent is for Applicants to be able to define the engineering problem clearly and to investigate and analyse well-defined engineering problems. For Engineering Technicians to solve well-defined engineering problems, it is imperative to understand the nature of the engineering problem. Inability to understand the engineering problem could lead to incorrect design or development of solutions. Defining an engineering problem requires an in-depth knowledge and a history of the system, other attempted or successful solutions, and how far reaching a solution to the problem may be. Investigation of the engineering problem could be in the form of equipment failure in the electrical and/or electronic system, development of new products, and provision of services to a greenfield area.

Engineering problems should be thoroughly investigated through site visits, collecting technical information, and checking engineering drawings. No investigation can be completed using desktop information only. Sufficient technical and business information about a plant or system should be collected, evaluated, and analysed for accuracy and reliability. Analysis of the information assists Applicants in reviewing the instruction given in the initial engineering problem and assessing if the work instruction was well understood. Engineering analysis involves applying scientific analytic principles and processes to reveal the properties and state of the system, device, or mechanism under study. Applicant Maritime Engineering Technicians or persons willing to register as Professional Maritime Engineering Technicians should be able to demonstrate how well-defined engineering problems were defined and investigated.

4.3.2 Outcome 2: Design or develop solutions to well-defined engineering problems

Once the analysis of the engineering problem has been established, Applicants are expected either to design or to develop engineering solutions to resolve the well-defined engineering problems. Well-defined engineering problems can be solved in standardised or prescribed ways. They are encompassed by standards, codes, and documented procedures.

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Engineering Technicians encounter various engineering problems and should provide solutions to return the plant or system to its normal functioning state. Designing or developing solutions for a well-defined engineering problem normally follows the steps presented below:

- a. List possible solutions
- b. Evaluate and rank the possible solutions
- c. Develop a detailed plan for the most attractive solutions
- d. Re-evaluate the plan to check desirability
- e. Check the result through calculations
- f. Implement the plan
- g. Communicate the results

Applicant Maritime Engineering Technicians should be able to demonstrate the application of calculations and engineering concepts in designing or developing solutions to a well-defined engineering problem. Engineering norms and standards should be applied in the process of developing well-defined engineering solutions.

Once the received task is fully understood and interpreted, a solution to the posed problem can be developed (designed). To synthesise a solution means “the combination of separate parts, elements, substances, etc. into a whole or into a system” by the following:

- a. Design work for Applicant Maritime Engineering Technicians mainly involves the use and configuration of manufactured components and repetitive design work using an existing design as an example. Engineering Technicians apply existing codes and procedures in their design.
- b. Defined incidents and condition monitoring and operations would be mainly on controlling, maintaining, and improving engineering systems and operations.
- c. The development (design) of more than one way to solve an engineering task or problem should always be done, including the costing and impact assessment for each alternative. All the alternatives must meet the requirements set out by the instruction that was received, and the theoretical calculations to support each alternative must be done and submitted as an attachment.
- d. The Applicant Maritime Engineering Technician will, in some cases, not be able to support proposals with the complete theoretical calculation to substantiate every aspect and must, in these cases, refer his/her alternatives to a supervisor or Mentor

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for scrutiny and support. The alternatives and particularly the recommended alternative must be convincingly detailed to win customer support. The selection of alternatives might be based on tenders submitted with alternatives deviating from those specified.

4.3.3 Outcome 3: Comprehend and apply knowledge that is embodied in established engineering practices that are specific to the jurisdiction in which the Engineering Technician practises

Applicant Maritime Engineering Technicians are required to apply the engineering knowledge acquired during the accredited undergraduate programmes to resolve the well-defined engineering problems and subsequently, to provide solutions to such problems. During training, Applicant Engineering Technicians are expected to be introduced to the engineering standards, procedures, and different systems that are used in the process of engineering problem solving. It is imperative that Applicant Engineering Technicians are able to understand and demonstrate the application of acceptable engineering theory, engineering standards, engineering procedures, systems, and governing laws in solving well-defined engineering problems.

Engineering problem solving of well-defined activities involves justifying the reason why National Diploma theory is applied and, in most cases, requires the Engineering Technician to perform calculations to justify certain engineering decisions and assumptions.

Applicant Maritime Engineering Technicians are expected to work within prescribed engineering standards and codes in solving engineering problems or to justify operating outside these standards and codes. Engineering Technicians may also rely on knowledge from the National Rationalised Specifications (NRS), the South African Bureau of Standards (SABS), and technical standards and specifications to develop solutions to well-defined engineering activities.

4.3.4 Outcome 4: Manage part or all of one or more well-defined engineering activities

The areas in which Applicant Maritime Engineering Technicians work generally follow a conventional project or a product development life-cycle model.

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Maritime Technicians may contribute to or participate in a project by managing one or more activities in the project life cycle. The key activities of project management involve time, cost, and quality. Applicant Maritime Engineering Technicians should be able to manage their activities to minimise project delays or engineering work activities either in operations and maintenance or in capital projects. Sometimes, work priorities need to be tracked using project-management software tools to manage the critical path of project activities.

Applicant Maritime Engineering Technicians must expose themselves to the tools or the software that is used to manage well-defined engineering activities and to understand their role within the team. Applicant Maritime Engineering Technicians or persons wishing to register with the ECSA as a Professional Technician must participate in and contribute to the work activities in the project life cycle. Applicant Maritime Engineering Technicians are not expected to change their places of employment to acquire all the skills in the project life cycle as listed above.

4.3.5 Outcome 5: Communicate clearly using multiple mediums and collaborate inclusively with a broad range of stakeholders in the course of engineering activities

While conducting engineering works, Applicant Maritime Engineering Technicians are expected to communicate with their team members, supervisors, clients, and contractors effectively. Professional communication is a vital skill for Applicant Maritime Engineering Technicians since all their decisions are communicated to different parties. Professional communication is important for Applicant Maritime Engineering Technicians to conduct effective meetings, work with people who are not technical, work with other cultures, issue and receive instructions, report on engineering works, and share ideas.

The main type of professional communication includes oral, written, and graphic techniques or a combination thereof. During the execution of engineering work activities, Maritime Engineering Technicians hold meetings, develop technical reports, develop tender document specification, and develop bills of quantity. These should be clear and concise to convey the correct message to the recipients. Creating presentations using visual aids and supporting documents for the purpose of presenting to colleagues, team members, supervisors, or clients

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is an important part of engineering problem solving. Oral and written communication skills are important for effective professional communication.

Applicants should develop effective communications skills during training and be able to demonstrate such skills in order to be registered as Professional Maritime Engineering Technicians.

4.3.6 Outcome 6: Recognise the reasonably foreseeable economic, social, cultural, and environmental effects of well-defined engineering activities seeking to achieve sustainability

Performing always means there will be an impact socially, environmentally, and culturally because engineering work happens within the environment. Engineering work is meant to improve services or products but not have an impact on cultural beliefs and norms. Applicants should be able to recognise and address the impact of their well-defined engineering activities. This involves understanding and evaluating the potential consequences of the activities and taking measures to mitigate any adverse effects.

- Social effects** encompass all issues that affect people and their livelihoods, directly or indirectly. Engineering activities may affect people's way of life, political system, health and well-being, and personal and property rights.
- Environmental effects** include people's environment, namely large ecosystems, air and water quality, exposure to dust and noise, and adequacy of sanitation. These effects may include disruption of ecosystems and fauna and flora, increased land temperatures, and the impact on historical buildings.
- Cultural effects** include people's customary beliefs, religion, language, and norms, for example, the ceremonies and customs of a particular group or society.

Applicants should always remember that these activities are mostly outward looking. Applicants must be able to describe the impact of engineering work on these items and be able to provide mitigation measures for the affected parties. Stakeholder engagement is always important in mitigating the impacts to a level that is acceptable to affected parties.

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4.3.7 Outcome 7: Meet all legal and regulatory requirements and protect the health and safety of persons during all well-defined engineering activities

Engineering work is performed under various legal and regulatory requirements that ensure the safety of personnel, protection of the environment, and continued service delivery to the public. Applicant Maritime Engineering Technicians should be familiar with major laws and regulations that are applicable in their area of operation. Regulations include standards and specifications that are there to ensure safety and the continuation of service. Such knowledge ensures that work is done safely and no unnecessary risks are taken during the work.

Applicants are expected to have a working knowledge of the regulations and Acts and how the legislation affects their working environment. The list of International and Applicable Standards/Acts is provided in section 4.1.7 of this document. This list is not exhaustive.

Other Acts may also be pertinent to an Applicant's specific work environment. Candidates are expected to have a basic knowledge of the relevant Acts and to investigate whether any Acts are applicable to their specific work environment.

Note: International and other applicable standards are acceptable after proper justification.

4.3.8 Outcome 8: Conduct engineering activities ethically

Ethical problems arise during engineering activities, for example, using unsustainable material for a solution or contravening other regulations in the process of developing solutions. Other general ethical problems may also arise while performing engineering activities. Engineering practitioners should be able to identify ethical issues arising during engineering activities and identify affected parties and how such issues may affect them. A solution to an ethical problem must consider all affected parties.

