



# ENSURING THE EXPERTISE TO GROW SOUTH AFRICA


## **Discipline-Specific Training Guide for Candidate Engineering Technicians in Mining Engineering**

**R-05-MIN-PN**

**REVISION No. 2: 25 July 2019**

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## DEFINITIONS

**Engineering science:** A body of knowledge that is based on the natural sciences and uses mathematical formulation where necessary, which 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:** Problems for which the requirements are not fully defined or may be defined erroneously by the requesting party

**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


**Management of engineering works or activities:** The co-ordinated activities that are required are as follows:

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

**Over-determined problem:** A problem for which the requirements are defined in excessive

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detail, making the required solution impossible to attain in all of its aspects

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


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

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

**Specified Category:** A category of registration for persons registered through the Engineering Profession Act or through a combination of the Engineering Profession Act and external legislation with specific engineering competencies at NQF Level 5 regarding an identified need to protect the safety, health and interest of the public and the environment in the performance of an engineering activity

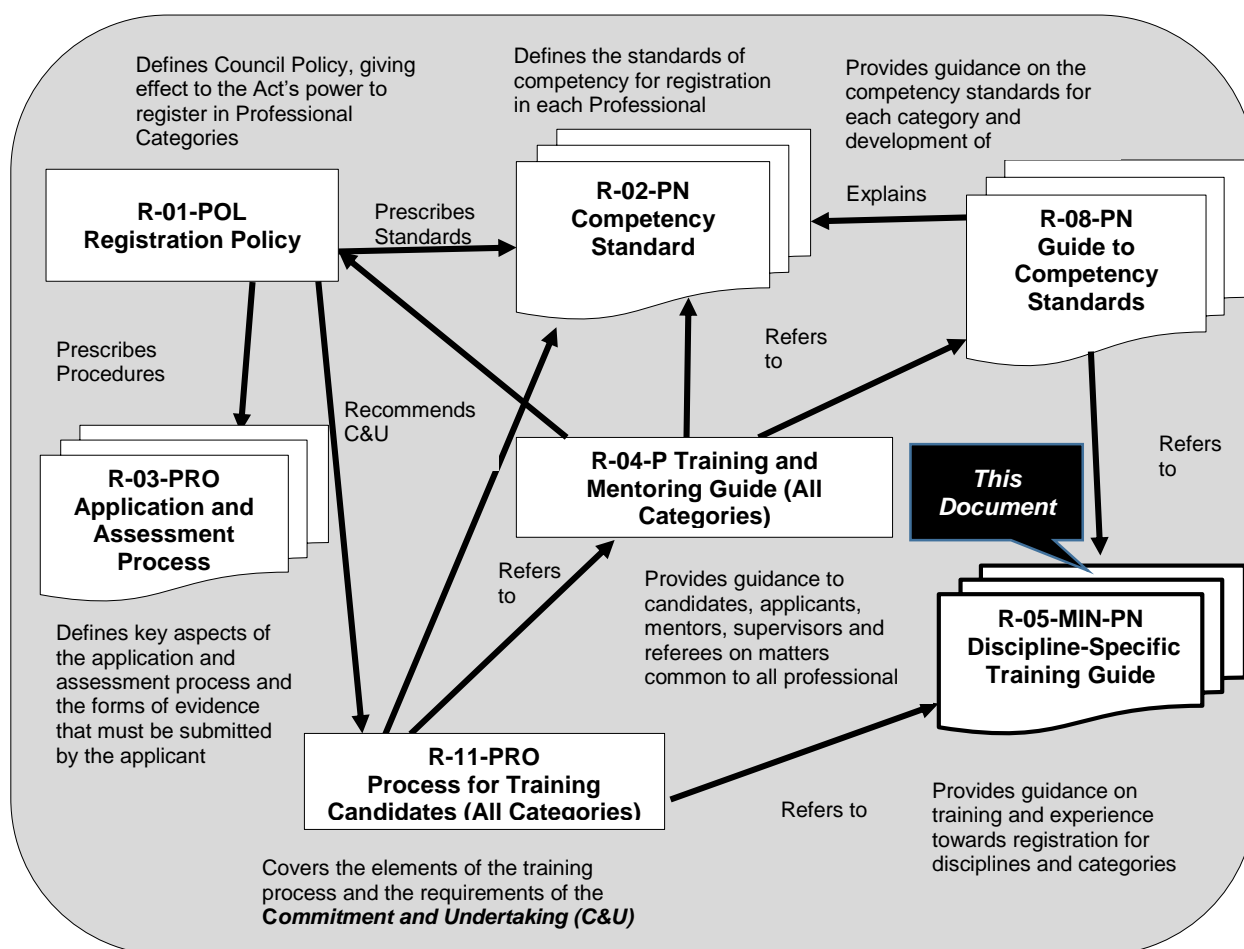
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## BACKGROUND

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



## Documents defining the ECSA Registration System


### 1. PURPOSE OF THIS DOCUMENT

All persons applying for registration as a Professional Engineering Technician are expected to demonstrate the competencies specified in document **R-02-PN** through work performed by the applicant at the prescribed level of responsibility, irrespective of the trainee's discipline.

This document supplements the generic Training and Mentoring Guide (document **R-04-P**) and the Guide to the Competency Standards for Professional Engineering Technicians

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(document **R-08-PN**).

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

- Duration of training and length of time working at level required for registration
- Principles of planning, training and experience
- Progression of training programme
- Documenting Training and Experience
- Demonstrating responsibility

The second document (document **R-08-PN**) provides both a high-level and an outcome by outcome understanding of the Competency Standards that form an essential basis for this Discipline Specific Training Guide (DSTG).

This guide and the documents **R-04-P** and **R-08-PN** are subordinate to the Policy on Registration (document **R-01-POL**), the Competency Standard (document **R-02-PN**) and the application process definition (document **R-03-PRO**).

## 2. AUDIENCE


This guide is directed towards candidates and their employers, supervisors and mentors in the discipline of Mining Engineering. It is also applicable to Engineering Technicians who study in related sub-disciplines or practice areas but whose engineering work is primarily Mining Engineering and who wish to be assessed for professional registration based on their work/experience in the Mining Engineering environment.

This guide applies to persons who have:

- completed the education requirements by obtaining an accredited Dip (Engineering), Dip (Eng Tech), Adv Cert (Engineering) type qualification or a Dublin-Accord recognised qualification or through evaluation/assessment;
- registered as a Candidate Engineering Technician; and
- embarked on a process of acceptable training under a registered Commitment and Undertaking (C&U) with a mentor guiding the professional development process at each stage.

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### 3. PERSONS NOT REGISTERED AS CANDIDATES OR NOT BEING TRAINED UNDER COMMITMENT AND UNDERTAKING

All applicants for registration must present the same evidence of competence and be assessed against the same standards, irrespective of the development path followed. Application for registration as a Professional Engineering Technician is permitted without being registered as a Candidate Engineering Technician and without training under a C&U. Mentorship and adequate supervision are, however, key factors in effective development to the level required for registration. A C&U indicates that the company is committed to mentorship and supervision and will make the necessary resources available to support the training and development of the Candidate or Engineering Technician-in-Training.

If the trainee's employer has not signed a C&U with the ECSA, the trainee 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 Voluntary Association for the discipline should be consulted for assistance in locating an external mentor. A mentor should be in place at all stages of the development process.

