ENSURING THE
EXPERTISE TO GROW
SOUTH AFRICA

Competency Standard for Registration as a Professional Engineering Technician

R-02-PN

Revision: 3

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ECSA

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DEFINITIONS

Competency area: The performance area in which all the outcomes can be demonstrated at the level prescribed by the specific technology in an integrated manner

Competency indicator: The typifying guide to evidence indicating competence that is not normative

Continuing Professional Development: The systematic maintenance, improvement and broadening of knowledge and skills and the development of personal qualities necessary for the execution of professional and engineering duties throughout an engineering practitioner's career

Engineering science: 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, to solve problems and to provide the knowledge base for engineering specialisations

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

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

Integrated performance: The overall satisfactory outcome of an activity, which 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: A measure of performance demands at which outcomes must be demonstrated

Management of engineering works or activities: The coordinated activities required

- to direct and control all that is constructed or results from construction or manufacturing operations;

- to operate engineering works safely and in the manner intended;
- to return engineering works, plant and equipment to an acceptable condition by the renewal, replacement or mending of worn, damaged or decayed parts;
- to direct and control engineering processes and systems together with the commissioning, operation and decommissioning of equipment; and
- to maintain engineering works or equipment in a state in which they can perform their required functions.

Outcome: A statement of the performance that a person must demonstrate in order to be judged competent to operate in a competency area at the professional level

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

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

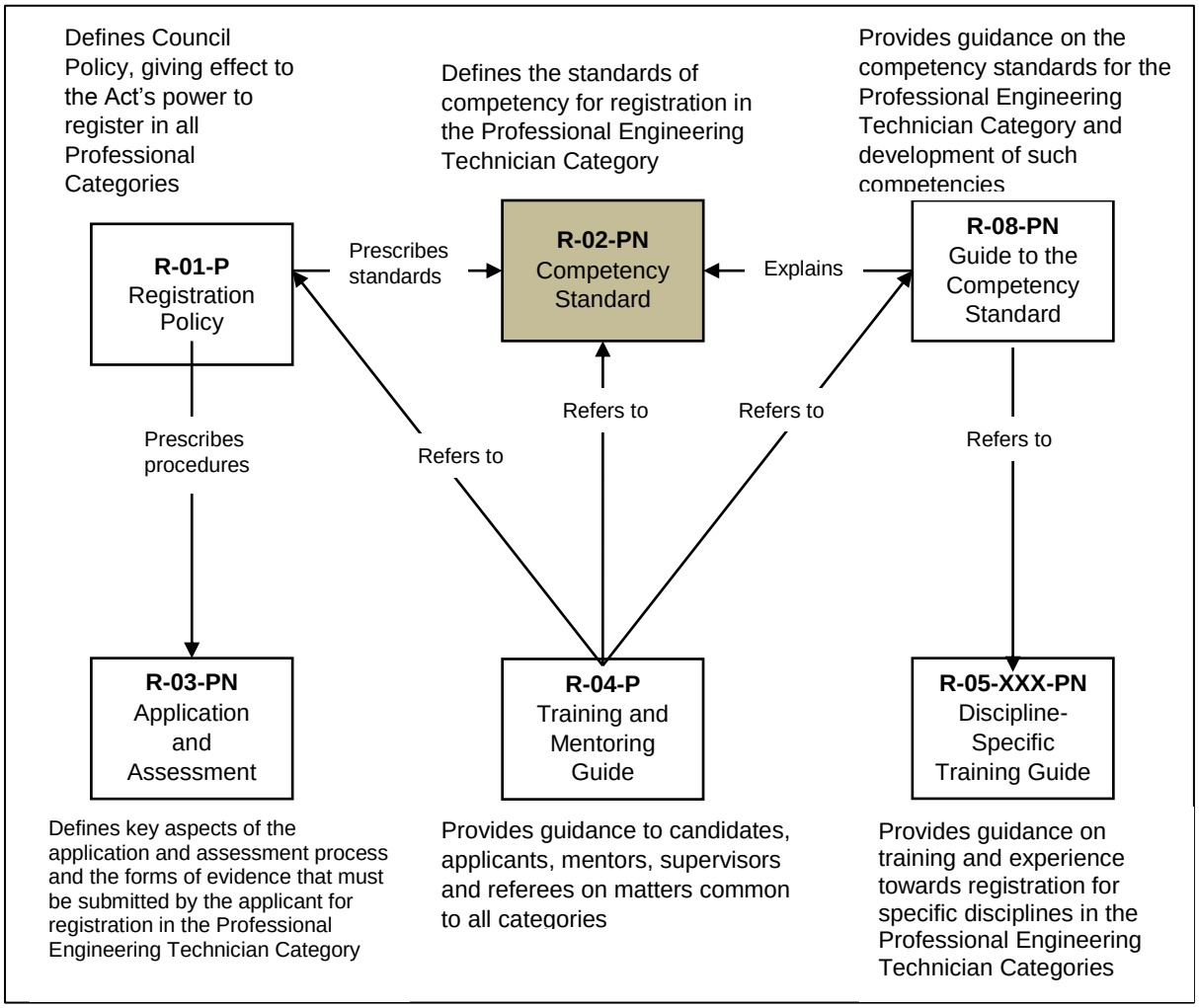
Range statement: The required extent of or limitations on expected performance stated in terms of situations and circumstances in which outcomes are to be demonstrated in a particular competency area

