
# Guide to the Competency Standards for Registration as a Professional Engineering Technician

## R-08-PN

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## BACKGROUND: ECSA REGISTRATION SYSTEM DOCUMENTS

Figure 1 below defines the documents that comprise the Engineering Council of South Africa (ECSA) system for Registration of programmes that meet the educational requirements for professional categories. The illustration also locates the current document.

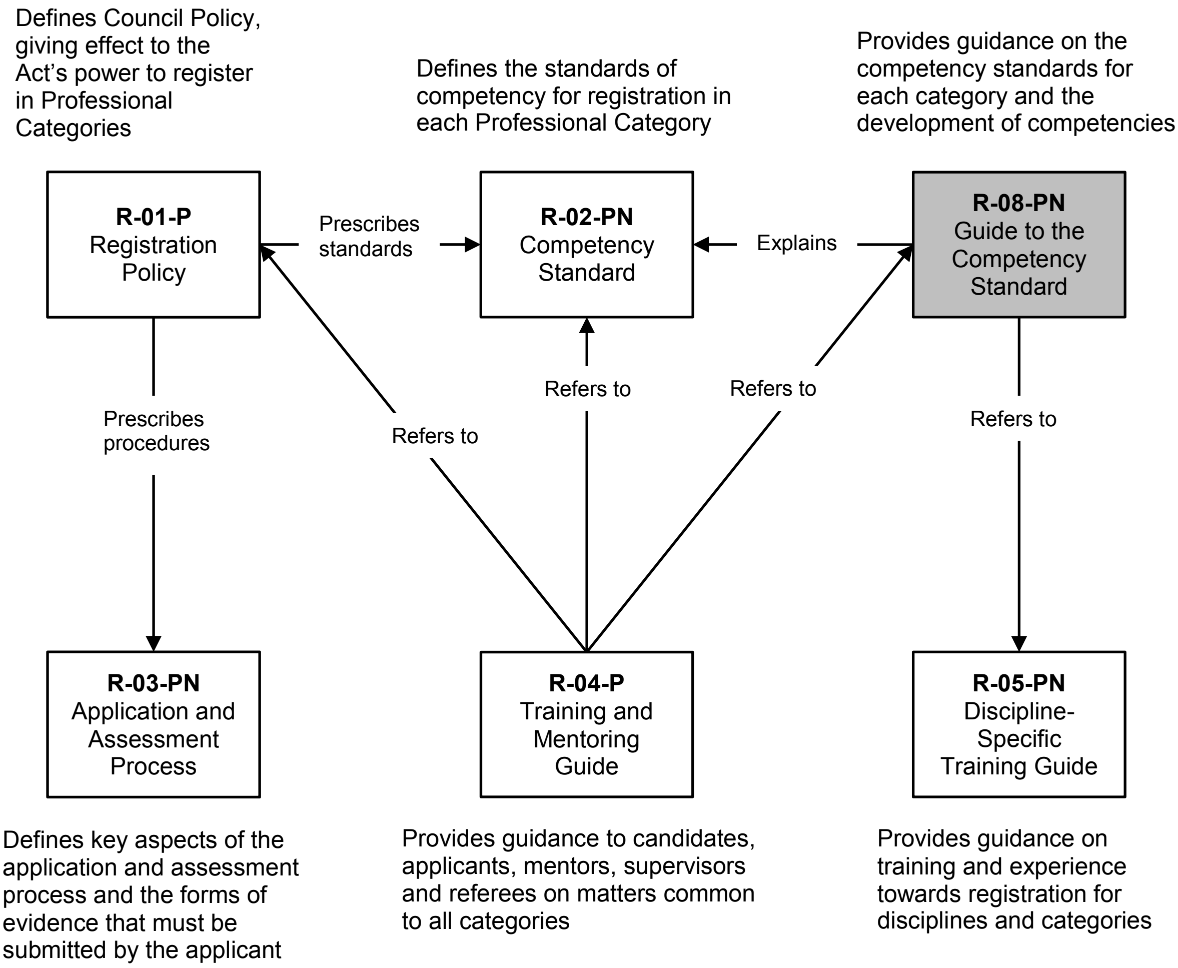


**Figure 1: Documents defining the ECSA Registration System**

## 1. PURPOSE

This guide amplifies the general training and mentoring guide, document R-04-P, and concentrates on the Competency Standards for Professional Engineering Technicians that are defined in document R-02-PN. This guide also indicates ways of developing the requisite competencies and how the competencies can be demonstrated through engineering work. This guide may be supplemented by the Discipline-Specific Training Guide if it exists for the trainee's discipline.

The intended audience of this guide includes candidates undergoing training towards professional registration, mentors, supervisors and assessors of applicants for registration.

## 2. INTRODUCTION TO COMPETENCY, STANDARDS AND PERFORMANCE

What is the competency of a Professional Engineering Technician? In general, *competence* is the possession of the *knowledge, skills and attitudes* that are necessary to perform the activities within the professional category to the standards expected in independent employment or practice.