Applicant Maritime Engineering Technicians must perform engineering work and make technical decisions while adhering to the ECSA Code of Conduct for Registered Persons. Engineering work should be performed while considering the following factors:

- a. Make decisions within the limits of the practitioner's education, training, and experience.
- b. Act with integrity and according to the general norms of professional conduct.

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- c. Strive to respect health and safety and the interests of the public and minimise the environmental impact.

Where the scope of work falls outside the area of expertise, Applicant Maritime Engineering Technicians should seek guidance from relevant parties. Conflict of interest while conducting engineering activities should be avoided/declared so that decisions are made transparently and to the best of one's ability.

4.3.9 Outcome 9: Exercise sound judgement by evaluating the outcomes, impacts, and alternatives in the course of well-defined engineering activities

Sound judgement and decision-making can be defined as the ability to assess situations or circumstances objectively using all the relevant information and to apply past experience to arrive at a conclusion. Applicant Maritime Engineering Technicians should be able to make a judgement regarding a sustainable solution after ensuring that all factors, including consideration of other disciplines, have been considered.

It is essential to have a reliable analysis solution for technical-risk management to ensure early detection of problems. This prevents issues from occurring without warning and drastically decreases the effort required to alleviate sudden infrastructure or system problems. Applicant Maritime Engineering Technicians must familiarise themselves with organisational risk policies and standards. These risks may be identified or demonstrated in building services, product development, or research and development related projects. Applicant Maritime Engineering Technicians should strive to acquire experience in all the generic engineering competencies of problem-solving implementation, operation, risk and impact mitigation, and management of engineering activities.

4.3.10 Outcome 10: Be responsible for making decisions on part or all of well-defined engineering activities

Responsible decision-making includes applying engineering knowledge acquired from accredited engineering programmes. It includes using relevant calculations to justify why certain solutions are chosen to solve well-defined engineering problems. Where an Applicant Maritime Engineering Technician does not have the required knowledge, it is responsible to

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ask for advice from a relevant authority or those who have the information. This could be on matters within the engineering discipline or other disciplines affecting the work of the Applicant Maritime Engineering Technician. Any decisions taken should be evaluated for shortcomings to ensure no complications at the end of the project/activity.

4.3.11 Outcome 11: Undertake sufficient professional developmental activities to maintain and extend competence and enhance the ability to adapt to emerging technologies and the ever-changing nature of work

Professional development refers to continuing education and career training after a person has entered the workforce. Professional development assists in developing new skills, broadening of knowledge, staying up to date on current trends and technologies, and advancing one's career. A registered Professional Maritime Engineering Technician is required to maintain and extend the level of competency through CPD activities to retain registration.

When applying for registration, Applicants should provide evidence of IPD that has been attained during the training period. These activities could include engineering courses, management courses, and computer courses. Enrolling for a postgraduate engineering programme is considered part of developmental activities. Applicants must be able to demonstrate professional development by the following:

- a. Adopting a strategy for own professional development
- b. Selecting appropriate professional developmental activities
- c. Keeping thorough records of professional developmental activities
- d. Demonstrating independent learning ability through completing developmental activities.

Professional development is essential for Engineers to improve their skills continually and advance their careers. To facilitate this key professional development, Applicants can consider the list of useful courses that present such learning activities (see section 4.1.11 of this document).

If possible, a specific field of the sub-discipline is chosen, available developmental alternatives are established, a programme is drawn up (in consultation with the employer if costs are involved), and options that are open to expand knowledge into additional fields are

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investigated. Record-keeping must not be left to the employer or anybody else. Trainees must manage their own training independently by taking initiative and being in charge of experiential development towards the level of Professional Engineering Technician. Knowledge of the employer's policy and procedures on training is essential.

Note: Refer to **Appendix D** for various levels of developmental activities.

5. LOCATION OF TRAINING IN OVERALL ENGINEERING LIFE CYCLE

The area in which Maritime Engineers work generally follows the conventional stages of the life cycle of the project or product. These stages are as follows:

- Research and development of new products or systems or advancement of solutions to system problems or system obsolescence.
- System or product design to establish a new system or product, to solve system or product problems, to achieve a particular desired result or to select equipment for a particular purpose.
- Operation, maintenance and support of the system, network, or product.
- Project Engineering to install, test, and commission the necessary equipment or system to achieve the desired result.
- Decommissioning the system or network.

Candidates are not expected to change their places of employment in order to work in all the areas listed above. Candidates must, however, ensure that in the area in which they are employed, tasks are undertaken that provide experience in all the generic engineering competencies of problem solving, implementation and operation, risk and impact mitigation, and management of engineering activities.

The schema presented in **Appendix A: Training Elements** indicates the functions in which a Candidate should be competent when carrying out the various phases of a project:

- Solving problems based on engineering and contextual knowledge
- Implementing and operating engineering projects, systems, products, and processes
- Mitigating risk and impact

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d. Managing engineering activities

Three levels of description are given. Regarding the third level, the description is largely independent of the discipline. Discipline specifics may be included as fourth and fifth levels as required. These specifics would include the types of evidence of performance that would be appropriate at each line and record-keeping of the evidence.

Candidates should demonstrate that they have gained experience in working in a multidisciplinary and multi-engineering Category team in executing a ship design project or a significant portion of a project.

6. FUNCTIONS PERFORMED

Special considerations in the discipline, sub-discipline, or speciality must be given to the competencies specified in the following groups:

- Knowledge-based problem solving (this should be a strong focus)
- Management and communication
- Identifying and mitigating the impacts of engineering activity
- Judgement and responsibility
- Independent learning

It is useful to measure the progression of a trainee's competency using the Degree of Responsibility Scale, the Problem-Solving Scale, and the Engineering-Activity Scale as specified in document **R-02-STA-PE/PT/PCE/PN**.

Appendix A has been developed against the Degree of Responsibility Scale. Activities should be selected to ensure the Candidate reaches the required level of competency and responsibility.

It should be noted that a Candidate working at Responsibility Level E carries responsibility equivalent to that of a Registered Person **except** that the trainee's supervisor is accountable for the trainee's recommendations and decisions.

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6.1 Statutory and regulatory requirements

Candidates are expected to have a working knowledge of the following regulations and Acts and how this legislation affects their working environment:

- Engineering Profession Act, No. 46 of 2000, including the ECSA Rules and Code of Conduct
- Occupation Health and Safety Act, No. 85 of 1993 as amended by Act 181 of 1993 (latest revision used)
- Factory Regulations
- Machinery and Works Regulations
- Labour Relations Act, No. 66 of 1995
- Environment Conservation Act, No. 73 of 1989 as amended by Act 52 of 1994 and Act 50 of 2003
- Industry-specific work instructions and specifications
- Applicable SANS specifications

Other Acts not listed here may also be pertinent to a trainee's work environment. Candidates are expected to have a basic knowledge of the applicable Acts and Maritime Industry Rules:

- Engineering Council of South Africa – its Rules and Code of Conduct
- IMO and IACS Rules and Guidelines and Codes of Practice
- International Ship and Port Security (ISPS)
- International Safety Management (ISM)
- Maritime Labour Convention (MLC)
- Safety of Life at Sea (SOLAS)
- Marine Pollution (MARPOL)
- Fire Safety Systems (FSS) Code
- Life Saving Appliances (LSA)
- Industry-Specific Work Instructions
- Applicable SANS and other international standards such as ISO, EN, DIN, or US Federal Standards
- SAMSA Codes and Regulations
- Applicable Classification Society rules and regulations

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- n. Flag State rules and regulations
- o. Marine Pollution (Prevention of Pollution from Ships) Act 1986

6.2 Desirable formal learning

The following list of formal learning activities is by no means extensive; it is simply a sample of useful courses.

- a. Project management
- b. Conditions of Contract / Value Engineering – New Engineering Contract (NEC), Shipbuilding Contracting and Repair Contracting, Joint Building Contract Committee (JBCC), etc.
- c. Standards
- d. Specifications
- e. Preparation of specifications
- f. Negotiation skills
- g. Engineering finance
- h. Risk analysis
- i. Quality systems
- j. Occupation health and safety
- k. Engineering ethics
- l. Discipline-specific courses
- m. Maritime tariffs
- n. Maintenance engineering
- o. Environmental impacts
- p. Management
- q. Report writing
- r. Planning methods
- s. System engineering
- t. Industrial relations
- u. Public speaking

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The following list of formal learning is a sample of some useful course types:

- a. CPD courses on specific disciplines
- b. Occupation health and safety legal liability
- c. Asset life cycle management
- d. Project management
- e. Value engineering
- f. Preparation of specifications
- g. Negotiation skills
- h. Engineering finance
- i. Risk analysis
- j. Quality systems
- k. Energy efficiency
- l. Water management and treatment
- m. Maintenance engineering
- n. Environmental impacts management
- o. Engineering management
- p. Technical report writing
- q. Professional skills report writing and communication planning methods
- r. Computers and IT knowledge
- s. Ship construction regulations
- t. Problem solving and analysis tools

6.3. Degree of Responsibility

Progression throughout the Candidacy period presented in document **R-04-T&M-Guide-PC** and below in **Table 1** refers to the gradual increase in the Degree of Responsibility to which the Candidate Engineer is exposed during professional training. Considering the nature of the work, specific examples and outcomes appropriate to training in Maritime Engineering are given in Table 1 below.

