Ensuring the Expertise to Grow South Africa

Discipline-Specific Training Guideline for Engineering Technologist in Mechanical Engineering

R-05-MEC-PT

Revision No. 2: 10 October 2019

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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 are 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 coordinated 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 licensed 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.

Figure 1: Documents defining the ECSA Registration System

1. PURPOSE OF THIS DOCUMENT

All persons applying for registration as Professional Engineering Technologists are expected to demonstrate the competencies specified in document R-02-PT 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 Technologists, document R-08-PT.

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.

Document R-08-PT 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, as well as R-04-P and R-08-PT, is subordinate to the Policy on Registration, (R-01-POL), the Competency Standard (R-02-PT) 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 Technologists. This 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 BTech (Engineering) or BEng Tech type qualification, or a Sydney-Accord recognised qualification or through evaluation / assessment;
- registered as a Candidate Engineering Technologist; 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 Technologist is permitted without being registered as a Candidate Engineering Technologist 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 that 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 (VA) 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 of the policy R-01-POL. Mature applicants for registration may apply the guide retrospectively to identify possible gaps in their development.

Any applicant who has not been though a mentorship programme is advised to request an experienced mentor (internal or external) to act as an application adviser while they prepare their application for registration.

The 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 Technologists Organising Framework for Occupations (OFO)

Registered Mechanical Engineering Technologists 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, 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 Technologist 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.

Practising Mechanical Engineering Technologists 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;
5. NATURE AND ORGANISATION OF THE INDUSTRY

Mechanical engineering technologists may be employed in both the private and public sectors.

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, 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 technologists 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 insufficiently diverse to develop all the competencies required in both Groups A and B noted in document R-02-PT. 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 that secondments are arranged with other organisations, so that the candidate is able develop all the competencies required for registration.

These secondments are usually reciprocal in nature so both employers and their employees get 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 environment is the core of mechanical engineering. A logical thinking process requires engineering technologists to apply their minds diligently in bringing solutions to technically broadly 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 broadly 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 broadly 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 broadly 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 broadly defined engineering problem?

‘Broadly defined’ in broadly defined engineering problems can be defined as follows:

“Composed of many inter-related conditions; requiring underpinning methods, procedures and technical judgment to create a solution within a set of originally broadly 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 requires a broader application of various theoretical aspects of mechanical engineering, ranging from fluid systems and energy systems to structures and machines.

The design is a logical thinking process that requires engineering technologists to apply their minds carefully in bringing solutions to technically broadly 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 as sufficiently broadly defined engineering designs 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 broadly 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 technologists must obtain experience in solving a variety of problems in their work environment, and the solution to these problems should involve the use of fundamental and advanced mechanical engineering knowledge obtained at a university. 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 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:

- Broadly defined fluid systems, which includes rotating or reciprocating machines;
- Broadly defined machines/equipment or major parts thereof;
- Broadly defined energy systems involving heat transfer;
- Broadly defined pressure systems/HVAC systems;
5. Broadly defined structures;
   Broadly defined material transfer and storage system.

Broadly defined design reviews would include reviews of major machine systems such as turbines / compressors with their auxiliary systems, power station systems and their major components, broadly defined refrigeration systems, petrochemical and other production, manufacturing plant systems and the like.

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 technologist 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; and/or,
- 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 the 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 technologists, 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 technologists, 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.
- Registered mechanical engineering technologists are bound to report unsafe conditions to users, owners or the Department of Labour.
- Registered mechanical engineering technologists could offer trustworthy constructive advice or service to the industry within their competence.
- Registered mechanical engineering technologists should be kept abreast of new development through Continuous Professional Development (CPD).
- Easy access to mechanical engineering technologists via known details could involve them in assisting with standard and regulation development.
- Registered mechanical engineering technologists will receive recognition from industry while enjoying protection.

