ENSURING THE
EXPERTISE TO GROW
SOUTH AFRICA

Discipline-Specific Training Guide (DSTG) for Registration as a Professional Engineer in Mechanical Engineering

R-05-MEC-PE

REVISION 2: 16 November 2017

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ECSA

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1. BACKGROUND: ECSA REGISTRATION SYSTEM DOCUMENTS

The illustration below defines the documents that comprise the Engineering Council of South Africa (ECSA) system for registration in professional categories. The illustration also locates the current document.

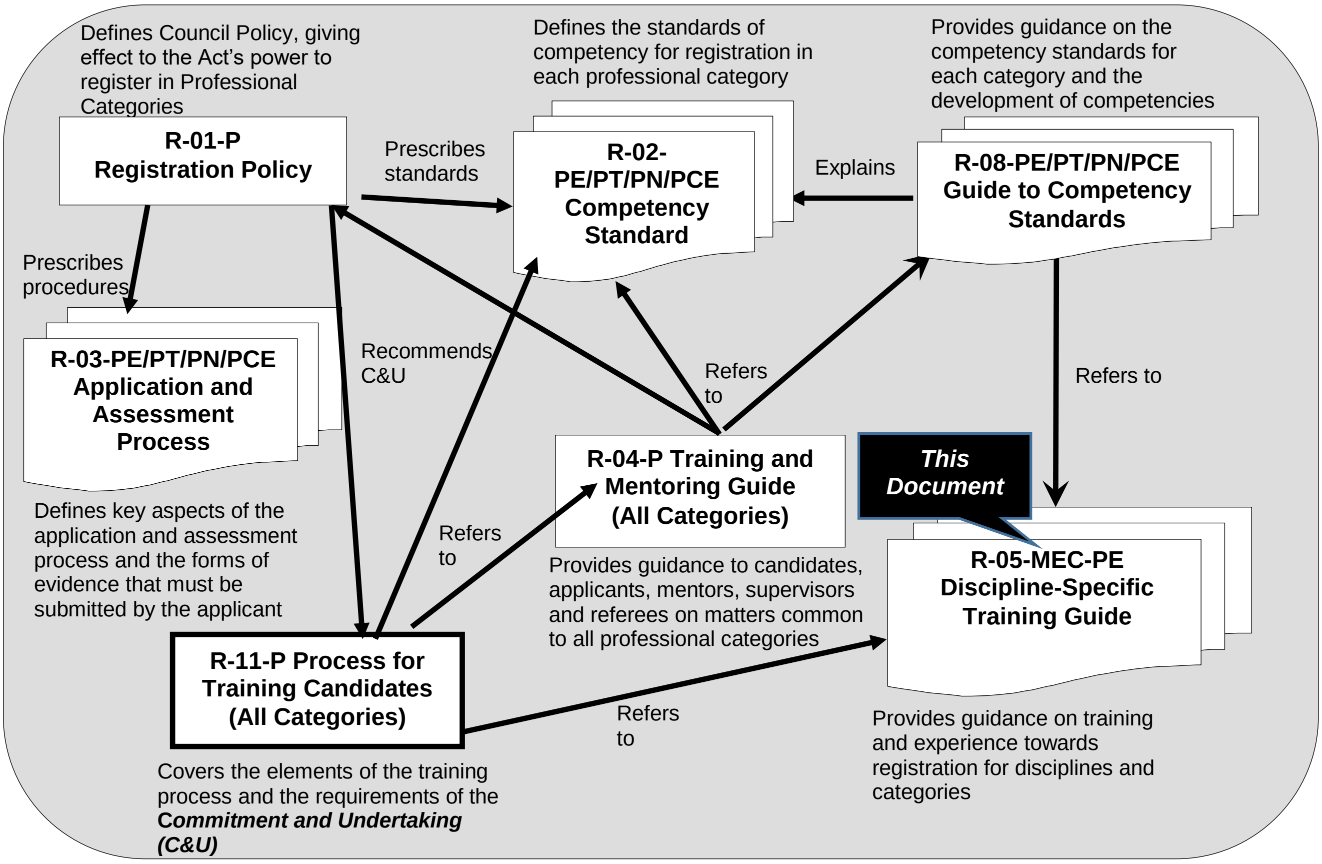

Figure 1: Documents defining the ECSA Registration System

2. PURPOSE

All persons applying for registration as Professional Engineers are expected to demonstrate the competencies specified in document R-02-PE through work performed at the prescribed level of responsibility, irrespective of the trainee's discipline. This document supplements the generic *Training and Mentoring Guide* (document R-04-P) and the *Guide to the Competency Standards for Professional Engineers* (document R-08-PE).

In document R-04-P, attention is drawn to the following sections:

7.3.2 Duration of training and length of time working at level required for registration

7.3.3 Principles of planning, training and experience

7.3.4 Progression of training programme

7.3.5 Documenting training and experience

7.4 Demonstrating responsibility

The second document (document R-08-P) provides a high-level, outcome-by-outcome understanding of the competency standards that form an essential basis for this Discipline-Specific Training Guide (DSTG).

This guide and the documents R-04-P and R-08-PE are subordinate to the Policy on Registration (document R-01-P), the Competency Standard (document R-02-PE) and the application process definition (document R-03-PE).

3. AUDIENCE

This DSTG is directed towards candidates and their supervisors and mentors in the discipline of Mechanical Engineering. The guide is intended to support a programme of training and experience through incorporating good practice elements.

This guide applies to persons who have:

- Completed the tertiary educational requirements in Mechanical Engineering
  - by obtaining an accredited B.Eng.-type qualification from a recognised tertiary university in South Africa,
  - by obtaining a Washington Accord recognised qualification, or
  - through evaluation/assessment;
- registered with the ECSA as a Candidate Engineer; and/or
- embarked on a process of acceptable training under a registered Commitment and Undertaking (C&U) programme under the supervision of an assigned mentor guiding the professional development process at each stage.

4. PERSONS NOT REGISTERED AS A CANDIDATE AND/OR NOT TRAINED UNDER COMMITMENT AND UNDERTAKING

Irrespective of the development path followed, all applicants for registration must present the same evidence of competence and be assessed against the same standards. Application for registration as a Professional Engineer is permitted without being registered as a Candidate Engineer and without training under C&U. Mentorship and adequate supervision are, however, key factors in effective development to the level required for registration.