The knowledge component of competency consists of knowledge from the engineering education process and knowledge that is subsequently acquired, which is likely to be specialised and related to the engineering work context. The skills and attitude components are defined by a set of assessable outcomes.

What is the standard of competence for registration as a Professional Engineering Technician? The ECSA document R-02-PN provides the formal definition of the competence that must be demonstrated and states the requirement for registration as indicated below.

Competence must be demonstrated

- **within** *well-defined engineering activities,* as defined in document R-02-PN;
- **by** *integrated performance* of the outcomes defined in document R-02-PN; and
- **at** the *level defined* for each outcome in document R-02-PN.

The standard applies across all engineering disciplines and specialties. Contexts and functions in which competency may be developed and the outcomes demonstrated may be described in the applicable Discipline-Specific Training Guide.

This guide enlarges on the outcomes, level of performance and integrated performance required of an applicant wishing to register as a Professional Engineering Technician.

The Competency Standard defines 11 outcomes, conveniently grouped in Table 1.

**Table 1: Overview of outcomes**

| GROUP | OUTCOME | DESCRIPTION |
|---|---|---|
| **Group A** Knowledge-based Engineering problem-solving | **1** | Define, investigate and analyse well-defined engineering problems |
| | **2** | Design or develop solutions to well-defined engineering problems |
| | **3** | Comprehend and apply the knowledge embodied in established engineering practices and the knowledge specific to the jurisdiction in which they practise |
| **Group B** Managing engineering activities | **4** | Manage part or all of one or more well-defined engineering activities |
| | **5** | Communicate clearly with others in the course of his/her engineering activities |
| **Group C** Impacts of engineering activity | **6** | Recognise the reasonably foreseeable social, cultural and environmental effects of well-defined engineering activities |
| | **7** | Meet all legal and regulatory requirements and protect the health and safety of persons in the course of his/her well-defined engineering activities |
| **Group D** Exercise judgement, take responsibility and act ethically | **8** | Conduct engineering activities ethically |
| | **9** | Exercise sound judgement in the course of well-defined engineering activities |
| | **10** | Be responsible for making decisions on part or all of the well-defined engineering activities |
| **Group E** Professional Development | **11** | Undertake sufficient Professional Development activities to maintain and extend his/her competence |

### 2.1. How does one visualise the outcomes?

The outcomes do not stand alone. Competent engineering work invariably requires the simultaneous performance of several actions embodied in the outcomes. The Competency

Standard, document R-02-PN, calls for *integrated performance* of the outcomes. The outcomes can be thought of as nesting, as shown in Figure 2 of this document.

The set of 11 outcomes has a logic that flows through it, as suggested by the column headings in Table 1 above.

**Group A**

*Outcomes 1, 2, 4 and 5* capture the essential functions of Professional Engineering Technicians, which involve the analysis and solution of problems and the management of processes, projects and operations to deliver results, all of which are supported by communication.

**Group B**

To perform these core functions, *outcomes 4 and 5* rely on fundamental and specialised engineering knowledge in addition to knowledge of the context in which the work takes place. *Outcome 3* reflects the importance of engineering knowledge; this is the essence of engineering.

**Group C**

While solving problems and managing processes, the Professional Engineering Technician must be able to identify and deal with the impacts of the solutions and the applicable regulatory requirements as reflected in the grouped *outcomes 6 and 7*.

**Group D**

A number of attributes are essential at a personal level: The Professional Engineering Technician must act ethically, exercise judgement and take responsibility as reflected in the grouped *outcomes 8, 9 and 10*.

**Group E**

The single *Outcome 11*, shown as an underpinning layer to all the other outcomes, exposes the need to develop professionally, that is, to increase the knowledge and competencies required for effective performance of engineering work.