The following steps should be considered when performing broadly 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.
- Technologists 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, risks registers, and risk mitigation plans.
• Using 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-PT

6.1 Contextual knowledge

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

The profession identifies specific contextual activities considered essential to the development of the Mechanical Engineering Technologist’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 Technologist 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 speciality 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 the Degree of 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:

- Machinery and Works Regulations Labour Relations Act;
- Mine Health and Safety Act, 29 of 1996;
- Industry Specific Work Instructions;
- South Africa Bureau of Standards (SABS) Act 24 of 1945; Act 29 of 2008;
- 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; and
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 technologists 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;
- Report writing
- 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 in becoming registered Professional Engineering Technologists. 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. This is 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 Technologists 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 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 broadly defined developments or designs are constructible, operable and designed considering life cycle costing and long-term sustainability.

The training programme should be such that Candidate progresses through levels of work capability that are described in document R-04-P, such that by the end of the training period, the candidate must perform individually and as a team member at the level of problem solving and engineering activity required for registration and exhibit Degree of Responsibility Level E.
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-PT.

7.3 Generalists, specialists, researchers and academics

Document R-08-PT adequately describes what would be 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 Candidate Engineering Technologists enter a programme after graduation and continues with the programme until ready to submit an application for registration. It 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.
The Discipline-Specific Training Guide (DSTG) for

Registration as a Professional Engineering Technologist in Mechanical Engineering

Revision 2 dated 10 October 2019 and consisting of 22 pages reviewed for adequacy by the Business Unit Manager and approved by the Executive: Research, Policy and Standards (RPS).

Business Unit Manager

Executive: RPS

Date

Date

This definitive version of this policy is available on our website.
APPENDIX A: Training Elements

Synopsis: A Candidate Engineering Technologist 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 to 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; and
11. Become conversant with your employer’s training and development program and develop your own lifelong development program within this framework.

Broadly defined engineering work is usually characterised by the application of novel technology deviating from standard procedures, codes and systems, the deviation verified by research, modelling and/or substantiated design calculations.

Responsibility Levels: A = Being Exposed; B = Assisting; C = Participating; D = Contributing; E = Performing.
### Competency standards for registration as a Professional Engineering Technologist

<table>
<thead>
<tr>
<th>1. Purpose</th>
<th>Explanation and responsibility level</th>
</tr>
</thead>
<tbody>
<tr>
<td>This standard defines the competence required for registration as a Professional Engineering Technologist. Definitions of terms having particular meaning within this standard are given in text in Appendix D.</td>
<td>Discipline Specific Training Guides (DSTG) give context to the purpose of the Competency Standards. Professional Engineering Technologists operate within the nine disciplines recognised by ECSA. 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). <strong>NOTE:</strong> The training period must be utilised to develop the competence of the trainee towards achieving the standards. below at a responsibility level E, i.e. Performing. (Refer to 7.1 in the specific DSTG)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Demonstration of competence</th>
<th>Engineering activities can be divided into (approximately):</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competence must be demonstrated within broadly 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.</td>
<td>• 5% Complex (Professional Engineers)</td>
</tr>
<tr>
<td><strong>Level descriptor:</strong> Broadly defined engineering activities (BDEAs) have several of the following characteristics:</td>
<td>• 5% Broadly Defined (Professional Engineering Technologists)</td>
</tr>
<tr>
<td>a) Scope of practice area is linked to technologies used and changes by adoption of new technology into current practice.</td>
<td>• 10% Well-defined (Professional Engineering Technologists)</td>
</tr>
<tr>
<td></td>
<td>• 15% Narrowly Well-defined (Registered Specified Categories)</td>
</tr>
<tr>
<td></td>
<td>• 20% Skilled Workman (Engineering Artisan)</td>
</tr>
<tr>
<td></td>
<td>• 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>
<td><strong>Level Descriptor:</strong> BDEAs in the various disciplines are characterised by several or all of the following:</td>
</tr>
</tbody>
</table>
b) Practice area is located within a wider, complex context, requires teamwork and has interfaces with other parties and disciplines.

c) Involve the use of a variety resources, including people, money, equipment, materials, technologies.


d) Require resolution of occasional problems arising from interactions between wide-ranging or conflicting technical, engineering or other issues.

e) Are constrained by available technology, time, finance, infrastructure, resources, facilities, standards and codes, and applicable laws.

f) Have significant risks and consequences in the practice area and in related areas.

