ENSURING THE EXPERTISE TO GROW

SOUTH AFRICA

Sub Discipline-Specific Training Guide for Registration as Glazing Practitioner in specified category

R-05-GP-SC

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ECSA

TABLE OF CONTENTS

DEFINITIONS

Accredited qualification: A qualification awarded on successful completion of an accredited programme.

Alternative Route: The term "alternative route" refers to an applicant who aspires to become registered in a Specified Category and who have acquired experience as stipulated in document **R-01-POL-SC**.

Assessor: A professionally registered person who carries out the Experience Appraisal assessment.

Benchmark Route: The normal process required to attain registration that consists of the completion of an accredited, recognised qualification for the category of registration.

Building: In the context of this document, it includes:

(a) any other structure, whether of a temporary or permanent nature and irrespective of the materials used in the erection thereof, erected or used for or in connection with –

  (i) the accommodation or convenience of human beings or animals
  (ii) the manufacture, processing, storage, display or sale of any goods
  (iii) the rendering of any service
  (iv) the destruction or treatment of refuse or other waste materials
  (v) the cultivation or growing of any plant or crop

(b) any wall, swimming bath, swimming pool, reservoir or bridge or any other structure connected therewith

(c) any fuel pump or any tank used in connection therewith

(d) any part of a building, including a building as defined in paragraph (a), (b) or (c)

(e) any facilities or system, or part or portion thereof, within or outside but incidental to a building, for the provision of a water supply, drainage, sewerage, stormwater disposal, electricity supply or other similar service in respect of the building.

Candidate: means a person who is registered in terms of section 19(2)(b) of the Engineering Profession Act, 46 of 2000.

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

Competency Assessment: A summative assessment of an individual's competency against the prescribed standard based on evidence from the individual's work, reports by qualified observers and other tests that may include a Professional Review.

Competency indicators: The typifying guide to evidence indicating competence and is not normative.

Competency Standard: Statement of competence required for a defined purpose.

Competent Person (Glazing): A person who is recognised by an institute, who has specialist expertise in the field of glazing, as generally having the necessary experience and training to determine glazing requirements in accordance with the provisions of SANS 10137

Competent Person (Structures): A person who is:

(a) registered in terms of the Engineering Profession Act, 46 of 2000, as either a Professional Engineer or a Professional Engineering Technologist

(b) generally recognised as having the necessary experience and training to undertake rational assessments or rational designs in the field of structural systems (SANS 10400-Part B).

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

Experience Appraisal: A documentary assessment of the applicant's evidence of competence.

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

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, solve problems and provide the knowledge base for engineering specialisations.

Glass: Inorganic glazing material used in buildings typically as defined by SANS 50572 series of soda lime silica glass including the variants annealed, patterned, laminated, toughened, laminated toughened, organic coated glass (painted, coated, mirrored, filmed etc) and surface modified glasses such as coated, etched, sandblasted and polished.

Glazing (*noun*)**:** Glass, plastics and organic coated glass fixed in frames in windows, doors, and roof lights, or that form doors (SANS 10400-N).

Glazing (*verb*)**:** The act of installing glazing into or onto a building or other structure.

Glazing Practitioner: A person registered in terms of Section 18(1)(c) of the Engineering Professional Act, 46 of 2000, carrying out specifically defined engineering activities in the field of glazing.

Generic baseline competency: The competency for a Professional Category defined in terms of outcomes and including the expected level of performance that can be demonstrated in a range of occupational contexts.

Initial professional development: Systematic participation in the activities typical of Continuing Professional Development but carried out prior to professional registration.

Integrated Performance: 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: A measure of performance demands at which outcomes must be demonstrated.

Knowledge area*:* An important subject area that forms part of the overall knowledge base needed for a certain competency.

Management of engineering activities with respect to glazing, The coordinated activities required to:

- direct and control all that is constructed or results from construction or manufacturing operations
- operate engineering activities safely and in the manner intended
- return engineering activities, plant and equipment to an acceptable condition by the renewal, replacement or mending of worn, damaged or decayed parts
- direct and control engineering processes and systems in addition to the commissioning, operation and decommissioning of equipment
- maintain equipment or engineering activities in a state in which it can perform its required function.

Mentor: An ECSA Registered Person (Professional Engineer or Professional Engineering Technologist or Professional Technician) who guides the competency development of a candidate in an appropriate category and/or is registered with South African Glass Institute (SAGI).

Moderator: A Professionally Registered Person who carries out the moderation of the Experience Appraisal and Professional Review assessments.

Outcome: A statement of the performance that a person must demonstrate to be judged competent at the specified category level.

Practice area: A distinctive area of knowledge and expertise developed by an Engineering Specialist through the path of education, training and experience followed by competence and responsible application in practice.

Prescribed standards: The Competency Standards (outcomes) for the category and the discipline-specific requirements (if any) that must be satisfied by an applicant for registration.

Professional Review: An integrative assessment of the applicant's competence, including professional attributes specified in the standard and sub discipline-specific requirements for the category and the sub discipline via a comprehensive review of the applicant's evidence and an interview.

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.

Rational Designer (Glazing Specialist): Rational Designer (Glazing Specialist): Is registered in terms of the Engineering Profession Act, 46 of 2000, as either a Professional Engineer or a Professional Engineering Technologist in Civil Engineering and overlaps with other disciplines and is professionally recognised as having the necessary experience and training to undertake rational assessments or rational designs in the field of structural systems incorporating glazing as defined in SANS 10400.

Reviewer: A Professionally Registered Person who carries out the Professional Review assessment.

Specified Category: a category of registration for persons who must be registered through the Engineering Profession Act or a combination of the Engineering Profession Act and external legislation as having specific engineering competencies normally 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.

Standards: Statements of outcomes to be demonstrated and the levels of performance and content baseline requirements in the context of engineering educational programmes.

Substantial equivalence (applied to educational programmes)**:** Two programmes while not meeting a single set of criteria are both acceptable for preparing their respective graduates to gain training and experience towards professional registration.

Supervisor: A person who oversees and controls engineering work performed by an applicant.

ABBREVIATIONS

C&U	Commitment and Undertaking
CESA	Consulting Engineers South Africa
CPD	Continuing Professional Development
DSTG	Discipline-specific Training Guide
EA	Experience Appraisal
ECSA	Engineering Council of South Africa
EPA	Engineering Profession Act, 46 of 2000
LPC	Loss Prevention Council
NBR	National Building Regulations
PR	Professional Review
Pr Cert Eng	Professional Certificated Engineer
Pr Eng	Professional Engineer
Pr Tech Eng	Professional Engineering Technologist
QE	Qualification Evaluation
RD	Rational Design
SANS	South African National Standards
SAGI	South African Glass Institute
SC	Specified Category
TER	Training and Experience Report
TES	Training and Experience Summary
VA	Voluntary Association