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Table 1: Progression throughout the Candidacy period

Degree of Responsibility	Nature of work	Activities/duties to be undertaken during training
A: Being Exposed	The Candidate undergoes induction and observes the processes and work of competent practitioners.	• Understand the business environment and the dynamics that shape the businesses and the industries in which they operate. • Understand the business model, its key conversion processes, and critical outcomes. • Understand the value added by Maritime Engineers and other professionals in the business.
B: Assisting	The Candidate performs specific processes under close supervision.	• Develop insight and understanding of the different processes and systems in the transformation of inputs into goods and services. • Develop an appreciation of the numerous resources that are at the disposal of the Maritime Engineer. • Obtain experience in the day-to-day operations of the business to gain insight and understanding of the different processes and systems involved in the transformation of inputs into goods and services, with specific emphasis on productivity and quality measurements.
C: Participating	The Candidate performs specific processes as directed with limited supervision.	• Gain first-hand experience of a broad range of Maritime Engineering activities (e.g. process design and re-engineering, planning and control, work study, Value Engineering, materials and information management, people-management skills, logistics, specialists' inputs, tools and equipment, and quality assurance). • Note the problems and limitations of specific philosophies, methods and techniques, with emphasis on cost/effort and relative benefit.
D: Contributing	The Candidate performs specific work with detailed approval of work outputs.	• Be involved in activities such as the planning of production, the control of quality and costs of process study and work study, good material handling and workplace layout, activity-based costing, benchmarking, business cases, process re-engineering, maintenance practice and procedures, project management and system specification. Of particular importance is the collective working of such activities in the economic use of people, materials, and machines. • Give specific attention to human aspects concerning communication, interpersonal relationships and teamwork, training and cost analysis, budget control, and profit accountability. These should proceed in parallel, applying Maritime Engineering techniques and using computers in problem solving.
E: Performing	The Candidate works in a team without supervision, recommends work outputs, and is responsible but not accountable.	• Assume escalating technical responsibility and increasingly co-ordinate the work of others. • Gain exposure to and develop skills in management areas such as labour relations, management accounting, business law, and general business management. This is important for the development of a well-rounded Engineer. • Seek assignments that require judgement, even if full information is not available. This leads to a position of

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		professional responsibility, which is of great value and should be pursued.
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REVISION HISTORY

Revision number	Revision date	Revision details	Approved by
Rev. 0 Draft A	28 May 2026	The working group submitted the first draft	Working Group
Rev. 0 Draft B	1 June 2026	Draft submitted to Registration BU for comments	Registration BU
Rev. 0 Draft C	29 June 2026	The document was shared with stakeholders for inputs and comments	RID BU
Rev. 0 Draft D	06 Jul 2026	The RID BU hosted a webinar with industry stakeholders to solicit inputs and comments	RID BU & Working Group
Rev. 0 Draft E	20 Jul 2026	Review and recommendation for Approval	Acting Executive RSIR
Rev. 0	05 Aug 2026	Approval	RPSC
Rev. 0	19 Aug 2026	Round-robin approval	RPSC

Discipline-Specific Training Guide for

Registration as a Professional Engineer, Technologist, or Technician in Maritime Engineering

Revision 0 dated 19 August 2026 and consisting of 85 pages reviewed for adequacy by the Business Unit Assistant Manager and is approved by the Acting Executive: Regulatory Services & International Relations (**ERSIR**).



Business Unit Assistant Manager

13 October 2026

Date



Acting Executive: RSIR

13 October 2026

Date

This definitive version of this policy is available on our website.

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APPENDIX A: TRAINING ELEMENTS

Synopsis: Applicants should achieve specific competencies at the prescribed level during their development towards professional registration and at the same time, accept progressively more responsibility as experience is gained. The outcomes achieved and established during the Candidacy phase should form the template for all engineering work performed after professional registration regardless of the level of responsibility at any specific stage of an engineering career:

- Confirm understanding of instructions received and clarify if necessary.
- Use theoretical training to develop possible solutions: select the best and present to the recipient.
- Apply theoretical knowledge to justify decisions taken and processes used.
- Understand role in the work team and plan and schedule work accordingly.
- Issue complete and clear instructions and report comprehensively on work progress.
- Be sensitive about the impact of the engineering activity and take action to mitigate this impact.
- Consider and adhere to legislation applicable to the task and the associated risk identification and management.
- Adhere strictly to high ethical behavioural standards and ECSA's Code of Conduct.
- Display sound judgement by considering all factors, their interrelationship, consequences, and evaluation when all evidence is not available.
- Accept responsibility for own work by using theory to support decisions, seeking advice when uncertain, and evaluating shortcomings.
- Become conversant with employer's training and development programme and develop own lifelong development programme within this framework.

Complex, broadly defined, and well-defined engineering work is usually characterised by the application of engineering deviating from standard procedures, codes and systems, deviations verified by research, modelling, and/or substantiated design calculations.

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Responsibility Level E

Competency Standards for Registration as a Professional Engineer, Technologist, or Technician	Explanation and Responsibility Level
1. Purpose	
This standard defines the competence required for registration as a Professional Engineer, Technologist, and Technician . Definitions of terms having a specific meaning within this standard is given in the text of the relevant section.	The DSTGs give context to the purpose of the Competency Standards. The Engineer, Technologist, and Technician operate within the 12 disciplines recognised by the ECSA. Each discipline can be further divided into sub-disciplines and finally into specific workplaces, as indicated in section 4 of the specific DSTG. The DSTGs are used to facilitate experiential development towards ECSA registration and assist in compiling the required portfolio of evidence (specifically, the Engineering Report in the application form). Note: The training period must be used to develop the trainee's competence towards achieving the standards below at Responsibility Level E (i.e. Performing). Refer to the specific DSTG.
2. Demonstration of competence	
Competence must be demonstrated within complex, broadly defined, and well-defined <i>engineering activities</i> (detailed below) by integrated performance of the outcomes specified at the level defined for each outcome. Required contexts and functions may be specified in the applicable DSTG. Level Descriptor: Complex engineering activities (CEA), broadly defined engineering activities (BDEA), and well-defined engineering activities (WDEA) have several of the following characteristics:	Engineering activities can be approximately divided as follows: 5% Complex (Professional Engineers) 5% Broadly defined (Professional Engineering Technologists) 10% Well-defined (Professional Engineering Technicians) 15% Narrowly well-defined (Registered Specified Categories) 20% Skilled workman (Engineering Artisan) 55% Unskilled workman (Artisan Assistant) Activities can be in-house or contracted out; evidence of integrated performance can be submitted irrespective of the situation. Level Descriptor: CEA, BDEA, and WDEA in the various disciplines are characterised by several or all of the following:

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Competency Standards for Registration as a Professional Engineer, Technologist, or Technician	Explanation and Responsibility Level
a. Scope of practice area is linked to technologies used and changes due to adoption of new technology into current practice. b. Practice area is located within a wider, complex context; requires teamwork; and has interfaces with other parties and disciplines.	a. Scope of practice area does not cover the entire field of the discipline (exposure limited to the sub-discipline and specific workplace). Some technologies used are well established, and adoption of new technologies needs investigation and evaluation. b. Practice area varies substantially with unlimited location possibilities and an additional responsibility to identify the need for advice on complex, broadly defined, and well-defined engineering activities and problems. Complex, broadly defined, and well-defined engineering activities in the sub-discipline need interfacing with Professional Engineers, Professional Technicians, artisans, architects, financial staff, etc. as part of the team.
a. Involve a variety of resources, including people, money, equipment, materials, and technologies. b. Require resolution of occasional problems arising from interactions between wide-ranging or conflicting technical, engineering, or other issues. c. Are constrained by available technology, time, finance, infrastructure, resources, facilities, standards and codes, and applicable laws. d. Have significant risks and consequences in the practice area and related areas.	a. The bulk of the work involves a familiar, defined range of resources, including people, money, equipment, and materials, but new technologies are investigated and implemented. b. Most of the impacts in the sub-discipline are on wider issues, but some arise from conflicting technical and engineering issues that must be addressed by the application of broadly defined, non-standard engineering principles. c. The work packages and associated parameters are constrained by operational context with variations limited to different locations only (cannot be covered by standards and codes). d. Even locally important minor risks can have far-reaching consequences.
Activities include design; planning; investigation and problem resolution; improvement of materials, components, systems or processes; manufacture or construction; engineering operations; maintenance; project management; research; development; and commercialisation.	Activities include design; planning; investigation and problem resolution; improvement of materials, components, systems, or processes; engineering operations; maintenance; and project management. For Engineers, Technologists, and Technicians , research, development, and commercialisation happen frequently in some disciplines but are seldom encountered in others.