Sustainable development: Development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs

XXX: Indicates an abbreviation for a specific discipline (e.g. CIV for Civil, AER for Aeronautical, ELE for Electrical, IND for Industrial, CHE for Chemical, MEC for Mechanical)

BACKGROUND: THE ECSA REGISTRATION SYSTEM DOCUMENTS

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



Documents defining the ECSA Registration System

1. PURPOSE

This Competency Standard defines the competencies required for registration as a Professional Engineering Technician. Abbreviations and definitions of terms having particular meaning within this standard are given the section of definitions. Competency indicators are

listed in Appendix A.

2. DEMONSTRATION OF COMPETENCE

Competence must be demonstrated within *well-defined engineering* activities (defined below) by the integrated performance of the outcomes defined in section 3 at the level defined for each outcome. Required contexts and functions may be referred to in the applicable Discipline Specific Training Guidelines (e.g. **R-05-CIV-PN**, etc.).

2.1 Level descriptor

Well-defined engineering activities are characterised by several or all of the following:

- Scope of practice area is defined by the techniques that are applied and the techniques that are changed through the adoption of new techniques into current practice.
- Practice area is located within a wider, complex *context* and involves well-defined working relationships with other parties and disciplines.
- Work involves a familiar and defined range of *resources*, including people, money, equipment, materials and technologies.
- Resolution of *interactions* manifested among specific technical factors with limited impact on wider issues is required.
- Activities are *constrained* by operational context, defined work packages, time, finance, infrastructure, resources, facilities, applicable laws, and standards and codes.
- Activities demonstrate *risks* and *consequences* that are locally important but are not generally far reaching.

2.2 Activities

Activities include design; planning; investigation and problem resolution; improvement of materials, components, systems or processes; implementation, manufacture or construction; engineering operations; maintenance; project management; and research, development and commercialisation.

3. GROUP A OUTCOMES: ENGINEERING PROBLEM-SOLVING

3.1 Outcome 1

Define, investigate, interpret and analyse *well-defined engineering* problems

Level descriptor

Well-defined engineering problems are mainly solved by practical engineering knowledge underpinned by related theory.

The characteristics of *well-defined engineering* problems include one or more of the following characteristics:

- *Well-defined engineering* problems are largely defined but may require clarification.
- *Well-defined engineering* problems are discrete, focused tasks within engineering systems.
- *Well-defined engineering* problems are routine and frequently encountered and may be unfamiliar but in a familiar context.

And one or more of the following:

- *Well-defined engineering* problems can be solved in standardised or prescribed ways.
- *Well-defined engineering* problems are encompassed by standards, codes and documented procedures (authorisation required to work outside limits).
- Information is concrete and largely complete but requires checking and possible supplementation.
- *Well-defined engineering* problems involve several issues but few of these impose conflicting constraints and involve a limited range of interested and affected parties.

And one or both of the following:

- Interpretation requires practical judgement in the practice area in evaluating solutions and in considering interfaces with other role-players.
- *Well-defined engineering* problems have consequences that are locally important but

are not far reaching (wider impacts are dealt with by others).

Range statement

The problem may be part of a larger engineering activity or may stand-alone. The design problem is amenable to solution by established techniques practised regularly by the candidate within the competence area. Outcome 1 is concerned with the interpretation and understanding of the problem whereas Outcome 2 is concerned with the solution.

