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DEFINITIONS

**Alternative Route:** Refers to an applicant who aspires to become registered in a Candidate or Professional Category but does not have the accredited or recognised qualifications and who proposes to meet the educational requirement through further study and assessment.

**Benchmark Route:** The normal process required to attain registration that consists of the completion of an accredited, recognised or evaluated equivalent qualification and a well-structured and effectively executed programme of training and experience for the category of registration.

**Competency area** means the performance area where all the outcomes can be demonstrated at the level prescribed in a specific technology in an integrated manner.

**Engineering science** means a body of knowledge, based on the natural sciences and using mathematical formulation where necessary, that extends knowledge and develops models and methods to support its application, solve problems and provide the knowledge base for engineering specialisations.

**Engineering problem** means a problematic situation that is amenable to analysis and solution using engineering sciences and methods.

**Ill-posed problem** means a problem whose requirements is not fully defined or may be defined erroneously by the requesting party.

**Integrated performance** means that an overall satisfactory outcome of an activity requires several outcomes to be satisfactorily attained, for example, a design will require analysis, synthesis, analysis of impacts, checking of regulatory conformance and judgement in decisions.

**Level descriptor** means a measure of performance demands at which outcomes must be demonstrated.

**Management of engineering works or activities** means the co-ordinated activities required to:

(a) direct and control everything that is constructed or results from construction or manufacturing operations;

(b) operate engineering works safely and in the manner intended;
(c) return engineering works, plant and equipment to an acceptable condition by the renewal, replacement or mending of worn, damaged or decayed parts;

(d) direct and control engineering processes, systems, commissioning, operation and decommissioning of equipment;

(e) maintain engineering works or equipment in a state in which it can perform its required function.

Over-determined problem means a problem whose requirements are defined in excessive detail, making the required solution impossible to attain in all of its aspects.

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

Practice area means 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 means the required extent of or limitations on expected performance stated in terms of situations and circumstances in which outcomes are to be demonstrated.

Specified category means a category of registration for persons who must be registered through the Engineering Profession Act or a combination of the Engineering Profession Act and external legislation as having specific engineering competencies at NQF Level 5 related to an identified need to protect the public safety, health and interest or the environment, in relation to an engineering activity.
BACKGROUND

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.

![Diagram of ECSA registration system]

Figure 1: Documents defining the ECSA registration system

1. PURPOSE OF THIS DOCUMENT

All persons applying for registration as a Professional Engineering Technician are expected to demonstrate the competencies specified in document **R-02-PN** at the prescribed level, irrespective of the trainee’s discipline, through work performed by the applicant at the prescribed level of responsibility.
This document supplements the generic Training and Mentoring Guide R-04-P and the Guide to the Competency Standards for Professional Engineering Technicians, document R-08-PN.

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

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

The second document, R-08-PN, provides both a high-level and an outcome-by-outcome understanding of the competency standards as an essential basis for this discipline specific guide (DSTG). This DSTG, together with R-04-P and R-08-PN, are subordinate to the Policy on Registration, document R-01-POL, the Competency Standard (R-02-PN) and the application process definition (R-03-PRO).

2. AUDIENCE

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

This guide applies to persons who have:

- completed the education requirements by obtaining an accredited National Dip (Engineering), Dip (Eng Tech), Adv Cert (Engineering) type qualification, or a Dublin-Accord Recognised qualification or through evaluation/assessment;
- registered as a Candidate Engineering Technician; and/or
- embarked on a process of acceptable training under a registered Commitment and Undertaking (C&U) with a Mentor guiding the professional development process at each stage.
3. PERSONS NOT REGISTERED AS CANDIDATES OR NOT BEING TRAINED UNDER C&U

Irrespective of the development path followed, all applicants for registration must present the same evidence of competence and be assessed against the same standards. It must be noted that application for registration as a Professional Engineering Technician is permitted without being registered as a Candidate Engineering Technician or without C&U training. Mentorship and adequate supervision are, however, key factors in effective development to the level required for registration. A C&U indicates the company is committed to mentorship and supervision.

If the trainee’s employer does not offer C&U, the trainee should establish the level of mentorship and supervision the employer is able to provide. In the absence of an internal mentor, the services of an external mentor should be secured. Alternately, the Voluntary Associations (VAs) for the discipline should be consulted for assistance in locating an external mentor. A mentor must be kept abreast of all stages of the development process.

This DSTG is written for the recent graduate who is training and gaining experience toward registration as stipulated by council in the policy R-01-POL. Mature applicants for registration may apply the guide retrospectively to identify possible gaps in their development.

Any applicants who have not been though a mentorship programme are advised to request an experienced mentor (internal or external) to act as an application adviser while they prepare their applications for registration. This DSTG may be applied in the case of a person moving into a candidacy programme at a later stage that is at a level below that required for registration (see Section 7.5 of this document).

4. ORGANISATIONAL FRAMEWORKS FOR OCCUPATION

Mechanical Engineering Technicians Organising Framework for Occupations

Registered Mechanical Engineering Technicians undertake the planning, design, construction, operation and maintenance of materials, components, machines plant and systems for lifting, hoisting and materials handling; turbines, pumps and fluid power; heating, cooling, ventilating...
and air-conditioning; fuels, combustion, engines, steam plant, petrochemical plant, turbines; automobiles, trucks, aircraft, ships and special vehicles; fire protection; nuclear energy generation, lifts and escalators; and they advise on mechanical aspects of particular materials products or processes through the application of engineering sciences: mechanics, solid mechanics, thermodynamics, fluid mechanics.