If the employer of the trainee does not offer C&U, the trainee 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 for the discipline may be consulted for assistance in locating an external mentor. A mentor should keep abreast of all stages of the development process.

This guide is written for the recent graduate who is training and gaining experience towards registration. Mature applicants 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 application for registration.

5. ORGANISING FRAMEWORK FOR OCCUPATIONS

Mechanical Engineering (Organising Framework for Occupations (OFO) 214401)

Mechanical Engineering involves the planning, design, construction, operation and maintenance of materials, components, machines, plants and systems for lifting, hoisting and handling of materials. The discipline is concerned with turbines, pumps and fluid power, heating, cooling, ventilating and air-conditioning, fuels, combustion, engines and gas turbines in addition to steam, petrochemical and food processing plants. Mechanical Engineering also focuses on automobiles, trucks, aircraft, ships, special vehicles, lifts and escalators plus fire protection and nuclear energy power generation. Mechanical Engineers advise on the mechanical aspects of particular materials, products and processes through the application of the engineering sciences of mechanics, solid mechanics, thermodynamics, fluid mechanics, physics, chemistry, applied mathematics and computational techniques.

Typical tasks that a Mechanical Engineer may undertake include

- advising on and designing machinery and tools for manufacturing, mining, construction, agricultural and other industrial purposes;
- advising on and designing steam, internal combustion and other non-electric motors and engines, gear boxes and drive trains used for propulsion of railway locomotives, road vehicles and aircraft and systems for driving industrial and other machinery;
- advising on and designing hulls, superstructures and propulsion systems of ships, mechanical plants and equipment for the release, control and utilisation of energy in addition to heating, ventilation and refrigeration systems, steering gear, pumps, pipe work, valves and other associated mechanical equipment;
- advising on and designing airframes, undercarriages and other equipment for aircraft plus suspension systems, brakes, vehicle bodies and other components of road vehicles;
- advising on and designing non-electrical parts of apparatus or products such as word processors, computers, precision instruments, cameras and projectors;
- establishing control standards and procedures to ensure efficient functioning and safety of machines, machinery, tools, motors, engines, industrial plants, equipment and systems; and
- ensuring that the operation and maintenance of equipment complies with design specifications and safety standards.