**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.

---

a) Scope of practice area does not cover the entire field of the discipline (exposure limited to the sub-discipline and specific workplace). Some technologies used are well established and adoption of new technologies needs investigation and evaluation.

b) Practice area varies substantially with unlimited location possibilities and an additional responsibility to identify the need for advice on complex activities and problems. Broadly defined activities in the sub-discipline need interfacing with professional engineers, professional technologists, artisans, architects, financial staff, etc. as part of the team.

c) The bulk of the work involves familiar, defined range of resources, including people, money, equipment, materials, but new technologies are investigated and implemented.

d) Most of the impacts in the sub discipline are on wider issues, but some arise from conflicting technical and engineering issues that have to be addressed by the application of broadly defined non-standard engineering principles.

e) The work packages and associated parameters are constrained by operational context with variations limited to different locations only. (Cannot be covered by standards and codes.)

f) Even locally important minor risks can have far reaching consequences.

**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 Technologists, research, development and commercialisation happen more frequently in some disciplines and 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>
</table>
| **Outcome 1:** Define, investigate and analyse *broadly defined* engineering problems. | **Responsibility Level E**  
Analysis of an engineering problem means the "separation into parts possibly with comment and judgement".  
*Broadly* means "not minute or detailed" and "not kept within narrow limits". |

*broadly defined engineering problems have the following characteristics:*  
a) require coherent and detailed engineering knowledge, underpinning the technology area;  
and *one or more of:*  
b) are ill-posed, under- or over-specified, require identification and interpretation into the technology area;  
c) encompass systems within complex engineering systems;  
d) belong to families of problems that are solved in well-accepted but innovative ways;  
and *one or more of:*  
e) can be solved by structured analysis techniques;  
f) may be partially outside standards and codes; must provide justification to operate outside;  
g) require information from practice area and sources  
a) coherent and detailed engineering knowledge for Engineering Technologists means the problem encountered cannot be solved without the combination of all the relevant detail including engineering principles applicable to the situation;  
b) the nature of the problem is not immediately obvious and further investigation to identify and interpret the real nature of the problem is necessary;  
c) the problem is not easily recognised as part of the larger engineering task, project or operation and may be obscured by the complexity of the larger system;  
d) recognise that the problem can be classified as a falling within a typical solution requiring innovative adaptation to meet the specific situation;  
e) solving the problem needs a step-by-step approach adhering to proven logic;  
f) the standards, codes and documented procedures must be analysed to determine to what extent they are applicable to solve the problem and justification must be given to operate outside these;  
g) the responsibility lies with the Engineering Technologist to verify that some information...
interfacing with practice area that is complex and incomplete;
h) involve a variety of issues which may impose conflicting constraints: technical, engineering and interested or affected parties; and one or both of:
i) require judgement in decision-making in practice area, considering interfaces to other areas;
j) have significant consequences which are important in practice area but may extend more widely.