Typical tasks a Mechanical Engineering Technician 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 used for propulsion of railway locomotives, road vehicles or aircraft or for driving industrial or other machinery;
- advising on and designing hulls, superstructures and propulsion systems of ships; mechanical plant and equipment for the release, control and utilisation of energy, 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 as well as 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 plant, equipment or systems;
- ensuring that equipment operation and maintenance comply with design specifications and safety standards.

Practicing Mechanical Engineering Technicians generally concentrate in one or more of the following areas:

- Air-conditioning heating and ventilation, including fire protection and detection engineering;
- Automotive engineering;
- Diesel engineering;
- Fluid mechanics engineering;
- Forensic engineering;
Machine design and development;
Engineering maintenance management;
Mechatronics engineering;
Piping reticulation engineering;
Power generation engineering;
Pressurised vessels engineering;
Rotational plant engineering;
Structural steel engineering;
Thermodynamics engineering;
Transportation systems engineering.

5. NATURE AND ORGANISATION OF THE INDUSTRY

Mechanical Engineering Technicians may be employed in both the private and public sector. Typically, in the private sector they would be involved in consulting and contracting, or in supplier or 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 activities include planning, construction and labour and resource management. Those working in supply or manufacturing companies could be involved in research and development, and would be involved in production, supply and quality control.

The public sector is responsible for service delivery and is usually the client, though in some departments, design and construction is also carried out. Mechanical engineering technicians are required at all levels of the public sector, including at national, provincial and local government level, state owned enterprises (SOEs) and public utilities. The public sector largely handles planning, specifying, overseeing implementation, operations and maintenance of infrastructure.

An extension of the public sector would include tertiary academic institutions and research organisations.
Depending on where the candidate is employed, there may be situations where the opportunities in-house are not sufficiently diverse to develop all the competencies required in all the groups noted in document R-02-PN. For example, the opportunity to develop problem solving competence (including design or developing solutions) and to manage engineering activities (including implementing or constructing solutions) may not both be available to the candidate. In such cases, employers are encouraged to appoint an external mentor.

It has been fairly common practice that where an organisation is unable to provide training in certain areas, secondments are arranged with other organisations so that the candidate is able to develop all the competencies required for registration. These secondments are usually reciprocal in nature so both employers and their employees get the mutual benefit from the other party. Secondments between consultants and contractors and between the public and private sectors should be possible.

5.1 Investigation and problem analysis

Problem solving in design, operational, maintenance, construction and research environments is the core of mechanical engineering. A logical thinking process requires engineering technicians to apply their minds diligently in bringing solutions to technically well-defined problems. This process involves the analysis of systems or assembly of mechanical components and integration of various elements in mechanical engineering through the application of basic and engineering sciences.

Applicants are required to demonstrate the insight and ability to use and interface various design aspects through verifiable work carried out in providing engineered and innovative solutions to practical well-defined problems experienced in their operating work environment. 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 participating in the execution of practical work such that they have learnt sufficient details of basic mechanical procedures to be able to exercise judgment in the workplace thereafter.
Applicants must show evidence of adequate training in this function through well-defined 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 should accompany the application. This report should describe a synthesised solution to sufficiently well-defined engineering problems to demonstrate that applicants have had an 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 well-defined engineering problem?**

Well-defined in well-defined engineering problems can be defined as follows:

“Composed of inter-related conditions: requiring underpinning methods, procedures and techniques judgment to create a solution within a set of originally well-defined circumstances.”

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

The design or development is a logical thinking process that requires engineering technicians to apply their minds carefully in bringing solutions to technically well-defined problems. This process involves the analysis of systems or assembly of mechanical components, and integration of various elements in mechanical engineering through the application of basic and engineering sciences. Simple, straightforward calculation exercises and graphical representations from computer-generated data are not considered sufficiently well-defined engineering design or development because anybody with qualifications in basic science and
engineering science could perform this kind of work, whereas professional registration requires advanced application of engineering knowledge in well-defined design problems.

As part of demonstrating advanced application of theoretical knowledge with respect to these systems, applicants must incorporate calculations with clearly defined inputs to the formulae used and detailed interpretation of the results obtained. They have to demonstrate how the calculated results have been used to provide the solution to the problem at hand and the economic benefit to the project or the operating work environment.

Candidate Engineering Technicians must obtain experience in solving a variety of problems in their work environments, and the solutions to these problems should involve the use of fundamental and advanced mechanical engineering knowledge obtained at a university or from an accredited academic engineering programme. The problems that require scientific and engineering approach to solve them may be encountered in any engineering work environment that consists of integrated engineering systems, equipment, machinery and infrastructure. From their early 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 period of time and degree of practical participation should also 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.

5.2 Design and manufacturing

Examples of acceptable designs, development and manufacturing would include but are not limited to the following:

- Well-defined fluid systems, which include rotating or reciprocating machines;
- Well-defined machines/equipment or major parts thereof;
- Well-defined energy systems involving heat transfer;
- Well-defined pressure systems/HVAC systems;
- Well-defined structures;
- Well-defined material transfers and storage system.
5.3 Operations and maintenance

Operations and maintenance would mostly deal with investigating failure or underperformance of major equipment or systems and the synthesis of implemented and proven solutions to avoid recurrence of the problem. In addition, this category of work will also involve the improvement projects necessary for optimising the operational efficiencies. The engineering technician when performing the aforementioned work must apply professional engineering judgment to all work done in the management of operations. This would include but would not be limited to the ability to assess design work against the following criteria:

- Conformance to design specifications, health and safety regulations;
- Ease of fabrication and assembly;
- Constructability;
- Maintainability;
- Conformance to environmental requirements;
- Ergonomic considerations;
- Life cycle costs;
- Alternative solutions.