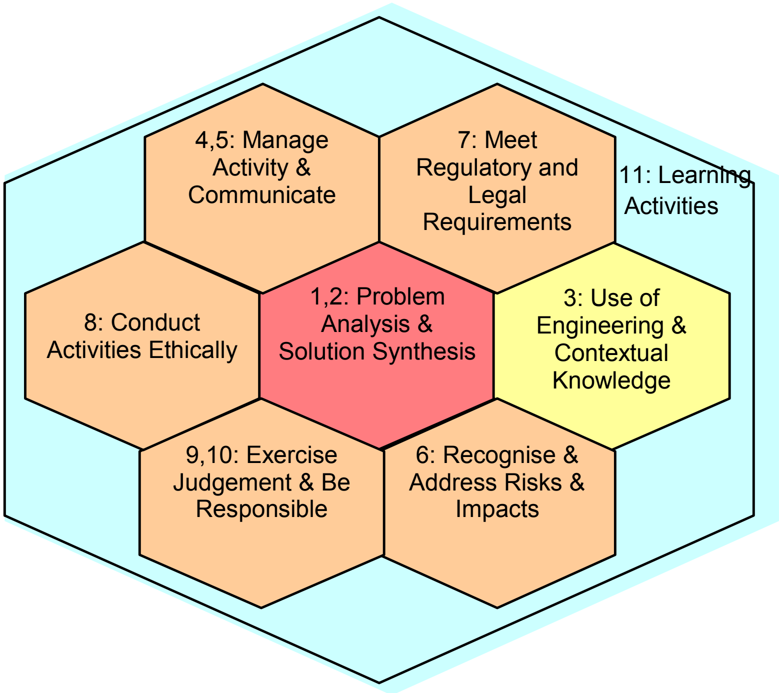


**Figure 2: Summary of all 11 outcomes**

### 2.2. At which level must achievement of outcomes be demonstrated?

All of the outcomes defined in document R-02-PN and summarised in Figure 2 of this document may arise from work with varying levels of demand. At which level must a person demonstrate the defined outcomes to be judged competent to register as a Professional Engineering Technician? Two level-defining phrases are presented with their specific meanings in the Competency Standard, document R-02-PN.

What are engineering activities? The standard takes a broad view of engineering activities, listing a number of possible functions that include design; planning; investigation and problem resolution; improvement of materials, components, systems or processes; implementation, construction, and manufacture of engineering operations; maintenance; project management; and research, development and commercialisation. Discipline Specific Training Guides elaborate on the types of activities for which a person must demonstrate competence.

In summary, evidence of competent performance has two essential requirements: (i) the capability to *perform a number of defined actions* must be demonstrated; and (ii) the performance must be at or exceed a *specified level of demand*. The defined actions are the outcomes, and the level is defined by a specification for the demands of the engineering activities and the nature of the problem-solving. In a professional field, evidence of competent performance is obtained from the competent performance of substantial engineering tasks by the person being assessed. Typical tasks provide evidence of several outcomes, and assessment is holistic.

### 2.3. Introduction of Competency Standards

The Competency Standards in document R-02-PN are introduced via the adoption of the set of documents shown in Figure 1. The intention is not to change the standard required for registration as a Professional Engineering Technician but to express it better in order to support focused training and effective presentation of evidence and assessment. Document R-03-PN identifies areas of change from the training-based requirements to output-based competency standards and the accompanying changes in preparation for application and assessment of competency.

## 3. GROUP A: KNOWLEDGE-BASED ENGINEERING PROBLEM-SOLVING

### 3.1. What is engineering problem-solving?

*Problem-solving* is a process carried out by individuals or teams to bring about a change from a given state to a desired state by means of multistep or multipath activities that have barriers that must be overcome using knowledge and abilities and taking situational requirements into account. Engineering problem-solving is distinguished by requiring engineering knowledge; that is, it relies on fundamental engineering activities and specialised engineering knowledge. Proficiency in solving engineering problems at the level described as *well-defined* is a characteristic of the competency of a Professional Engineering Technician.

Problem-solving is the common thread that runs through engineering activities including design, planning, implementing and constructing in addition to operating and closing engineering systems, infrastructure and plants. Competent problem-solving has two phases, analysis and solution synthesis, as captured in outcomes 1 and 2 of document R-02-PN. Because engineering problem-solving is knowledge-based, Outcome 3 is grouped with outcomes 1 and 2. However, Outcome 3 also supports other outcomes, as depicted in Figure 2.

The test for a *well-defined* engineering problem, which is presented in document R-02-PN, is based on four logical steps:

**Step 1:** Factor a) establishes if a problem is, in fact, an engineering problem by virtue of requiring engineering knowledge. For example, a person performing only project management functions with no role in the engineering aspects of a project would not be solving an engineering problem.

**Step 2:** Factors b), c) and d) establish the factors that describe complexity of the initial state and the desired end state of the problematic situation – How many factors are known or specified? What is unknown? Are there multiple goals?

**Step 3:** Factors e) to h) test the complexity of the solution path or process from the initial state to the goal state.

**Step 4:** Factors i) and j) test the level of decision-making needed in the process of solving the problem and evaluating the solutions and the possible consequences for which responsibility must be taken.

**Table 2: Illustrating the test for a well-defined engineering problem**

| Is the problem an engineering problem? | Factors |
|---|---|
| Can the problem | a) be solved mainly by practical engineering knowledge that is underpinned by related theory? |
| What is the nature of the problem? Does it have one of the characteristics, b, c or d?<br><br>Problems | b) are largely defined but may require clarification;<br>c) are discreet, focused tasks within engineering systems; and<br>d) are routine and frequently encountered and may be unfamiliar but in a familiar context. |
| What is encountered in the solution process?<br>Do the solutions have one of the characteristics, e, f, g or h?<br><br>Solutions | e) can be solved in standardised or prescribed ways;<br>f) are encompassed by standards, codes and documented procedures (require authorisation to work outside limits);<br>g) require information that is concrete and largely complete but require checking and possible supplementation; and<br>h) involve set of interested and affected parties with defined needs to be taken into account, including needs for sustainability. |
| What is involved in decision-making while solving the problem and in evaluating the solution?<br>Does it have one of the characteristics, i or j?<br><br>Do decisions | i) require practical judgement in the practice area of evaluating solutions and considering interfaces with other role-players?<br>j) have consequences that are locally important but not far reaching (wider impacts are dealt with by others)? |