<table>
<thead>
<tr>
<th>Assessment criteria: A structured analysis of broadly defined problems typified by the following performances is expected:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Performed or contributed in defining engineering problems leading to an agreed definition of the problems to be solved.</td>
</tr>
<tr>
<td>1.2 Performed or contributed in investigating engineering problems including collecting, organising and evaluating information.</td>
</tr>
<tr>
<td>1.3 Performed or contributed in analysis of engineering problems using conceptualisation, justified assumptions, limitations and evaluation of results.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Range Statement: The problem may be a design</th>
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</thead>
<tbody>
<tr>
<td>Please refer to clause 4 of the specific DSTG.</td>
</tr>
</tbody>
</table>

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

1.1 make sure that 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 segregate the engineering problem and related information from the bulk of the information investigated and evaluated;

1.3 ensure that the instruction and information to do the work is fully understood and complete, including engineering theory needed to understand the task and acceptance criteria, and to carry out and/or check calculations; if needed supplementary information must be gathered, studied and understood; concepts and assumptions must be justified by engineering theory and calculations, if applicable.
requirement, an applied Research and Development requirement or a problematic situation in an existing component, system or process. The problem is one amenable to solution by technologies known to the candidate. This outcome is concerned with the understanding of a problem: Outcome 2 is concerned with the solution.

**Outcome 2:** Design or develop solutions to broadly defined engineering problems

**Assessment criteria:** This outcome is normally demonstrated after a problem analysis as defined in outcome 1. Working systematically to synthesise a solution to a broadly defined problem, typified by the following performances is expected:

1. Designed or developed solutions to broadly defined engineering problems.
2. Systematically synthesised solutions and alternative solutions or approaches to the problem by analysing designs against requirements, including costs and impacts on outside parameters. (Requirements.)
3. Drawing up of detailed specification requirements and design documentation for implementation to the

**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”.

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

1. The development (design) of more than one way to solve an engineering task or problem should always be done including the costing and impact assessment for each alternative. All the alternatives must meet the requirements set out by the instruction received, and the theoretical calculations to support each alternative must be done and submitted as an attachment.
2. The Engineering Technologist will in some cases not be able to support proposals with the complete theoretical calculation to substantiate every aspect and must in these cases refer his / her alternatives to an Engineer for scrutiny and support. The alternatives and alternative recommended must be convincingly detailed to win customer support for the alternative recommended. Selection of alternatives might be based on tenders submitted with
satisfaction of the client. alternatives deviating from those specified.

2.3 The best complete and final solution selected must be followed up with a detailed technical specification, supporting drawings, bill of quantities, etc., for the execution of work to meet customer requirements.

**Range Statement:** Solutions are those enabled by the technologies in the Candidate’s practice area.

Applying theory to do broadly defined engineering work is mostly done in a way that has been used before, probably developed by engineers in the past "and documented in written procedures, specifications, drawings, models, examples, etc. Engineering Technologists must seek approval of any deviation from these established methods, but also initiate and/or participate in the development and revision of these norms.

**Outcome 3:** Comprehend and apply the knowledge embodied in widely accepted and applied engineering procedures, processes, systems or methodologies and those specific to the jurisdiction in which he/she practices.

**Responsibility level E**
Comprehend means “to understand fully”. The jurisdiction in which an Engineering Technologist 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.

Design work for Engineering Technologists is based on BTech theory and is mostly the utilisation and configuration of manufactured components and selected materials and associated novel technology. Engineering Technologists develop and apply codes and procedures in their design work. Investigation would be on broadly defined be incidents and condition monitoring, and operations mostly on developing and improving engineering systems and operations.

3.1 Applied engineering principles, practices, technologies, including the application of BTech theory in the practice area.

3.2 Indicated working knowledge of areas of practice that

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interact with practice area to underpin teamwork.
3.3 Applied related knowledge of finance, statutory, safety and management.

Range statement: Applicable knowledge includes:

a) Technological knowledge that is well-established and applicable to the practice area irrespective of location, supplemented by locally relevant knowledge, for example, established properties of local materials. Emerging technologies are adopted from formulations of others.
b) A working knowledge of interacting disciplines (engineering and other) to underpin teamwork.
c) Jurisdictional knowledge includes legal and regulatory requirements as well as locally relevant codes of practice. As required for practice area, a selection of laws of contract, health and safety, environmental, intellectual property, contract administration, quality management, risk management, maintenance management, regulation, project and construction management.