5.4 Research and development

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

5.5 Risk management and impact mitigation

The potential impact of ethically bound and evaluated mechanical engineering technicians, who are registered and conducting their daily duties in a prescribed manner, is incalculable. Their proactive identification of potential hazards and risks / incidents will definitely lead to fewer incidents/accidents, as well as minimising loss of life and injury and lost productivity with a reduction in environmental impacts. All stakeholders, which include manufacturers, equipment users, rental organisations, maintainers and mechanical engineering technicians, agree that
registration of inspectors, after evaluation and being ethically bound, will be of tremendous advantage to the industry. Some of the obvious advantages are as follows:

- The Department of Labour promulgated legislation to ensure that only registered persons may undertake inspections.
- The registered mechanical engineering technician is bound to report unsafe conditions to users, owners or the Department of Labour.
- Registered mechanical engineering technicians could offer trustworthy constructive advice or service to the industry within their competence.
- The registered mechanical engineering technician should be kept abreast of new developments through Continuous Professional Development (CPD).
- Easy access to the mechanical engineering technicians via known details could involve them in assisting with standards and regulation development.
- Registered mechanical engineering technicians will receive recognition from industry while enjoying protection.

The following are the steps that should be considered when performing well defined mechanical engineering tasks:

- Risk Management process during project management or plant operation or performing any engineering task by considering social, cultural, environmental, legal and regulatory requirements.
- Technicians may be involved in risk management, identification and analysis within the plant, system or project life cycle.
- Undertaking risk assessments prior to conducting plant test work, installations or operations.
- Compiling risk assessment plans, risk registers and risk mitigation plans.
- Using the risk analysis tools to undertake risk impact and analysis and develop impact mitigation strategies.
- Consideration of risk attributes or factors during risk assessments such as cost, programme, quality, labour, profitability, logistics, political, social, cultural and environmental, legislation, technology, etc.
• In chemical engineering, inherent safety risk is thought of during risk response and control processes.
• Compilation of risk management stakeholder and communication plan.

6 DEVELOPING COMPETENCY: DOCUMENT R-08-PN

6.1 Contextual knowledge

Candidates are expected to be aware of the requirements of the engineering profession. The VAs applicable to the Mechanical Engineering Technician and their functions and services to members, for example, provide a broad range of contextual knowledge for the Candidate Engineering Technician through the full career path of the registered Engineering Technician.

The profession identifies specific contextual activities that are considered essential to the development of Mechanical Engineering Technician’s competence. These include awareness of basic workshop, manufacturing and fabrication activities and the competencies required of the engineer, technologist, technician and artisan. Exposure to practice in these areas will be identified in each programme within the employer environment.

ECSA’s Professional Technician Registration peer evaluation process carries out the assessment review and moderation of the Candidate’s portfolio of evidence at the completion of the training period.

6.2 Functions performed

Special considerations in the discipline, sub-discipline or specialty must be given to the competencies specified in the following groups as described in the Degree of Responsibility scales in document R-04-P:

• Group A: Knowledge based problem solving (this should be a strong focus);
• Group B: Management and Communication;
• Group C: Identifying and mitigating the impacts of engineering activity;
• Group D: Judgement and responsibility;
• Group E: Independent learning.
It is useful to measure the progression of the Candidate’s competency by using the scales for Degree of Responsibility, Problem Solving and Engineering Activity as specified in the relevant documentation. 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 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. The nature of work and degrees of responsibility defined in document R-04-P are used here (and in Appendix A below):

<table>
<thead>
<tr>
<th>A: Being Exposed</th>
<th>B: Assisting</th>
<th>C: Participating</th>
<th>D: Contributing</th>
<th>E: Performing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undergoes induction, observes processes and work of competent practitioners.</td>
<td>Performs specific processes under close supervision.</td>
<td>Performs specific processes as directed with limited supervision.</td>
<td>Performs specific work with detailed approval of work outputs.</td>
<td>Works in team without supervision, recommends work outputs, responsible but not accountable.</td>
</tr>
<tr>
<td>Responsible to supervisor.</td>
<td>Limited responsibility for work output.</td>
<td>Full responsibility for supervised work.</td>
<td>Full responsibility to supervisor for immediate quality of work.</td>
<td>Level of responsibility to supervisor is appropriate to a registered person; supervisor is accountable for applicant’s decisions.</td>
</tr>
</tbody>
</table>

The Mentor and Candidate must identify at which level of responsibility an activity provides the compliance with and demonstration of the various outcomes. Evidence of the Candidate’s activities and acceptance by the Mentor will be recorded on the appropriate system such that it meets the requirements of the Training Elements Appendix A. ECSA will specify the applicable recording system.