BACKGROUND

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

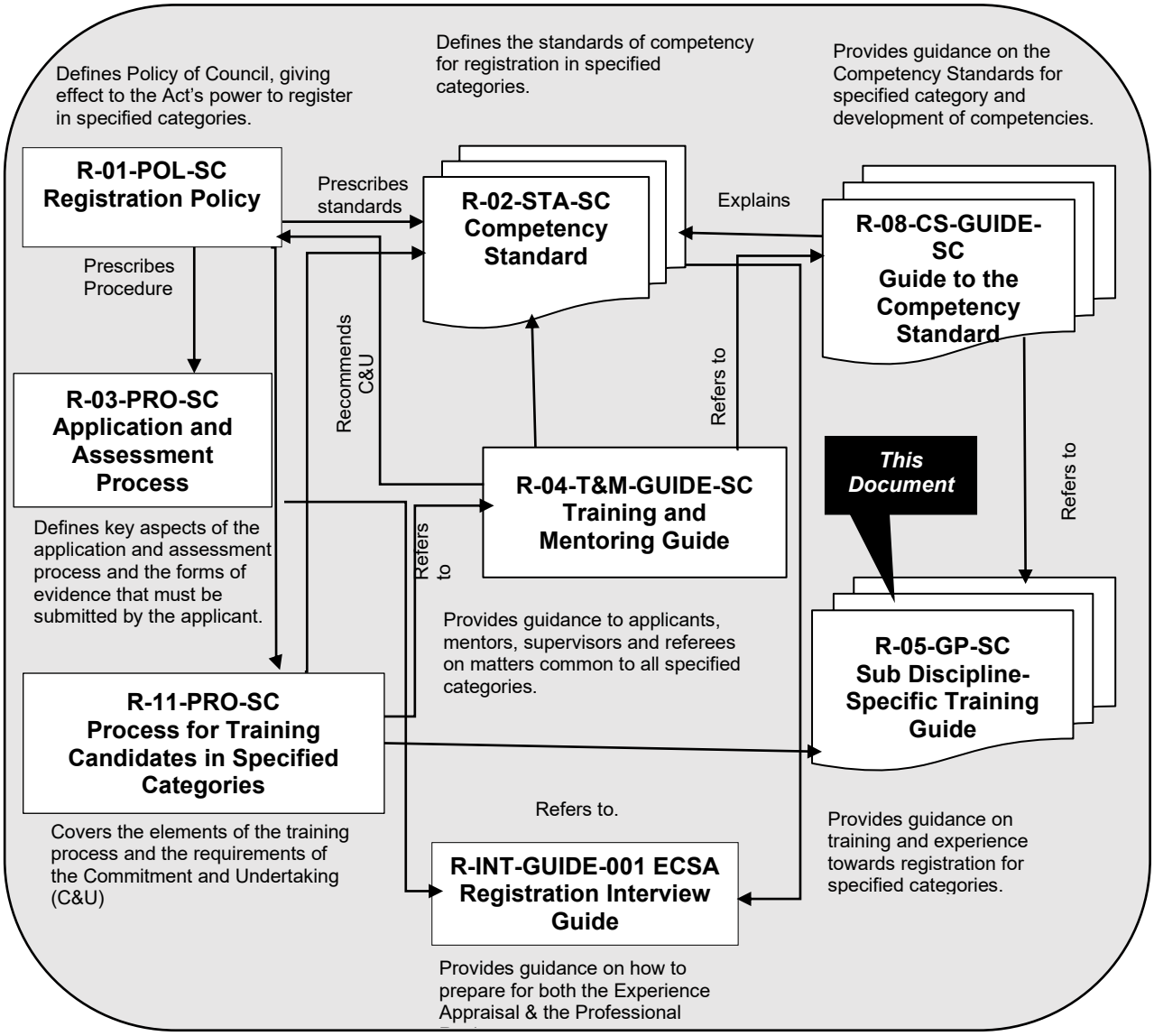

Figure 1: Documents defining the ECSA registration system

1. PURPOSE OF THIS DOCUMENT

All persons applying for registration in the Specified Category of Glazing Practitioner are expected to demonstrate the competencies specified in document **R-02-STA-SC** through work performed at the prescribed level of responsibility. In addition, the sub discipline-specific requirements set out in **Section 8.8.2** below must be met.

This training requirements document supplements the generic *Training and Mentoring Guide* (document **R-04-T&M-GUIDE-SC**), the *Guide to the Competency Standards for Registered Specialists* (document **R-08-CS-GUIDE-SC)** and the *Process for Training Engineering Candidates towards Specified Category Registration* (document **R-11-PRO-SC**).

In document **R-04-T&M-GUIDE-SC**, attention is drawn to the following sections:

- Duration of training and period working at level required for registration
- Principles of planning Training and Experience
- Progression of Training Programme
- Documenting Training and Experience
- Demonstrating responsibility.

The second set of documents (documents **R-08-CS-GUIDE-SC**) is applicable to Alternative Route applicants. It provides both a high-level and an outcome-by-outcome understanding of the Competency Standards as an essential basis for this sub discipline-specific training requirements document.

The third document (document **R-11-PRO-SC**) elaborates on the elements of the training process and the requirements of the Commitment and Undertaking (C&U).

This training requirements document and the documents **R-04-T&M-GUIDE-SC**, **R-08-CS-GUIDE-SC** and **R-11-PRO-SC** are subordinate to the *Policy on Registration* (document **R-01-POL-SC**), the *Competency Standards* (document **R-02-STA-SC**) and the application process definition (document **R-03-PRO-SC**).

2. AUDIENCE

This guide is directed towards Glazing Practitioner Applicants and their supervisors and mentors in the sub discipline of Glazing Practitioner. The requirements are intended to support a programme of training for Glazing Practitioners to gain experience incorporating good practice elements.

The requirements are directed towards the members of the engineering team as listed in Table 1. The table presents the different categories for the engineering team of registered practitioners who accept full responsibility for their area of work and adhere to the ECSA Code of Conduct and the Engineering Professions Act, 46 of 2000 (EPA).

Table 1: Different categories of registered Specialists in engineering team

Category	Authority	Underpinning knowledge	Area of responsibility
Professional Engineer – EPA Section 18(1)(a)(i)	Educated, trained and experienced to carry out complex, defined engineering work.	Graduate attributes acquired in education at NQF 8 level (560 credits).	Complex interaction between professions and disciplines; justify work outside codes, standards and procedures.
Professional Certificated Engineer – EPA Section 18(1)(a)(iii)	Educated, trained and experienced to carry out broadly defined engineering work.	Graduate attributes acquired in education at NQF 7 level (420 credits) and Government Certificate of Competency.	Interaction with other professions and disciplines; authorisation required to work outside codes, standards and procedures after conducting research and investigation; legal responsibility (OHS Act).
Professional Engineering Technologist – EPA Section 18(1)(a)(ii)	Educated, trained and experienced to carry out broadly defined engineering work	Graduate attributes acquired in education at NQF 7 level (420 credits)	Interaction with other professions and disciplines; authorisation required to work outside codes, standards and procedures after conducting research and investigation.
Professional Engineering Technician – EPA Section 18(1)(a)(iv)	Educated, trained and experienced to carry out well-defined engineering work	Graduate attributes acquired in education at NQF 6 level (280 to 360 credits)	Mainly working within a single discipline; strict adherence to codes, standards and procedures; repetitive work.
Specified Category Specialist – EPA Section 18(1)(c)	Educated, trained and experienced to carry out specifically defined engineering work	Graduate attributes acquired in education at NQF 5 level (140 credits)	Working within a single discipline in a specific field; may be legally responsible for work.

Finally, this guide applies to persons who:

- have completed the education requirements by obtaining at least an accredited NQF Level 5 Higher Certificate (Engineering) type qualification or through evaluation/assessment.
- have embarked on a process of acceptable training under a registered Commitment and Undertaking (C&U) and Training Academies with a Mentor guiding the professional development process at each stage; or not completed the benchmark academic qualification (HCert or equivalent or a Completed Apprenticeship). This application will be considered through the Alternative Route. The difference must be compensated by extended periods of engineering experience.
- intend to adhere to the ECSA Code of Conduct, prohibiting the undertaking of engineering work for which the registered person is not qualified, trained or experienced.

The minimum duration of education, training and experience for various pathways towards registration is presented in Ref. **R-01-POL-SC** in Table 2 below.

Table 2: Minimum duration of education, training and experience for various pathways towards registration

Pathway	Qualification	Post-qualification total training and experience in the Specific Discipline	Post-qualification experience (part of total) with
Experience Route (Alternative Route)	No tertiary qualification	NQF 1 level: 20 years NQF 2 level: 15 years NQF 3 level: 10 years NQF 4 level: 5 years	2 years testing and inspection or commissioning
Benchmark Route	Higher Certificate in Engineering or equivalent (NQF 5) or Completed apprenticeship in an acceptable trade (up to 4 years)	NQF 5 level: 3 years	2 years inspection, testing, commissioning, handover, certification, etc.

3. PERSONS NOT REGISTERED AS A CANDIDATE OR TRAINING UNDER A C&U OR TRAINING ACADEMY

All applicants for registration must present the same evidence of competence and be assessed against the same standards and requirements, irrespective of the development path followed. Application for registration as a Specified Category Glazing Practitioner is permitted without being registered as a Candidate Specified Category or without training under a C&U or Training Academy. Mentorship and adequate supervision are, however, key factors in effective development to the level required for registration. A C&U or Training Academy indicate that the company is committed to mentorship and supervision.

If the Applicant's employer has no C&U or Training Academy, the Applicant should establish the level of mentorship and supervision that the employer is able to provide. In the absence of an internal mentor, the services of an external mentor should be secured. The recognised Voluntary Association (VA) for the sub discipline should be consulted for assistance in locating an external mentor. During training and experiential period, the Employer should commit to provide the Applicant with mentors registered with ECSA who should ensure adequate mentoring of Applicants as well as providing regular guidance to the Applicant through supervision and mentoring.

These Requirements are written for the recent graduate who is training and gaining experience towards registration. Mature applicants for registration may apply the Requirements retrospectively to identify possible gaps in their development. Mature applicants for Glazing Practitioner registration may apply the requirements retrospectively to identify possible gaps in their development.

Applicants who have not enjoyed mentorship are advised to request an experienced mentor (internal or external) to act as an application adviser while they prepare their applications for Glazing Practitioner registration.

This training requirements document 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.

4. TRAINING OBJECTIVE

To achieve ECSA Glazing Practitioner registration, a training programme designed by the employer, supervisor or mentors should achieve the following:

- Expose the applicants to Experience and Training, enabling them to apply engineering theory acquired during educational development to practical workplace situations for the prescribed period.
- Incorporate an increasing level of responsibility to enable applicants to submit evidence in the Training and Experience reports (TERs) of achieving the duration and the level detailed in Appendix B of this document (Degrees of Responsibility).
- Develop the engineering competency of applicants to cover the sub discipline-specific requirements referred to in **Section 8.8.2** of this document.