3.2 The understanding of broadly defined procedures and techniques must be based on fundamental mathematical, scientific and engineering knowledge, as part of personal contribution within the engineering team.
3.3 The ability to manage the resources within legal and financial constraints must be evident.

a) 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 systems, materials, components and projected customer requirements and expectations. New ideas, materials, components and systems must be investigated, evaluated and applied accompanied by complex theoretical motivation.
b) In spite of having a working knowledge of interacting disciplines, Engineering Technologists take responsibility for the multidisciplinary team of specialists like Civil Engineers on structures and roads, Mechanical Engineers on fire protection equipment, Architects on buildings, Electrical Engineers on communication equipment, etc.
c) Jurisdictional in this instance means “having the authority”, and Engineering Technologists must be aware of and decide on the relevant requirements applicable to each specific project that he/she is responsible for. They are usually appointed as the “responsible person” for specific projects in terms of the OHS Act.
**Outcome 4:** Manage part or all of one or more broadly defined engineering activities.

**Assessment criteria:** The candidate is expected to display personal and work process management abilities:

4.1 Managed self, people, work priorities, processes and resources in broadly defined engineering work.
4.2 Role in planning, organising, leading and controlling broadly defined engineering activities evident.
4.3 Knowledge of conditions and operation of contractors and the ability to establish and maintain professional and business relationships evident.

**Responsibility Level D**
Manage means “control”.

In engineering operations, Engineering Technologists will typically be given the responsibility to carry out projects.

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.
4.2 The basic elements of management must be applied to broadly defined engineering work.
4.3 Depending on the project, Engineering Technologists can be the team leader, a team member or can supervise appointed contractors. To achieve this, maintenance of relationships is important and must be demonstrated.

**Outcome 5:** Communicate clearly with others in the course of his or her broadly defined engineering activities

**Assessment criteria:** Demonstrates effective communication by:

5.1 ability to write clear, concise, effective technical, legal and editorially correct reports shown.
5.2 ability to issue clear instructions to stakeholders using appropriate language and communication skills evident.
5.3 Oral presentations made using structure, style,...

**Responsibility Level C**

5.1 Refer to Range Statement for Outcome 4 and 5 below.
5.2 Refer to Range Statement for Outcome 4 and 5 below.
5.3 Presentation of point of view mostly occurs in meetings and discussions with immediate
### Range statement for Outcomes 4 and 5: Management and communication in well-defined engineering involves:

| a) Planning broadly defined activities;  |
| b) Organising broadly defined activities; |
| c) Leading broadly defined activities;   |
| d) Controlling broadly defined activities.|

**Engineering Technologists write specifications for the purchase of materials and/or work to be done, recommendations on tenders received, place orders and variation orders, write work instructions, report back on work done, draw, correct and revise drawings, compile test reports, use operation and maintenance manuals to write work procedures, write inspection and audit reports, write commissioning reports, prepare and present motivations for new projects, compile budget reports, report on studies done and calculations carried out, report on customer requirements, report on safety incidents and risk analysis, report on equipment failure, report on proposed system improvement and new techniques, report back on cost control, etc.**

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**Definition of terms:**

a) Planning means "the arrangement for doing or using something, considered in advance".

b) Organising means "put into working order; arrange in a system; make preparations for".

c) Leading means to "guide the actions and opinions of; influence; persuade".

d) Controlling means the "means of regulating, restraining, keeping in order; check".
Group C: Impacts of Engineering Activity.

<table>
<thead>
<tr>
<th>Outcome 6: Recognise the foreseeable social, cultural and environmental effects of broadly defined engineering activities generally.</th>
<th>Explanation and Responsibility Level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Responsibility level B</strong></td>
<td>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”.</td>
</tr>
</tbody>
</table>

**Assessment criteria:** This outcome is normally displayed in the course of analysis and solution of problems. The Candidate typically:

6.1 has the ability to identify interested and affected parties and their expectations in regard to interactions between technical, social, cultural and environmental considerations shown;

6.2 takes measures taken to mitigate the negative effects of engineering activities evident.