This guide is written for the recent graduate who is training and gaining experience towards registration. Mature applicants for registration may apply the guide retrospectively to identify possible deficiencies in their professional 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 application for registration.


The guide may be applied in the case of a person moving into a candidacy programme that is at a level below that required for registration (see Section 8.5) at a later stage.

### 4. MINING ENGINEERING (OFO 214600)

The Mining Engineering Technician (MEN) designs and prepares specifications for mineral extraction (Mining) methodology, processes and systems and the management of the operation of Mining Engineering processes for different types of mineral depositions and

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minerals.

#### 4.1 Typical tasks performed by Mining Engineering Technicians


Typical tasks that a MEN may perform include one or more of the following:

- Conduct well-defined fundamental or operational research and advise on well-defined occupational health and safety (OH&S) and environmentally responsible mineral excavation methodology, processes and systems
- Design and specify well-defined mineral excavation (production) processes; apply required mining resources and mining technical support services; observe occupational health, safety and environmental considerations and verify quality assurance
- Review and validate the geological and resource model to ensure integrity
- Review and validate the geotechnical model and inputs to ensure integrity
- Develop mining equipment fleet requirements
- Analyse drilling and blasting requirements
- Select and quantify other minor mining equipment
- Provide estimates of the mining manpower requirements
- Provide mining cost estimates – Capital expenditures (CAPEX) and operating expenses (OPEX)
- Develop an End Destination Schedule for Waste
- Establish well-defined production/operational control standards and procedures to ensure compliance with legislative and site-specific requirements
- Manage occupational health, safety and environmentally related hazards and accompanying risks
- Perform tests throughout the lifecycle stages and mineral excavation processes to determine the degree of control over variables identified during the well-defined strategic and tactical Mine Design and Planning processes
- Assist in the development of an appropriate site-specific Risk Management Policy and appropriate Procedures and Standards (Codes of Practice)
- Prepare Pre-Feasibility and Feasibility Reports and Life-of-Mine Exploitation Strategies and Plans, Business Plans and Bankable Documents based on site-specific assumptions, premises, constraints and best practice standards, for example, SAMCODES (i.e. SAMREC and SAMVAL)

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- Convert mineral resources into mineral reserves
- Administer the Education and Training of Candidate MEN Practitioners

#### 4.2 Typical practice areas for Mining Engineering Technicians

Practising MENs generally concentrate on one or more of the following practice areas:

- Mineral Excavations / Mining Operations
- Rock Engineers / Strata Control
- Occupational Environmental Engineering and Hygiene
- Mineral Asset Valuations (MAVs)
- Research and Development
- Development of a preliminary process flow control philosophy
- Undertaking of METSIM modelling and mass balance calculations
- Development of the preliminary process equipment list
- Development of a preliminary human resource plan
- Provision of process cost estimates (CAPEX and OPEX)
- Performance of Hazard and Operability Analysis (HAZOP) studies
- Participation in risk workshops
- Mine Planning and Design
- Education and Training of MEN Practitioners
- Consultancy work


##### 4.2.1 Mining Engineering Technicians conducting mineral excavations / mining operations

Mining Engineering Technicians whose training has been concerned predominantly with production (mineral excavation) processes should obtain competency/experience in the following:

- **Production:** Mineral Excavation Processes, including Occupational Health and Safety and Environmental Management
- **Production Programming and Scheduling:** To be captured in an appropriate Mining Plan
- **Project Work / Research and Development:** To be covered in a Project Report
- **Mining Technical Services:** Work Study, Survey and Mineral Evaluation, Ventilation

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Engineering and Occupational Hygiene, Rock Mechanics, Strata Control, Mineral Beneficiation, Geology, Grade Control and Administration, Integrated Environmental Management; Dewatering of open cast pit and underground (U/G) mine

- **Supervisory Experience:** Miner/Rockbreaker, Shift Supervisor, Mine Overseer or equivalent and preferably assisting a Subordinate Manager
- **Training and Development of MENs:** Assisting lecturers at tertiary institutions and aiding supervisors and mentors
- **Consultancy work:** Assisting in specialist consultancy services in one or more of the MEN practice areas

#### **4.2.2 Rock Engineers / Strata Control**

Mining Engineering Technicians whose training has been concerned with Rock Engineering / Strata Control should obtain competency/experience in the following:


- **Production:** Mineral excavation processes, including occupational health and safety and environmental management
- **Production Programming and Scheduling:** To be recorded in an appropriate mining plan
- **Basic Mining processes and procedures:** Mineral excavation processes, including OH&S, support installation and rock stability, stability of mining excavations
- **Project Work / Research and Development:** To be covered in a project report
- **Rock Mechanics Design:** Optimisation of well-defined mining layouts, computer applications in rock mechanics, selection of occupationally safe Mining Methods, addressing Hazards and Risks related to OH&S and Stability of mining excavations
- **Supervision of Rock Mechanics:** Support installation in a supervisory capacity (e.g. miner/rockbreaker, shift supervisor / mine overseer equivalent), monitoring and maintenance of support installations
- **Consultancy work:** Assisting in specialist consultancy services in one or more of the MEN practice areas

#### **4.2.3 Occupational Environmental Engineering and Hygiene**

Mining Engineering Technicians whose training has been concerned with the ventilation of mines and occupational hygiene should demonstrate that they have obtained

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competency/experience in the following:

- **Basic Mining:** Mineral excavation processes including Occupational Health and Safety and Environmental Management
- **Project Work / Research and Development:** To be covered in a project report
- **Mine Environment Design and Specification:** layouts, refrigeration, fan specifications, airflow, occupational environmental control/hygiene
- **Supervision of Ventilation:** control and monitoring of air controls, dust, fumes and gases in a section of a mine; installation of fans and air conditioners; Management of Hazardous Substances and Pollution, etc.
- **Installation:** fans, air controls, brattices, etc.
- **Training and Development of Mine Environment Practitioners:** assisting lecturers at tertiary institutions and aiding supervisors and mentors
- **Consultancy work:** Assisting in specialist consultancy services in one or more of the MEN practice areas


#### **4.2.4 Mineral Asset Valuations**

Mining Engineering Technicians whose training has been concerned with the evaluation of mineral deposits should obtain competency experience in the following:

- **Basic Mining:** Mineral excavation processes including occupational health and safety and environmental management
- **Tonnage / Grade Estimates:** sampling, regression, geostatistics, kriging, geology, sedimentology on evaluation process
- **Mine Planning and Design:** Impact of mine layouts on the evaluation process, rock mechanics, hazard identification and risk analysis (hira)
- **Survey:** Appreciation of survey techniques and interpretation of mine plans
- **Project Work / Research and Development:** To be covered in a project report
- **Economic Evaluation:** costs, revenue, pay limits, life of mine calculations, cash flow estimates, return on investment, pre-feasibility and feasibility studies, bankable documents and business planning
- **Geology:** Appreciation of geological analysis techniques and interpretation of well-defined geological models

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- **Training and Development of MAV Practitioners:** assisting lecturers at tertiary institutions and aiding supervisors and mentors
- **Consultancy work:** Assisting in specialist consultancy services in one or more of the MEN practice areas and conducting bankable studies to assess the viability of the mine.