Practising Mechanical Engineers generally specialise in expert fields as one or more of the following:

- Fire Protection and Detection Engineer (includes air-conditioning, heating, ventilation and Fire Protection and Detection Engineer
- Automotive Engineer
- Diesel Engineer
- Fluid Mechanics Engineer
- Forensic Engineer
- Heating and Ventilation Engineer
- Machine Design and Development Engineer
- Maintenance Management Engineer

- Mechanical Engineer – Mining industry
- Mechatronics Engineer
- Piping Engineer
- Power Generation Engineer (Mechanical Systems)
- Pressurised Vessels Engineer
- Propulsion System Engineer
- Rotating Equipment Plant Engineer
- Structural Steel Engineer
- Thermodynamics Engineer
- Transportation Systems Engineer

6. NATURE AND ORGANISATION OF THE INDUSTRY

Mechanical Engineers may be employed in either the private or the public sector. In the private sector, Mechanical Engineers are typically involved in consulting and contracting and work in supply and manufacturing organisations. Engineering consultants are responsible for planning, designing, documenting and supervising the construction of projects on behalf of their clients. Engineering contractors are responsible for project implementation, and their activities include design, planning, construction, plant erection, commissioning and labour and resource management. Mechanical Engineers working in supply and manufacturing companies are involved in production, supply, product certification and quality assurance and control and may be engaged in research and development.

The public sector is responsible for service delivery and is usually the client. However, in some departments, design and construction are also carried out. Mechanical Engineers are required at all levels of the public sector, including national, provincial and local government levels, state-owned enterprises and public utilities. The public sector largely handles planning, specifying and overseeing implementation of infrastructure projects in addition to engaging in operations and maintenance of infrastructure. An extension of the public sector includes tertiary academic institutions and research organisations.

Depending on where the candidate is employed and the nature of the enterprise, there may be situations in which the in-house opportunities are not sufficiently diverse to develop all the required competencies that are noted in groups A and B in document R-02-PE. For example, the opportunities for developing problem-solving competence (including designing and developing solutions) and for managing engineering activities (including implementing and constructing solutions) may not be available to the candidates through their direct employers. In such cases, employers are encouraged to implement a secondment system, enabling candidates to obtain experience in a specific category of training. It is fairly common practice that for situations in which organisations are not able to provide training in certain areas, secondments are arranged with other organisations so that the candidates are able to develop all the competencies required for registration.

Problem-solving of mechanical systems in the environments of design, operation, construction and research is the core of Mechanical Engineering. It is a logical thinking process that requires engineers to apply their minds diligently in bringing solutions to technically complex problems. This process involves the analysis of systems or the assembly of mechanical components and the integration of various elements of Mechanical Engineering through the application of basic and engineering sciences.

Problem-solving experience may be obtained in the following work categories that are linked to the lifecycle of the product, system, plant or equipment.

6.1 Investigation

The candidate may be tasked to perform specific investigations, literature studies, process evaluations, defect or failure investigations, product performance evaluations and manufacturing or production baseline studies. The technical information thus gathered may then be used in design improvement, process optimisation, performance enhancement and product, system and plant efficiency upgrades. The type of work outputs can generally be used as inputs for mechanical engineering processes further along the value chain.

6.2 Research and development

This type of work is carried out in the research and product-development centres of business organisations and academic institutions. Candidates undertake research and developmental work that is predominantly of a mechanical engineering nature, and this work involves an in-depth application of the various aspects of Mechanical Engineering, including product or system testing under controlled experimental conditions.