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.

6.2 Mitigating measures taken may include environmental impact studies, environmental impact management, community involvement and communication, barricading and warning signs, temporary crossings, alternative supplies (ring feeders and bypass roads), press releases, compensation paid, etc.
Outcome 7: Meet all legal and regulatory requirements and protect the health and safety of persons in the course of his or her broadly defined engineering activities.

### Responsibility Level E

**Assessment criteria:**

7.1 Identified applicable legal and regulatory requirements including health and safety requirements for the engineering activity.

7.2 Circumstances stated where applicant assisted in or demonstrated awareness of the selection of safe and sustainable materials, components and systems, and identified risk and applied risk management strategies.

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**Range statement for Outcomes 6 and 7:**

Impacts and regulatory requirements include:

a) Requirements include both explicit regulated factors and those that arise in the course of particular work.

b) Impacts considered extend over the lifecycle of the project and include the consequences of the technologies applied.

c) Effects to be considered include direct and indirect, immediate and long-term related to the technology.

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The OHS Act is supplemented by a variety of parliamentary acts, regulations, local authority by-laws, standards and codes of practice. Places of work might 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.

It is essential to attend a Risk Management (Assessment) course, and to investigate and study the materials, components and systems used in the workplace. The Engineering Technologist seeks advice from knowledgeable and experienced specialists if the slightest doubt exists that safety and sustainability cannot be guaranteed.

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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 may be complex and are identified and studied by the Engineering Technologist before starting the work.

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 Technologist is responsible to see that this is done, and if not, he/she...
establishes which regulations apply and ensures that they are adhered to. Usually the people working on site are strictly controlled w.r.t. health and safety, but the Engineering Technologist checks that this is done, but may authorise unavoidable deviation after setting conditions for such deviations. 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 maintained.

c) Effects associated with risk management are mostly well known if not obvious, and methods used to address, clearly defined. Risks are mostly associated with elevated structures, subsidence of soil, electrocution of human beings and moving parts on machinery. The Engineering Technologist needs to identify, analyse and manage any long-term risks, and develop strategies to solve these by using alternative technologies.

d) The safe and sustainable materials, components and systems must be selected and prescribed by the Engineering Technologists, or other professional specialists must be consulted. It is the Engineering Technologist’s responsibility to use his/her knowledge and experience to confirm that prescriptions by others are correct and safe.

e) Application of regulations associated with the particular aspects of the project must be carefully identified and controlled by the Engineering Technologist.
<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:</strong> Conduct engineering activities ethically.</td>
<td><strong>Responsibility level E</strong></td>
</tr>
<tr>
<td>Ethically means “science of morals; moral soundness”.</td>
<td></td>
</tr>
<tr>
<td>Moral means “moral habits; standards of behaviour; principles of right and wrong”.</td>
<td></td>
</tr>
<tr>
<td><strong>Assessment criteria:</strong> Sensitivity to ethical issues and the adoption of a systematic approach to resolving these issues is expected, typified by:</td>
<td>Systematic means “methodical; based on a system”.</td>
</tr>
<tr>
<td>8.1 conversance and operation in compliance with ECSA’s Rules of Conduct for registered persons confirmed;</td>
<td>8.1 ECSA’s Code of Conduct, as per ECSA’s website, is known and adhered to.</td>
</tr>
<tr>
<td>8.2 how ethical problems and affected parties were identified, and the best solution to resolve the problem selected.</td>
<td>8.2 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.</td>
</tr>
<tr>
<td><strong>Outcome 9:</strong> Exercise sound judgement in the course of broadly defined engineering activities.</td>
<td><strong>Responsibility Level E</strong></td>
</tr>
<tr>
<td>Judgement means “good sense: ability to judge”.</td>
<td></td>
</tr>
<tr>
<td><strong>Assessment criteria:</strong> Judgement is displayed by the following performance:</td>
<td></td>
</tr>
<tr>
<td>9.1 Judgement exercised in arriving at a conclusion within the application of technologies and their interrelationship to other disciplines and</td>
<td>9.1 The extent of a project given to a junior Engineering Technologist is characterised by several broadly defined and a few well-defined factors and their resulting interdependence. He/she will seek advice if educational and/or experiential limitations are</td>
</tr>
</tbody>
</table>
9.2 Factors taken into consideration given, bearing in mind, risk, consequences in technology application and affected parties.