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Competency Standards for Registration as a Professional Engineer, Technologist, or Technician	Explanation and Responsibility Level
3. Outcomes to be satisfied:	Explanation and Responsibility Level
Group A: Engineering Problem Solving	
Outcome 1: Define, investigate, and analyse <i>complex, broadly defined, and well-defined</i> engineering problems	Responsibility Level E Analysis of an engineering problem means the 'separation into parts, possibly with comment and judgement'. Complex, <i>broadly defined, and well-defined</i> means: 'not minute or detailed' and 'not kept within narrow limits'.
Complex, broadly defined, and well-defined engineering problems have the following characteristics: a. They require coherent and detailed engineering knowledge, underpinning the technology area <i>and one or more of the following:</i> b. Are ill-posed, are under- or over-specified, require identification and interpretation in the technology area c. Encompass systems within complex engineering systems d. Belong to families of problems that are solved in well-accepted but innovative ways <i>and one or more of the following:</i> e. Can be solved by structured analysis techniques f. May be partially outside standards and codes—justification to operate outside must be provided. g. Require information from the practice area and sources interfacing with the practice area that are complex and incomplete. h. Involve a variety of issues that may impose conflicting	a. Coherent and detailed engineering knowledge for the Engineer, Technologist, and Technician means the problem encountered cannot be solved without combining all the relevant details, including the engineering principles that are applicable to the situation. b. The nature of the problem is not immediately obvious, and further investigation to identify and interpret the real nature of the problem is necessary. c. The problem is not easily recognised as part of the larger engineering task, project, or operation and may be obscured by the complexity of the larger system. d. It is recognised that the problem can be classified as falling within a typical solution requiring innovative adaptation to meet the specific situation. e. Solving the problem needs a step-by-step approach adhering to proven logic. f. The standards, codes, and documented procedures must be analysed to determine to what extent they are applicable in solving the problem, and justification must be given to operate outside these. g. The responsibility lies with the Engineer, Technologist, and Technician to verify that some information received as part of the problem may remain incomplete, and solutions to problems may need justified assumptions. h. The problems handled by the Engineer, Technologist, and Technician may be solved by alternatives that are unaffordable, detrimental to the environment, socially unacceptable, not maintainable, not sustainable, etc., and the

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Competency Standards for Registration as a Professional Engineer, Technologist, or Technician	Explanation and Responsibility Level
constraints: technical, engineering, and interested or affected parties. <i>and one or both of the following:</i> i. Require judgement in decision-making in the practice area, considering interfaces to other areas. j. Have significant consequences that are important in the practice area but may extend more widely.	Engineer, Technologist, and Technician will have to justify their recommendations. i. Practical solutions to problems include knowledge and judgement of the roles displayed by the multidisciplinary team and the impact of own work in the interactive environment. j. The Engineer, Technologist, and Technician must realise that their actions might seem to be of local importance only but may develop significant consequences extending beyond their own ability and practice area.
Assessment criteria: A structured analysis of broadly defined problems typified by the following performances is expected: 1.1 Performed or contributed to defining engineering problems leading to an agreed definition of the problems to be solved. 1.2 Performed or contributed to investigating engineering problems including collecting, organising, and evaluating information. 1.3 Performed or contributed to the analysis of engineering problems using conceptualisation, justified assumptions, limitations, and evaluation of results.	To perform an engineering task, the Engineer, Technologist, and Technician will typically receive an instruction from a senior person (customer) to do a specific task, and they must 1.1 Ensure the instruction is complete, clear and within their capability and that the person who issued the instruction agrees with their interpretation. 1.2 Ensure the engineering problem and related information are segregated from the bulk of the investigated and evaluated information. 1.3 Ensure that the instruction and information to do the work is fully understood and complete, including the acceptance criteria and the engineering theory needed to understand the task and to carry out and/or check calculations. If needed, supplementary information must be gathered, studied, and understood. Concepts and assumptions must be justified by engineering theory and calculations if applicable.
3. Outcomes to be satisfied:	Explanation and Responsibility Level
Range statement: The problem may be a design requirement, an applied research and development requirement, or a problematic situation in an existing component, system, or process. The problem is one amenable to solution by technologies known to the Candidate. This outcome is concerned with the understanding of a problem: Outcome 2 is concerned with the solution.	Please refer to section 4 of the specific DSTG.

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Competency Standards for Registration as a Professional Engineer, Technologist, or Technician	Explanation and Responsibility Level
Outcome 2: Design or develop solutions to complex, broadly defined, and well-defined engineering problems	Responsibility Level E Design means 'drawing or outline from which something can be made'. Develop means 'come or bring into a state in which it is active or visible'.
Assessment criteria: This outcome is normally demonstrated after a problem analysis, as defined in Outcome 1.	After the received task is fully understood and interpreted, a solution to the problem posed can be developed (designed). The synthesis of a solution is 'the combination of separate parts, elements, substances, etc. into a whole or into a system' by the following:
Working systematically to synthesise a solution to a broadly defined problem, typified by the following performances is expected: 2.1 Designed or developed solutions to complex, broadly defined, and well-defined engineering problems. 2.2 Systematically synthesised solutions and alternative solutions or approaches to the problem by analysing designs against requirements, including costs and impacts on outside parameters (requirements). 2.3 Drawing up of detailed specification requirements and design documentation for implementation to the satisfaction of the client.	2.1 The development (design) of more than one way to solve an engineering task or problem should always be done, including the costing and impact assessment for each alternative. All the alternatives must meet the requirements set out by the received instruction, and the theoretical calculations to support each alternative must be done and submitted as an attachment. 2.2 The Engineer, Technologist, or Technician will, in some cases, be unable to support the proposals with the complete theoretical calculation to substantiate every aspect and must, in these cases, refer his/her alternatives to an Engineer for scrutiny and support. The alternatives and the recommended alternative must be convincingly detailed to win customer support for the recommended alternative. Selection of alternatives might be based on tenders submitted with the alternatives deviating from those specified. 2.3 The best complete and final solution selected must be followed up with a detailed technical specification, supporting drawings, bill of quantities, etc. for the execution of work to meet the customer requirements.
Range Statement: Solutions are those enabled by the technologies in the Candidate's practice area.	Applying theory to conduct complex, broadly defined, and well-defined engineering work is mostly done in a way that has been used before, probably developed by Engineers in the past and documented in written procedures, specifications, drawings, models, examples, etc. The Engineer, Technologist, and Technician must seek approval for any deviation from these established methods but must also initiate and/or participate in the development and

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Competency Standards for Registration as a Professional Engineer, Technologist, or Technician	Explanation and Responsibility Level
	revision of these norms.
Outcome 3: Comprehend and apply the knowledge embodied in widely accepted and applied engineering procedures, processes, systems, or methodologies and those specific to the jurisdiction in which they practise.	Responsibility Level E Comprehend means 'to understand fully'. The jurisdiction in which an Engineer, Technologist, and Technician practises is given in section 4 of the specific DSTG.
Assessment criteria: This outcome is normally demonstrated in the course of design, investigation, or operations.	Design work for the Engineer, Technologist, and Technician is based on BEng, BTech, and NDip theory and mainly comprises the use and configuration of manufactured components and selected materials and associated
Group B: Managing Engineering Activities	Explanation and Responsibility Level
Outcome 4: Manage part or all of one or more complex, broadly defined, and well-defined engineering activities.	Responsibility Level E Manage means 'control'.
Assessment criteria: The Candidate is expected to display personal and work-process management abilities:	In engineering operations, Engineers, Technologists and Technicians are typically given the responsibility to carry out projects:
4.1 Managed self, people, work priorities, processes, and resources in broadly defined engineering work.	4.1 Resources are usually subdivided based on availability and controlled by a work-breakdown structure and scheduling to meet deadlines. Quality, safety, and environmental management are important aspects.
4.2 Role in planning, organising, leading, and controlling broadly defined engineering activities evident.	4.2 The basic elements of management must be applied to broadly defined engineering work.
4.3 Knowledge of conditions and operation of contractors and the ability.	4.3 Depending on the project, the Engineer, Technologist, and Technician can be team leaders or team members or they can supervise appointed contractors. To achieve this, maintenance of relationships is important and must be demonstrated.