3.2 Outcome 2

Design or develop sustainable solutions to *well-defined engineering* problems

Range statement

The solution is amenable to established methods, techniques or procedures within the applicant's competence area. Engineering should not only consider decreasing impacts but also consider restoring and regenerating through design and the development of systems.

3.3 Outcome 3

Comprehend and apply knowledge that is embodied in established engineering practices and that is specific to the jurisdiction in which the Engineering Technician practises

Range statement

Applicable knowledge includes the following:

- Technical knowledge, which is knowledge that is applicable to the practice area, irrespective of location. It is supplemented by locally relevant knowledge, for example, established properties of local materials.
- A working knowledge of immediately interacting disciplines confined to the competence area. Codified knowledge includes the related areas of finance, statutes, safety and management.
- Jurisdictional knowledge includes legal and regulatory requirements together with prescribed codes of practice and the application of sustainable materials and

practices.

4. GROUP B OUTCOMES: MANAGING ENGINEERING ACTIVITIES

4.1 Outcome 4

Manage part or all of one or more *well-defined engineering* activities

4.2 Outcome 5

Communicate clearly with others in the course of the engineering activities

Range statement for outcomes 4 and 5

Management and communication involves the following:

- Planning of *well-defined engineering* activities
- Organising *well-defined engineering* activities
- Leading *well-defined engineering* activities
- Implementing *well-defined engineering* activities
- Directing, managing and controlling *well-defined engineering* activities

Communication relates to information regarding the technical/project progress and involves verbal and written instructions to the team. Formats for documents are defined. The Engineering Technician is expected to perform the communication functions reliably and repeatedly and confine such functions to the competence area.

5. GROUP C: IMPACTS OF ENGINEERING ACTIVITY

5.1 Outcome 6

Recognise the foreseeable social, cultural, environmental and sustainable effects of *well-defined engineering* activities.

5.2 Outcome 7

Meet all legal and regulatory requirements, protect the health and safety of persons and adhere to sustainable practices in the course of the *well-defined engineering* activities.

Range statement for outcomes 6 and 7

Impacts and regulatory requirements include the following:

- Impacts to be considered are generally those identified within the established methods, techniques or procedures used in the practice area and within the customs and behaviours that exist in a population.
- Regulatory requirements are prescribed.
- Prescribed risk management strategies are to be applied.
- Effects to be considered and methods used are defined.
- Safe and sustainable materials, components and systems are prescribed.
- The health and safety of persons located both inside and outside the workplace are to be protected.
- The environment must be protected at all times.

6. GROUP D OUTCOMES: EXERCISE JUDGEMENT, TAKE RESPONSIBILITY AND ACT ETHICALLY

6.1 Outcome 8

Conduct engineering activities ethically

Range statement

Ethical behaviour is at minimum that defined by the Code of Conduct.

6.2 Outcome 9

Exercise sound judgement in the course of *well-defined engineering* activities

Range statement

Judgement is expected in the implementation of the applicant's methods, techniques and procedures and in the assessment of their immediate impacts. Judgement in decision-making involves

- considering limited risk factors, some of which may be ill-defined;
- considering the consequences that are in the immediate work contexts; or
- identifying the set of interested and affected parties and considering their defined needs and the needs of sustainability.

6.3 Outcome 10

Be responsible for making decisions on part or all of the *well-defined engineering* activities

Range statement

The applicant is expected to discharge responsibility for significant parts of one or more *well-defined engineering* activities.

7. GROUP E OUTCOMES: CONTINUING PROFESSIONAL DEVELOPMENT

7.1 Outcome 11

Undertake sufficient professional development activities to maintain and extend competence

Range statement

Professional development involves

- taking ownership of one's own professional development;
- planning own professional development strategy;
- selecting appropriate professional development activities;
- recording own professional development strategy and activities while displaying independent learning ability; and

- taking responsibility of one's ongoing professional development.