6.3 Process design

Examples of acceptable designs include

- complex fluid systems, incorporating rotating and reciprocating machines;
- complex machines and equipment or major parts thereof;
- complex energy systems, involving heat and/or power transfer;
- complex pressure systems (heating, ventilating and air-conditioning (HVAC) systems); and
- complex structures of
  - vehicles
  - boats
  - trains
  - aircraft structures
  - conveying equipment
  - piping systems
  - transmissions / drive trains / gearboxes
  - defence equipment
  - chemical process plants
  - equipment for handling materials
  - mine processing plants
  - pressurised systems, vessels, valves, equipment
  - buildings, hospitals, mechanical systems in public centres
  - process manufacturing plants.

Acceptable complex design reviews include reviews of major machine systems such as turbines and compressors with their auxiliary systems, power station systems and their major components, complex refrigeration systems, petrochemical plants and other production and manufacturing plant systems.

6.4 Risk and impact mitigation

Risk and impact mitigation mainly deals with the investigation of failure or under-performance of major equipment and systems and the synthesis of implemented and proven solutions to avoid recurrence of the problem. In addition, this category of work involves improvement projects that are necessary for optimising operational efficiencies. In risk and impact mitigation, engineers must apply professional engineering judgement to all work done. This includes the ability to assess design work against the following criteria:

- Conformance to design specifications and health and safety regulations
- Ease of fabrication and assembly
- Constructability
- Maintainability
- Conformance to environmental requirements
- Ergonomic considerations
- Lifecycle costs
- Alternative solutions

6.5 Engineering project management

The Candidate Engineer must be granted the opportunity to manage an engineering project or facets thereof to gain integration experience relating to the product, system, equipment or plant in accordance with the project management methodology of the enterprise. Various standards and software are deployed in industry that are linked to international specialised knowledge and expert systems (e.g. MS Project, PS Next 'Sciforma', SAP PM Modules, Siemens PLM, PMBOK, ISO standards).

The Engineering Council of South Africa is not prescriptive in this regard, but aspects of the following should be included in the candidate's experience base of Engineering Project Management as far as practically possible:

- engineering task formulation, work-breakdown structures (WBS), Statements of Work (SOW);
- time-based scheduling, budgeting, personnel allocation, project staffing (e.g. Gantt-charts);
- equipment, facilities and site selection, preparation and planning;
- sub-contracting, procurement and supplier monitoring;
- financial budgeting, management, costing, Value Engineering;
- product lifecycle management (PLM) and planning;
- engineering change procedures, product baseline management, configuration control;
- technical documentation and reports management;
- technical staff training support and technical assistance and project support;

- project status and progress management, control and reporting; and
- identification, planning and implementation of corrective action.

Examples of Engineering Project Management include setting up / establishing a Systems Engineering Management Plan (SEMP) or setting up / establishing a Project Management Plan (PMP) for a specific project or a specific phase(s) of a project within the employer's enterprise.

6.6 Implementation/Commissioning

Ideally, the Candidate Engineer gains exposure in an integration responsibility role, interfacing with other engineering disciplines related to the project, product, system or plant. This normally occurs when higher-level systems, equipment or plants are built, constructed or assembled on site and followed by commissioning and acceptance-test processes. Elements in which the candidate may gain experience include

- assembly and compilation of build instructions, Fits and Clearances, build-record sheets;
- acceptance methods (Means of Compliance) (define, analyse, inspect, demonstrate, test);
- planning and execution of commissioning process, preparation of 'punch lists';
- plant or equipment assembly, commissioning, pass-off testing, certification (in conjunction with inspection and/or Quality Assurance (QA) departments and inspectors);
- environmental impact assessments, compliance, plant measurements during commissioning; and
- mechatronics:
  - plant control and automation (control and instrumentation (C&I) interfacing), condition and performance monitoring, measurements,
  - installation of control systems, commissioning, upgrade of hardware and software control systems,
  - plant performance monitoring , data acquisitioning (e.g. SCADA , PLC systems), and
  - digital systems, automation.