#### **4.2.5 Research and Development**

Candidates must undertake well-defined research and developmental work that is predominantly of a Mining Engineering nature, and this work must include the application of the various aspects of Mining Engineering principles. Candidates must be involved in the improvement projects necessary for mining operational efficiencies. In addition, applicants must develop the skills required to demonstrate the advanced use of well-defined Mining Engineering knowledge in mining business optimisation through the following:

- Application of Mining Engineering principles in well-defined mine design problems
- Use of applied Operations Research in Mineral Resource Management
- Mine-to-mill or resource to market optimisation
- Decision analysis techniques


#### **4.2.6 Mine Planning and Design**

Mining Engineering Technicians whose training has been concerned with the Planning and Design of mines should develop competency and gain experience in the following:

- Well-defined mineral resource to mineral reserve conversion
- Well-defined Mineral Resource, Geology, Geotechnical Engineering and Hydrology
- Well-defined Mining Value Chain
- Well-defined mine design criteria
- Technical risk analysis in mining
- Production forecasting
- Public reporting requirements, compliance with Codes
- Well-defined planning horizons and planning cycles
- Multi criteria decision process and trade-off studies
- Planning integration
- Mining business optimisation

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- Mineral Resource Management
- Value engineering
- Geology
- Mine Design
- Mining Operations
- Product Marketing
- Environmental Impact Assessments and Management Plans
- Completion of drilling, sampling, test work, etc. that may be required as an integral part of the Feasibility Study
- Acquisition of licences and permits required for the project

#### **4.2.7 Education and Training of Mining Engineering Technicians**

Education and Training enables MENs to participate in the following:

- The education of Candidate MENs and/or specialist Candidate MENs
- The performance of Supervisors' duties as set out in document **R-04-P**
- The performance of Mentors' duties as set out in document **R-04-P**

#### **4.2.8 Consultancy work**


Consultancy work involves MENs whose education, training and/or experience qualifies them to be recognised specialists in a unique competency area and to provide specialist consultancy services in one or more of the practice areas set out in Section 4.2.1 to Section 4.2.7 of this document.

### **5. THE NATURE AND ORGANISATION OF THE INDUSTRY**

Mining Engineering Technicians may be employed in the private or the public sector. In the private sector, MENs would typically be involved in consulting or contracting or be employed in supply or manufacturing organisations. The MEN consultant is responsible for planning, designing, documenting and supervising the construction of projects on behalf of their clients. The MEN contractor is responsible for project implementation, and activities include planning and construction, and labour and resource management. Those working in supply or manufacturing companies could be involved in research and development and would be involved in production, supply and quality control. An extension of the public sector would

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include tertiary academic institutions and research organisations.

Depending on where the candidate is employed, there may be situations where the in-house opportunities are not sufficiently diverse to develop all the required competencies that are noted in groups A and B in document **R-02-PN**. For example, the opportunity for developing problem-solving competence (including design and developing solutions) and the opportunity for managing engineering activities may not both be available to the candidate. In such cases, employers are encouraged to implement a secondments system.

It is fairly common practice that where an organisation is not able to provide training in certain areas, secondments are arranged with other organisations so that the candidate is able to develop all the competencies required for registration. Such secondments are usually of a reciprocal nature so that both employers and their respective employees mutually benefit from each other. Secondments between consultants and contractors and between the public and private sectors should be possible.

Problem solving in the environments of design, operations, construction and research is the core function of the MEN. Problem solving is a logical thinking process that requires Engineering Technicians to apply their minds diligently in bringing solutions to technically well-defined problems. The process involves the analysis of systems or the assembly of mechanical components together with the integration of various elements of Mechanical Engineering through the application of basic and engineering sciences.


### **5.1 Diversity of mining**

Due to the diversity in the application of Mining Engineering within the South African (SA) Mining Industry, MENs can follow a range of routes to registration across multiple minerals/commodities (e.g. precious metals, precious stones, ferrous metals, coal) in different mining method environments (e.g. surface mining, narrow tabular U/G mining, massive U/G mining) and U/G coal mining.

These routes to registration usually cover a period of operational experience from graduation as a Candidate MEN to specialisation in an application of Mining Engineering in a particular field or sector of the SA Mining Industry. Typically, these fields are mining operations, mine

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planning and design, rock engineering / strata control, occupational environmental engineering (ventilation), refrigeration engineering, techno-economic evaluation, equipment selection, establishment and maintenance of mining infrastructure, provision of mining consulting services and Education and Training of Engineering Technicians-in-Training.

Each field should cover all the supplementary elements that are mentioned after each practice areas. The objective should be that the MEN becomes a well-rounded Engineering Technician.

## 5.2 Engineering lifecycle considerations

Mining projects follow the typical Mining Value Chain. Mining Engineering Technicians should demonstrate sufficient and appropriate exposure and experience across the elements of the typical Mining Value Chain. Specific appropriate exposure and/or experience should be demonstrated across the following five phases of the typical mining project lifecycle:

- Project data collection and investigations
- Evaluation Planning and Design
- Construction and Mine Establishment
- Mining Operations (Mineral excavation/exploitation)
- Mine Decommissioning and Closure


## 6. DEVELOPING COMPETENCY: DOCUMENT R-08-PN

Applicants are required to demonstrate the insight and the ability to use and interface various design aspects through verifiable work carried out in the provision of engineered and innovative solutions to well-defined practical problems experienced in their operating work environment. In addition, applicants must develop the skills required to demonstrate the use of MEN knowledge in optimising the efficiency of operations. Applicants must show/provide evidence of adequate training in these activities through well-defined project work carried out in the analysis of problems and the synthesis of solutions.

Applicants need to demonstrate that they have had an opportunity to apply their technical knowledge and engineering expertise gained through technical university education and practical work experience. In applying technical and scientific knowledge gained through

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academic training, the applicant must also demonstrate the financial and economic benefits of engineered solutions synthesised from scientific and engineering principles at a sufficiently advanced level.

### **What is a sufficiently well-defined engineering problem?**

The definition of well-defined in well-defined engineering problems can be summarised as follows:

*Composed of **inter-related conditions**; require **practical judgement** to create a solution within a set of **largely defined, frequently encountered circumstances***

Candidate Engineering Technicians must obtain experience in solving a variety of problems in their work environment, and the solutions to these problems should involve the use of fundamental MEN knowledge obtained at a university of technology. Problems that require a scientific and engineering approach in their solution may be encountered in any engineering work environment that consists of integrated engineering systems, equipment, machinery and mining infrastructure. From their early training years, candidates must actively seek opportunities to obtain experience in the area of synthesising solutions to real-life engineering problems encountered in the workplace.

Candidates are encouraged to familiarise themselves with the Mining and Minerals Sector in general by reading journals, joining relevant professional associations and attending conferences. This includes gaining knowledge of industry standards and specifications.

### **6.1 Contextual knowledge**

Candidates are expected to be aware of the requirements of the engineering profession. The Voluntary Associations applicable to the MEN and their functions and services to members provide a broad range of contextual knowledge through the full career path of the Engineering Professional, from the Candidate Engineering Technician to the registered Engineering Technician.