5. AREAS OF PRACTICE

Glazing Practitioners perform activities diligently, safely and cost effectively to mitigate the risks associated with glazing, which include, among others:

- using SANS **10400 N** and other existing standards to design, produce, check, interpret, evaluate and approve the glazing design inspection of building work regarding the compliance of glazing design in relation to all buildings and structures containing glazing
- design for energy requirements in eco-friendly applications
- evaluation and testing of proposed and installed glazing in systems
- manufacturing, installing, inspection, commissioning, and signing off and subsequent maintenance of glazing material.

Typical tasks that Glazing Practitioners may undertake include the following:

- **Research:** conduct research and develop specifically defined, new or improved theories and methods related to the performance of glazing materials, glazing composites and their connections to structure.
- **Procurement:** develop a specification on the performance and aesthetic requirements of glazing to include in bills of quantity as well as to advise on the merits of completing tender submissions on compliance or deficiencies to the technical specification.

- **Safety and environment:** assist in establishing control systems to ensure efficient functioning of infrastructure as well as safety and environmental protection.
- **Operations:** organise and direct the maintenance and repair of glazing materials.
- **Technical support:** analyse the behaviour of glazing materials when failure has occurred.
- **Quality control and management:** assess and analyse the stability of structures and test the behaviour and durability of materials and sub-assemblies used in construction.
- **Construction:** construction monitoring of the execution of the design elements according to the specifications and approved construction drawings.

Glazing Practitioners must document all assumptions made and determine the construction and material specifications necessary to achieve the design intent.

In addition, Glazing Practitioners:

- specify and verify suitable designs, test and verify that the tested product is matched by that installed on site
- design or develop specifically defined glazing solutions that can withstand imposed loads to the building that cause stresses and strains associated with the building loads, while performing their function as a barrier or structural element
- design or develop specifically defined glazing solutions to prevent condensation formation on glass surfaces management
- conduct assessment and establish cause of failure characterisation of glazing failure
- assess and design glazing to resist potential manual, ballistic and explosive threats
- design glazing solutions for noise reduction, where required
- determine colour shift of a particular glass for approval by an Interior Designer
- design or develop specifically defined glazing solutions for serviceability limits glass appearance properties
- design for relevant legislative requirements.

6. GLAZING MATERIALS

Glazing Practitioners are concerned with the application of glazing materials using scientific and engineering principles, rules (codes), legislative requirements and expert judgement, based on an understanding of the performance and limitations of glazing and how it affects and contributes to the building to which it is attached to meet structural, safety, security, aesthetic, longevity, water infiltration and energy performance of a building; as well as how glazing contributes to the designed experiences of the building.

Glazing is concerned with different types of material and components which include but are not limited to those in Table 3 below.

Table 3: Different types of glazing material and components

Glass	Plastics
a) ordinary clear flat glass b) patterned or obscure glass c) special glass such as fire-retardant, glare-reducing, heat-absorbing, heat-reflecting, safety glass and wired glass d) enhanced performance glass such as but not limited to laminated, toughened, coated and double glazed	a) polycarbonate b) polyethylene terephthalate (PET) c) polymethyl methacrylate (PMMA), also known as “acrylic” d) polyethylene terephthalate, glycol modified (PETG) e) poly(vinyl chloride) (PVC).

Glazing Practitioners must develop design methodologies, commencing with the functional and legislative requirements of the building to which the glazing is applied. Thereafter, Glazing Practitioners design or develop solutions to specifically defined engineering problems based on theoretical academic knowledge, supported by design codes and standards where applicable.

Glazing Practitioners:

- understand the nature and characteristics of glazing, its strengths and limitations
- understand the interaction among the glazing material, its framing and fixing methods and their interaction with the principle structural elements of the building

- understand how runoff water (rain, cleaning, leaks, etc.) will be handled and directed away to avoid damage to building components.

Glazing Practitioners are essential to integrating these glazing components into the Built Environment without compromise to the architectural intent or the creation of a productive and efficient space that does not discriminate against those less fortunate.

Glazing Practitioners should demonstrate knowledge and competence in glazing methods which include, among others:

- application of putty and sealants
- use of flexible glazing compounds
- use of preformed adhesive strip material
- use of flush glazing, which includes:
    - finished surfaces (anodic, powder-coating finishes).
    - galvanized steel, in-situ surface coatings), unfinished surfaces (stainless steel and other materials)
- surface preparation such as solvent cleaning, priming and sealing of porous surface
- application of one-way vision
- control of reflections in windows.

7. TRAINING IMPLICATIONS OF THE NATURE AND ORGANISATION OF THE INDUSTRY

7.1 Nature of training

Applicants can be trained in line with applicable codes, standards and specifications on glazing in buildings. The training should equip Applicants with the knowledge and understanding of glazing material for them to be able to demonstrate competency in line with prescribed standards for registration.

Glazing Practitioners may use any method of calculation they deem fit for purpose, provided such methods represent good engineering design practice, acceptable safety factors and deflections, and can be backed up by referring to reference material or test data.

Applicants must demonstrate the ability to select the type of glazing material and its characteristics. As part of demonstrating the application of theoretical knowledge, Applicants must incorporate calculations with clearly defined input parameters used and detailed interpretation of the results obtained. Applicants must demonstrate how the calculated results have been used to provide the solution to the problem at hand and indicate the benefit to the project or the operating work environment.

Glazing Practitioners must gain experience in solving a variety of specifically defined engineering problems in their work environment, and the solution to these problems must involve the use of fundamental engineering knowledge obtained during their education, training and experience.

The problems that require a scientific and engineering approach in their solution are often encountered in the work of Glazing Practitioners. Throughout their training years, Applicants must actively seek opportunities to gain experience in the areas of defining, investigating, analysing and developing solutions to specifically defined engineering problems. Applicants should be familiar with the competency standards for registration in the specified category (**R-02-STA-SC**).

7.2 Training process design

Glazing Practitioners must be trained to demonstrate the ability to define, investigate and analyse specifically defined engineering problems in accordance with ECSA information documents, **R-02-STA-SC, and R-04-T&M-GUIDE-SC**, typified by the following performances:

7.2.1 Meeting client requirements

- Use personal experience and knowledge and an understanding of the employer's commercial position and available glazing resources to identify potential projects or opportunities and consider their technical viability.
- Demonstrate ability to define safety glazing design and use this capability together with related expertise of other specialists to provide a holistic solution.
- Analyse and clarify information, drawings, codes and procedures.

- Demonstrate the ability to select the type of glazing material that will not deteriorate for the design life of the glazing material.
- Demonstrate the ability to interpret the engineering and architectural designs and drawings.

7.2.2 Be conversant with latest developments in the glazing field

Carry out initial professional development to remain abreast of key developments in the field of glazing, such as changes in regulations or in glazing practices and international product development and processing capabilities and be aware of key research/experimental programmes that are likely to have an influence in the field. Applicants should familiarise themselves with changes in regulations or industry practices and norms, such as changes emanating from the National Building Regulations and Building Standards Act, 103 of 1977.

7.2.3 Engage in the creative and innovative development of engineering technology

Engage in the creative and innovative development of engineering technology and continuous improvement to design specifically defined engineering solutions.

7.2.4 Develop and analyse alternative approaches

Develop and analyse alternative approaches to do the work and check impacts and sustainability of solutions.

7.3 Risk and impact mitigation

Glazing Practitioners must undertake engineering activities in a way that contributes to sustainable development and exercise sound judgement during specifically defined engineering activities within glazing to:

- promote the considerations and actions required in engineering practice to improve, sustain and restore the environment
- encourage the wise use of non-renewable resources through waste minimisation, recycling and the development of alternatives, where possible

- strive to achieve the beneficial objectives of glazing design through minimising the consumption of raw materials and energy and designing sustainable management procedures
- account for life-cycle implications with respect to how glazing designs affect the environment
- understand and secure stakeholder involvement in sustainable development
- use resources efficiently and effectively.

Glazing Practitioners must also meet the requirements for safety and security of people and property while designing or developing solutions in glazing. The following factors must be considered when selecting glazing materials:

- Human impact
- Glazing material visibility
- Burglary and vandalism
- Armed attack, etc.

7.4 Engineering project management

Glazing Practitioners must plan for effective project implementation, meet all legal and regulatory requirements and protect the health and safety of persons during their specifically defined engineering activities through:

- identifying the factors affecting project implementation
- preparing and developing project proposals and negotiating contractual arrangements with customers, suppliers and partners to secure the employer's commercial position
- analysing and organising the provision of resources required to execute the work
- recognising and addressing the reasonably foreseeable social, cultural and environmental effects of specifically defined engineering activities
- complying with international, national and local laws, regulations, by-laws and standards relating to glazing safety and emergency services to ensure end-to-end, sustainable glazing safety solutions.

Glazing Practitioners must demonstrate the ability to plan, budget, organise, direct and control tasks, people and resources by:

- setting work objectives and priorities including milestone outputs, project deadlines, quality standards and budgets
- organising project teams and exercising leadership over other engineers and technical and other personnel as appropriate
- monitoring and/or auditing tasks to ensure that work is executed as planned and determine appropriate corrective actions.