If one or more factors are applicable to each step, the problem is classified as a *well-defined engineering problem.*

### 3.2. How will I know if my performance of problem-solving is adequate?

When considering the problem of assessing a person's performance against learning outcomes 1 and 2, registration requires that the applicant must demonstrate the ability to perform a creative, systematic analysis of problems (at the required level) and to work systematically to synthesise solutions to the problems.

An example of a schema for the systematic analysis is presented below. The applicant:

- interprets the client's demands, leading to an agreed statement of requirements;
- clarifies the requirements and draws issues and impacts to the client's attention;
- identifies standards for design aspects and codes and procedures to be followed;
- gathers information required for problem analysis;
- identifies acceptance criteria for work product;
- verifies that the design problem is amenable to solution by his/her techniques; and
- documents functional solution requirements and gains client acceptance.

A similar schema would apply to the synthesis phase. The applicant:

- identifies and analyses alternative approaches for meeting the problem specification;
- seeks advice on aspects of the proposal or design process that fall outside established practices or standards;
- plans tasks and selects methods to complete the design process;
- carries out design or develops solutions and synthesises tasks;
- assembles the complete solution and reviews to check compliance with the client's requirements;
- checks solution and impacts of solution on interested and affected parties; and
- reviews documented design with the client to obtain formal acceptance.

Which types of problems could be presented to demonstrate problem-solving ability? Many types of problems would suffice. The problem may be a design requirement, a development requirement or a problematic situation in an existing component, system or process.

The solution may be the design of a component, system or process or the recommendation of the remedy to a problematic situation.

The level of the problem analysed must be gauged by the test described above to determine its suitability for presentation as evidence of competence.

### 3.3. Developing knowledge-based engineering problem-solving

Problem-solving is the core activity of engineering. A wide range of engineering functions are either specific manifestations of problem-solving or rely on problem-solving at different levels. Some examples follow:

- Design: This is the systematic process of conceiving and developing materials, components, systems and processes to serve useful purposes. Design involves the transformation from an initial requirement to the documented instructions on how to realise the end product. In the process of developing a solution, barriers must be overcome. A design assignment, therefore, is an engineering problem and involves sub-problems that must be addressed.
- Product or Process Improvement: It frequently happens that an existing piece of infrastructure, plant or process is in need of improvement. The proper approach is to analyse the exiting state and define the desired final state. The process for moving from the initial state to the final state must be determined. Again, the investigation is a problem-solving activity as is the solution synthesis phase.

Problem-solving for other engineering activities is based on engineering knowledge of planning, development and technology transfer, quality assurance, risk analysis, domain-specific project management, managing engineering processes, safe work practices, environmental protection, sustainability analysis and systems engineering.

At the end of training, candidates must demonstrate these problem-solving competencies through their work. The starting point of training is the level of problem-solving ability of the new graduate. The complexity level of the engineering problems that the graduate needs to solve does not change from tertiary education to the workplace; what changes is that in the workplace, the problem is no longer of an academic nature. The candidate must develop problem-solving abilities in an environment in which the consequences of engineering decisions and actions are significant.

At graduation, the knowledge of the applicant centres on the scientific basis of engineering, engineering technologies and some contextual knowledge and specialist knowledge. During candidacy, knowledge must develop in the candidate's practice area and be relevant to the context in which the candidate practices.

Mentors, supervisors and candidates must plan the progression of tasks and responsibility to ensure the development of these competencies. They are advised to use suitable planning, recording and assessment tools. The candidate's progress should be evaluated against each outcome using the degree of responsibility indicated in document R-04-P. It should be noted that the same body of work may serve to develop competencies in other groups.

The strategy for developing problem-solving competence to the level required in the workplace and the degree of responsibility suggested in document R-04-P are useful.

The progression of levels of engineering work and the degrees of responsibility defined in document R-04-P are stated below.

| | |
| --- | --- |
| Level A | Being exposed |
| Level B | Assisting |
| Level C | Participating |
| Level D | Contributing |
| Level E | Performing |

Initially, the candidate assists experienced engineering personnel in their problem analysis and solution activities, receiving detailed guidance and monitoring. Thereafter, the candidate progresses to contributing individually and as a team member to the solution of engineering problems. Finally, the candidate must develop to the level of performing individually and as a team member to solve problems at the required level. In this last phase, the candidate must perform over the entire problem lifecycle.

The candidate should be given the opportunity to experience well-defined problem-solving in contexts such as design, investigation, process or product improvement and planning. The candidate should be encouraged to apply first principles to well-defined problems and to develop and apply specialist and contextual knowledge.