6.7 Production

Producibility of a product design in accordance with stipulated quality standards and specified acceptance criteria is a major element of a product's lifecycle. The Candidate Engineer needs to obtain experience in product realisation either during the early development of models or prototypes or during the development of various models in the phases of the project (e.g. prototype, experimental, advanced, engineering development, pre-production or serial production).

Focus areas in which the applicant can obtain exposure include

- material selection, raw material sourcing and certification;
- processing techniques (computer numerical control (CNC) machining, milling, turning);
- special processes (welding, vacuum brazing, laser piercing, cutting, heat treatment, shot-peening, surface treatment, electro-discharge machining (EDM), cladding);
- surface coatings (nitriding, carburising, chromising, aluminising, plasma spray thermal coatings, plating, anodising);
- manufacturing process selection and optimisation (collaboration with Industrial/Process Engineers);
- manufacturing trials;
- rapid prototyping, 3D additive manufacturing;
- tooling and fixture design, manufacture, tool proving;
- product acceptance (demonstration, test, inspect, measure) (digital coordinate measuring machine (CMM), fluid flow measurements);
- non-destructive testing (NDT) (dye penetrant, magnetic particle inspection, ultra-sonic, X-ray);
- manufacturing verification and validation procedures, Quality Assurance / Quality Control (QA/QC);
- First Article Acceptance, Factory Acceptance Test;
- quality audits, technical assistance in compilation of Quality Management Plan (QMP); and
- quality inspection reports.

6.8 Operations and maintenance

Possible work involvement that the Candidate Engineer may expect in the Operations and Maintenance

Phase of a product, system or plant lifecycle includes

- providing technical support for scheduled and planned maintenance actions;
- safety, health, environment and quality (SHEQ) studies (evacuation, emergency and safe shutdown procedures, security systems, safeguards);
- prevention of hazardous material spillage, containment, risks identification;
- plant site / system hazard identification and mitigation processes and procedures;
- process hazard analysis (PHA);
- Reliability, Availability, Maintainability (RAM) studies;
- maintenance optimisation, plant shutdown and startup procedures/sequences;
- equipment monitoring (health and usage, condition monitoring), interfacing with C&I;
- plant vibration, critical temperatures, pressures, mass flow monitoring;
- radiation safeguards, plant zoning, 'design for nuclear safety' (e.g. for nuclear power plant);
- hazardous environments, operations, failure event studies (e.g. Hazard and Operability [HAZOP], Failure Modes, Effects and Criticality Analysis [FMECA]);
- plant control and automation (C&I interfacing), performance monitoring, measurements, tests;
- development of repair technology/techniques, salvaging schemes;
- maintenance, repair and overhaul (MRO) of mechanical products, systems and plants;
- Logistics Support Analysis (LSA);
- lifecycle analysis, component lifing/endurance studies;
- plant or system de-commissioning, decontamination, disposal, re-cycling of materials;
- reversion in alloys, re-processing, alternative use; and
- plant site close-out, site rehabilitation, recovery.

7. DEVELOPING COMPETENCY: ELABORATING ON SECTIONS IN THE GUIDE REGARDING COMPETENCY STANDARDS (DOCUMENT R-08-PE)

Applicants are required to demonstrate insight and the ability to use and interface various design aspects through verifiable work carried out in providing engineered and innovative solutions to practical problems experienced in their operating work environments. In addition, applicants must develop the skills required to demonstrate the advanced use of mechanical engineering knowledge in optimising the efficiency of operations or the constructability of projects.

Candidates must be able to demonstrate that they have been actively involved in a mechanical workshop environment and have participated in the execution of practical work to the extent that they have learnt sufficient details regarding basic mechanical procedures to be able to exercise judgement in the workplace. Applicants must also show evidence of adequate training in this function through complex project work carried out in the analysis of problems and the synthesis of solutions.

Evidence is required in the form of a separate comprehensive ***design report*** that must accompany the application. This report should describe synthesised solutions to sufficiently complex engineering problems in order to demonstrate that applicants have had the opportunity to apply their technical knowledge and engineering expertise gained through university education and practical work experience.