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Competency Standards for Registration as a Professional Engineer, Technologist, or Technician	Explanation and Responsibility Level
Outcome 5: Communicate clearly with others in the course of his/her broadly defined engineering activities.	Responsibility Level E
Assessment criteria: Demonstrates effective communication by the following: 5.1 Ability to write clear, concise, and effective technical, legal, and editorially correct reports shown. 5.2 Ability to issue clear instructions to stakeholders using appropriate language and communication skills evident. 5.3 Oral presentations made using structure, style, language, and visual aids	Refer to Range Statement for Outcome 4 and Outcome 5 below. Presentation of point of view mostly occurs in meetings and discussions with immediate supervisor.
Range Statement for outcomes 4 and 5: Management and communication in complex, broadly defined, and well-defined engineering involve the following: a. Planning complex, broadly defined, and well-defined activities b. Organising complex, broadly defined, and well-defined activities c. Leading complex, broadly defined, and well-defined activities d. Controlling complex, broadly defined, and well-defined activities.	a. Planning means 'the arrangement for doing or using something, considered in advance'. b. Organising means 'put into working order, arrange in a system, make preparations for'. c. Leading means to 'guide the actions and opinions of, influence, persuade'. d. Controlling means the 'means of regulating, restraining, keeping in order, check'. The Engineer, Technologist, and Technician write up specifications for the purchase of materials and/or work to be done, make recommendations on tenders received, place orders and variation orders, write up work instructions, report on work done, draw, correct, and revise drawings, compile test reports, use operation and maintenance manuals to write up work procedures, write up inspection and audit reports, write up commissioning reports, prepare and present motivations for new projects, compile budget reports, report on studies done and calculations carried out, report on

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Competency Standards for Registration as a Professional Engineer, Technologist, or Technician	Explanation and Responsibility Level
	customer requirements, report on safety incidents and risk analysis, report on equipment failure, report on proposed system improvement and new techniques, report on cost control, etc.
Group C: Impacts of Engineering Activity	Explanation and Responsibility Level
Outcome 6: Recognise the foreseeable social, cultural, and environmental effects of complex, broadly defined, and well-defined engineering activities generally	Responsibility Level E Social means 'people living in communities; of relations between persons and communities'. Cultural means 'all the arts, beliefs, social institutions, etc. that characterise a community'. Environmental means 'surroundings, circumstances, influences'.
Assessment criteria: This outcome is normally displayed in the course of the analysis and solution of problems. The Candidate typically shows 6.1 The ability to identify interested and affected parties and their	6.1 Engineering has a significant impact on the environment (e.g. servitudes, expropriation of land, excavation of
Range Statement for Outcome 4 and Outcome 5: Management and communication in complex, broadly defined, and well-defined engineering involves the following: a. Planning complex, broadly defined, and well-defined activities b. Organising complex, broadly defined, and well-defined activities c. Leading complex, broadly defined, and well-defined activities d. Controlling complex, broadly defined, and well-defined activities.	a. Planning means 'the arrangement for doing or using something, considered in advance'. b. Organising means to 'put into working order, arrange in a system, make preparations for'. c. Leading means to 'guide the actions and opinions of, influence, persuade'. d. Controlling means the 'means of regulating, restraining, keeping in order, checking'. The Engineer, Technologist, and Technician write up specifications for the purchase of materials and/or work to be done, make recommendations on tenders received, place orders and variation orders, write up work instructions, report on work done, draw, correct, and revise drawings, compile test reports, use operation and maintenance manuals to write

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Competency Standards for Registration as a Professional Engineer, Technologist, or Technician	Explanation and Responsibility Level
	work procedures, write inspection and audit reports, write commissioning reports, prepare and present motivations for new projects, compile budget reports, report on studies done and calculations carried out, report on customer requirements, report on safety incidents and risk analysis, report on equipment failure, report on proposed system improvement and new techniques, report on cost control, etc.
Group C: Impacts of Engineering Activity	Explanation and Responsibility Level
Outcome 6: Recognise the foreseeable social, cultural, and environmental effects of complex, broadly defined, and well-defined engineering activities generally	Responsibility Level E Social means 'people living in communities; of relations between persons and communities'. Cultural means 'all the arts, beliefs, social institutions, etc. that characterise a community'. Environmental means 'surroundings, circumstances, influences'.
Assessment criteria: This outcome is normally displayed in the course of the analysis and solution of problems. The Candidate typically shows the following: 6.1 Ability to identify interested and affected parties and their expectations regarding interactions between technical, social, cultural, and environmental considerations shown. 6.2 Measures taken to mitigate the negative effects of engineering activities evident.	6.1 Engineering has a significant impact on the environment (e.g. servitudes, expropriation of land, excavation of trenches with associated inconvenience, borrow pits, dust, obstruction of streets and other crossings, power dips and interruptions, visual and noise pollution, malfunctions, oil and other leaks, electrocution of human beings, detrimental effect on animals and wildlife, dangerous rotating and other machines, and demolishing of structures). 6.2 Mitigating measures taken may include environmental impact studies, environmental impact management, community involvement and communication, barricading and warning signs, temporary crossings, alternative supplies (ring feeders and bypass roads), press releases, and compensation paid.

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Competency Standards for Registration as a Professional Engineer, Technologist, or Technician	Explanation and Responsibility Level
Outcome 7: Meet all legal and regulatory requirements and protect the health and safety of persons in the course of his/her broadly defined engineering activities.	Responsibility Level E
Assessment criteria: 7.1 Identified applicable legal and regulatory requirements including health and safety requirements for the engineering activity. 7.2 Circumstances stated where the Applicant assisted in or demonstrated awareness of the selection of safe and sustainable materials, components, and systems and has identified risk and applied risk-management strategies.	7.1 The OHS Act is supplemented by a variety of parliamentary Acts, regulations, local authority by-laws, standards, and codes of practice. Places of work may have standard procedures, instructions, drawings, and operation and maintenance manuals available. Depending on the situation (emergency, breakdown, etc.), these documents are consulted before work commences and during the activity. 7.2 It is essential to attend a Risk Management (Assessment) course and to investigate and study the materials, components, and systems used in the workplace. The Engineer, Technologist, and Technician must seek advice from knowledgeable and experienced specialists if the slightest doubt exists that safety and sustainability cannot be guaranteed.
Range Statement for Outcome 6 and Outcome 7: Impacts and regulatory requirements include the following: a. Requirements include both explicit regulated factors and those that arise in the course of particular work. b. Considered impacts extend over the life cycle of the project and include the consequences of the technologies that are applied. c. Effects to be considered include direct and indirect and immediate and long-term effects related to the technology used.	a. The impacts will vary substantially with the location of the task (e.g. the impact of laying a cable or pipe in the main street of town will be entirely different from the impact of construction in a rural area). The methods, techniques, or procedures will differ accordingly and may be complex. These are identified and studied by the Engineer, Technologist, and Technician before starting the work. b. The Safety Officer and/or the Responsible Person appointed in accordance with the OHS Act usually confirms or checks that the instructions are in line with regulations. The Engineer, Technologist, and Technician are responsible for verifying that this is done, and if not, establishing which regulations apply and ensuring that they are adhered to. Usually, the people working on site are strictly controlled w.r.t. health and safety, but the Engineer, Technologist, and Technician check that this is done and may authorise unavoidable deviation after setting conditions for such deviations. Projects are most frequently carried out where contact with the public cannot be avoided, and safety measures such as barricading and warning signs must be used and maintained.

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d. Safe and sustainable materials, components, and systems. e. Regulatory requirements are explicit for the context in general.	c. Effects associated with risk management are mostly well known if not obvious, and methods used to address these are clearly defined. Risks are mostly associated with elevated structures, subsidence of soil, electrocution of human beings, and moving parts on machinery. The Engineer, Technologist, and Technician need to identify, analyse, and manage any long-term risks and develop strategies to solve these by using alternative technologies. d. Safe and sustainable materials, components and systems must be selected and prescribed by the Engineer, Technologist, and Technician . Alternatively, other professional specialists must be consulted. It is the responsibility of the Engineer, Technologist, and Technician to use their knowledge and experience to confirm that prescriptions by others are correct and safe. e. Application of regulations associated with the particular aspects of the project must be carefully identified and controlled by the Engineer, Technologist, and Technician .
Group D: Exercise judgement, take responsibility, and act ethically	Explanation and Responsibility Level
Outcome 8: Conduct engineering activities ethically.	Responsibility Level E Ethically means 'science of morals; moral soundness'. Moral means 'moral habits; standards of behaviour; principles of right and wrong'.
Assessment Criteria: Sensitivity to ethical issues and the adoption of a systematic approach to resolving these issues is expected, typified by: a. Conversance and operation in compliance with ECSA's Rules of Conduct for Registered Persons confirmed. b. How ethical problems and affected parties were identified and how the best solution to resolve the problem was selected.	Systematic means 'methodical; based on a system'. a. The ECSA's Code of Conduct, as per ECSA's website, is known and adhered to. b. Ethical problems that can occur include tender fraud, payment bribery, alcohol abuse, sexual harassment, absenteeism, favouritism, defamation, fraudulent overtime claims, fraudulent expenses claimed, fraudulent qualifications, and misrepresentation of facts.

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Outcome 9: Exercise sound judgement in the course of complex, broadly defined, and well-defined engineering activities	Responsibility Level E Judgement means 'good sense: ability to judge'.
Assessment criteria: Judgement is displayed by the following performance: a. Judgement exercised in arriving at a conclusion within the application of technologies and their interrelationship with other disciplines and technologies. b. Factors taken into consideration given, bearing in mind risk, consequences in technology application, and affected parties.	a. The extent of a project allocated to a junior Engineer, Technologist, and Technician is characterised by several broadly defined and a few well-defined factors and their resulting interdependence. They will seek advice if educational and/or experiential limitations are exceeded. b. Risky decisions will lead to equipment failure, excessive installation and maintenance cost, damage to persons and property, etc. Evaluation includes engineering calculations to substantiate the decisions taken and the assumptions made.
Range Statement for Outcome 8 and Outcome 9: <i>Judgement</i> in decision-making involves the following: a. taking several risk factors into account; or b. significant consequences in technology application and related contexts; or c. ranges of interested and affected parties with widely varying needs.	In engineering, about 5% of engineering activities can be classified as broadly defined. For these, the Engineer, Technologist, and Technician use standard procedures, codes of practice, specifications, etc, but develop variations and completely unique standards when needed. Judgement must be displayed to identify any activity falling inside the broadly defined range, as defined above: a. Getting the work done despite numerous risk factors needs good judgement and substantiated decision-making. b. Consequences are part of the project (e.g. extra cost due to unforeseen conditions, incompetent contractors, long-term environmental damage) c. Interested and affected parties with defined needs that may be in conflict (e.g. need for a service irrespective of environmental damage, local traditions, and preferences) need sound management and judgement.