Across all routes to registration, the MEN in training should demonstrate appropriate exposure and experience in the following:

- Mineral Excavation processes

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- Mine Planning and Design
- Project execution
- Research and Development
- Supervision and Management
- Technical and Financial valuation
- Occupational Health and Safety and Environmental Impact Management; which should be done in one or more of the following sub-sectors/contexts of the SA Mining Industry:
  - U/G narrow tabular hard rock;
  - U/G massive hard rock;
  - U/G coal mining; and
  - surface mining, including open pits, open cast and quarrying operations.

## 6.2 Functions performed

Special considerations in the discipline, sub-discipline or specialty must be given to the competencies specified in the following learning outcome groupings:

- Group A: Knowledge based problem solving (this should be a strong focus)
- Group B: Management and communication
- Group C: Identifying and mitigating the impacts of the engineering activity
- Group D: Judgement and responsibility
- Group E: Independent learning


It is very useful to measure the progression of the candidate's competency by making use of the Degree of Responsibility, the Problem Solving and the Engineering Activity scales, as specified in the relevant documentation. The degrees of responsibility defined in Table 4 of document **R-04-P** are presented below and in **Appendix B**.

A: Being Exposed	B: Assisting	C: Participating	D: Contributing	E: Performing
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Degree of Responsibility E means performing at the level required for registration. This corresponds to the Range Statement in Outcome 10 in the Competency Standard (document **R-02-PN**), which requires the applicant to display responsibility 'for the outcomes of significant parts of one or more well-defined engineering activities'.

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It should be noted that the candidate working at Responsibility Level E carries the responsibility appropriate to that of a registered person except that the candidate's supervisor is accountable for the candidate's recommendations and decisions.

#### **6.4 Industry-related statutory requirements**

Candidates are expected to have a working knowledge of at least the following mining-related legislations and how they affect their working environment:

- ECSA – Engineering Profession Act, No. 46 of 2000, its Rules and the Code of Conduct
- Labour Relations Act, No. 66 of 1995
- Environment Conservation Act, No. 73 of 1989, as amended by Act No. 52 of 1994 and Act No. 50 of 2003
- Water Services Act, No. 108 of 1997
- National Water Act, No. 36 of 1998
- Mine Health and Safety Act, No. 29 of 1996; Minerals Act, No. 50 of 1991 and Regulations to the Minerals Act, 1991
- Mandatory Codes of Practice
- SANS and other relevant mining-related Standards
- Directives/Instructions issued by the Chief Inspector of Mines
- Guidelines issued by the Chief Inspector of Mines

Candidates are also expected to have in-depth knowledge of at least the following site- and mine specific and mining-related standards and requirements:


- HIRA/HAZOP; Occupational Health and Safety Risk Management Programme; Managerial Instructions
- Mine and site-specific Standards and Procedures
- List of recorded and significant Risks relating to OH&S; Working Guides
- Relevant Specifications of Original Equipment Manufacturer (OEM)

#### **6.5 Recommended formal learning activities**

Candidates may find many of the recommended formal learning activities presented below useful in developing the required competencies. The list is by no means extensive:

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- Formally registered Continuing Professional Development (CPD) courses
- Project Management (basic)
- Value Engineering
- Negotiation Skills
- Engineering Finance
- HIRA, HAZOP
- Quality Systems
- Environmental Impacts
- Project Schedule
- Writing technical papers
- Planning methodology and technique
- Presenting technical papers or lectures at organised events
- Public speaking
- Systems Engineering
- Mineral Resource, Geology, Geotechnical Engineering and Hydrology
- Ore Processing
- Process Water Supply
- Infrastructure
- Operational Readiness
- Security
- Manpower
- Project Planning
- Procurement Operations Plan / Subcontractor Operations Plan
- Permit and Licence acquisitions
- Financials
- Quality
- Inbound and Outbound Logistics
- Rehabilitation

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## 7. PROGRAMME STRUCTURE AND SEQUENCING

### 7.1 Best-practice programmes

Since professional development programmes (PDPs) should primarily be outcome-based, there is no ideal (prescribed) training programme structure or unique sequencing that constitutes best practice.

The training programme for each candidate will consequently depend on the work opportunities that are available at the time for the employer to assign to the candidate.

It is suggested that candidates work with their mentors to determine appropriate projects to gain the exposure and experience needed to comply with the desired outcomes. A regular reporting structure with suitable recording of evidence of achievement against the competency outcomes and responsibility needs to be put in place.

The training programme should be such that the candidate progresses through the levels of work capability described in document **R-04-P** so that by the end of the training period, the candidate exhibits the Degree of Responsibility E and is able to perform individually and as a team member at the level of problem solving and engineering activity required for registration.

Depending on the nature and extent of the engineering-related work undertaken by the employer, it should be possible to develop candidate-specific PDPs that will provide opportunities to gain the necessary exposure and experience described in the phased approach in **Appendix A**. This guidance should be read in conjunction with the previous sections of this document.


**Appendix B** has been developed against the Degree of Responsibility Scale. Activities should be selected to ensure that the candidate reaches the required level of competency and responsibility.

### 7.2 Orientation requirements

- Introduction to the company
- Company OH&S requirements

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- Company Code of Conduct
- Company Staff Code and Regulations
- Typical functions and activities
- Hands-on experience and orientation in each of the major company divisions
- Overall mining operations and mining-related facilities

### 7.3 Realities

Regardless of the discipline, it is generally unlikely that the period of training and development will be less than three years, which is the minimum period prescribed by the ECSA. The length of the candidate's individual PDP will be determined by the Recognition of Prior Learning (RPL) and the availability of opportunities in the actual work situation.

It should also be appreciated that the envisaged period of three years for the individual PDP will most probably only accommodate exposure to experience in one of the following sub-sectors / specialisation practice areas:

- U/G thin tabular hard rock operations; u/g massive hard rock operations;
- U/G coal mining; and
- surface mining

In the case of candidates specialising in practice areas referred to in Section 4.2.2 through to Section 4.2.8, the recommended period for the candidate-specific PDP is five years. Should the candidate require exposure to or experience in more than the initial sub sector / specialisation practice area, this would have to be addressed through a supplementary PDP.

### 7.4 Considerations for generalists, specialists, researchers and academics


Document **R-08-PN** adequately describes what is expected of persons whose formative development has not followed a conventional path, for example, academics, researchers and specialists. The overriding consideration is that irrespective of the route followed, the applicant must provide evidence of competence against the prescribed standard.

### 7.5 Moving into or changing candidacy training programmes

This guide assumes that the candidate enters a programme after graduation and continues

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with the programme until ready to submit an application for registration. It also assumes that the candidate is supervised and mentored by persons who meet the requirements stipulated in document **R-04-P**. In the case of a person changing from one candidacy programme to another or moving into a candidacy programme from a less structured environment, it is essential that the following steps are completed:

- The candidate must complete the Training and Experience Summary (TES) and the Training and Experience Reports (TERs) for the previous programme or unstructured experience. In the latter case, it is important to reconstruct the experience as accurately as possible. The TERs must be signed off.
- On entering the new programme, the mentor and supervisor should review the candidate's development while considering past experience and opportunities and the requirements of the new programme. At minimum, the mentor and supervisor should plan the next phase of the candidate's programme.