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

What is a sufficiently complex engineering problem?

According to the ECSA, the definition of *complex* in *complex engineering problems* can be defined as:

> Composed of many ***inter-related conditions***; requiring ***first principle empirical judgment*** to create a solution within a set of ***originally undefined circumstances***. (ECSA, 2018:6)

Mechanical Engineering forms an integral part of broader engineering systems and infrastructure in technologically complex environments such as manufacturing, processing, mining, construction, product-development and research. Applicants are required to undertake mechanical engineering projects that significantly enhance the operability and constructability of integrated engineering systems and infrastructures. Such project work should not be stand-alone assignments but should form part of the solutions to integrated engineering systems that require a broad application of various theoretical aspects of Mechanical Engineering ranging from fluid systems and energy systems to structures and machines.

Engineering design is a logical thinking process that requires engineers to apply their minds carefully in bringing solutions to technically complex problems. This process involves the analysis of systems or the assembly of mechanical components and the integration of various elements of Mechanical Engineering through the application of basic and engineering sciences. Simple and straightforward calculation exercises and graphical representations from computer-generated data are not considered sufficiently complex engineering designs since anybody with qualifications in basic science and engineering science is able to perform this type of work. However, professional registration requires advanced application of engineering knowledge in complex design problems.

In demonstrating advanced application of theoretical knowledge in regard to these systems, applicants must incorporate calculations with clearly defined inputs of the formulae used and detailed interpretation of the results obtained. In addition, 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 and simplification of system).

Candidate Engineers must obtain experience in solving a variety of problems in their work environment, and the solutions to these problems must involve the use of the fundamental and advanced mechanical engineering knowledge that was obtained at university. Problems that require a scientific and engineering approach in their solution may be encountered in any engineering work environment that consists of integrated engineering systems, equipment, machinery and infrastructure. From early in their training years, candidates must actively seek opportunities to obtain experience in the area of synthesising solutions to real-life engineering problems encountered in the workplace.

A suitable length of time and degree of practical participation should be sought in the workshop environment, learning the basic practices that are the essence of the mechanical discipline so that the candidate can judge the efficacies of such practices in the general workplace thereafter.

7.1 Contextual knowledge

Candidates must be aware of the requirements of the engineering profession. The Voluntary Associations applicable to the Mechanical Engineer and their functions and services to members provide a broad range of contextual knowledge for the Candidate Engineer that continues through the full career path of the Registered Engineer.

The profession identifies specific contextual activities that are considered essential to the development of competence of the Mechanical Engineer. These include participation in basic workshop, manufacturing and fabrication activities and awareness of the competencies required of the technologist, technician and artisan. These areas of practice are identified in each programme within the employer environment.

7.2 Functions performed

Special consideration 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 very useful to measure the progression of the candidate's competency by making use of the scales for Degree of Responsibility, Problem Solving and Engineering Activity as specified in the relevant documentation. The attached appendix was developed against the Degree of Responsibility Scale.

It should be noted that the candidate working at Responsibility Level E carries the responsibility appropriate to that of a registered person except that the candidate's supervisor is accountable for the candidate's recommendations and decisions.

7.3 Statutory and regulatory requirements

Candidates 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), its rules and the Code of Conduct;
- Occupation Health and Safety Act as amended by Occupation Health and Safety Act, No. 181 of 1993 (OHSA);
- Building Regulations – National Building Regulations and Building Standards Act, No. 103 of 1977 as amended by National Building Regulations and Building Standards Act, No. 49 of 1995;
- Machinery and Works Regulations;
- Labour Relations Act, No. 66 of 1995;
- Environment Conservation Act, No. 73 of 1989 as amended by Environment Conservation Act,

No. 52 of 1994 and Environment Conservation Amendment Act, No. 50 of 2003;

- Mine Health and Safety Act, No. 29 of 1996; and
- Specific work instructions, standards and/or specifications of enterprise.

Other Acts not listed here may also be pertinent to a candidate'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 particular work environment.