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Outcome 10: Be responsible for making decisions on part or all of one or more complex, broadly defined and well-defined engineering activities.	Responsibility Level E Responsible means 'legally or morally liable for carrying out a duty; for the care of something or somebody in a position where one may be blamed for loss, failure, etc.'
Assessment criteria: Responsibility is displayed by the following performance. 10.1 Engineering, social, environmental and sustainable development considered when discharging responsibilities for significant parts of one or more activities. 10.2 Advice sought from a responsible authority on matters outside your area of competence. 10.3 Academic knowledge of at least BEng, BTech, or NDip levels combined with past experience used in formulating decisions.	10.1 Considering all interrelated factors is indicative of professional responsibility being accepted when working on broadly defined activities. 10.2 The Engineer, Technologist, and Technician do not operate on tasks at a higher level than complex, broadly defined, and well defined, respectively, and consult professionals at Engineer level if elements of the project to be done are beyond their education and experience (e.g. power system stability). 10.3 Continual self-evaluation is conducted to ascertain that the task given is done correctly, on time, and within budget. Continual feedback to the originator of the task instruction and corrective action, if necessary, forms an important element. The calculations, for example, fault levels, load calculations, and losses are done to ensure that the correct material and components are used. 10.4 The responsibility is mostly allocated within a team environment, with increasing designation as experience is gathered.
Outcome 11: Undertake sufficient independent learning activities to maintain and extend competence.	Responsibility Level E
Assessment criteria: Self-development managed typically by the following: 11.1 Strategy independently adopted to enhance professional development evident. 11.2 Awareness of philosophy of employer regarding professional development evident.	11.1 If possible, a specific field of the sub-discipline is chosen, available developmental alternatives are established, a programme is drawn up (in consultation with the employer if costs are involved), and options open to expand knowledge into additional fields are investigated. 11.2 Record-keeping must not be left to the employer or anybody else. Trainees must manage their own training independently, taking initiative and being in charge of their experiential development towards professional registration.

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Range Statement: Professional development involves the following: a. Planning own professional development strategy b. Selecting appropriate professional developmental activities c. Recording professional development strategy and activities while displaying independent learning ability.	a. In most places of work, training is seldom organised by a training department. It is the responsibility of the Engineer, Technologist, and Technician to manage their own experiential development. Engineers, Technologists and Technicians frequently end up in a 'dead-end street', being left behind doing repetitive work. If self-development is not driven by oneself, success is unlikely. b. Preference must be given to engineering development rather than developing soft skills. c. Developing a learning culture in the workplace environment of the Engineer, Technologist, and Technician is vital to their success.

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APPENDIX B: SCOPE OF TRAINING ELEMENTS

1	Introduction
1.1	<i>Induction programme (typically 1–5 days)</i>
1.1.1	Company structure
1.1.2	Company policies
1.1.3	Company Code of Conduct
1.1.4	Company safety regulations
1.1.5	Company staff code
1.1.6	Company regulations
1.2	<i>Exposure to Practical Aspects of Engineering (typically 6–12 months) and covers how things are: (Responsibility Levels A–B)</i>
Experience in one or more of these sectors but not all:	
1.2.1	Manufacturing
1.2.2	Construction
1.2.3	Erection
1.2.4	Field installation
1.2.5	Testing
1.2.6	Commissioning
1.2.7	Operation
1.2.8	Maintenance
1.2.9	Fault location
1.2.10	Problem investigation
2	Design or develop solution
2.1	<i>Experience in design and application of design knowledge (typically 12–18 months). Focus is on planning, design, and application (Responsibility Levels C–D).</i>
Experience in one or more of the sectors below:	
2.1.1	Analysis of data and systems
2.1.2	Planning of networks and systems
2.1.3	System modelling and integration
2.1.4	System design
2.1.5	Network/circuit design

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2.1.6	Component/product design
2.1.7	Software design
2.1.8	Research and investigation
2.1.9	Preparation of specifications and associated documentation
2.1.10	Preparation of contract documents and associated documentation
2.1.11	Development of standards
2.1.12	Application of quality systems
2.1.13	Configuration Management
3	Engineering tasks
3.1	<i>Experience in the execution of engineering tasks</i> (remainder of training period). <i>Focus should be on projects and project management</i> (Responsibility Level E).
	Working in one or more of these sectors but not all:
3.1.1	Design or development of solutions
3.1.2	Manufacture
3.1.3	Construction
3.1.4	Erection
3.1.5	Installation
3.1.6	Commissioning
3.1.7	Maintenance
3.1.8	Modifications
3.2	<i>Organising implementation of 3.1</i> (Responsibility Level E)
3.2.1	Management of resources
3.2.2	Optimisation of resources and processes
3.3	<i>Controlling implementation or operation of 3.1</i> (Responsibility Level E)
3.3.1	Monitoring progress and delivery
3.3.2	Monitoring quality
3.4	<i>Completion of 3.1</i> (Responsibility Level E)
3.4.1	Commissioning completion
3.4.2	Documentation completion
3.4.3	Documentation handover
3.5	<i>Maintenance and repair of 3.1</i> (Responsibility Level E)
3.5.1	Planning and scheduling maintenance

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3.5.2	Monitoring quality
3.5.3	Overseeing maintenance and repair
4	Risk and impact mitigation
4.1	<i>Impact and risk assessments</i> (Responsibility Level E)
4.1.1	Risk assessments
4.2	<i>Regulatory compliance</i> (Responsibility Level E)
4.2.1	Health and safety
4.2.2	Codes and standards
4.2.3	Legal and regulatory
5	Managing engineering activities
5.1	<i>Self-management</i> (Responsibility Levels C–D)
5.1.1	Manages own activities
5.1.2	Communicates effectively
5.2	<i>Team environment</i> (Responsibility Levels C–D)
5.2.1	Participates in and contributes to team planning activities
5.2.2	Manages people
5.3	<i>Professional communication and relationships</i> (networking) (Responsibility Levels C–D)
5.3.1	Establishes and maintains professional and business relationships
5.3.2	Communicates effectively
5.4	<i>Exercising judgement and taking responsibility</i> (Responsibility Level E)
5.4.1	Ethical practices
5.4.2	Code of Conduct
5.4.3	Exercises sound judgement in the course of complex engineering activities
5.4.4	Is responsible for decision-making in some or all engineering activities
5.5	<i>Competency development</i> (Responsibility Level D)
5.5.1	Plans own development programme
5.5.2	Constructs Initial Professional Development (IPD) record

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APPENDIX C: MARITIME ENGINEERING PRACTICE AREAS

Maritime Engineering Professionals in the main disciplines of the following:

Naval Architecture (Engineering)

Marine Mechanical Engineering

Marine Electrical Engineering

The above are expected to have exposure and expertise in the following areas, as identified in the Maritime Engineering disciplines.

Practising Maritime Engineering Professionals generally specialise in one or more of the identified expert fields (the list is not exhaustive). The expertise areas can often be found in more than one discipline, each with differences in critical subject matters.

Ship Design

Ship Structures

Ship Propulsion Systems

Oil and Gas Rigs and related Structures

Hydrodynamics

Maritime Electronics

Stability and Manoeuvring Control

Towing Tank or Propeller Testing

Ship or Marine Systems, including hydraulic, pneumatic, and control systems

Ship Trials and Testing

Ship Performance Monitoring

Shipyards Management

Certification and System Safety Programmes

Design

Power Systems Design

Vessel Design

Construction and Repair

Regulation, Surveying, and Overseeing

Research and Development

Consultancy

Marketing and Sales

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Operations

Education and Training

Infrastructure, Services, and Skills such as

Harbour Design

Floating Docks

Shipyards

Shore-Side Maintenance Facilities

Shore-Side Power Supply Networks

Cranes

Container Handling

Services Design

Surveys and Audits

Discipline Specialist

Differentiation between the type of work that the various grades of Engineers are expected to do is identified by the type of work: Complex for Pr Eng, broadly defined for Pr Tech Eng, and well-defined for Pr Techni Eng, even though the work description is similar.

The typical work performed by each Maritime Engineering discipline is described below.

Naval architects

Naval architects must have a general understanding of all engineering disciplines because they generally start the process of designing a vessel. After they determine its basic size and shape, they address hull form and resistance, propulsion power requirements, ship structure, weight distribution, stability, and the efficient location of the many compartments throughout the ship.

Naval Architecture is concerned with ship design as a whole and not with the internal design of pieces of equipment placed in or on the ship. The work includes the following:

- Design, construction, operation, remodelling, and decommissioning of whole entities
- Design, construction, and integration of internal and external shipboard systems and structures, including the arrangement and installation of equipment or systems and the establishment of standards, safety regulations, and operational guidance and procedures.