### 3.4. Outcome 3: Using engineering and contextual knowledge

All engineering activities and problem-solving in particular rely on a body of knowledge. The statement of Outcome 3 recognises three components regarding the knowledge of a Professional Engineering Technician:

1. Knowledge is rooted in principles, that is, the general laws of the natural and engineering sciences and the principles of good engineering practice.
2. It is recognised that individual Professional Engineering Technicians develop specialised knowledge that may be in a generally recognised area or may be a particular combination of topics.
3. Knowledge that is specific to the environment in which the person practises is essential. This includes knowledge about the society, economy, regulatory system and the physical environment in which the person practises engineering.

Engineering knowledge is too diverse to allow a detailed specification of knowledge for every discipline, sub-discipline or practice area. Rather, it is recognised that each engineering practitioner develops a practice area. This may be a commonly understood area such as structural engineering or power distribution or may be a particular blend arising from the individual's experience. The knowledge requirements in document R-02-PN are, therefore, stated in generic terms.

For the Professional Engineering Technician, the technical knowledge acquired in the undergraduate programme is the basis for practice area knowledge, and the Professional Engineering Technician must be capable of practical analysis. Technical knowledge may be used explicitly or tacitly.

Professional Engineering Technicians invariably work in teams with specialists, engineering role-players, contractors and other parties from other engineering disciplines. It is, therefore, essential to have a working knowledge of the discipline and the areas in which interaction is necessary.

Engineering work does not occur in isolation, and knowledge of the health and safety, environmental, contractual, quality and risk regulatory requirements is essential.

### 3.5. How do I display my application of knowledge?

This outcome is normally demonstrated in the course of design, investigation or operations. The applicant typically

- displays mastery of established methods, procedures and techniques in the practice area;
- applies the knowledge that underpins methods, procedures and techniques to support technician activities;
- displays working knowledge of areas that interact with the practice area;
- applies codified knowledge in related areas (i.e. financial, statutory, safety, management); and
- uses information technology effectively as required in the practice area.

## 4. GROUP B: MANAGEMENT OF ENGINEERING ACTIVITIES

Groups B, C and D reflect competencies that are linked to problem-solving and are essential to engineering activities at the professional level. For example, considering impacts is an important stage in the solution of a problem. Similarly, an engineering operation also has impacts that must be assessed and managed.

### 4.1. What are engineering management competencies?

Competent engineering practitioners must not only perform technical functions but must also manage engineering activities. Two statements of management competency are presented in Group B in document R-02-PN. Competency to manage *well-defined engineering activities* must be demonstrated as being linked with engineering management, and the ability to communicate with those involved in the engineering activities must be evidenced.

*Engineering management* can be defined as the application of the generic management functions of planning, organising, leading and controlling together with engineering knowledge in contexts including the management of projects, construction, operations, maintenance, quality, risk, change and business. The level of engineering management in which a candidate is either involved or sufficiently experienced is invariably limited at the stage of applying for registration as a Professional Engineering Technician.

Engineering management is more than project management. Project management is, in most cases, supportive of technical engineering activity. Work that is predominantly project management with minor technical engineering content is not acceptable as a demonstration of performance at the degree of responsibility in Group E.

**4.2. Which level of activities must I be able to manage?**

The Competency Standard, document R-02-PN, provides a test to determine whether a given engineering activity is classed as a *well-defined* engineering activity or not. The test is applied to the activity itself to determine the complexity of its scope and operating environment, resource intensiveness and the severity of constraints, risks and consequences. This test is not independent of the test for *well-defined* problem-solving. Most of the factors that give rise to barriers in the problem-solving process also render the problem *well defined*.

The definition of the required level of activity in document R-02-PN does not imply that practitioners in every category work at the level stipulated all the time. Rather, the practitioner in each category must demonstrate the ability to practise at the required level. Similarly, at the culmination of training, the applicant must demonstrate capability of performing the required actions at the required level through actual work done in the work situation.

**4.3. Developing competency to manage engineering activities**

The progression of levels of engineering work and degrees of responsibility defined in document R-04-P, namely *Being exposed, Assisting, Participating, Contributing* and *Performing*, also apply to the management outcomes and the communication outcome at the stage of applying for registration as a Professional Engineering Technician.

Various candidates phase activities that assist in developing the ability to plan, organise, lead and control. The applicant must be able to perform these functions, both alone and in a team. Conducting engineering work on one's own or in a team requires planning and organising to attain the required technical outcomes. Team participation and contribution as a team member and as a leader give the opportunity to demonstrate leadership and the ability to control on a limited scale.

Technical communication at a level that supports analysis, synthesis and the implementation of solutions is an inherent part of engineering work. The applicant needs the opportunity to communicate orally and in writing not only about engineering matters but also about the financial, social, cultural, environmental and political aspects of engineering activity.