Glazing Practitioners must demonstrate the ability to lead teams and develop staff to meet changing technical and managerial needs through:

- agreeing on objectives and work plans with teams and individuals
- contributing to the identification of the training needs of teams and individuals to respond to changing technical and managerial requirements and to further their professional progression
- developing external and work experience-related training plans for teams and individuals and identifying and procuring appropriate training activities and resources.

7.5 Management of design implementation

Glazing Practitioners must demonstrate the ability to manage implementation of specifically defined design solutions and evaluate their effectiveness in accordance with ECSA documents, **R-02-STA-SC,** and **R-04-T&M-GUIDE-SC** through:

- preparing documented proposals that clearly identify and describe the glazing solutions that have been engineered to satisfy the functional objectives of the project
- ensuring that any testing or proving requirements are discussed and that any potential problem areas are highlighted, with options for modifications or adaptions identified as necessary
- taking corrective action to overcome the shortcomings or omissions that are identified with the proposals

- determining the impact on glazing design solutions of factors such as construction, installation, commissioning, life-cycle implications, glazing material replacement, technical support, training of users and shifting user needs
- in consultation with affected parties, evaluating the issues that affect them and how resolution of these issues will influence the design.

7.6 Continuing professional development

Glazing Practitioners registered by ECSA are able to contribute to further their education, development and training regarding glazing practice to ensure competency and the acceptance of work responsibility. Participating in ECSA's candidacy scheme with the associated C&U, adhering to ECSA's continuing professional development requirements and complying with the ECSA Code of Conduct will improve the service to the public and promote the standing of Glazing Practitioners.

7.7 Application of glazing material

Glazing Practitioners must ensure that any material used in the glazing of a building is of a secure and durable type and is fixed in a manner and position that ensures that it will:

- safely sustain any wind actions which can reasonably be expected
- not allow penetration of water to the interior of the building
- be apparent, in the case of clear glazing, to any person approaching such glazing.

7.8 Operations and maintenance

Glazing Practitioners must demonstrate understanding of repair and renovation of glazing which complies with the provisions of applicable standards, irrespective of the type of glazing used originally.

Glazing Practitioners must demonstrate the ability to conduct an assessment and make recommendations for repairs and maintenance.

8. DEVELOPING COMPETENCY

8.1 Contextual knowledge

Applicants are expected to be aware of the requirements of the engineering profession as well as the functions and services of recognised Voluntary Associations (VAs) applicable to Glazing Practitioners in providing a broad range of contextual knowledge prior to registration and also through the full career path of Registered Glazing Practitioners.

The practice area of Glazing Practitioners identifies specific contextual activities that are considered essential in the competence development of Glazing Practitioners.

ECSA's Panel Members, with the discipline-specific assessing team, perform a review of the portfolio of evidence of Candidate Glazing Practitioners at the completion of the training period.

8.2 Functions performed

Special considerations must be given to the competencies specified in the following groups as describedin the Degree of Responsibility Scale presented in document **R-04-T&M-GUIDE-SC**:

- Responsibility Level A: Knowledge-based problem-solving
- Responsibility Level B: Management and communication
- Responsibility Level C: Identifying and mitigating the impacts of the engineering activity
- Responsibility Level D: Judgement and responsibility
- Responsibility Level E: Independent learning.

The progression of a candidate's competency can be measured as indicated in **Appendix B**, which was developed to align the progression of Glazing Practitioners with the Degree of Responsibility Scale. It should be noted that Glazing Practitioners working at Responsibility Level E carry the responsibility for work performed that is appropriate to that of a Professionally Registered Person, except that Glazing Practitioners' supervisors are still responsible for their recommendations and decisions.

8.3 Statutory

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

- Occupation Health and Safety Act, 85 of 1993, as amended by Act 181 of 1993
- Environment Conservation Act, 73 of 1989, as amended by Act 52 of 1994 and Act 50 of 2003
- Labour Relations Act, 66 of 1995
- Building Regulations – National Building Regulations and Building Standards Act, 103 of 1977, as amended by Act, 49 of 1995
- SANS and other international standards such as ISO, EN, DIN or US Federal Standards. (Refer to Appendix C)
- National Building Regulations Act, 103 of 1977 etc.

Many other Acts that are not listed here may also be pertinent to the work environment of Glazing Practitioners. Applicants are expected to have a basic knowledge of the applicable Acts and to investigate whether or not any Acts are applicable to the particular work environment.

8.4 Recommended formal learning activities

The following list of formal learning activities is a sample of useful courses:

- Courses on specific disciplines training
- National and International technical conferences and webinars
- Elementary project management
- Negotiation skills
- Risk analysis
- Quality systems
- Occupational health and safety
- Maintenance engineering
- Environmental impacts
- Report writing and communication

- Planning methods
- Facilities management, etc.

8.5 Best practice

There is no ideal training programme structure or unique sequencing that constitutes best practice. The training programme for each Applicant depends on the work opportunities available at the time for the employer to assign to the Applicant. It is suggested that Applicants work with their mentors to select appropriate training to gain exposure to the eventual responsibility for design, installation, commissioning and/or maintenance of the glazing.

The training programme should be such that Applicants progress through the levels of work capability described in document **R-04-T&M-GUIDE-SC**, so that by the end of the training period they can perform individually and as team members, meeting the sub discipline-specific requirements (and the engineering outcomes for Alternative Route applicants) at the level required for registration and exhibiting the Degree of Responsibility E. The nature of work and the degrees of responsibility defined in document **R-04-T&M-GUIDE-SC** are indicated in **Appendix B**.

Mentors and Glazing Practitioners must identify the level of responsibility at which an activity is compliant and demonstrates the various requirements and if applicable, the outcomes. Evidence of an applicant's activities is recorded on the appropriate system such that it meets the Requirements and, if applicable, the Training Elements indicated in **Appendix A**. ECSA will specify the applicable recording system in the Application for Registration form (usually a Sub Discipline-specific Requirement Report and for Alternative Route applicants, an Engineering Report, with the associated calculations, sketches, installation schedules, maintenance schedules, commission results, etc. for each selection that is applied for).

8.6 Realities

It is generally unlikely that the period of training will be 3 years, the minimum time ECSA requires. Typically, it will be longer and will be determined by the availability of functions in the actual work situation among other concerns.

Each Applicant will effectively undertake a unique programme in which the various activities carried out at the discipline-specific level are linked to the generic competency requirements presented in document **R-08-CS-GUIDE-SC** and to the Sub Discipline-specific Training Requirements that are to be met during the Training and Experience.

8.7 Moving into candidacy programmes

This guide encourages Applicants to enter a candidacy programme after meeting training requirements and continue with it until ready to apply for registration. The guide also assumes that Applicants are supervised and mentored by persons who meet the requirements stated in document **R-04-T&M-GUIDE-SC**. In the case of a person changing from one candidacy programme to another or moving into a candidacy programme from a less structured environment, it is essential that the following steps are completed:

- Candidate Glazing Practitioners and Alternative Route Glazing Practitioner Candidates must complete the Training and Experience Summary (TES) and the 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 Glazing Practitioner's development while considering past experience and opportunities and the requirements of the new programme.
- The next phase of the candidate's programme must be planned.
- Candidate Glazing Practitioners must complete the Sub Discipline-specific Requirements Report on elements already covered during the initial part of the candidacy.

8.8 Programme structure and sequencing

8.8.1 Consideration for generalists, specialists, researchers and academics

The ECSA **R-08-CS-GUIDE-SC** documents adequately describe what is expected of persons whose formative development has not followed a conventional path, for example, academics, researchers, specialists and those who have not followed a candidate training programme.

The overriding consideration is that irrespective of the route followed, Applicants must provide evidence of competence against the Sub Discipline-specific Requirements and in the case of Alternative Route Applicants, against the Standards.

8.8.2 Discipline-specific requirements to be met

The industry has a critical need to identify people who are able to conduct the essential operations associated with the efficient and safe design, installation, commissioning, maintenance and inspection of glazing. An additional need exists to identify Competent Persons in Glazing Practitioners. This will lead to competence in this field of work and thereby add value to the industry and improve the country's economy. It will also lead to a balanced society where learners understand how the work they do fits into the greater engineering industry.

During Training and Experience period, all Applicants, assisted by mentors and supervisors, must ensure that they are conversant with the practical knowledge set out in form **APP-REG-SC-GP** (part of the *Application for Registration* form) and submit evidence as such in the form of a Sub Discipline-specific Requirements Report **APP-REG-SC-GP**.

Furthermore, **Alternative Route Candidates** must ensure they are conversant with the practical knowledge set out in form **ER-SC** (part of the *Application for Registration* form) and submit evidence of such in the form of an Engineering Report (**ER-SC**).