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Naval architects determine the principal dimensions of the vessel in collaboration with ship operators or others who specify performance requirements. Once this determination has been made, naval architects prepare the preliminary ship design with the delineation of the lines, the displacement and stability calculations, general arrangement plans, weight calculations, and strength calculations. After the preliminary design is completed, the work involves building a physical model or models (particularly for new forms).

In addition to the basic work, the following specialisation may be encountered:

Arrangements: Work primarily involves the functional external and internal layout of a ship, naval vessel, or marine structure and encompasses the following:

- Considerations for compartmentalisation and access, which involve the allocation of interior and exterior shipboard space
- Functional studies of the stability and safety of the ship for various spaces (e.g. machinery rooms, repair shops, crew quarters, recreation spaces, storage and cargo spaces)
- Determination of locations for deck machinery (e.g. winches, cranes, and cargo handling gear)

Structural design: This involves specification of the actual structure of the ship, including framing, shell, decks, bulkheads and equipment foundations, ensuring that the ship can withstand the weight of cargo loading and the impact of waves. Combat ships must be able to withstand battle damage from weapons such as missiles, torpedoes, and underwater mines. Submarine specialisation work includes structural and hull form design for resisting deep ocean pressure and the selection of materials for this hostile environment. Oil and gas rigs must be able to maintain position in the heavy sea and wave/wind conditions.

Hydrodynamics: Work primarily involves the application of the scientific theories and principles in physics concerning motion, water, and/or liquids:

- To develop hydrodynamic design criteria for hull forms, ship appendages, and other marine devices used in surface and underwater structures
- To conduct studies on problems such as
 - resistance
 - propulsion

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- pressure distribution
- steering and turning
- propeller cavitation
- propeller noise

- To investigate hydrodynamic issues, conditions, and problems

Ship design: Work primarily involves all design elements (e.g. structure, equipment, systems, and their components) of naval vessels (excluding small boats) to integrate the basic design features and the desired characteristics of the ship as a whole.

Stability: Work primarily focuses on the buoyancy and stability of ships, involving their design, construction, operation, and functionality and includes the following:

- stability studies for ships (intact, damaged, and special cases);
- inclining experiments and trim dives (for submarines);
- preparing damage control data; and
- stability calculations and studies for launching, dry-docking, mooring, or towing vessels.

Structural: Work primarily involves structural engineering concerns for naval vessels and marine structures, including the following:

- ensuring materials used in primary and secondary structures are adequate for the loads imposed and meet standards, and
- designing the structural and strength portions of the ship such as
 - hull forms or shells with the main structural connections (e.g. keels, inner-bottoms, decks, bulkheads, web frames, longitudinals, frames, beams, pillars, girders, armour, and other protective plating)
 - superstructure and deck houses
 - masts and towers
 - underwater ship appendages (e.g. propeller struts, bilge keels, and docking keels)
 - foundations for machinery or other heavy equipment installed on shipboard.

Naval Architecture work involves the generation and/or application of theories, principles, practical concepts, processes, and systems related to

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- design, standards, codes, techniques, and practices for naval vessels and marine structures;
- advanced mathematics, economics, and computer science;
- physical and biological sciences; and
- critical inquiry, analytical reasoning, problem solving, and scientific methodology.

Naval Architecture work involves ship design and calculations for new ships and for existing ships that are being altered (by means of conversion, rebuilding, modernisation, or repair).

Naval architects also solve problems involving major design changes incidental to the conversion, alteration, repair, modernisation, inactivation, and disposal of the vessel.

Marine Mechanical Engineers

Marine Mechanical Engineers are responsible for designing mechanical systems for propulsion and auxiliary services and for selecting the associated equipment such as steam boilers and turbines, diesel and gas turbine internal combustion engines, and gears.

Marine Mechanical Engineers design specific items of machinery such as cranes, hoists, elevators, and equipment for anchoring, steering, controlling submarine depth, or moving weapons and other supplies both within the ship and between ships at sea. A knowledge of fluid systems is required for designing fuel, lubrication, and water installations in addition to firefighting, compressed air, heating, ventilating, and air-conditioning (HVAC) systems.

Marine Electrical Engineers

Marine Electrical Engineers are involved in the generation and distribution of electricity throughout the ship for lighting, power, system controls, and various other ship's services. Today's ships also require a multitude of electronic navigation, communication, and combat systems.

Ocean Engineers

Ocean Engineers are concerned with work both on and below the surface of the sea, studying ocean movements and their effect on ships and craft that are both on the surface and

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submerged. An Ocean Engineer may design small sub-surface vehicles and devices that are intended for deep submergence and perform ocean bottom scanning, salvage operations, object recovery, and submarine rescue. The work includes structural, propulsion, and hull form design for resisting deep ocean pressure and the selection of materials for this hostile environment.

Common Engineering

Construction Management: Work primarily involves the performance and/or oversight of on-site construction work, including inspection and acceptance of construction work performed by a contractor.

Construction and Design management involves the preparation and/or evaluation of contract plans and specifications, including the following:

- Detailed working drawings of the ship's basic characteristics, mechanical systems, electrical installations and systems, hull piping and air-conditioning, hull fitting arrangement, and interior arrangement
- Estimates of the cost of the ship and the time it will take to build
- Provisions for the final trial and acceptance runs to test the ship's performance.

Small Craft/Boat: Work primarily involving self-propelled boats or small craft (i.e. vessels up to 30 metres), including their hull, form, arrangements, weight control and displacement, and stability and trim.

Seagoing Marine Engineers (IMO STCW compliant)

Chief or Second Engineer Officers can register as Pr Cert Eng once they have achieved the required certification, qualification and experience defined in document **R-05-ME-PCE** Sub-DSTG for Candidate Certificated Engineers (Marine Engineers) Rev: 01 Year: 2026.

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APPENDIX D: PROFESSIONAL DEVELOPMENT (OUTCOME 11)

Level	Professional Development Activity
Entry	a. Occupational health and safety and regulations b. Introduction to System Engineering Management c. Basic conditions of employment d. Introduction to Labour Industrial Relations e. Management principles and ethics f. Basic Project and Finance Management g. Negotiation skills h. Public speaking and presentation skills i. Technical report writing j. Development of technical specifications k. Introduction to Risk Management l. Quality Management Systems m. Environmental Management aspects
Intermediate	a. Occupational health and safety and regulations b. Preparation of standards and specifications c. Intermediate Project and Finance Management d. Systems Engineering Management e. Contract Management f. Risk assessment, analysis, and management g. Quality Management Systems h. Environmental management i. Technical and business report writing j. Business presentation skills. k. Attendance marine conferences and courses
Advanced	a. Sustainability and Environmental, Social, and Governance (ESG) b. Advanced business and project management c. Advanced safety, health and environmental / sustainable development d. Postgraduate qualification in maritime subjects, finance, marketing, or business administration e. Advanced systems engineering f. Digitalisation and digital technologies g. ECSA working groups to write or update governing documents h. Advanced industrial relations and public relations.

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APPENDIX E: DETAILED MARITIME ENGINEERING PROFESSIONS

Maritime Design Engineers, Technologists, and Technicians

Maritime Design Engineers, Technologists, and Technicians are those involved with the broadly defined aspects relating to the design of ships and ship systems and those who are involved in actual design such as preliminary design, performance predictions, hydrodynamic design, structural design, power plant trade-off studies, and control system design. Specific investigations could include literature studies, process evaluation, defect or failure investigations, product/system performance evaluation, and manufacturing or production baseline studies. Information thus gathered may be used in design improvement, process optimisation, performance enhancement, and product, system, and plant efficiency upgrades. These are the activities in which Maritime Craft products and systems are designed to meet needs, specifications, and standards.

The activities in the table below are recommended for Maritime Design Engineers, Technologists, and Technicians in training.

Type of experience	Specific complex, broadly defined, well-defined activities
Problem/Requirements definition	a. Formulation of user requirement statements (URS) b. Generate performance specifications (Specs) c. Qualification/verification matrix design <i>(Use standards/specifications/handbooks for guidance in the preparation of above documents.)</i>
Project planning (for design)	a. Resource planning (computing/drafting/manufacturing, etc.) b. Time scales, critical path, identification of bottlenecks / critical milestones, etc.
Examination of alternatives	a. Literature study b. Identifying potential techniques/technologies/materials c. Generation of concepts d. Elimination of unsuitable alternatives e. Preliminary performance prediction

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Type of experience	Specific complex, broadly defined, well-defined activities
Trade-off studies	a. Using decision-making tools to choose between viable alternatives b. Examining impacts of alternatives on ability to meet URS/Specs c. Negotiating with customers regarding requirement trade-offs and reformulation of URS/Specs
Detailed design	a. Material selection b. Selection of hydrofoil and high-lift devices c. Selection of components/sub-systems d. Structural/hydrodynamic/mechanical design e. Performance prediction f. Stress analysis g. Hydrodynamic and hydrostatic analysis h. Stability and control analysis and design i. Hazard and operability (HAZOP) studies j. Failure modes, effects, and criticality analysis (FMECA) k. Updating of specifications l. Maintenance requirements design
Design documentation	a. Generation of drawings b. Generation of design reports c. Updating of documents/specifications as design progresses d. Configuration control
Supervision of production	a. Design of processes/tests b. Handling of engineering queries/concessions/deviations c. Design and implementation of quality control methods d. Handling of materials e. Handling of scrap/reworkable items, etc.
Verification testing	a. Qualification/verification test planning b. Qualification/verification testing c. Test report writing d. Commissioning of plants/equipment
Product support	a. Support during production testing b. Support during operational testing and evaluation c. Management of upgrades/repairs

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Maritime Systems Engineers, Technologists, and Technicians

Maritime Systems Engineers, Technologists, and Technicians are those involved with the specification, in-service management, and fleet engineering of vessels or vessel systems. These would typically be Engineering Technicians in organisations that operate one or more seagoing vessels who are responsible for ensuring the continued seaworthiness of the fleet and for addressing obsolescence issues. These Engineering Technicians operate subject to regulations and regulating bodies such as the South African Maritime Safety Authority (SAMSA).