REVISION HISTORY

Revision Number	Revision Date	Revision Details	Approved By
Rev. 1	2006		Approved by Council
Rev. 1 Draft A	25 Nov 2010	Level descriptors revised Assessment criteria moved into R-04-P	JIC Working Document
Rev. 1 Draft B	15 Feb 2011	Editorial and Formatting	Submitted to Council for approval
Rev. 1.1	17 March 2011	Minor editorial changes	Approved by Council
Rev. 1.2	11 Jan 2012	Wording added	Approved by Council
Rev. 2 Concept A	6 April 2015	'Assessment Criteria' re-introduced and designated 'Competency indicators'. Sustainability incorporated into wording. Term 'competency area' added to Competency indicators and Range statement.	Draft for submission to SGG
Rev. 2 Concept B	6 Dec 2015	Illustration updated to include C&U; Revisions from R-02-PT incorporated	Second draft for submission to SGG
Rev. 2 Concept C	23 Jan 2016	Minor editing and CPD definition updated	SGG draft submission to the ESGB
Rev. 2 Concept C	2 March 2016	Minor editing; Final submission to Council	Amended and approved by the ESGB
Rev. 2	24 March 2016	No amendments	Approved by Council
Rev. 3	11 Sept 2018	Approval	PDSG Committee

* C&U: Commitment and Undertaking

**CPD: Continuing Professional Development

The Competency Standard for:

Registration as a Professional Engineering Technician

Revision 3 dated 11 September 2018 and consisting of 14 pages has been reviewed for adequacy by the Business Unit Manager and is approved by the Executive: Research, Policy and Standards (RPS).

.....
Business Unit Manager

14/02/2019
Date

.....
Executive: RPS

14/02/2019
Date

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

Appendix A: Exemplified associated competency indicators

The competency indicators presented here are typifying; they are not normative.

Outcome 1:

A definition, an investigation into and an analysis of *well-defined engineering* problems within the competence area and typified by the following performances are expected: Received work instructions are interpreted, checking with the client or supervisor that the interpretation is correct. Further clarifying information is obtained, analysed, interpreted and evaluated, and instruction is revised as a result.

Outcome 2:

This outcome is normally demonstrated after the problem analysis referred to in Outcome 1 has been performed. Working systematically to reach a solution to a *well-defined* problem that is typified by the following performances is expected:

- Present designed or developed and analysed alternative approaches to conduct the work
- Check impacts and sustainability
- Attach competency assessment to support calculations and engineering documentation
- State the final solution to performing the work and ensure that the client or the supervisor is in agreement

Outcome 3:

This outcome is normally demonstrated in the course of the planning, investigation or operations confined to the competence area:

- Procedures and systems at N Dip-level or equivalent engineering standard used to execute the work and applied Dip-level theory to understand and/or verify these procedures
- Theoretical calculations at N Dip-equivalent level and/or reasoning on why the

application of this theory is considered to be correct (Actual examples)

Outcome 4:

Display of personal and work-process management abilities confined to the competence area is expected:

- Manage self, priorities, processes and resources when performing the work
- Provide evidence of the role and contribution of the work team

Outcome 5:

Demonstrates effective communication by providing evidence:

- Present your point of view and the compiled reports after completion of the work
- Compile and issue instructions to entities working on the same task

Outcome 6:

This outcome is normally displayed in the course of evaluating and planning tasks within the competence area typically by

- identifying the social, cultural, environmental impacts and the long-term sustainability of the engineering activity; and
- communicating mitigating measures to affected parties and acquiring stakeholder engagement.

Outcome 7:

Identify applicable legal, regulatory, health and safety requirements and standards and sustainable practices for the *well-defined engineering* activity, and state how health and safety matters are being handled. Manage risks and use safe and sustainable materials, components and systems, seeking advice when necessary on the risk management system that is applied.

Outcome 8:

Sensitivity to ethical issues and the adoption of a systematic approach to resolving these issues are expected:

- Identify ethical issues, the affected parties and their interests and state the action that is to be taken should a problem arise
- Confirm conversance and compliance with the ECSA Code of Conduct
- State why this compliance is important in conducting work

Outcome 9:

Exhibition of judgement is expected and is demonstrated by

- considering how the most important factors applicable to the work done were applied and how they were interrelated; and
- how work consequences were foreseen and situations evaluated in the absence of full evidence.

Outcome 10:

Responsibility is displayed by the following performances carried out within the competency area:

- use N Dip-level theoretical calculations to justify decisions taken in performing engineering work (Attach actual calculations);
- take responsible advice on any matter falling outside own education and experience; and
- take responsibility for own work and evaluate any shortcomings in output.

Outcome 11:

Self-development is managed typically by

- adopting an independent strategy to enhance one's own professional development;

and

- realising the philosophy of one's employer in regard to professional development.