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## REVISION HISTORY

Revision Number	Revision Date	Revision Details	Approved By
Rev. 1	17 July 2014		Central Registration Committee
Rev. 2	25 July 2019	Routine Review Approval	RPSC

The Discipline-Specific Training Guide (DSTG) for  
**Candidate Engineering Technicians in Mining Engineering**

Revision 2 dated 25 July 2019 and consisting of 23 pages was reviewed for adequacy by the Business Unit Manager and is approved by the Executive: Research, Policy and Standards (RPS).



Business Unit Manager

01/20/2019

Date




Executive: RPS

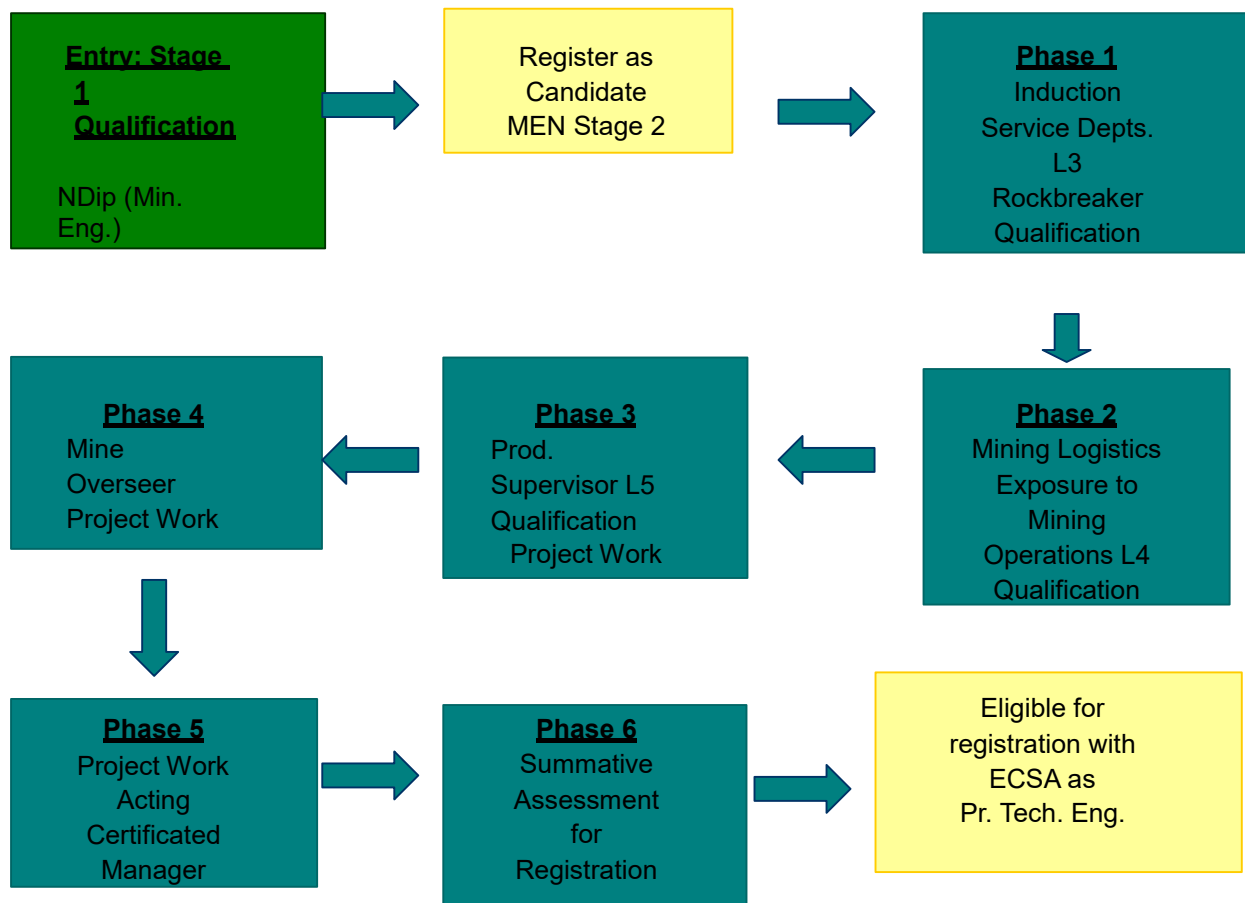
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Date

This definitive version of the policy is available on our website

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## Appendix A: Phased approach for Professional Development Programmes



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## Appendix B: Training elements

**Synopsis:** A Candidate Engineering Technician should achieve specific competencies at the prescribed level during his/her development towards professional registration, at the same time accepting more and more responsibility as experience is gained. The outcomes achieved and established during the candidacy phase should form the template to all engineering work performed after professional registration regardless of the level of responsibility at any particular stage of an engineering career:


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

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

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

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<b>Competency Standards for Registration as a Professional Engineering Technician</b>	<b>Explanation and Responsibility Level</b>
<p><b>1. Purpose</b></p> <p>This standard defines the competence required for registration as a Professional Engineering Technician. Definitions of terms having particular meaning within this standard is given in text in Appendix D.</p>	<p>Discipline-Specific Training Guides (DSTG) gives context to the purpose of the Competency Standards. Professional Engineering Technicians operate within the nine disciplines recognised by ECSA. Each discipline can be further divided into sub-disciplines and finally into specific workplaces as given in Clause 4 of the specific Discipline-Specific Training Guideline. <u>DS TG's are used to facilitate experiential development towards ECSA registration and assist in compiling the required portfolio of evidence (Specifically the Engineering Report in the application form).</u></p> <p><b>NOTE:</b> The training period must be utilised to develop the competence of the trainee towards achieving the standards below at a responsibility level E, i.e. Performing. (Refer to 7.1 of the specific DSTG)</p>
<p><b>2. Demonstration of Competence</b></p> <p>Competence must be demonstrated within <b>well-defined engineering activities</b>, defined below, by integrated performance of the outcomes defined in Section 3 at the level defined for each outcome. Required contexts and functions may be specified in the applicable Discipline-Specific Training Guide.</p> <p><b>Level Descriptor: Well-defined engineering activities (WDEA) have</b> several of the following characteristics:</p> <ol style="list-style-type: none"> <li>Scope of practice area is defined by techniques applied; change by adopting new techniques into current practice;</li> <li>Practice area is located within a wider, complex context, with well-defined working relationships with other parties and disciplines;</li> <li>Work involves familiar, defined range of resources, including people, money, equipment, materials, technologies;</li> <li>Require resolution of interactions manifested between specific technical factors with limited impact on wider issues;</li> <li>Are constrained by operational context, defined work package, time, finance, infrastructure, resources, facilities, standards and codes, applicable laws;</li> <li>Have risks and consequences that are locally important but are generally not far reaching.</li> </ol> <p><b>Activities</b> include but are not limited to: design; planning; investigation and problem resolution; improvement of materials, components, systems or processes; manufacture or construction; engineering operations; maintenance; project management; research; development and commercialisation.</p>	<p>Engineering activities can be divided into (approximately): 5% Complex (Professional Engineers) 5% Broadly Defined (Professional Engineering Technologists) 10% Well-defined (Professional Engineering Technicians) 15% Narrowly Well-defined (Registered Specified Categories) 20% Skilled Workman (Engineering Artisan) 55% Unskilled Workman (Artisan Assistants)</p> <p>The activities can be in-house or contracted out; evidence of integrated performance can be submitted irrespective of the situation.</p> <p><b>Level Descriptor: WDEA</b> in the various disciplines are characterised by several or all of:</p> <ol style="list-style-type: none"> <li>Scope of practice area does not cover the entire field of the discipline (exposure limited to the sub-discipline and specific workplace). Techniques applied are largely well established and change by adopting new techniques into current practice is the exception;</li> <li>Practice area varies substantially with unlimited location possibilities and an additional responsibility to identify the need for complex and/or broadly defined advice to be included in the well-defined working relationships with other parties and disciplines;</li> <li>The bulk of the work involves familiar, defined range of resources, including people, money, equipment, materials, technologies;</li> <li>Most of the impacts in the sub-discipline are on wider issues, and although occurring frequently, are well-defined and can be resolved by following established procedures.</li> <li>The work packages and associated parameters are constrained by operational context with variations limited to different locations only. (Cannot be covered by standards and codes).</li> <li>Even locally important minor risks can have far reaching consequences.</li> </ol> <p><b>Activities</b> include but are not limited to: design; planning; investigation and problem resolution; improvement of materials, components, systems or processes; engineering operations; maintenance; project management. For Engineering Technicians, research, development and commercialisation happen more frequently in some disciplines and are seldom encountered in others.</p>