### 4.4. How do I know when I am managing and communicating at the required level?

The applicant is expected to display personal and work-process management abilities:

- Manage self
- Work effectively in a team environment
- Manage people, work priorities, work processes and resources
- Maintain professional and business relationships

Effective communication can be demonstrated by

- writing clear, concise and effective reports that are technically, legally and editorially correct using a structure and style that meets communication objectives and user/audience requirements;
- reading and evaluating technical and legal matters relevant to the function of the Professional Engineering Technician;
- receiving instructions and ensuring correct interpretation;
- issuing clear instructions to subordinates using appropriate language and communication aids, thus ensuring that language and other communication barriers are overcome; and
- making oral presentations using structure, style, language, visual aids and supporting documents appropriate to the audience and purpose.

## 5. GROUP C: RISK AND IMPACT MITIGATION

### 5.1. What are the Group C outcomes?

Engineering activities deliver benefits to society and the economy in the form of infrastructure, services and goods. Engineering involves the harnessing or the mitigation of the effects of natural forces or the use and control of information. The actions inherent in engineering activity have accompanying risks. These risks must be mitigated to a level that is acceptable to the affected parties. The management of risk accompanying engineering activity is the very rationale for the regulation of the profession. Some risks are well known and well understood, and the means of addressing them may be embodied in regulation, for example, pressure vessel design. Other situations may not occur frequently or may occur for the first time with the application of new technology and may not, in consequence, be regulated. Certain risks may have objective technical measures, while others are subject to the judgement of individuals and communities. Some risks may be ethical (Outcome 8 in Group D). The ability to assess and deal with all prevailing risks is integral to the competency of an engineering practitioner. The Professional Engineering Technician is expected to be able to identify and deal with wide-ranging risks associated with engineering work.

The two outcomes in Group C, outcomes 6 and 7 as defined in document R-02-PN, deal respectively with the impacts of engineering activity that are not subject to regulation but rely on the professionalism of the practitioner and the impacts that are subject to regulation, both specific and general.

Outcome 7 is concerned with explicitly regulated aspects of engineering practice and the more general legislation that may apply. Candidates must ascertain the legislation that applies in their work environments. Appendix A provides a list of Acts that apply generally and in specific areas. Applicants are reminded that this list is provided for information only and is not exhaustive. The onus rests on each applicant to identify the applicable and current legislation.

Of particular importance is the legislation pertaining to occupational health and safety. There are two principal Acts: the Occupational Health and Safety Act, No. 85 of 1993 together with its various regulations and the Mine Health and Safety Act, No. 29 of 1996 as amended. While Certificated Engineers have specific responsibilities under these Acts, all engineering professionals must be cognisant with and act in accordance with the Acts.

### 5.2. Developing the competency to analyse and manage the impacts, benefits and consequences of engineering activity

Outcomes 6 and 7 in the Competency Standard are relevant to the cluster of competencies presented below.

The applicant should be given the opportunity to study, analyse and recommend measures for

- social/cultural impacts;

- community/political considerations;
- environmental impacts;
- sustainability analysis;
- regulatory conditions; and
- potential ethical dilemmas;

### 5.3. How do I know when I am performing at the right level?

To demonstrate competency in impact analysis and mitigation, the applicant should

- identify interested and affected parties and their expectations;
- identify environmental impacts of the engineering activity;
- identify sustainability issues;
- propose measures to mitigate negative effects of engineering activity; and
- communicate with stakeholders.

To demonstrate competency in regulatory aspects, the applicant should

- identify applicable legal, regulatory and health and safety requirements for the engineering activity;
- select safe and sustainable materials, components, processes and systems, seeking advice when necessary; and
- apply defined, widely accepted methods to identify and manage risk.

### 5.4. Developing Group C competencies

Outcome 6 (impacts of engineering), Outcome 7 (legal and regulatory aspects) and Outcome 8 (ethical behaviour in Group D) reflect the professional behaviour and attitudes expected of a Professional Engineering Technician. These are supported by knowledge of the context of the individual practices (aspect of Outcome 3). It is recognised that during candidacy, exposure to these issues may not be as intensive as for an experienced, registered engineering technician. Applicants are, therefore, expected to supplement experience by reading and reflecting on these issues before applying for registration. Appendix A and the discipline-specific training guides list material that should be consulted, including the relevant legislation. Applicants should also make use of suitable Continuing Professional Development courses in these areas.

## 6. GROUP D: EXERCISING JUDGEMENT AND TAKING RESPONSIBILITY

Engineering practitioners must make technical and managerial decisions that are related to the risks arising from their activity. Three outcomes in Group D are concerned with competencies exercised at a personal level.

Similar to other professions and business situations, ethical problems arise in engineering activity. These may relate to business practices, inducements or an unregulated impact, for example, the use of a rare, unsustainable material for a solution that will be required well into the future. The Professional Engineering Technician must be capable of detecting, analysing and dealing with ethical dilemmas and problems that arise in the course of engineering activity. This is a non-negotiable aspect of the ECSA Code of Conduct, and the Professional Engineering Technician must address any ethical problems that arise.