REVISION HISTORY

Revision number	Revision date	Revision details	Approved by
Rev. 0 Draft A	14 April 2023	Initial attempt at Glazing Practitioners	working Group
Rev. 0 Draft B	24 April 2023	Review drafts with the working group	RDDR
Rev. 0 Draft C	26 April 2023	Document submitted to Registration BU for inputs and comments	RDDR & Registration BU
Rev. 0 Draft D	03 May 2023	Webinar to solicit inputs and comments from downstream stakeholders	RDDR and working Group
Rev. 0 Draft E	8 May 2023	Review inputs received from webinar	Working Group
Rev. 0 Draft F	12 May 2023	Review and Recommendation for Approval	ERPS: EL Nxumalo
Revision 0	18 May 2023	Approval	RPSC
Revision 0	17 Aug 2023	Noting	Council

The sub discipline-specific Training Guide for:

Registration as a Glazing Practitioners in Specified Category

Revision 0 dated 18 May 2023 and consisting of 29 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

21/07/2023

Date

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Executive: RPS

25/07/2023

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Date

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

APPENDIX A: TRAINING ELEMENTS

This guide is written for Applicants who are training and gaining experience towards registration. Mature Applicants for registration and Alternative Route may also apply the guide retrospectively to identify possible gaps in their development.

Synopsis: Specified Category Practitioners should achieve specific competencies at the prescribed level during their development towards registration. The outcomes achieved and established during the training and experience phase include the following:

1. Confirming understanding of instructions received and clarify if necessary.
2. Using theoretical training to design, develop, plan or practice solutions to specifically defined engineering problems.
3. Applying theoretical knowledge to justify decisions taken and processes used.
4. Understanding one's role in the work team and planning and scheduling work accordingly.
5. Issuing complete and clear instructions and reporting comprehensively on work completed
6. Being sensitive about the impact of the engineering activity and take action to mitigate this impact.
7. Considering and adhering to the legislation that is applicable to the task and the associated risk identification and management.
8. Adhering strictly to high ethical behavioural standards and to the ECSA Code of Conduct
9. Displaying sound judgement when all evidence is not available by considering all factors and their interrelationship, consequences and evaluation.
10. Accepting responsibility for own work by using theory to support decisions, seeking advice when uncertain and evaluating shortcomings.
11. Becoming conversant with employer, supervisor or mentor training and development programme and developing own lifelong development programme within this framework.

Specifically defined activities include but are not limited to planning, investigation and problem resolution, improvement of materials, components, systems or processes, engineering operations, maintenance, project management, development and commercialisation.

In the following table, the **Responsibility Levels** are indicated as: A = Being Exposed; B = Assisting; C = Participating; D = Contributing; E= Performing.

Competency Standards for registration as a Specified Category Practitioner	Explanation and Responsibility Level
1. PURPOSE To define the competence required for registration as a Specified Category (Glazing Practitioner). Definitions of terms having particular meaning within this standard are given at the end of this appendix and in document **R-01SC**.	Discipline-specific Training Guides (DSTGs) give context to the purpose of the Competency Standards. Registered Specified Category Practitioners operate within ECSA recognised disciplines. Each discipline can be further divided into sub disciplines and finally into specific workplaces or competency areas. The DSTGs facilitate experiential development towards ECSA registration and assist in compiling the required portfolio of evidence (specifically the Engineering Report in the application form). **NOTE:** The training period must be used to develop the Applicant's competence towards achieving the standards presented below at the responsibility level indicated (mostly **Level E: Performing**). Refer to Table 4 in document **R-04-SC**.
2. DEMONSTRATION OF COMPETENCE Competence must be demonstrated within *specifically defined engineering activities* (defined below) by the integrated performance of the outcomes defined in Section 3 of this appendix at the level indicated for each outcome. Required contexts and functions are specified in the applicable sub DSTG. **Level descriptor: *Specifically defined engineering activities*** demonstrate several of the following characteristics:	Engineering activities can be approximately divided into: • 5% Complex (Professional Engineers) • 5% Broadly defined (Professional Engineering Technologists) • 10% Well-defined (Professional Engineering Technicians) • 15% Specifically defined (Registered Specified Categories) • 20% Skilled worker (Engineering Artisan) • 45% Unskilled worker (Artisan Assistants) The activities can be in-house or contracted out; evidence of integrated performance should be submitted irrespective of the situation.

• Scope of specific practice area is defined by specific applied techniques; change is by adopting new specific techniques into current practice. • Practice area is located within a wider, complex *context,* with specifically defined working relationships with other parties anddisciplines. • Work involves specific and familiar *resources,* including people, money, equipment, materials and technologies. • Activities require resolution of *interactions* manifested between specific technical factors with limited impact on wider issues. • Activities are constrained by operational context, defined workpackages, time, finance, infrastructure, resources, facilities, applicable laws, standards and codes. • Activities have risks and consequences that are locally important but are specifically defined. Activities include planning; investigation and problem resolution; improvement of materials, components, systems and processes; engineering operations; maintenance and project management; development and commercialisation.	**Level descriptor: *Specifically defined engineering activities*** in the specific discipline is characterised by several or all of the following: • *Scope* of practice area does not cover the entire field of the specific discipline (exposure limited to the relevant components of the specific sub discipline and specific workplace). Techniques applied are largely well established and change by adopting new specific techniques into current practice is the exception. • Practice area varies substantially with unlimited location possibilitiesand the additional responsibility of identifying the need for *complex, broadly defined and/or well-defined* advice is included in the specifically defined working relationships with other parties and disciplines. • The bulk of the work involves a familiar and defined range of *resources,* including people, money, equipment, materials andtechnologies. • Most of the impacts in the specific discipline are on wider issues and although occurring frequently are *specifically defined* and can be resolved by following established procedures. • The work packages and associated parameters are constrained by operational context with variations limited to different locations only. (Cannot be covered by laws, standards and codes only). • Even locally important minor risks can have far reachingconsequences. Activities include design; planning; investigation and problem resolution; improvement of materials, components, systems and processes; engineering operations; maintenance; project management; and general management. For Specified Category Practitioners, research,

	development and commercialisation occur more frequently in some disciplines and areseldom encountered in others.

3. OUTCOMES TO BE SATISFIED	Explanation and Responsibility Level
Group A: Engineering problem solving	
Outcome 1: Define, investigate and analyse specifically defined engineering problems (tasks)	**Responsibility Level D** Analysis of an engineering problem means the 'separation into parts, possibly with comment and judgement'.
Level descriptor: Specifically defined engineering problems have the following characteristics: • Can be solved mainly by specific, practical, engineering knowledge that is underpinned by related theory. And one or more of the following: • Are fully defined but require feedback. • Are discrete, specifically focused tasks within engineering systems. • Are routine, are frequently encountered and are in a familiar specified context. And one or more of the following: • Can be solved in standardised or prescribed ways. • Are encompassed by specific standards, codes and documented procedures and require authorisation to work outside limits.	• A practical problem for the Specified Category Practitioner means the encountered problem cannot be solved by artisans because theoretical calculations and engineering decisions are necessary to substantiate the proposed solution. • Further investigation to identify the nature of the problem is seldom necessary. • Discrete means individually distinct: The problem is easily recognised as part of the larger engineering task, project or operation. • The problem is recognised to be within the specific scope and has occurred in the past or the work to be done is a standard operation; it is seldom something new. • Solving the problem does not require the development of a new solution. Determine how it was solved/done before. • Encompassed means encircled: Standards, codes and documented procedures must be obtained to solve the problem, and authorisation

• Information is concrete, specific and largely complete but requires checking and possible supplementation. • Involve specific issues but few of these impose conflicting constraints and include a specific range of interested and affected parties. And one or both of the following: • Require practical judgement in specific practice areas in evaluating solutions and considering interfaces with other role players. • Have consequences that are locally important but are within a specified category (wider impacts are dealt with by others).	from the Responsible Professionals must be obtained to waive the stipulations. • The responsibility lies with the Specified Category Practitioner to check that the information received as part of the instruction is correct and is added to as necessary to ensure the correct and complete execution of the work. • The problem that is to be addressed by a Specified Category Practitioner must be limited to well known, specific matters that need standardised solutions without possible complications. • Practical solutions to problems include knowledge of the skills displayed by Practical Specialists and Engineering Artisans without sacrificing theoretical engineering principles and/or economising to satisfy the parties involved. • Specified Category Practitioners must realise that their engineering actions may appear to be of local importance only but may cause further problems for which support from Engineering Professionals may be needed to manage the consequences.