6.3 Statutory and regulatory requirements

Candidates are expected to have a working knowledge of the following regulations and Acts and how they affect their working environment:

• Labour Relations Act, 1995 (ACT NO 66 OF 1995
• Mine Health and Safety Act, 29 of 1996;
• Industry Specific Work Instructions;
• South Africa Bureau of Standards (SABS) Act, 24 of 1945;
• Mineral and Petroleum Resources Royalty (Administration), Act 29 of 2008;
• SANS 10248, 1023: Waste Classification and Management Regulations from South Africa Constitution Act, 108 of 1996;
• Hazardous Substances Act, 5 of 1973;
• National Radioactive Waste Disposal Institute Act, 53 of 2008;
• National Nuclear Regulator (NNR) Act, 47 of 1999;
• Nuclear Energy Act, 46 of 1999;
• National Water Act, 36 of 1998;
• Applicable SANS and other international standards such as ISO, EN, DIN or US Federal Standards;
• SANS Codes for Specification for Piping Design / Material (ANSI), see www.sabs.co.za;
• SANS codes for food and beverages, e.g. SANS 10133, etc. from www.sans.co.za;
• Fire Protection Standard SANS Code 10139: 2012 for fire detection and alarm systems for buildings – system design, installation and servicing.
• ISO 9001: 2015;

Many other Acts not listed here may also be pertinent to a Candidate’s work environment. Candidates will be expected to have a basic knowledge of the applicable Acts and to investigate whether any Acts are applicable in the particular work environment.

6.4 Desired formal learning

Candidate Engineering Technicians should register with the relevant VA to access lists of training, conferences and seminars and other relevant information. The following list of formal learning is a sample of some useful course types:
• CPD courses on specific disciplines;
• Project management;
• Value engineering;
• Standard conditions of contract: NEC, FIDIC, GCC, etc.;
• Preparation of specifications;
• Negotiation skills;
• Engineering finance;
• Risk analysis;
• Quality systems;
• Occupation health and safety;
• Energy efficiency;
• Maintenance engineering;
• Environmental impacts management;
• Professional skills report writing and communication planning methods;
• Computers and IT knowledge;
• Construction regulations;
• Problem solving and analysis tools.

7 PROGRAMME STRUCTURE AND SEQUENCING

7.1 Best practice

Best practice is a developmental process that assists Candidates to become registered Professional Engineering Technicians. Best practice comprises the process for continuous development of the Candidate. A number of courses (technical and managerial) must be attended to gain the Initial Professional Development (IPD) points required for registration, in addition to on-the-job learning at the organisation where the candidate is employed. Refer to the South African Institute of Mechanical Engineering (SAIMechE) for best practice ideas. Candidates may register with these bodies to gain access to courses, articles and relevant information for their development. This may also extend to the opportunity to meet with experts during seminars.
It is suggested that Candidate Engineering Technicians work with their mentors to select appropriate equipment types to gain exposure to eventual responsibility for inspection and load testing on the lifting machines selected. A regular reporting structure with suitable recording of evidence of achievement against the competency outcomes and responsibility needs to be in place.

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

It is suggested that Candidates work with their mentors to determine appropriate projects to gain exposure to elements of the asset cycle to ensure that their well-defined developments or designs are constructible, operable, and are designed considering life cycle costing and long-term sustainability.

7.2 Realities

Generally, irrespective of the discipline, it is unlikely that the training period will be three years – the minimum time required by ECSA. Typically, it will be longer and would be determined among others by the availability of functions in the actual work situation.

Each Candidate will effectively undertake a unique programme where the various activities carried out at the discipline specific level are then linked to the generic competency requirements of R-08-PN.

7.3 Generalists, specialists, researchers and academics

Document R-08-PN adequately describes what is expected of persons whose formative development has not followed a conventional path, for example academics, researchers, specialists and those who have not followed a candidate training programme.

The overriding consideration is that, irrespective of the route followed, the applicant must provide evidence of competence against the standard.

7.4 Orientation requirements

- Company Safety Regulations:
• Company Code of Conduct;
• Company Staff Code and Regulations;
• Company records and record keeping;
• Typical functions and activities in the company;
• Hands-on experience and orientation in each of the major company divisions.

7.5 Moving into or changing candidacy programmes

This DSTG assumes that the Candidate Engineering Technician enters a programme after graduation and continues with the programme until ready to submit an application for registration. It also assumes that Candidates are supervised and mentored by persons who meet the requirements in 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 be completed:

• The Candidate must complete the Training and Experience Summary (TES) and 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.
• On entering the new programme, the mentor and supervisor should review the Candidate’s development while being mindful of the experience and opportunities and requirements of the new programme, and plan at least the next phase of the Candidate’s programme.
Discipline-specific Training Guideline for Engineering Technicians in Mechanical Engineering

Compiler: MB Mtshali
Approving Officer: EL Nxumalo
Next Review Date: 10/10/2023

REVISION HISTORY

<table>
<thead>
<tr>
<th>Revision number</th>
<th>Revision date</th>
<th>Revision details</th>
<th>Approved by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rev 1</td>
<td>17 July 2014</td>
<td></td>
<td>Central Registration Committee</td>
</tr>
<tr>
<td>Rev 2</td>
<td>10 October 2019</td>
<td>Routine Review Approval</td>
<td>RPSC</td>
</tr>
</tbody>
</table>

The Discipline-Specific Training Guide (DSTG) for

Registration as a Professional Engineering Technician in Mechanical Engineering

Revision 2 dated 10 October 2019 and consisting of 21 pages reviewed for adequacy by the Business Unit Manager and approved by the Executive: Research, Policy and Standards (RPS).

Business Unit Manager

Date

Executive: RPS

Date

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

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APPENDIX A: Training Elements

Synopsis: A Candidate Engineering Technician should achieve specific competencies at the prescribed level during his/her development towards professional registration, at the same time accepting more and 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 particular stage of an engineering career:

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

Well-defined engineering work is usually restricted to applying standard procedures, codes and systems, i.e. work that was done before.