7.4 Recommended formal learning activities

The following includes useful courses for formal learning:

- Continuing Professional Development (CPD) courses on specific disciplines
- Project Management
- Value Engineering
- Standard Conditions of Contract (NEC, FIDIC, GCC, etc.)
- Preparation of Specifications
- Negotiation Skills in Engineering
- Finance Risk Analysis
- Quality Assurance Systems
- Occupational Health and Safety
- Energy Efficiency
- Maintenance Engineering
- Environmental Impact Management
- Report Writing
- Planning Methods

8. PROGRAMME STRUCTURE AND SEQUENCING

8.1 Best practice

There is no ideal training programme structure or unique sequencing that constitutes best practice. The training programme for each candidate depends on the available work opportunities at the time that are assigned to the candidate by the employer.

It is suggested that candidates work with the appointed mentors to determine appropriate projects in order to gain exposure to elements of the asset cycle and to ensure that their designs are constructible, operable and are designed considering lifecycle costing and long-term sustainability.

The training programme should be such that the candidate progresses through the levels of work capability described in section 7.3.4 of document R-04-P so that by the end of the training period, the candidate exhibits the degree of responsibility allocated during the particular period of training and is able to perform individually and as a team member at the level of problem-solving and engineering activity required for registration. The mentor and candidate must identify the level of responsibility that is required for an activity to be compliant and demonstrate the various exit level outcomes (ELOs). Evidence of the candidate's activities and their acceptance by the mentor are recorded on the appropriate system in order to meet the requirements of the Training Elements Appendix.

8.2 Realities

The minimum period for the Candidacy Phase is stated by the ECSA as three years. The likelihood, however, is that the period of training will be longer. This time frame is determined by the availability of opportunities and the exposure to various functions in the actual work environment.

Irrespective of the route followed, the overriding consideration is that the applicant must provide evidence of competence against the standard and provide objective evidence of meeting the 11 specified outcomes.

8.3 Generalists, specialists, researchers and academics

Section 10 of document R-08-PE adequately describes what is expected of persons whose formative development has not followed a conventional path, for example, academics, researchers, specialists and applicants who have not followed a candidate training programme. Each candidate must undertake a unique programme in which the various activities carried out at the discipline-specific level are linked to the generic competency requirements stated in document R-08-PE.

8.4 Multi-disciplinary exposure

Due to the complexity of today's modern systems, it is *advisable* that the Candidate Engineer gains experience in interfacing and interacting with other relevant engineering discipline tasks. This is naturally dependent on the employer's enterprise and requires that the Candidate Mechanical Engineer works under direct supervision of the alternative discipline engineer. Two examples are presented below.

Example 1:

In a steel processing plant, the Candidate Engineer assists in specifying the control instrumentation and data acquisitioning system for the plant's mechanical systems. The candidate works with the plant C&I Electronic Engineer and/or assists in the development of the control system software under the supervision of the Plant Process Engineer (Metallurgist/Chemical Engineer).

Example 2:

At a coal post-processing plant that converts coal to coke as raw material for a steel refinery, the Candidate Engineer performs Environmental Impact Assessments (EIAs) together with subject-matter experts (scientists, environmental biologists, air quality specialists) to assess emission levels of the by-products of the processing plant (contaminated water, waste gas, waste heat). The Candidate Engineer is supervised by the Chemical Engineer of the plant process.

8.5 Orientation requirements

For the Candidate Engineer starting a career with an employer, the basic introduction to the company's functions is usually performed during the first months of employment. The induction process usually includes the following aspects:

- Introduction to the company
- Company safety regulations
- Company code of conduct
- Company staff code and regulations
- Typical functions and activities

- Hands-on experience and orientation in each of the major company divisions

8.6 Moving into or changing candidacy training programmes

This DSTG assumes that the candidate enters a programme after graduation from the tertiary institution and continues with the programme until ready to submit an application for registration. It also assumes that the candidate is supervised and mentored by persons who meet the requirements stated in section 7.2 of document R-04-P.