<table>
<thead>
<tr>
<th>Range statement for Outcomes 8 and 9: Judgement in decision-making involves:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) taking several risk factors into account; or</td>
</tr>
<tr>
<td>b) significant consequences in technology application and related contexts; or</td>
</tr>
<tr>
<td>c) ranges of interested and affected parties with widely varying needs.</td>
</tr>
<tr>
<td>b) Consequences are part of the project, e.g. extra cost due to unforeseen conditions, incompetent contractors, long term environmental damage, etc.</td>
</tr>
<tr>
<td>c) Interested and affected parties with defined needs that may be in conflict, e.g. need for a service irrespective of environmental damage, local traditions and preferences, etc. needs sound management and judgement.</td>
</tr>
</tbody>
</table>
Outcome 10: Be responsible for making decisions on part or all of one or more broadly defined engineering activities.

<table>
<thead>
<tr>
<th>Outcome 10:</th>
<th>Responsibility level E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Be responsible for making decisions on part or all of one or more broadly defined engineering activities.</td>
<td>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.”.</td>
</tr>
</tbody>
</table>

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

10.1 Engineering, social, environment and sustainable development taken into consideration in discharging responsibilities for significant parts of one or more activities.

10.2 Advice sought from a responsible authority on matters outside area of competence.

10.3 Academic knowledge of at least BTech level combined with past experience used in formulating decisions.

**Range statement:** Responsibility must be discharged for significant parts of one or more broadly defined engineering activities.

10.1 All interrelated factors taken into consideration are indicative of professional responsibility accepted working on broadly defined activities.

10.2 The Engineering Technologist does not operate on tasks at a higher level than broadly defined and consults professionals at engineer level if elements of the project to be done are beyond his/her education and experience, e.g. power system stability.

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 form an important element. The calculations, for example fault levels, load calculations, losses, etc. are done to ensure that the correct material and components are utilised.

**Note 1:** Demonstrating responsibility would be under supervision of a competent engineering practitioner but he/she is expected to perform as if he/she is in a responsible position.

The responsibility is mostly allocated within a team environment with an increasing designation as experience is gathered.

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<table>
<thead>
<tr>
<th>Group E: Initial Professional Development (IPD)</th>
<th>Explanation and Responsibility Level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outcome 11:</strong> Undertake independent learning activities sufficient to maintain and extend his or her competence.</td>
<td>Responsibility Level D</td>
</tr>
</tbody>
</table>
| **Assessment criteria:** Self-development managed typically:  
  11.1 Strategy independently adopted to enhance professional development evident.  
  11.2 Awareness of philosophy of employer in regard to professional development evident. |  
  11.1 If possible, a specific field of the sub-discipline is chosen, available developmental alternatives established, a programme 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 Technologist level. |
| **Range statement:** Professional development involves:  
b) selecting appropriate professional development activities; and  
c) recording professional development strategy and activities, while displaying independent learning ability. |  
  a) In most places of work training is seldom organised by some training department. It is up to the Engineering Technologist to manage his/her own experiential development. Engineering Technologists 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.  
b) Preference must be given to engineering development rather than developing soft skills.  
c) Developing a learning culture in the workplace environment of the Engineering Technologist is vital to his / her success. Information is readily available, and most senior personnel in the workplace are willing to mentor, if approached. |