Competency indicators: A structured analysis of specifically defined problems typified by the following performances within the competency areais expected: 1.1 State how you interpreted the received work instruction, checking with your client or supervisor to ensure that your interpretation is correct. 1.2 Describe how you analysed, obtained and evaluated further clarifying information and state if the instruction was revised as a result	To perform an engineering task, a Specified Category Practitioner typically receives an instruction from a senior person (customer) and must: 1.1 ensure that the instruction is complete, clear and within his/her capabilityand that the person who issued the instruction agrees with his/her interpretation. 1.2 ensure that the instruction and information to do the work is fully understood and is complete and establish that the engineering theory needed to understand the task, to carry it out and to check calculations andthe acceptance criteria is not lacking. If needed, supplementary informationmust be gathered, studied and understood.
Range statement: The problem (task) may be part of a larger engineeringactivity or may stand alone. The design (planning) problem is amenable to solution by specific techniques that are practised regularly. This outcome is concerned with the understanding of a problem. Outcome 2 is concerned with the solution.	**Please refer to sections 7 to 8 of the applicable Sub Discipline-SpecificTraining Guide, document R-05-GP-SC.**
Outcome 2: Design or develop (plan) sustainable solutions to specifically defined engineering problems (tasks).	**Responsibility Level C** Design means a ‘drawing or outline from which something can be made’. Develop means ‘come or bring into a state in which it is active or visible’.
Competency indicators: This outcome is normally demonstrated after a problem analysis as defined in Outcome 1. Working systematically to synthesise a solution to a *specifically defined* problem typified by the following performances is expected: 2.1 Describe how you designed or developed and analysed alternative approaches to do the work Check impacts and sustainability.	The task given must be fully understood and interpreted; solutions must be developed (designed) for execution. To synthesise a solution means ‘the combination of separate parts, elements, substances, etc. into a whole or into a system’. 2.1 The development (design) of more than one way to do an engineering task or solve a problem should always be done and include the costing

Attach calculations. 2.2 State the final solution to perform the work with which the client or supervisor were in agreement.	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. The alternatives must be within the imposed legal boundaries. 2.2 Specified Category Practitioners will in some cases be unable to support proposals with a complete theoretical calculation to substantiate every aspect and must in these cases refer their alternatives to a Professional for scrutiny and support. The recommended alternative must be convincingly detailed to win customer support. The selection of alternatives may be based on tenders that are submitted with alternatives that deviate from those specified.
Range statement: The solution conforms to specific and established methods, techniques or procedures within the specifically defined competency area. Engineering should not only consider decreasing impactsbut also restoring and regenerating through design.	Applying theory to *specifically defined engineering* work is done in a way that has been used before (probably developed by Professionals in the past) and documented in written procedures, specifications, drawings, models, examples, etc. Specified Category Practitioners must seek approval and engineering verification for any deviation from these established methods.
Outcome 3: Comprehend and apply knowledge embodied in established specific engineering practices and knowledge specific to the field in which the applicant practices.	**Responsibility Level D** Comprehend means ‘to understand fully’. The jurisdiction in which a Specified Category Practitioner practises is given in **sections 5 to 8 of the applicable Discipline-Specific Training Guide (document R-05-GP-SC).**

Competency indicators: This outcome is normally demonstrated in the course of design, investigation or operations and is confined to the competency area. 3.1 State which HCert-level engineering standard procedures and systems you used to execute the work, and how HCert-level theory was applied to understand and/or verify these procedures. 3.2 Give your own HCert-level theoretical calculations and/or reasoning for why the application of this theory is considered to be correct (Include actualexamples).	Design (development) work for Specified Category Practitioners mainly involves utilising, configuring, certifying, testing, and verifying manufactured components or proven engineering/management systems and repetitive design (development) work using an existing design (development) as an example. Specified Category Practitioners apply existing codes, policies, andprocedures in their design (development) work. Investigations are concerned with specifically defined incidents, condition monitoring and operations and mainly involve controlling, maintaining and improving engineering systems and operations. 3.1 The understanding of specifically defined procedures and techniques must be based on fundamental mathematical, scientific and engineering knowledge. The specific procedures and techniques that are applied to do the work must be given and accompanied by the underpinning theory. 3.2 Calculations confirming the correct application and utilisation of equipment and/or systems listed in the Sub DSTG Guide(document **R 05-GP-SC**) must be done on practical, *specifically defined* activities. Reference must be made to the standards and the procedures used and how they were derived from HCert level theory.

Range statement: Applicable knowledge includes the following: • Technical knowledge that is applicable to the practice area, irrespective of location, and is supplemented by locally relevant knowledge, for example, established properties of local materials. • A working knowledge of interacting disciplines confined to the competency area (Codified knowledge in related areas – financial, statutory, safety, management and sustainability). • Jurisdictional knowledge that includes legal and regulatoryrequirements and prescribed codes of practice.	• The specific location of a task to be executed is the most important determining factor in the layout design and the utilisation of equipment and/or systems. A combination of educational knowledge and practical experience must be used to substantiate any decisions taken together with a comprehensive study of the laws, policies, procedures, standards, environment, manpower, materials, components and projected customer requirements and expectations. • Despite having a working knowledge of interacting disciplines, Specified Category Practitioners must appreciate the importance of working with specialists, for example, Civil Engineers on structures and roads, Mechanical Engineers onfire protection equipment, Architects on buildings and Electrical Engineers on communication equipment. The codified knowledge in the related areas means working towards and understanding the requirements set out by specialists in the areas mentioned. • Jurisdictional in this instance means ‘having the authority’, and Specified Category Practitioners must adhere to the terms and conditions associated with each task that is undertaken. The Specified Category Practitioner may even be appointed as the ‘responsible person’ for specific duties in terms of the OHS Act.

Group B: Managing engineering activities	Explanation and Responsibility Level
Outcome 4: Manage part or all of one or more *specifically defined* engineering activities	**Responsibility Level D** Manage means 'control'.
Competency indicators: The display of personal and work process management abilities within the competency area is expected: 4.1 State how you managed yourself, priorities, processes and resources inperforming the work (e.g., bar chart). 4.2 Describe your contribution and role in the work team.	In engineering operations and projects, Specified Category Practitioners are typically given the responsibility to carry out specific tasks and/or complete projects. 4.1 Resources are usually subdivided based on availability and are controlled by a work breakdown structure and scheduling to meet deadlines.Quality, safety, and environmental management are important aspects. 4.2 Depending on the task, Specified Category Practitioners can be the manager, the team leader or a team member and can supervise appointedcontractors.
Outcome 5: Communicate clearly with others in the course of his/her specifically defined engineering activities	**Responsibility Level D**
Competency indicators: Demonstration of effective communication 5.1 State how you presented your point of view and compiled reports after completion of the work. 5.2 State how you compiled and issued instructions to entities working on the same task.	5.1 Refer to the range statement for outcomes 4 and 5. Presentation of point of view mainly occurs in meetings and discussions with the immediate supervisor. 5.2 Refer to the range statement for outcomes 4 and 5.

Range statement for outcomes 4 and 5: Management and communication in *specifically defined engineering which* involves: a) planning activities b) organising activities c) leading activities d) implementing activities e) controlling activities. Communication relates to technical aspects and the wider impacts of professional work. The audience includes peers, other disciplines, clients, and stakeholders. Appropriate modes of communication must be selected. Specified Category Practitioners are expected to perform the communication functions reliably and repeatedly within the competency area.	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; to influence; to persuade'. d) Implementing means to 'put an undertaking, agreement, or promise into effect'. e) Controlling means 'regulating, restraining, keeping in order, checking'. Specified Category Practitioners participate in writing or adhere to specifications for the purchase of materials and/or work to be done, make recommendation on tenders received, place orders and variation orders, write up work instructions, report on work done, draw, correct and revise drawings, compile test reports, use operation and maintenance manuals to write up or apply work procedures, write inspection and audit reports, write commissioning reports, prepare and present motivations for new projects, compile budgets, 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, report on environmental impact and sustainability, etc.

Group C: Impacts of engineering activity	Explanation and Responsibility Level
Outcome 6: Recognise the foreseeable social, cultural, environmental and sustainabilityeffects of *specifically defined* engineering activities	**Responsibility Level D** Social means 'people living in communities; of relations between persons and communities'. Cultural means 'all the arts, beliefs, social institutions, etc. characteristic of acommunity'. Environmental means 'surroundings, circumstances, influences'. Sustainable is defined in the definitions below.
Competency indicators: This outcome is normally displayed in the course of analysis and solution of problems within the competency area: 6.1 Describe the social, cultural and environmental impacts and the long-term sustainability of the engineering activity. 6.2 State how you communicated mitigating measures to affected parties and acquired stakeholder engagement.	6.1 Engineering significantly affects 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 andinterruptions, visual and noise pollution, malfunctions, oil and other leaks, electrocution of human beings, detrimental effect on animals and wildlife, dangerous rotating and other machines, demolition of structures). 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 and compensation paid.