Responsibility Levels: A = Being Exposed; B = Assisting; C = Participating; D = Contributing; E = Performing

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When downloaded for the ECSA Document Management System, this document is uncontrolled and the responsibility rests with the user to ensure that it is in line with the authorised version on the database. If the ‘original’ stamp in red does not appear on each page, this document is uncontrolled.
Competency Standards for Registration as a Professional Engineering Technician

1. Purpose
This standard defines the competence required for registration as a Professional Engineering Technician. Definitions of terms having particular meaning within this standard are given in text in Appendix D.

<table>
<thead>
<tr>
<th>Explanation and Responsibility Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSTGs give context to the purpose of the Competency Standards. Professional Engineering Technicians operate within the nine disciplines ECSA recognises. Each discipline can be further divided into sub-disciplines and finally into specific workplaces as given in Clause 4 of the specific DSTG. 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).</td>
</tr>
<tr>
<td>NOTE: The training period must be utilised to develop the competence of the trainee towards achieving the standards below at Responsibility Level E, i.e. Performing. (Refer to 7.1 of the specific DSTG.)</td>
</tr>
</tbody>
</table>

2. Demonstration of competence
Competence must be demonstrated within well-defined engineering activities, defined below, by integrated performance of the outcomes defined in section 3 at the level defined for each outcome. Required contexts and functions may be specified in the applicable DSTG.

<table>
<thead>
<tr>
<th>Level descriptor: Well-defined engineering activities (WDEAs) have several of the following characteristics:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Scope of practice area is defined by techniques applied, change by adopting new techniques into current practice;</td>
</tr>
<tr>
<td>b) Practice area is located within a wider, complex context, with well-defined working relationships with other parties and disciplines;</td>
</tr>
<tr>
<td>Engineering activities can be divided into (approximately):</td>
</tr>
<tr>
<td>• 5% Complex (Professional Engineers)</td>
</tr>
<tr>
<td>• 5% Broadly Defined (Professional Engineering Technologists)</td>
</tr>
<tr>
<td>• 10% Well-defined (Professional Engineering Technicians)</td>
</tr>
<tr>
<td>• 15% Narrowly Well-defined (Registered Specified Categories)</td>
</tr>
<tr>
<td>• 20% Skilled Workman (Engineering Artisan) 55% Unskilled Workman (Artisan Assistants)</td>
</tr>
<tr>
<td>The activities can be in-house or contracted out; evidence of integrated performance can be submitted irrespective of the situation.</td>
</tr>
<tr>
<td>Level Descriptor: WDEAs in the various disciplines are characterised by several or all of the following:</td>
</tr>
<tr>
<td>a) Scope of practice area does not cover the entire field of the discipline (exposure limited to the sub-discipline and specific workplace). Techniques applied are largely well established and change by adopting new techniques into current practice is the exception.</td>
</tr>
</tbody>
</table>

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### Discipline-specific Training Guideline for Engineering Technicians in Mechanical Engineering

**Compiler:** MB Mtshali  
**Approving Officer:** EL Nxumalo  
**Next Review Date:** 10/10/2023

<table>
<thead>
<tr>
<th>c)</th>
<th>Work involves familiar, defined range of resources, including people, money, equipment, materials, technologies;</th>
</tr>
</thead>
<tbody>
<tr>
<td>d)</td>
<td>Require resolution of interactions manifested between specific technical factors with limited impact on wider issues;</td>
</tr>
<tr>
<td>e)</td>
<td>Are constrained by operational context, defined work package, time, finance, infrastructure, resources, facilities, standards and codes, applicable laws;</td>
</tr>
<tr>
<td>f)</td>
<td>Have risks and consequences that are locally important but are generally not far reaching.</td>
</tr>
</tbody>
</table>

**Activities** include but are not limited to 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.

<table>
<thead>
<tr>
<th>b)</th>
<th>Practice area varies substantially with unlimited location possibilities and an additional responsibility to identify the need for complex and/or broadly defined advice to be included in the well-defined working relationships with other parties and disciplines.</th>
</tr>
</thead>
<tbody>
<tr>
<td>c)</td>
<td>The bulk of the work involves a familiar, defined range of resources, including people, money, equipment, materials, and technologies.</td>
</tr>
<tr>
<td>d)</td>
<td>Most of the impacts in the sub discipline are on wider issues, and although occurring frequently, are well-defined and can be resolved by following established procedures.</td>
</tr>
<tr>
<td>e)</td>
<td>The work packages and associated parameters are constrained by the operational context with variations limited to different locations only. (Cannot be covered by standards and codes).</td>
</tr>
<tr>
<td>f)</td>
<td>Even locally important minor risks can have far reaching consequences.</td>
</tr>
</tbody>
</table>

**Activities** include but are not limited to design; planning; investigation and problem resolution; improvement of materials, components, systems or processes; engineering operations; maintenance; project management. For Engineering Technicians, research, development and commercialisation happen more frequently in some disciplines but are seldom encountered in others.
### 3. Outcomes to be satisfied:

<table>
<thead>
<tr>
<th>Group A: Engineering Problem Solving</th>
<th>Explanation and Responsibility Level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outcome 1</strong>: Define, investigate and analyse well-defined engineering problems</td>
<td><strong>Responsibility Level E</strong></td>
</tr>
<tr>
<td>Well-defined engineering problems have the following characteristics:</td>
<td>Analysis of an engineering problem means the “separation into parts possibly with comment and judgement”.</td>
</tr>
<tr>
<td>a) can be solved mainly by practical engineering knowledge, underpinned by related theory; <strong>and one or more of:</strong></td>
<td>a) practical problems for Engineering Technicians mean the problem encountered cannot be solved by artisans because theoretical calculations and engineering decisions are necessary to substantiate the solution proposed;</td>
</tr>
<tr>
<td>b) are largely defined but may require clarification;</td>
<td>b) further investigation to identify the nature of the problem is seldom necessary;</td>
</tr>
<tr>
<td>c) are discrete, focused tasks within engineering systems;</td>
<td>c) discrete means individually distinct: the problem is easily recognised as part of the larger engineering task, project or operation;</td>
</tr>
<tr>
<td>d) are routine, frequently encountered, may be unfamiliar but in familiar context; <strong>and one or more of:</strong></td>
<td>d) recognised that the problem occurred in the past or the possibility exists that it might have happened before – definitely not something new;</td>
</tr>
<tr>
<td>e) can be solved by standardised or prescribed ways;</td>
<td>e) solving the problem does not require the development of a new solution – find out how it was solved before;</td>
</tr>
<tr>
<td>f) are encompassed by standards, codes and documented procedures; requires authorisation to work outside limits;</td>
<td>f) encompassed means encircled: the standards, codes and documented procedures must be obtained to solve the problem and authorisation from the Engineer or Technologist in charge must be obtained to wave the stipulations;</td>
</tr>
<tr>
<td>g) information is concrete and largely complete, but requires checking and possible supplementation;</td>
<td>g) the responsibility lies with the Engineering Technician to check the information received as part of the problem encountered is correct and added to as is necessary to ensure the correct and complete execution of the work;</td>
</tr>
<tr>
<td>h) involve several issues but few of these imposing conflicting constraints and a limited range of interested and affected parties;</td>
<td>h) the problem handled by an Engineering Technician must be limited to well-known matters preferably needing standardised solutions without possible complications;</td>
</tr>
</tbody>
</table>
and one or both of:

i) requires practical judgment in practice area in evaluating solutions, considering interfaces to other role players;

j) have consequences which are locally important but not far reaching (wider impact is dealt with by others).

i) practical solutions to problems include knowledge of the skills displayed by Practical Specialists and Engineering Artisans without sacrificing theoretical engineering principles and / or cutting corners to satisfy parties involved;

j) Engineering Technicians must realise that their actions might seem to be of local importance only, but may develop into further problems where support from Engineers and Technologists might be needed to deal with these consequences.

Assessment criteria: A structured analysis of well-defined problems typified by the following performances is expected:

1.1 State how you interpreted the work instruction received, checking with your client or supervisor if your interpretation is correct

1.2 Describe how you analysed, obtained and evaluated further clarifying information, and if the instruction was revised as a result.

To perform an engineering task, an Engineering Technician will typically receive an instruction from a senior person (customer) to do this task, and must:

1.1 make sure the instruction is complete, clear and within his/her capability and that the person who issued the instruction agrees with his/her interpretation;

1.2 ensure that the instruction and information to do the work is fully understood and is complete, including the engineering theory needed to understand the task and to carry out and/or check calculations, and the acceptance criteria. If needed, supplementary information must be gathered, studied and understood.

Range statement: The problem may be part of a larger engineering activity or may be stand alone. The design problem is amenable to solution by established techniques practiced regularly by the Candidate. This outcome is concerned with the understanding of a problem: Outcome 2 is concerned with the solution.

Please refer to clause 4 of the specific DSTG.
### Outcome 2: Design or develop solutions to well-defined engineering problems.

**Responsibility Level C and D**

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. Working systematically to synthesise a solution to a well-defined problem, typified by the following performances is expected:

1. **Describe how you designed or developed and analysed alternative approaches to do the work.** Impacts checked. Calculations attached.
2. **State what the final solution to perform the work was; client or your supervisor in agreement.**

**Range statement:** The solution is amenable to established methods, techniques or procedures within the candidate’s practice area.

**Outcome 2:**

Applying theory to well-defined engineering work is done in a way that has been used before, probably developed by Engineers or Technologists in the past, and documented in written procedures, specifications, drawings, models, examples, etc. Engineering Technicians must seek approval for any deviation from these established methods.
Outcome 3: Comprehend and apply knowledge embodied in established engineering practices and knowledge specific to the jurisdiction in which he/she practices.

Responsibility Level E
Comprehend means “to understand fully”. The jurisdiction in which an Engineering Technician practices is given in Clause 4 of the specific DSTG.

Assessment criteria: This outcome is normally demonstrated in the course of design, investigation or operations.
3.1 State what NDip level engineering standard procedures and systems you used to execute the work, and how NDip level theory was applied to understand and/or verify these procedures.
3.2 Give your own NDip level theoretical calculations and/or reasoning on why the application of this theory is considered to be correct (actual examples).

Design work for Engineering Technicians is mostly to utilise and configure manufactured components and repetitive design work using an existing design as an example. Engineering Technicians apply existing codes and procedures in their design work. Investigation would be on well-defined incidents and condition monitoring and operations mostly on controlling, maintaining and improving engineering systems and operations.
3.1 The understanding of well-defined procedures and techniques must be based on fundamental mathematical, scientific and engineering knowledge. Specific procedures and techniques applied to do the work accompanied by the underpinning theory must be given.
3.2 Calculations confirming the correct application and utilisation of equipment listed in Clause 4 of the specific DSTG must be done on practical well-defined activities. Reference must be made to standards and procedures used and how it was derived from NDip theory.

Range statement: Applicable knowledge includes:

a) Technical knowledge that is applicable to the practice area irrespective of location, supplemented by locally relevant knowledge, for example established properties of local materials.
b) A working knowledge of interacting disciplines. Codified knowledge in related areas: financial, statutory, safety, management.
c) Jurisdictional knowledge includes legal and regulatory requirements as well as prescribed codes of practice.