In the case of a person changing from one candidacy programme to another or moving into a candidacy programme from a less structured environment, it is essential that the following steps are completed:

- The candidate must complete the Training and Experience Summary (TES) and the Training and Experience Reports (TERs) for the previous programme or unstructured experience. In the latter case, it is important to reconstruct the experience as accurately as possible. The TERs must be signed off by the responsible supervisor or mentor.
- On entering the new programme, the mentor and supervisor should review the candidate's development while being mindful of the past experience and the opportunities and requirements of the new programme. At minimum, the mentor and supervisor should plan the next phase of the candidate's programme.

REVISION HISTORY

Revision Number	Revision Date	Revision Details	Approved By
Rev 0: Concept A	16 Sep 2011	Initial draft	PAC Mech.
Rev 0: Concept B	4 July 2012	New template applied	
Rev 0: Concept C	7 Sept 2012	Revisions to Concept B	PAC Mech.
Rev 0: Concept D	29 Oct 2012	Standard sections 1–3 inserted, formatted	
Rev 0: Concept E	27 Feb 2013	Revision to section 3	JIC
Rev 1	12 Mar 2013		Registration Committee for Professional Eng.
Rev 2	28 Sept 2017	As per approved DSTG Framework	Gert van Rensburg
Rev 2	9 October 17	To be approved via round robin	PDSGC
Rev 2	16 Nov 2018	Approved	PDSGC

The Discipline-Specific Training Guide (DSTG) for:
Registration as a Professional Engineer in Mechanical Engineering

Revision 2 dated 16 November 2017 and consisting of 24 pages has been reviewed for adequacy by the Business Unit Manager and is approved by the Executive: Policy Development and Standards Generation (PDSG).

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Business Unit Manager

30/05/2018
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Date

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Executive: **PDSG**

30/5/2018
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Date

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

APPENDIX: TRAINING ELEMENTS

	Occupational		Work Experience	Scope of Work Experience
	Tasks	Contexts		
1	Solving problems based on engineering and contextual knowledge			
1.1		Conceptualisation of complex engineering problems		
1.1.1			Receive brief	
1.1.2			Investigate/evaluate requirements	
1.1.3			Develop preliminary solutions	
1.1.4			Justify the preliminary design	
1.2		Design or development processes for complex engineering problems		
1.2.1			Detailed design or development processes	
1.2.2			Documentation development for implementing complex engineering solutions	
2	Implementing or operating engineering projects, systems, products and processes			
2.1		Planning processes for implementation or operations		
2.1.1			Develop business and stakeholder relationships	
2.1.2			Scope and plan	
2.2		Organising processes for implementation or operations		
2.2.1			Manage resources	
2.2.2			Optimisation of resources and processes	
2.3		Controlling processes for implementation or operations		
2.3.1			Monitor progress and delivery	
2.3.2			Monitor quality	
2.4		Close-out processes for implementation or operations		
2.4.1			Commissioning processes	
2.4.2			Development of operational documentation	
2.4.3			Hand-over processes	
2.5		Maintenance and repair processes		
2.5.1			Maintenance planning and scheduling	
2.5.2			Monitoring quality	
2.5.3			Overseeing repairs and/or implementing remedial processes	
3	Risk and impact mitigation			
3.1		Impact and risk assessments		
3.1.1			Impact assessments	
3.1.2			Risk assessments	
3.2		Regulatory compliance processes		
3.2.1			Health and safety	
3.2.2			Codes and standards	
3.2.3			Legal and regulatory	
4	Managing engineering activities			
4.1		Self-management processes		
4.1.1			Manages own activities	
4.1.2			Communicates effectively	
4.2		Team environment		

4.2.1			Participates in and contributes to team planning activities
4.2.2			Manages people
4.3		Professional communication and relationships	
4.3.1			Establishes and maintains professional and business relationships
4.3.2			Communicates effectively
4.4		Exercising judgement and taking responsibility	
4.4.1			Ethical practices
4.4.2			Code of Conduct
4.4.3			Exercises sound judgement in the course of complex engineering activities
4.4.4			Is responsible for decision-making in some or all complex engineering activities
4.5		Competency development	
4.5.1			Plans own development strategy
4.5.2			Constructs initial professional development record