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 Applicant's specifically defined engineering activities	**Responsibility Level E**
Competency indicators: 7.1 List the major laws and regulations that apply to the particular activity and indicate how sustainability practices and health and safety matters were managed. 7.2 State how you obtained advice in conducting risk management for the work and elaborate on the risk management system applied.	7.1 The OHS Act is supplemented by a variety of parliamentary Acts, regulations, local authority by-laws, standards, and codes of practice. Placesof work may have standard procedures, instructions, drawings, and operation and maintenance manuals available. Depending on the situation (emergency, breakdown, etc.), these documents are consulted before work commences and during the activity. 7.2 It is advisable to attend a Risk Management (Assessment) course and to investigate and study the materials, components and systems used in the workplace. Specified Category Practitioners seek advice from knowledgeable and experienced specialists if any doubt exists that safety and sustainability cannot be guaranteed. • Usually, the safe and sustainable materials, components and systems are prescribed by Professionals or other specialists. It is Specified Category Practitioners' responsibility to use their knowledge and experience to check and interpret what is prescribed and thereafter to report anything that they are not satisfied with. • Maintenance systems and procedures from Codes of Practice and Manufacturer's Instructions must be drawn up. • Staff working on the task or project and persons affected by theengineering work being carried out must be protected.

Group D: Exercise judgement, take responsibility and act ethically	Explanation and Responsibility Level
Outcome 8: Conduct engineering activities ethically	**Responsibility Level E** Ethical means 'grounded in the science of morality, moral soundness'. Morality means 'moral habits; standards of behaviour; principles of right and wrong'. Systematic means 'methodical; based on a system'.
Competency indicators: Sensitivity to ethical issues and adoption of a systematic approach to resolving these issues is expected: 8.1 State how you identified ethical issues, the affected parties and their interests and how you managed the situation when a problem arose. 8.2 Confirm that you are conversant and compliant with the ECSA Code of Conduct and state why this is important in your work.	8.1 Ethical problems that can occur include tender fraud, payment bribery, alcohol abuse, sexual harassment, absenteeism, favouritism, defamation, fraudulent overtime claims, fraudulent expenses claimed, fraudulent qualifications and misrepresentation of facts. 8.2 The ECSA Code of Conduct, as specified on the ECSA website, is known and adhered to. Applicable examples are given.
Outcome 9: Exercise sound judgement in the course of *specifically defined* engineering activities	**Responsibility Level E** Judgement means 'good sense: ability to judge'.
Competency indicators: Exhibition of judgement is expected: 9.1 State the factors applicable to the work, their interrelationship and how you applied the most important factors. 9.2 Describe how you foresaw work consequences and evaluated situations in the absence of full evidence.	9.1 The extent of a project or task given to a junior Specified Category Practitioner is characterised by the limited number of factors and their resulting interdependence. Junior Specified Category Practitioners will seek advice if educational and/or experiential limitations are exceeded. Examples of the main engineering factors applied must be given.

	9.2 Risky decisions lead to equipment failure, excessive installation and maintenance cost, damage to persons and property, bankruptcy, poor service delivery, etc. Give examples.
Range statement for outcomes 8 and 9: Judgement is expected within the application of the candidate's category-specific methods, techniques and procedures and in the assessment of their immediate impacts. Judgement in decision-making involves: • consideration of limited risk factors, some of which may be ill-defined; or • consequences that are in the immediate work contexts; or • consideration of the identified set of interested and affected partieswith defined needs.	In engineering, about 15% of the activities can be classified as *specifically defined* and for which Specified Category Practitioners use standard procedures, codes of practice, specifications, etc. Judgement must be displayed to identify any activity falling outside the *specifically defined* range(defined above) by the following: • Advice is sought when risk factors exceed the capability of theApplicant . • Consequences outside the immediate work contexts (e.g., long-term) are not normally handled. • Interested and affected parties with defined needs outside the specifically defined parameters are considered.
Outcome 10: Be responsible for making decisions on part or all of one or more *specifically defined* engineering activities	**Responsibility Level E** Responsible means 'legally or morally liable for carrying out a duty; the care of something or somebody in a position where one may be blamed for loss, failure, etc.'
Competency indicators: Responsibility is displayed by the following performance: 10.1 Show how you used HCert-level theoretical calculations to justify decisions taken in performing engineering work. Attach actual calculations. 10.2 State how you took responsible advice on any matter falling outside your own education and experience.	10.1 Calculations, for example, fault levels, load calculations, losses, returnon investment are done to ensure that the correct material and componentsare utilised. 10.2 Specified Category Practitioners do not operate on tasks at a higher level than *specifically defined* and consult professionals if elements of

10.3 Describe how you took responsibility for your own work and evaluated any shortcoming in your output.	the tasks to be done are beyond their education and experience (e.g., power system stability, legal actions). 10.3 In the first instance, continuous self-evaluation to ascertain that the taskgiven is done correctly, on time and within budget. Continuous feedback to the originator of the task instruction and corrective action, if necessary, form important elements.
Range statement: Responsibility must be discharged for significant parts of one or more *specifically defined* engineering activities.	The responsibility is mainly allocated within a team environment, with an increasing designation as experience is gathered.
Note 1: Responsibility for the evaluation of work in a supervisory capacity	

Group E: Initial Professional Development (IPD)	**Explanation and Responsibility Level**
Outcome 11: Undertake independent learning activities sufficient to maintain and extend competence	**Responsibility Level E**
Competency indicators: Self-development managed by the following: 11.1 Provide the strategy that you will adopt independently to enhance your professional development (IPD report). 11.2 Be aware of the philosophy of the employer in regard to professional development. **Range statement:** Professional development involves: • taking ownership of own professional development • planning own professional development strategy	11.1 If possible, a specific field of the sub-discipline is chosen, available developmental alternatives are established, a programme is drawn up (inconsultation with employer if costs are involved) and options available to expand knowledge into additional fields are investigated. 11.2 Record-keeping must not be left to the employer or any other person. Applicants must manage their training independently, taking the initiative andbeing in charge of experiential development towards Specified

• selecting appropriate professional development activities • recording professional development strategy and activities whiledisplaying independent learning ability.	Category Practitioner registration level. Knowledge of the employer's policy and procedures regarding training is essential. • This is your professional development; it is not the responsibility ofthe organisation that you are working for. • In most places of work, training is seldom organised by a training department. It is the responsibility of Specified Category Practitioners to manage their own experiential development. Specified Category Practitioners frequently find themselves in situations in which no further progress is possible and are left behind doing repetitive work. If self-development is not self-driven, success is unlikely. • Preference must be given to engineering development rather than developing soft skills. • Developing a learning culture in the workplace environments of Specified Category Practitioners is vital to their success. Information is readily available, and most senior personnel in the workplace are willing to mentor if approached.

APPENDIX B: PROGRESSION THROUGHOUT THE CANDIDACY PERIOD

Degree of responsibility	Nature of work: Candidate	Responsibility of Candidate to Supervisor	Extent of Supervisor/Mentor Support
A: Being Exposed	Undergoes induction, observes processes, work of competent practitioners.	No responsibility.	Mentor explains challenges and forms of solution.
B: Assisting	Performs specific processes under close supervision.	Limited responsibility for work output.	Supervisor/Mentor coaches, offers feedback.
C: Participating	Performs specific processes as directed with limited supervision.	Full responsibility for supervised work.	Supervisor progressively reduces support but monitors outputs.
D: Contributing	Performs specific work with detailed approval of work outputs.	Full responsibility to supervisor for immediate quality of work.	Candidate articulates own reasoning and compares it with that of supervisor
E: Performing	Works in team without supervision, recommends work outputs, responsible but not responsible.	Level of responsibility to supervisor is appropriate to a registered person; supervisor is responsible for candidate's decisions.	Candidate takes on problem solving without support – at most, limited guidance.

APPENDIX C: REGULATIONS, STANDARDS AND SPECIFICATIONS

No.	Applicable Standard
1.	• ASTM C 1087, Standard test method for determining compatibility of liquid-applied sealants with accessories used in structural glazing systems. • SANS 110, *Sealing compounds for the building industry, two-component, polysulphide base*. • SANS 1077, Sealing compounds for the building and construction industry, two-component, polyurethane-base. • SANS 1305, *Sealing compounds for the building industry, one-component, silicone-rubber-base*.
2.	• ASTM E 1300a, *Standard practice for determining load resistance of glass in buildings*. • ASTM E2341 Determining the resistance of single glazed annealed architectural flat glass to thermal loadings. • BS EN 673, Glass in building – Determination of thermal transmittance (U-value) – Calculation method.BS EN 16612 – Glass in building – Determination of the lateral load resistance of glass panes by calculation • AS 1288 Glass in Buildings- Selection and Installation. • SANS 10160-1, Basis of structural design and actions for buildings and industrial structures – Part 1: Basis of structural design. • SANS 10160-2, Basis of structural design and actions for buildings and industrial structures – Part 2: Self-weight and imposed loads. • SANS 10160-3, Basis of structural design and actions for buildings and industrial structures – Part 3: Wind actions.
3.	• BS 952-1, Glass for glazing – Classification. • SANS 17, Glass and plastics in furniture. • SANS 10400-A, The application of the National Building Regulations – Part A: General principles and requirements. • SANS 10400-N, The application of the National Building Regulations – Part N: Glazing. • SANS 50572-1/EN 572-1, Glass in building – Basic soda lime silicate glass products – Part 1: Definitions and general physical and mechanical properties.
4.	• DIN 32622, Aquariums of glass – Safety requirements and testing. • SANS 1263-1, Safety and security glazing materials for buildings – Part 1: Safety performance of glazing materials under human impact. • SANS 1263-2, Safety and security glazing materials for buildings – Part 2: Burglar-resistant and vandal-resistant glazing materials. • SANS 1263-3, Safety and security glazing materials for buildings – Part 3: Bullet-resistant glazing materials. • ISO 12540:2017, Tempered soda lime silicate safety glass.