The following types of activities are recommended for the training of Maritime Systems Engineers, Technologists, and Technicians.

Type of experience	Specific complex, broadly defined, well-defined activities
Maintaining seaworthiness	a. Identification and implementation of relevant service bulletins 6 Implementation of seaworthiness directives 7 Implementation of ageing Maritime Craft programmes 8 Health and use monitoring 9 Failure reporting and corrective action
Maintenance optimisation	a. Staggering (fleet use & maintenance scheduling) 10 Negotiation with original equipment manufacturers (OEMs) to adapt servicing for fleet-specific requirements 11 Trend monitoring and maintenance adaptation
Fleet optimisation	a. Fleet redesign and adaptation 12 Route planning for optimal fleet fuel consumption
Maintaining fleet availability	a. Trade-off studies between cost and return of upgrades/retrofits vs fleet replacements 13 Vessel configuration control

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Type of experience	Specific complex, broadly defined, well-defined activities
Acquisition/Procurement projects	a. Definition of requirements for new products and systems 14 Integration of new mission equipment on existing vessels 15 Design of review activities 16 Selection and implementation of upgrades 17 Management of flight tests and other acceptance testing activities 18 Oversight of suppliers during developmental activities (e.g. weapons development) 19 Monitoring compliance with certification compliance matrices 20 Commissioning of ground systems and support equipment (simulators, new maintenance equipment, etc.)

Maritime Certification Engineers, Technologists, and Technicians

Maritime Certification Engineering involves Engineers, Technologists, and Technicians who ensure that vessel systems meet the requirements of seaworthiness regulations. These would typically be individuals employed by SAMSA or within the companies that are requesting certification of their products, and it is their responsibility to ensure compliance with the certification requirements.

The following types of activities are recommended for the training of Certification Engineers, Technologists, and Technicians.

Type of experience	Specific complex, broadly defined, well-defined activities
Compliance testing	a. Consultation with clients and other maritime authorities with regard to seaworthiness requirements and regulations 21 Setting up compliance matrices 22 Oversight of sea tests and other acceptance testing activities 23 Oversight of suppliers during developmental activities (e.g. mission equipment development)

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Type of experience	Specific complex, broadly defined, well-defined activities
Systems background	a. Training in systems on one or more vessel types b. Troubleshooting and fault analysis c. Use of design specifications during design or certification planning d. Floor level exposure to all aspects of vessel maintenance. a. Participation in software development and certification
System safety analysis	a. Training in and application of the system safety process b. Application of fault tree, HAZOP, and equivalent safety procedures
Organisational audits	a. Advising organisations in creating and implementing their manuals of procedures b. Quality systems and special process audits c. Periodic auditing of approved manufacturing and maintenance organisations
Monitoring compliance with seaworthiness directives, etc.	a. Ensuring approved organisations and fleet operators implement applicable seaworthiness directives b. Auditing/monitoring correct implementation of Service Bulletins / Ageing Vessel Programmes
Incident investigations	a. Serving as part of incident investigation teams b. Overseeing incident investigations c. Reviewing and analysing previous investigation reports for similarities/trends d. Writing incident investigation reports
Generation of regulations	a. Reviewing existing regulations b. Generating or updating regulations

Research and Development Engineers, Technologists, Technicians, and Academics

Research and Development Engineers, Technologists, Technicians, and academics are those employed by universities and research organisations. Their focus is on teaching students and the development of new knowledge, techniques, and technologies.

The following types of activities are recommended for the training of Maritime Research and Development Engineers, Technologists, Technicians, and academics.

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Type of experience	Specific complex, broadly defined, well-defined activities
Teaching	a. Reading in applicable fields of knowledge b. Curriculum development c. Selection and development of teaching materials d. Compilation of lecture notes e. Compilation of examination papers f. Demonstration of application of theory in practice g. Serve as supervisor for student projects
Study and research	a. Literature study b. Obtaining higher qualifications c. Advancement of the current state of the art in technology

Maritime Design Engineers, Technologists, and Technicians

Maritime Design Engineers, Technologists, and Technicians are those involved with the broadly defined aspects relating to the design of ships and ship systems and who execute the actual design such as the preliminary design, performance predictions, hydrodynamic design, structural design, power plant trade-off studies, and control system design. Specific investigations could include literature studies, process evaluation, defect or failure investigations, product/system performance evaluation, and manufacturing or production baseline studies. Information thus gathered may be used in design improvement; process optimisation; performance enhancement; and product, system, and plant efficiency upgrades. In these activities, maritime products and systems are designed to meet needs, specifications, and standards.

The activities in the table below are recommended in the training of Maritime Design Engineers, Technologists, and Technicians.

Type of experience	Specific complex, broadly defined, well-defined activities
Problem/Requirements definition	a. Formulation of user requirement statements (URS) b. Generate performance specifications (Specs) c. Qualification/verification matrix design <i>(Use standards/specifications/handbooks for guidance in the preparation of the above documents.)</i>

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Type of experience	Specific complex, broadly defined, well-defined activities
Project planning (for design)	a. Resource planning (computing/drafting/manufacturing, etc.) b. Time scales, critical path, identification of bottlenecks / critical milestones, etc.
Research	a. Literature study
Examination of alternatives	a. Identifying potential techniques/technologies/materials b. Generation of concepts c. Elimination of unsuitable alternatives d. Preliminary performance prediction
Trade-off studies	a. Using decision-making tools to choose between viable alternatives b. Examining impacts of alternatives on ability to meet URS/Specs c. Negotiate with customers regarding requirement trade-offs and reformulation of URS/Specs
Detailed design	a. Selection of material b. Selection of foil and high-lift devices c. Selection of components/sub-systems d. Structural/hydrodynamic/mechanical design e. Performance prediction f. Stress analysis g. Dynamic analysis h. Stability and control analysis and design i. Hazard and operability (HAZOP) studies j. Failure modes effects and criticality analysis k. Updating of specifications l. Maintenance requirements design
Design documentation	a. Generation of drawings b. Generation of design reports c. Updating of documents/specifications as design progresses d. Configuration control
Supervision of production	a. Design of processes/tests b. Handling of engineering queries/ concessions/ deviations c. Design and implementation of quality control methods d. Handling of materials e. Handling of scrap/reworkable items, etc.

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Type of experience	Specific complex, broadly defined, well-defined activities
Verification testing	a. Qualification/verification test planning b. Qualification/verification testing c. Test report writing d. Commissioning of plants/equipment
Product support	a. Support during production testing b. Support during operational testing and evaluation c. Management of upgrades/repairs

Maritime Systems Engineers, Technologists, and Technicians

Maritime Systems Engineers, Technologists, and Technicians are those involved with the specification, in-service management, and engineering of ships or ship systems. These would typically be Engineering Technicians in organisations that operate fleets who are responsible for ensuring the continued seaworthiness of the fleet and for addressing obsolescence issues. These Engineering Technicians operate subject to regulations and regulating bodies such as SAMSA.

The following types of activities are recommended for the training of Maritime Systems Engineers, Technologists, and Technicians.

Type of experience	Specific complex, broadly defined, well-defined activities
Maintaining seaworthiness	a. Identification and implementation of relevant service bulletins b. Implementation of seaworthiness directives c. Implementation of ageing vessel programmes d. Health and use monitoring e. Failure reporting and corrective action
Maintenance optimisation	a. Staggering (fleet use & maintenance scheduling) b. Negotiation with OEMs to adapt servicing for fleet's specific requirements c. Trend monitoring and maintenance adaptation d. Engineering management of suppliers and sub-contractors
Fleet optimisation	a. Fleet redesign and adaptation b. Route planning for optimal fleet fuel use

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Type of experience	Specific complex, broadly defined, well-defined activities
Maintaining fleet currency	a. Ship configuration currency analysis b. Trade-off studies between cost and return of upgrades / retrofits vs fleet replacements c. Ship configuration control
Acquisition/Procurement projects	a. Requirements definition for new products and systems b. Integration of mission equipment on existing vessels c. Design review activities d. Selection and implementation of upgrades e. Management of sea test and other acceptance testing activities f. Oversight of suppliers during developmental activities (e.g. equipment development) g. Monitoring compliance with certification compliance matrices h. Commissioning of shore-side systems and support equipment (simulators, new maintenance equipment, etc.)

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