The specific location of a task to be executed is the most important determining factor in the layout design and utilisation of equipment. A combination of educational knowledge and practical experience must be used to substantiate decisions taken including a comprehensive study of materials, components and projected customer requirements and expectations.

In spite of having a working knowledge of interacting disciplines, Engineering Technicians must appreciate the importance of working with specialists like Civil Engineers on structures and roads, Mechanical Engineers on fire protection equipment, Architects on buildings, Electrical Engineers on communication equipment, etc. The codified knowledge in the related areas means working to and understanding the requirements set out by specialists.
in the areas mentioned.

c) Jurisdictional in this instance means “having the authority”, and Engineering Technicians must adhere to the terms and conditions associated with each task undertaken. They may even be appointed as the “responsible person” for specific duties in terms of the OHS Act.

<table>
<thead>
<tr>
<th>Group B: Managing Engineering Activities</th>
<th>Explanation and Responsibility Level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outcome 4:</strong> Manage part or all of one or more well-defined engineering activities.</td>
<td>Responsibility Level D</td>
</tr>
<tr>
<td><strong>Assessment criteria:</strong> The display of personal and work process management abilities is expected:</td>
<td>Manage means “control”.</td>
</tr>
<tr>
<td>4.1 State how you managed yourself, priorities, processes and resources in doing the work (e.g. bar chart);</td>
<td>In engineering operations and projects, Engineering Technicians will typically be given the responsibility to carry out specific tasks and/or complete projects.</td>
</tr>
<tr>
<td>4.2 Describe your role and contribution in the work team.</td>
<td>4.1 Resources are usually subdivided based on availability and controlled by a work breakdown structure and scheduling to meet deadlines. Quality, safety and environment management are important aspects.</td>
</tr>
<tr>
<td><strong>Outcome 5:</strong> Communicate clearly with others in the course of his or her well-defined engineering activities</td>
<td>Responsibility Level C</td>
</tr>
<tr>
<td><strong>Assessment criteria:</strong> Demonstrates effective communication by the following:</td>
<td>5.1 Refer to Range State for Outcome 4 and 5 below. Presentation of point of view mostly occurs in meetings and discussions with immediate supervisor.</td>
</tr>
<tr>
<td>5.1 State how you presented your point of view and compiled reports after completion of the work.</td>
<td>5.2 Refer to Range State for Outcome 4 and 5 below.</td>
</tr>
<tr>
<td>5.2 State how you compiled and issued instructions to entities working on the same task.</td>
<td></td>
</tr>
</tbody>
</table>
Range statement for Outcomes 4 and 5: Management and communication in well-defined engineering involves:

a) Planning well-defined activities;
b) Organising well-defined activities;
c) Leading well-defined activities and 
d) Controlling well-defined activities.

Communication relates to technical aspects and wider impacts of professional work. Audience includes peers, other disciplines, client and stakeholders audiences. Appropriate modes of communication must be selected. The Engineering Technician is expected to perform the communication functions reliably and repeatedly.

Group C: Impacts of Engineering Activity.

Outcome 6: Recognise the foreseeable social, cultural and environmental effects of well-defined engineering activities generally.

Assessment criteria: This outcome is normally displayed in the course of analysis and solution of problems, by typically the following:

6.1 Describe the social, cultural and environmental impact of this engineering activity;
6.2 State how you communicated mitigating measures to

Explanation and Responsibility Level

Responsibility Level B

Social means “people living in communities; of relations between persons and communities”.
Cultural means “all the arts, beliefs, social institutions, etc. characteristic of a community”.
Environmental means “surroundings, circumstances, influences”.

6.1 Engineering impacts heavily on the environment, e.g. servitudes, expropriation of land, excavation of trenches with associated inconvenience, borrow pits, dust and obstruction, street 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 wild life, dangerous rotating and other machines, demolishing of structures, etc.
**Outcome 7:** Meet all legal and regulatory requirements and protect the health and safety of persons in the course of his or her well-defined engineering activities.

**Assessment criteria:**
- **7.1** List the major laws and regulations applicable to this particular activity and how health and safety matters were handled.
- **7.2** State how you obtained advice in doing risk management for the work and elaborate on the risk management system applied.

**Range statement for Outcomes 6 and 7:** Impacts and regulatory requirements include the following:
- a) Impacts to be considered are generally those identified within the established methods, techniques or procedures used in the practice area;
- b) Regulatory requirements are prescribed;
- c) Application of prescribed risk management strategies;
- d) Effects to be considered and methods used are defined;
- e) Prescribed safe and sustainable materials, components and systems.

**Responsibility Level E**

- **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. These documents, depending on the situation (emergency, breakdown, etc.) are consulted before work is commenced and during the activity;

- **7.2** It is advisable to attend a Risk Management (assessment) course, and to investigate and study the materials, components and systems used in the workplace. The Engineering Technician seeks advice from knowledgeable and experienced specialists if the slightest doubt exist that safety and sustainability cannot be guaranteed.