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<b>3. Outcomes to be satisfied:</b>	<b>Explanation and Responsibility Level</b>
<b>Group A: Engineering Problem Solving.</b>	
<b>Outcome 1:</b> Define, investigate and analyse well-defined engineering problems	<b>Responsibility level E</b> Analysis of an engineering problem means the “separation into parts possibly with comment and judgement”.
<p><b>Well-defined engineering problems</b> have the following characteristics:</p> <p>(a) can be solved mainly by practical engineering knowledge, underpinned by related theory; and one or more of:</p> <p>(b) are largely defined but may require clarification; (c) are discrete, focused tasks within engineering systems; (d) are routine, frequently encountered, may be unfamiliar but in familiar context; and one or more of:</p> <p>(e) can be solved by standardised or prescribed ways; (f) are encompassed by standards, codes and documented procedures; requires authorisation to work outside limits; (g) information is concrete and largely complete, but requires checking and possible supplementation; (h) involve several issues but few of these imposing conflicting constraints and a limited range of interested and affected parties; and one or both of:</p> <p>(i) requires practical judgement in practice area in evaluating solutions, considering interfaces to other role players; (j) have consequences which are locally important but not far reaching (wider impact are dealt with by others).</p>	<p>(a) practical problems for Engineering Technicians means the problem encountered cannot be solved by artisans because theoretical calculations and engineering decisions are necessary to substantiate the solution proposed; (b) further investigation to identify the nature of the problem is seldom necessary; (c) discrete means <i>individually distinct</i>. The problem is easily recognised as part of the larger engineering task, project or operation; (d) recognised that the problem occurred in the past or the possibility exists that it might have happened before – definitely not something new; (e) solving the problem does not require the development of a new solution – find out how it was solved before; (f) encompassed means <i>encircled</i>: The standards, codes and documented procedures must be obtained to solve the problem and ; authorisation from the Engineer or Technologist in charge must be obtained to waive the stipulations; (g) the responsibility lies with the Engineering Technician to check the information received as part of the problem encountered is correct, and added to as is necessary to ensure the correct and complete execution of the work; (h) the problem handled by an Engineering Technician must be limited to well-known matters preferably needing standardised solutions without possible complications; (i) practical solutions to problems includes knowledge of the skills displayed by Practical Specialists and Engineering Artisans without sacrificing theoretical engineering principles and / or cutting corners to satisfy parties involved; (j) Engineering Technicians must realise that their actions might seem to be of local importance only, but may develop into further problems where support from Engineers and Technologists might be needed to deal with these consequences.</p>
<p><b>Assessment Criteria:</b> A structured analysis of well-defined problems typified by the following performances is expected:</p> <p>1.1 State how <u>you</u> interpreted the work instruction received, checking with your client or supervisor if your interpretation is correct 1.2 Describe how <u>you</u> analysed, obtained and evaluated further clarifying information, and if the instruction was revised as a result.</p>	<p>To perform an engineering task an Engineering Technician will typically receive an instruction from a senior person (customer) to do this task, and must:</p> <p>1.1 Make very sure that the instruction is complete, clear and within his/her capability and that the person who issued the instruction agrees with his/her interpretation. 1.2 Ensure that the instruction and information to do the work is fully understood and is complete, including the engineering theory needed to understand the task and to carry out and/or check calculations, and the acceptance criteria. If needed supplementary information must be gathered, studied and understood.</p>

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<b>Range Statement:</b> 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. This outcome is concerned with the understanding of a problem: Outcome 2 is concerned with the solution.	<b>Please refer to Clause 4 of the specific DSTG.</b>
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<b>Outcome 2:</b> Design or develop solutions to well-defined engineering problems.	<b>Responsibility level C and D</b> Design means “drawing or outline from which something can be made”. Develop means “come or bring into a state in which it is active or visible”.
<b>Assessment Criteria:</b> This outcome is normally demonstrated after a problem analysis as defined in outcome 1. Working systematically to synthesise a solution to a well-defined problem, typified by the following performances is expected: 2.1 Describe how <u>you</u> designed or developed and analysed alternative approaches to do the work. Impacts checked. Calculations attached  2.2 State what the final solution to perform the work was, client or your supervisor in agreement	After the task received is fully understood and interpreted, a solution to the problem posed can be developed (designed). To synthesise a solution means “the combination of separate parts, elements, substances, etc. into a whole or into a system” by:  2.1 The development (design) of more than one way to solve an engineering task or problem should always be done, including the costing and impact assessment for each alternative. All the alternatives must meet the requirements set out by the instruction received, and <u>the theoretical calculations to support each alternative must be done and submitted as an attachment.</u>  2.2 The Engineering Technician will in some cases not be able to support proposals with the complete theoretical calculation to substantiate every aspect, and must in these cases refer his / her alternatives to an Engineer or Technologist for scrutiny and support. The alternatives and alternative recommended must be convincingly detailed to win customer support for the alternative recommended. Selection of alternatives might be based on tenders submitted with alternatives submitted deviating from those specified.
<b>Range Statement:</b> The solution is amenable to established methods, techniques or procedures within the candidate’s practice area.	Applying theory to <i>well-defined engineering</i> work is done in a way that has been used before, probably developed by Engineers or Technologists in the past, and documented in written procedures, specifications, drawings, models, examples, etc. Engineering Technicians must seek approval for any deviation from these established methods.
<b>Outcome 3:</b> Comprehend and apply knowledge embodied in established engineering practices and knowledge specific to the jurisdiction in which he/she practices.	<b>Responsibility level E</b> Comprehend means “to understand fully”. The jurisdiction in which an Engineering Technician practices is given in <b>Clause 4 of the specific DSTG.</b>
<b>Assessment Criteria:</b> This outcome is normally demonstrated in the course of design, investigation or operations.  3.1 State what NDip level <u>engineering standard procedures and systems you</u> used to execute the work, and how NDip level theory was applied to understand and/or verify these procedures; 3.2 Give <u>your own</u> NDip level theoretical calculations and/or reasoning on why the application of this theory is considered to be correct (Actual examples).	Design work for Engineering Technicians is mostly to utilise and configure manufactured components and repetitive design work using an existing design as an example. Engineering Technicians apply existing codes and procedures in their design work. Investigation would be on well-defined incidents and condition monitoring and operations mostly on controlling, maintaining and improving engineering systems and operations.  3.1 The understanding of well-defined procedures and techniques must be based on fundamental mathematical, scientific and engineering knowledge. Specific procedures and techniques applied to do the work accompanied by the underpinning theory must be given. 3.2 Calculations confirming the correct application and utilisation of equipment listed in Clause 4 of the specific DSTG must be done on practical <i>well-defined</i> activities. Reference must be made to standards and procedures used and how it was derived from NDip theory.