The Professional Engineering Technician is expected to make decisions in situations where the information to underpin the decision may be incomplete or may be complex, that is, it has more than one part, with interactions between the parts. Such decision-making requires due care by the practitioner and may be informed by experience. The Professional Engineering Technician must, therefore, have the ability to think of more than one matter at once together with their interdependence, their relative importance and their consequences. This process is known as exercising *judgement* within *well-defined engineering activities* or exercising *judgement* in the solution of *well-defined engineering problems.*

Engineering technicians are accorded professional status in society by virtue of their competence and the facts that the profession self-regulates and that professionals are accountable for their actions. The person registering as a Professional Engineering Technician must, therefore, understand the obligation to be responsible and to have experience in making decisions, which if wrong, could have adverse consequences. Subject to the limitations regarding taking responsibility as a candidate or unregistered person discussed in document R-04-P, the applicant for registration as a Professional Engineering Technician must demonstrate the capacity to make recommendations that display responsible behaviour.

### 6.1. Developing competency to make ethical decisions

Outcome 8 simply states: Conduct engineering activities ethically. The baseline for ethical behaviour is the ECSA Code of Conduct as published in terms of the Engineering Profession Act, No. 46 of 2000.

The Code of Conduct covers the need to practise ethically and within one's area of competence, to work with integrity, to respect public interest and the environment and to uphold the dignity of the profession, including one's relationship with fellow professionals. There is also a section on administrative matters that relate to ethical practice. The candidate must study the ECSA Code of Conduct and be aware of its implications in situations that arise in engineering work.

### 6.2. Developing competency to exercise judgement and to take responsibility

Applicants should be given the opportunity and be challenged to

- make decisions when full information is not available;
- take due care that the outputs and the impacts of the assignment are addressed; and
- self-assess their competence from time to time.

### 6.3. How do I know when I am performing at the right level?

To demonstrate sensitivity and capability in dealing with ethical issues, the applicant should adopt a systematic approach to resolving these issues that is typified by

- identifying the central ethical problem;
- identifying affected parties and their interests;
- searching for possible solutions for the dilemma;
- evaluating each solution using the interests of those involved and according suitable priority; and
- selecting and justifying the solution that is best to resolve the dilemma.

Exhibiting judgement is typically demonstrated by

- considering a limited number of factors, some of which may not be well defined;
- considering the interdependence, interactions and relative importance of factors;

- foreseeing consequences of actions;
- evaluating a situation in the absence of full evidence; and
- drawing on experience and knowledge.

Being responsible is evidenced by

- demonstrating a professional approach at all times;
- displaying due regard to technical, social, environmental and sustainable development considerations;
- taking advice from a responsible authority on any matter considered to be outside one's area of competence; and
- evaluating work output, revising as required and taking responsibility for work output.

## 7. GROUP E: PROFESSIONAL DEVELOPMENT

Professional Development (PD) is the systematic maintenance, improvement and broadening of knowledge and skills and the development of personal qualities necessary for the execution of professional and technical duties throughout an engineering technician's career. A registered Professional Engineering Technician is required to maintain and extend competence and must complete at least the required level of PD to maintain registration.

Candidates training towards registration do not have to satisfy a formal PD requirement. However, at the time of applying for registration as a professional, applicants will be assessed as to their ability to manage and complete PD-type activities. This is an integral part of the professional competence required to practise safely and effectively in engineering. The PD-type activity carried out before registration is often termed Initial Professional Development (IPD).

The ability to develop and maintain competency is an essential and demonstrable competency and is embodied in Outcome 11, namely the ability to undertake sufficient PD activities to maintain and extend competence. This is more than completing courses or activities. The emphasis falls on the individual's ability to self-develop. This capability has several dimensions: take responsibility for one's own development; reflect on strengths and weaknesses; recognise needs; plan and execute development activities; and overcome obstacles.

The range of methods open to the candidate for presentation of IPD is substantial and comprises reading, researching, in-house training, accredited PD courses, credit-bearing courses in higher education institutions and higher qualification studies that complement the individual's training and work experience. The essential test is to confirm that the activity is appropriate for the specific developmental needs of the individual. Also, involvement of the candidate in the planning of the learning activities rather than simply entrusting this to the employer is important.

The ability to develop one's skills continually is regarded as sufficiently important in an engineering professional to be enshrined as an outcome that must be demonstrated in order to attain registration.

### 7.1. At which level must I manage my development?

For a Professional Engineering Technician, it should be noted that boundaries of practice areas change over time, new engineering principles are formulated, new procedures, standards and codes are developed and new engineering practice is advanced. Initial Professional Development should be planned with these factors in mind.