- 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 to construction in a rural area. The methods, techniques or procedures will differ accordingly and are identified and studied by the Engineering 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 Engineering Technician is responsible to see that this is done, and if not, establish which regulations apply, and ensure they are adhered to. Usually the people working on site are strictly controlled w.r.t. health and safety, but the Engineering Technician checks this is done. Tasks and projects are mostly carried out where contact with the public cannot be avoided and safety measures like barricading and warning signs must be used and
i) Persons whose health and safety are to be protected are both inside and outside the workplace.

j) Risks are mostly associated with elevated structures, subsidence of soil, electrocution of human beings and moving parts on machinery. Risk management strategies are usually done by more senior staff but are understood and applied by the Engineering Technician.

d) Effects associated with risk management are mostly well known if not obvious and methods used to address are clearly defined.

e) Usually the safe and sustainable materials, components and systems are prescribed by Engineers, Technologists or other professional specialists. It is the responsibility of the Engineering Technician to use his/her knowledge and experience to check and interpret what is prescribed and report anything that he/she is not satisfied with.

f) Staff working on the task or project as well as persons affected by the engineering work being carried out.

<table>
<thead>
<tr>
<th>Group D: Exercise judgment, take responsibility, and act ethically</th>
<th>Explanation and Responsibility Level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outcome 8: Conduct engineering activities ethically.</strong></td>
<td><strong>Responsibility Level E</strong></td>
</tr>
</tbody>
</table>
| Ethically means “science of morals; moral soundness”. | Systematic means “methodical; based on a system”.
| 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 the following: | 8.1 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, misrepresentation of facts, etc. |
| 8.1 State how you identified ethical issues and affected parties and their interest and what you did about it when a problem arose. | 8.2 ECSA’s Code of Conduct, as per ECSA’s website, is known and adhered to. Applicable |
Outcome 9: Exercise sound judgement in the course of well-defined engineering activities.

**Assessment criteria:** Judgement is displayed by the following performance:

9.1 State the factors applicable to the work, their interrelationship and how you applied the most important factors.

9.2 Describe how you foresaw work consequences and evaluated situations in the absence of full evidence.

**Range statement for Outcomes 8 and 9:** Judgement in decision making involves:

a) taking limited risk factors into account some of which may be ill-defined; or

b) consequences are in the immediate work contexts; or

c) identified set of interested and affected parties with defined needs to be taken into account.

In engineering about 10% of the activities can be classified as well-defined where the Engineering Technician uses standard procedures, codes of practice, specifications, etc. Judgement must be displayed to identify any activity falling outside the well-defined range, as defined above by:

a) Seeking advice when risk factors exceed his/her capability.

b) Consequences outside the immediate work contexts, e.g. long-term, not normally handled.

c) Interested and affected parties with defined needs outside the well-defined parameters to be taken into account.
### Outcome 10: Be responsible for making decisions on part or all of all of one or more 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.”

<table>
<thead>
<tr>
<th>Assessment criteria: Responsibility is displayed by the following performance:</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.1 Show how you used NDip theoretical calculations to justify decisions taken in doing engineering work. Attach actual calculations.</td>
</tr>
<tr>
<td>10.2 State how you took responsible advice on any matter falling outside your own education and experience.</td>
</tr>
<tr>
<td>10.3 Describe how you took responsibility for your own work and evaluated any shortcoming in your output.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Range statement: Responsibility must be discharged for significant parts of a one or more well-defined engineering activity.</th>
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</thead>
<tbody>
<tr>
<td>The responsibility is mostly allocated within a team environment with an increasing designation as experience is gathered.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Note 1: Demonstrating responsibility would be under supervision of a competent engineering practitioner but is expected to perform as if he/she is in a responsible position.</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.1 The calculations, for example fault levels, load calculations, losses, etc. are done to ensure that the correct material and components are utilised.</td>
</tr>
<tr>
<td>10.2 The Engineering Technician does not operate on tasks at a higher level than well-defined and consult professionals at engineer and/or technologist level if elements of the tasks to be done are beyond his/her education and experience, e.g. power system stability.</td>
</tr>
<tr>
<td>10.3 This is in the first instance continuous self-evaluation to ascertain that the task given is done correctly, on time and within budget. Continuous feedback to the originator of the task instruction, and corrective action if necessary, forms an important element.</td>
</tr>
</tbody>
</table>
### Group E: Initial Professional Development (IPD)

#### Outcome 11: Undertake independent learning activities sufficient to maintain and extend his or her competence

**Assessment criteria:** Self-development managed by typically the following:

- **11.1** Provide your strategy adopted independently to enhance professional development. (IPD report).
- **11.2** Be aware of the philosophy of employer in regard to professional development.

**Range statement:** Professional development involves:

- **a)** taking ownership of own professional development;
- **b)** planning own professional development strategy;
- **c)** selecting appropriate professional development activities; and
- **d)** recording professional development strategy and activities; while displaying independent learning ability.

**Explanation and Responsibility Level**

- **Responsibility Level D**

  - **11.1** If possible, a specific field of the sub-discipline is chosen, available developmental alternatives established, a program drawn up (in consultation with employer if costs are involved), and options open to expand knowledge into additional fields investigated.
  - **11.2** Record keeping must not be left to the employer or anybody else. The trainee must manage his/her own training independently, taking initiative and be in charge of experiential development towards Professional Engineering Technician level. Knowledge of the employer’s policy and procedures on training is essential.

- **a)** This is your professional development, not the organisation you are working for.
- **b)** In most places of work training is seldom organised by some training department. It is up to the Engineering Technician to manage his/her own experiential development. Engineering Technicians frequently end up in a ‘dead-end street’ being left behind doing repetitive work. If self-development is not driven by him/herself, success is unlikely.
- **c)** Preference must be given to engineering development rather than developing soft skills.
- **d)** Developing a learning culture in the workplace environment of the Engineering Technician is vital to his / her success. Information is readily available, and most senior personnel in the workplace are willing to mentor, if approached.