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<p><b>Range Statement:</b> Applicable knowledge includes:</p> <p>(a) Technical knowledge that is applicable to the practice area irrespective of location, supplemented by locally relevant knowledge, for example established properties of local materials.</p> <p>(b) A working knowledge of interacting disciplines. Codified knowledge in related areas: financial, statutory, safety, management.</p> <p>(c) Jurisdictional knowledge includes legal and regulatory requirements as well as prescribed codes of practice.</p>	<p>(a) The specific location of a task to be executed is the most important determining factor in the layout design and utilisation of equipment. A combination of educational knowledge and practical experience must be used to substantiate decisions taken including a comprehensive study of materials, components and projected customer requirements and expectations.</p> <p>(b) In spite of having a working knowledge of interacting disciplines, Engineering Technicians must appreciate the importance of working with specialists like Civil Engineers on structures and roads, Mechanical Engineers on fire protection equipment, Architects on buildings, Electrical Engineers on communication equipment, etc. The codified knowledge in the related areas means working to and understanding the requirements set out by specialists in the areas mentioned.</p> <p>(c) Jurisdictional in this instance means "having the authority", and Engineering Technicians must adhere to the terms and conditions associated with each task undertaken. They may even be appointed as the "responsible person" for specific duties in terms of the OHS Act.</p>
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<b>Group B: Managing Engineering Activities</b>	<b>Explanation and Responsibility Level</b>
<b>Outcome 4:</b> Manage part or all of one or more <i>well-defined</i> engineering activities.	<b>Responsibility level D</b> Manage means “control”.
<b>Assessment Criteria:</b> The display of personal and work process management abilities is expected: 4.1 State how <u>you</u> managed yourself, priorities, processes and resources in doing the work (e.g. bar chart); 4.2 Describe <u>your</u> role and contribution in the work team.	In engineering operations and projects Engineering Technicians will typically be given the responsibility to carry out specific tasks and/or complete projects. 4.1 Resources are usually subdivided based on availability and controlled by a work breakdown structure and scheduling to meet deadlines. Quality, safety and environment management are important aspects. 4.2 Depending on the task, Engineering Technicians can be the team leader, a team member, or can supervise appointed contractors.
<b>Outcome 5:</b> Communicate clearly with others in the course of his or her well-defined engineering activities	<b>Responsibility level C</b>
<b>Assessment Criteria:</b> Demonstrates effective communication by: 5.1 State how <u>you</u> presented your point of view and compiled reports after completion of the work. 5.2 State how <u>you</u> compiled and issued instructions to entities working on the same task	5.1 Refer to Range State for Outcome 4 and 5 below. Presentation of point of view mostly occurs in meetings and discussions with immediate supervisor. 5.2 Refer to Range State for Outcome 4 and 5 below.
<b>Range Statement for Outcomes 4 and 5:</b> Management and communication in <i>well-defined engineering</i> involves: (a) Planning <i>well-defined</i> activities; (b) Organising <i>well-defined</i> activities; (c) Leading <i>well-defined</i> activities and (d) Controlling <i>well-defined</i> activities. Communication relates to technical aspects and wider impacts of professional work. Audience includes peers, other disciplines, client and stakeholder’s audiences. Appropriate modes of communication must be selected. The Engineering Technician is expected to perform the communication functions reliably and repeatedly	(a) Planning means “the arrangement for doing or using something, considered in advance”. (b) Organising means “put into working order; arrange in a system; make preparations for”. (c) Leading means to “guide the actions and opinions of; influence; persuade”. (d) Controlling means the “means of regulating, restraining, keeping in order; check”. Engineering Technicians write or participate in writing specifications for the purchase of materials and/or work to be done, make recommendations on tenders received, place orders and variation orders, write work instructions, report back on work done, draw, correct and revise drawings, compile test reports, use operation and maintenance manuals to write work procedures, write inspection and audit reports, write commissioning reports, prepare and present motivations for new projects, compile budget reports, report on studies done and calculations carried out, report on customer requirements, report on safety incidents and risk analysis, report on equipment failure, report on proposed system improvement and new techniques, report back on cost control, etc.
<b>Group C: Impacts of Engineering Activity</b>	<b>Explanation and Responsibility Level</b>
<b>Outcome 6:</b> Recognise the foreseeable social, cultural and environmental effects of <i>well-defined</i> engineering activities generally	<b>Responsibility level B</b> Social means “people living in communities; of relations between persons and communities”. Cultural means “all the arts, beliefs, social institutions, etc. characteristic of a community”. Environmental means “surroundings, circumstances, influences”.

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<p><b>Assessment Criteria:</b> This outcome is normally displayed in the course of analysis and solution of problems, by typically:</p> <p>6.1 Describe the social, cultural and environmental impact of this engineering activity;</p> <p>6.2 State how <u>you</u> communicated mitigating measures to affected parties and acquired stakeholder engagement.</p>	<p>6.1 Engineering impacts heavily on the environment e.g. servitudes, expropriation of land, excavation of trenches with associated inconvenience, borrow pits, dust and obstruction, street and other crossings, power dips and interruptions, visual and noise pollution, malfunctions, oil and other leaks, electrocution of human beings, detrimental effect on animals and wild life, dangerous rotating and other machines, demolishing of structures, etc.</p> <p>6.2 Mitigating measures taken may include environmental impact studies, environmental impact management, community involvement and communication, barricading and warning signs, temporary crossings, alternative supplies (ring feeders and bypass roads), press releases, compensation paid, etc.</p>
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<b>Outcome 7:</b> Meet all legal and regulatory requirements and protect the health and safety of persons in the course of his or her well-defined engineering activities.	<b>Responsibility level E</b>
<b>Assessment Criteria:</b> 7.1 List the major laws and regulations applicable to this particular activity and how health and safety matters were handled;  7.2 State how <u>you</u> obtained advice in doing 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. Places of work might have standard procedures, instructions, drawings and operation and maintenance manuals available. These documents, depending on the situation (emergency, breakdown, etc.) are consulted before work is commenced and during the activity;  7.2 It is advisable to attend a Risk Management (Assessment) course, and to investigate and study the materials, components and systems used in the workplace. The Engineering Technician seeks advice from knowledgeable and experienced specialists if the slightest doubt exist that safety and sustainability cannot be guaranteed.
<b>Range Statement for Outcomes 6 and 7:</b> Impacts and regulatory requirements include: (a) Impacts to be considered are generally those identified within the established methods, techniques or procedures used in the practice area; (b) Regulatory requirements are prescribed;  (c) Apply prescribed risk management strategies;  (d) Effects to be considered and methods used are defined;  (e) Prescribed safe and sustainable materials, components and systems.  (f) Persons whose health and safety are to be protected are both inside and outside the workplace.	(a) The impacts will vary substantially with the location of the task, e.g. the impact of laying a cable or pipe in the main street of town will be entirely different to construction in a rural area. The methods, techniques or procedures will differ accordingly, and is identified and studied by the Engineering Technician before starting the work. (b) The Safety Officer and/or the Responsible Person appointed in accordance with the OHS Act usually confirm or check that the instructions are in line with regulations. The Engineering Technician is responsible to see to it that this is done, and if not, establishes which regulations apply, and ensure that they are adhered to. Usually the people working on site are strictly controlled w.r.t. health and safety, but the Engineering Technician checks that this is done. Tasks and projects are mostly carried out where contact with the public cannot be avoided, and safety measures like barricading and warning signs must be used and maintained. (c) Risks are mostly associated with elevated structures, subsidence of soil, electrocution of human beings and moving parts on machinery. Risk management strategies are usually done by more senior staff, but are understood and applied by the Engineering Technician. (d) Effects associated with risk management are mostly well known if not obvious, and methods used to address, clearly defined. (e) Usually the safe and sustainable materials, components and systems are prescribed by Engineers, Technologists or other professional specialists. It is the responsibility of the Engineering Technician to use his/her knowledge and experience to check and interpret what is prescribed and report anything that he/she is not satisfied with. (f) Staff working on the task or project as well as persons affected by the engineering work being carried out.