### 7.2. Managing own development

All the activities listed below, including combinations thereof, constitute PD and thus, IPD:

- Attending courses, seminars, congresses and technical meetings organised by Engineering Institutions/Institutes, universities, other professional bodies and course providers
- Actively participating in conferences, serving on technical or professional committees and engaging in working groups
- Undertaking structured self-study (i.e. using textbooks with examples). Studying technical literature (e.g. journals, magazines)
- Taking correspondence courses and studying other supervised study packages in addition to taking in-house courses provided by employers
- Enrolling for formal postgraduate studies (limited credits)
- Writing technical papers or presenting papers or lectures at organised events

Pre-registration IPD is not subject to the requirement of annual points. Initial Professional Development involves learning activities initiated by the applicant that are distinct from the structured learning activities required by the employer.

### 7.3 How do I know when I am performing at the right level?

Management of one's PD is demonstrated by:

- planning own PD strategy;
- selecting appropriate PD activities;
- keeping a record of PD strategy and activities;
- displaying independent learning ability; and
- completing PD activities.

## 8. APPLICANTS WHO HAVE COMPLETED ADVANCED QUALIFICATIONS

Applicants who have completed higher education programmes beyond the National Diploma or have the equivalent educational level that is required for registration as a Professional Engineering Technician should identify opportunities to present evidence at the required level against the outcomes defined in the competency standards. The registration policy allows such applicants to offer appropriate aspects of the advanced programme as part of the evidence of competence against particular outcomes.

## REVISION HISTORY

| Revision Number | Revision Date | Revision Details | Approved By |
|---|---|---|---|
| Rev. 0: Concept A | 9 April 2014 | Adapted from document R-08-PE | JIC Working Document |
| Rev. 0: Concept B | 10 April 2014 | Corrections | Erasmus |
| Rev. 1 | 9 July 2014 | Corrections of Dr Stidworthy incorporated | Approved by JIC |
| Rev. 1 | 18 September 2014 | Minor editing changes of Dr Stidworthy incorporated | Approved by Council |
| Rev. 2 | 22 May 2018 | Routine review and alignment to R-01-P | Approved by PDGSC |

The Guide for:

**Competency Standards for Registration as a Professional Engineering Technician**

Revision 2 dated 22 May 2018 and consisting of 28 pages has been reviewed for adequacy by the Business Unit Manager and is approved by Executive: Policy Development and Standards Generation (PDSG)

.................................. 31/07/2018

Business Unit Manager Date

.................................. 01/08/2018

Executive: **PDSG** Date

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

**APPENDIX A:**

**EXAMPLES OF LEGISLATION APPLICABLE GENERALLY AND IN PARTICULAR AREAS OF ENGINEERING**

1. Engineering Profession Act No. 46 of 2000

2. Occupational Health and Safety Act No.85 of 1993:

    2.1. General Machinery Regulations

    2.2. Construction Regulations

    2.3. Driven Machinery Regulations

    2.4. Pressurised Equipment Regulations

3. Mine Health and Safety Act No. 29 of 1996:

    3.1. Design of underground dam walls, plugs and barricades Regulations on use of water for mining

4. Environment Conservation Act No.73 of 1989

    4.1. National Environmental Management Act No 107 of 1998
    4.2. National Environmental Management Waste Act 59 of 2008
    4.3. National Radioactive Waste Disposal Institute Act 53 of 2008
    4.4. National Nuclear Regulator (NNR) Act 1999, Act 47 of 1999
    4.5. Mine and Safety Act of 1996
    4.6. SANS 10248, 1023: Waste Classification and Management Regulations from South Africa Constitution Act 108 OF 1996 Hazardous substance Act 5 of 1973.

5.

6. National Building Regulations and Building Standards Act No.103 of 1977:

    6.1. Certify structural system of a building or home

    6.2. Certification of fire protection system

    6.3. Certification of artificial ventilation systems

    6.4. Geotechnical site investigations, Stability of excavations, Geotechnical investigations on sites underlain by dolomites

    6.5. Fire Protection Standard SANS Code 10139: 2012 for fire detection and alarm systems for buildings- system design, installation and servicing.

7. National Water Act No.36 of 1998:

   7.1 Various measures relating to pollution of a water resource;

   7.2 South Africa Bureau of Standards (SABS) Act 24 of 1945; Act 29 of 2008

   7.3 List of SABS/TC 147 STANDARDS listing SANS codes for chemical use for treatment of water intended for human consumption and other purposes. E.g. SANS 241:2015 Drinking Water Standard

   7.4 SANS codes for food and beverages e.g. SANS 10133, etc. from www.sans.co.za

8 Water Act No.54 of 1956

   8.1 Determination of persons permitted to design dams

9 ISO 9001: 2015

10 South Africa Bureau of Standards (SABS) Act 24 of 1945; Act 29 of 2008

11 Nuclear Energy Act 46 of 1999

   11.1 Minerals and Energy Acts, e.g. Mineral and Petroleum Act 28 of 2002.

12 SANS Codes from www.sabs.co.za