No.	Applicable Standard
	• ISO 12543 -1:2011, Glass in buildings – Laminated glass laminated safety glass- Part 1: Definitions and description of components parts. • ISO 12543 -2:2011, Glass in buildings – Laminated glass laminated safety glass – Part 2: Laminated safety glass. • ISO 12543 -3: Glass in buildings – Laminated glass laminated safety glass – Part 3: Laminated glass. • ISO 12543 -4: 2011 Glass in buildings – Laminated glass laminated safety glass- Part 4: Test methods for durability. • ISO 12543 -5:2021 Glass in buildings – Laminated glass laminated safety glass – Part 5: Dimensions and edge finishing. • ISO 12543 -6:2011 Glass in buildings – Laminated glass laminated safety glass – Part 6: Appearance. • ISO 20657:2017 Glass in buildings – Heat-soaked, tempered soda lime silicate safety glass. • ISO 11485 -1:2011 Glass in buildings – Curved glass Part 1: Terminology and definitions. • ISO 11485-2:2011 Glass in buildings – Curved glass Part 2: Quality requirements. • ISO 11485 -3:2014 Glass in buildings – Curved glass Part 3: Requirements for curved and laminated safety glass. • ISO 29584: 2015 Glass in buildings – Pendulum impact testing and classification of safety glass.
5.	• ISO 7391-2, Plastics – Polycarbonate (PC) moulding and extrusion materials – Part 2: Preparation of test specimens and determination of properties. • SANS 10177-5, Fire-testing of materials, components and elements used in buildings – Part 5: Non-combustibility at 750 °C of building materials.
6.	• ISO 48, Rubber, vulcanized or thermoplastic – Determination of hardness (hardness between 10 IRHD and 100 IRHD). • SANS 680, Glazing putty for wooden and metal window frames. • SANS 999, Anodized coatings on aluminium (for architectural applications). • SANS 1274, Coatings applied by the powder-coating process.
7.	• SANS 50572-1/EN 572-1, Glass in building – Basic soda lime silicate glass products – Part 1: Definitions and general physical and mechanical properties. • SANS 50572-2/EN 572-2, Glass in building – Basic soda lime silicate glass products – Part 2: Float glass. • SANS 50572-3/EN 572-3, Glass in building – Basic soda lime silicate glass products – Part 3: Polished wire glass. • SANS 50572-4/EN 572-4, Glass in building – Basic soda lime silicate glass products – Part 4: Drawn sheet glass.

No.	Applicable Standard
	• SANS 50572-5/EN 572-5, Glass in building – Basic soda lime silicate glass products – Part 5: Patterned glass. • SANS 50572-8:2014 (Ed. 1.00) Glass in building – Basic soda lime silicate glass products Part 8: Supplied and final cut sizes. • SANS 50572-9:2014 (Ed. 1.00) • Glass in building – Basic soda lime silicate glass products Part 9: Evaluation of conformity/Product standard
8.	• SANS 10137:2011 Edition 4, South African National Standard. • The installation of glazing in buildings.
	• SANS 613, Fenestration products – Mechanical performance criteria. Amdt 1. • SANS 727, Windows and doors made from rolled mild steel sections. • SANS 1545-1, Safety rules for the construction and installation of lifts – Part 1: Electric lifts. Amdt 1. • SANS 1545-2, Safety rules for the construction and installation of lifts – Part 2: Hydraulic lifts. Amdt 1. • SANS 1545-3, Safety rules for the construction and installation of lifts – Part 3: Lifts for persons with disabilities (stair lifting platforms). Amdt 1. • SANS 1545-4, Safety rules for the construction and installation of lifts – Part 4: Lifts for persons with disabilities (vertical lifting platforms). Amdt 1. • SANS 1545-5 Safety rules for the construction and installation of lifts – Part 5: Electric and hydraulic access, goods only lifts. Amdt 1. • SANS 1553-2, PVC-U window and door frames for external use – Part 2: Windows with frames made from PVC-U profiles. • SANS 2001-CG1, Construction works – Part CG1: Installation of glazing in window and door frames. • SANS 10400-A, The application of the National Building Regulations – Part A: General principles and requirements. • SANS 10400-B (SABS 0400-B), The application of the National Building Regulations – Part B: Structural design. • SANS 10400-T, The application of the National Building Regulations – Part T: Fire protection. Amdt 1. • SANS 10400-XA, The application of the National Building Regulations – Part X: Environmental sustainability – Part XA: Energy usage in buildings. Amdt 1. • ISO 1288-1:2016 Glass in building – Determination of the bending strength of glass – Part 1: Fundamentals of testing glass. • ISO 1288-2:2016 Glass in building – Determination of the bending strength of glass – Part 2: Coaxial double-ring test on flat specimens with large test surface areas.

No.	Applicable Standard
	• ISO 1288-3:2016 Glass in building – Determination of the bending strength of glass – Part 3: Test with specimen supported at two points (four-point bending). • ISO 1288-4:2016 Glass in building – Determination of the bending strength of glass – Part 4: Testing of channel shaped glass. • ISO 1288-5:2016 Glass in building – Determination of the bending strength of glass – Part 5: Coaxial double ring test on flat specimens with small test surface areas. • ISO/CD 1288-3 Glass in building – Determination of the bending strength of glass – Part 3: Test with specimen supported at two points (four-point bending). • ISO 9050:2003 Glass in building – Determination of light transmittance, solar direct transmittance, total solar energy transmittance, ultraviolet transmittance and related glazing factors. • ISO 10291:1994 Glass in building – Determination of steady-state U values (thermal transmittance) of multiple glazing – Guarded hot plate method. • ISO 10292:1994 Glass in building – Calculation of steady-state U values (thermal transmittance) of multiple glazing. • ISO 10293:1997 Glass in building – Determination of steady-state U values (thermal transmittance) of multiple glazing – Heat flow meter method. • ISO/NP 10293 Glass in building – Determination of steady-state U values (thermal transmittance) of multiple glazing – Heat flow meter method. • ISO 14438:2002 Glass in building – Determination of energy balance value – Calculation method. • ISO 16932:2016 Glass in building – Destructive-windstorm-resistant security glazing – Test and classification. • ISO/PRF 16932 Glass in building – Destructive-windstorm-resistant security glazing – Test and classification. • ISO 16933:2007 Glass in building – Explosion-resistant security glazing – Test and classification for arena air-blast loading. • ISO 16933:2007/COR 1:2008 Glass in building – Explosion-resistant security glazing – Test and classification for arena air-blast loading – Technical Corrigendum 1. • ISO 16934:2007 Glass in building – Explosion-resistant security glazing – Test and classification by shock-tube loading. • ISO 16934:2007/COR 1:2008 Glass in building – Explosion-resistant security glazing – Test and classification by shock-tube loading – Technical Corrigendum 1. • ISO 16935:2007 Glass in building – Bullet-resistant security glazing – Test and classification. • ISO 16935:2007/COR 1:2008 Glass in building – Bullet-resistant security glazing – Test and classification – Technical Corrigendum 1. • ISO 16936-1:2005 Glass in building – Forced-entry security glazing – Part 1: Test and classification by repetitive ball drop.

No.	Applicable Standard
	• ISO 16936-2:2005 Glass in building – Forced-entry security glazing – Part 2: Test and classification by repetitive impact of a hammer and axe at room temperature. • ISO 16936-3:2005 Glass in building – Forced-entry security glazing – Part 3: Test and classification by manual attack. • ISO 16936-4:2005 Glass in building – Forced-entry security glazing – Part 4: Test and classification by pendulum impact under thermally and fire stressed conditions. • ISO/PRF 16936-1 Glass in building – Forced-entry security glazing – Part 1: Test and classification by repetitive ball drop. • ISO 16940:2008 Glass in building – Glazing and airborne sound insulation – Measurement of the mechanical impedance of laminated glass. • ISO 22897:2003 Glass in building – Glazing and airborne sound insulation – Product descriptions and determination of properties. • ISO/WD 22897 Glass in building – Glazing and airborne sound insulation – Product descriptions and determination of properties. • ISO 28278-1:2011 Glass in building – Glass products for structural sealant glazing – Part 1: Supported and unsupported monolithic and multiple glazing. • ISO 28278-2:2010 Glass in building – Glass products for structural sealant glazing – Part 2: Assembly rules. • ISO 29584:2015 Glass in building – Pendulum impact testing and classification of safety glass.