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<b>Group D: Exercise judgement, take responsibility, and act ethically</b>	<b>Explanation and Responsibility Level</b>
<b>Outcome 8:</b> Conduct engineering activities ethically.	<b>Responsibility level E</b> Ethically means "science of morals; moral soundness". Moral means "moral habits; standards of behaviour; principles of right and wrong".
<b>Assessment Criteria:</b> Sensitivity to ethical issues and the adoption of a systematic approach to resolving these issues is expected, typified by: 8.1 State how <u>you</u> identified ethical issues and affected parties and their interest and what you did about it when a problem arose.  8.2 Confirm that <u>you</u> are con-versant and in compliance with ECSA's Code of Conduct and why this is important in your work.	Systematic means "methodical; based on a system".  8.1 Ethical problems that can occur include tender fraud, payment bribery, alcohol abuse, sexual harassment, absenteeism, favouritism, defamation, fraudulent overtime claims, fraudulent expenses claimed, fraudulent qualifications, misrepresentation of facts, etc. 8.2 ECSA's Code of Conduct, as per ECSA's website, is known and adhered to. Applicable examples given.
<b>Outcome 9:</b> Exercise sound judgement in the course of <i>well-defined</i> engineering activities	<b>Responsibility level E</b> Judgement means "good sense: ability to judge".
<b>Assessment Criteria:</b> Judgement is displayed by the following performance: 9.1 State the factors applicable to the work, their interrelationship and how <u>you</u> applied the most important factors.;  9.2 Describe how <u>you</u> 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 Engineering Technician is characterised by the limited number of factors and their resulting interdependence. He/she will seek advice if educational and/or experiential limitations are exceeded. Examples of the main engineering factors applied must be given. 9.2 Taking risky decisions will lead to equipment failure, excessive installation and maintenance cost, damage to persons and property, etc. Give examples.
<b>Range Statement for Outcomes 8 and 9:</b> Judgement in decision making involves:  (a) taking limited risk factors into account some of which may be ill-defined; <b>or</b> (b) consequences are in the immediate work contexts; <b>or</b> (c) identified set of interested and affected parties with defined needs to be taken into account.	In engineering about 10% of the activities can be classified as <i>well-defined</i> where the Engineering Technician uses standard procedures, codes of practice, specifications, etc. Judgement must be displayed to identify any activity falling outside the <i>well-defined</i> range, as defined above by: (a) Seeking advice when risk factors exceed his/her capability.  (b) Consequences outside the immediate work contexts, e.g. long-term, not normally handled. (c) Interested and affected parties with defined needs outside the <i>well-defined</i> parameters to be taken into account.

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<b>Outcome 10:</b> Be responsible for making decisions on part or all of all of one or more <i>well-defined</i> engineering activities	<b>Responsibility level E</b> Responsible means "legally or morally liable for carrying out a duty; for the care of something or somebody in a position where one may be blamed for loss, failure, etc."
<b>Assessment Criteria:</b> Responsibility is displayed by the following performance: 10.1 Show how <u>you</u> used NDip theoretical calculations to justify decisions taken in doing engineering work. Attach actual calculations; 10.2 State how <u>you</u> took responsible advice on any matter falling outside your own education and experience; 10.3 Describe how <u>you</u> took responsibility for your own work and evaluated any shortcoming in <u>your</u> output	10.1 The calculations, for example fault levels, load calculations, losses, etc. are done to ensure that the correct material and components are utilised. 10.2 The Engineering Technician does not operate on tasks at a higher level than <i>well-defined</i> and consult professionals at engineer and/or technologist level if elements of the tasks to be done are beyond his/her education and experience, e.g. power system stability. 10.3 This is in the first instance continuous self-evaluation to ascertain that the task given is done correctly, on time and within budget. Continuous feedback to the originator of the task instruction, and corrective action if necessary, forms an important element.
<b>Range Statement:</b> Responsibility must be discharged for significant parts of a one or more <i>well-defined</i> engineering activity.	The responsibility is mostly allocated within a team environment with an increasing designation as experience is gathered.
<b>Note 1:</b> Demonstrating responsibility would be under supervision of a competent engineering practitioner but is expected to perform as if he/she is in a responsible position.	

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<b>Group E: Initial Professional Development (IPD)</b>	<b>Explanation and Responsibility Level</b>
<b>Outcome 11:</b> Undertake independent learning activities sufficient to maintain and extend his or her competence	<b>Responsibility level D</b>
<b>Assessment Criteria:</b> Self-development managed by typically:	
11.1 Provide <u>your</u> strategy adopted independently to enhance professional development. (IPD report);  11.2 Be aware of the philosophy of employer in regard to professional development.	11.1 If possible, a specific field of the sub-discipline is chosen, available developmental alternatives established, a programme drawn up (in consultation with employer if costs are involved), and options open to expand knowledge into additional fields investigated.  11.2 Record keeping must not be left to the employer or anybody else. The trainee must manage his/her own training independently, taking initiative and be in charge of experiential development towards Professional Engineering Technician level. Knowledge of the employer's policy and procedures on training is essential.
<b>Range Statement:</b> Professional development involves: (a) Taking ownership of own professional development; (b) Planning own professional development strategy;  (c) Selecting appropriate professional development activities; and (d) Recording professional development strategy and activities; while displaying independent learning ability.	(a) This is <u>your</u> professional development, not the organisation you are working for. (b) In most places of work training is seldom organised by some training department. It is up to the Engineering Technician to manage his/her own experiential development. Engineering Technicians frequently end up in a 'dead-end street' being left behind doing repetitive work. If self-development is not driven by him/herself, success is unlikely. (c) Preference must be given to <u>engineering</u> development rather than developing soft skills. (d) Developing a learning culture in the workplace environment of the Engineering Technician is vital to his / her success. Information is readily available, and most senior personnel in the workplace are willing to mentor, if approached.

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