




# ENSURING THE EXPERTISE TO GROW SOUTH AFRICA

**Mechanical Engineering**

**Code of Practice**




<b>Document No.:</b>	<b>Revision No.:</b>	<b>Effective Date:</b>	
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## DEFINITIONS

**Act** means the Engineering Profession Act, 46 of 2000 “as revised”.

**Code of Conduct** means the Code of Conduct for Registered Persons: Engineering Profession Act, 46 of 2000.

**Competency** means a combination of knowledge, training, experience and applicable qualifications that enables an individual to perform a task or an activity successfully.

**Council** means the Engineering Council of South Africa established by Section 2 of the Act.

**Discipline** means the disciplines of engineering as recognised by the Engineering Council of South Africa.

**Engineering Work** means the process of applying engineering and scientific principles, concepts, contextual and engineering knowledge to the research, planning, design, implementation, maintenance and management of work in the natural and built environments. It includes advisory services, assessment of engineering designs and determination of the risks posed by the design on workers, the public, and environment.


**Identification of Engineering Work** means the Identification of Engineering Work as gazetted.

**Overarching Code of Practice** means the Overarching Code of Practice for the Performance of Engineering Work as gazetted

**Practice** means any engineering professional service, advisory service or creative work requiring engineering education, training and experience and the application of special knowledge of the mathematical, physical and engineering sciences, or creative work such as consultation, research, investigation, evaluation, planning, surveying, risk assessment and design, in connection with any public or private utility, structure, building, machine, equipment, process, work or project.

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**Profession** means Engineering Profession.

**Registration Category** means a professional registration category as specified under Section 18(1) (a)–(c) of the Act, including Professional Engineer, Professional Engineering Technologist, Professional Certificated Engineer, Professional Engineering Technician, Candidate and Specified Category Practitioner.

**Registered Person** means a person registered under a category referred to in Section 18 of the Act.


**Specified Category** means those registration categories classified as such by ECSA, for example those related to fire protection systems, lifting machinery and medical equipment.

**Specified Category Practitioner** means a person registered in terms of section 18(1)(c) of the Engineering Profession Act, carrying out specifically defined engineering activities.

**Unregistered Person** means any person undertaking engineering work who is not registered in terms of the Act. This does not include persons registered by other statutory bodies and are part of teams undertaking engineering work.

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## ABBREVIATIONS

API	American Petroleum Institute
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
BSI	British Standards Institution
CAD	Computer-aided design
CAM	Computer-aided manufacturing
CFD	Computational fluid dynamics
CoP	Code of Practice
ECSA	Engineering Council of South Africa
FEA	Finite element analysis
IFE	The Institution of Fire Engineers
ISO	International Standard Organization
SANS	South African National Standards
SAE	Society of Automotive Engineers

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## 1 INTRODUCTION

In terms of Section 27(1) of the Act, the Council must draw up a Code of Conduct for Registered Persons and may draw up a Code of Practice in consultation with the Council for the Built Environment, Voluntary Associations and registered persons. The Council is also responsible for administering the Code of Conduct and the Code of Practice and ensuring that these codes are available to all members of the public at all reasonable times. An "Overarching Code of Practice for the Performance of Engineering Work" was therefore developed and published in the Government Gazette dated 26 March 2021, which further in this document is referred to as the "Overarching Code of Practice", for brevity. The Overarching Code of Practice applies to all engineering disciplines.

Respective disciplines and sub-disciplines may develop their own codes of practice to complement this code, of which this Mechanical Engineering Code of Practice is an example. The Mechanical Engineering Code of Practice is specifically aimed at mechanical engineering and should be read in conjunction with the Overall Code of Practice and is not intended to duplicate the requirements thereof.

## 2 POLICY STATEMENT

This Code is a statement of good practice for the performance of mechanical engineering work by Registered. It is applicable to the entire mechanical engineering profession. Section 27(3) of the Act requires Registered Persons to adhere to the requirements of this Code when they perform mechanical work.


## 3 PURPOSE AND SCOPE OF DOCUMENT

The purpose of this Code is to ensure that any person undertaking mechanical engineering work meets the prescribed requirements when practicing and executing mechanical engineering work within the jurisdiction of the Act. This Code sets appropriate levels of competence, regulating the execution of mechanical engineering work and specifying technical standards and best practices.

This Code also applies when a mechanical engineering practitioner performs mechanical engineering work in the specified categories, such as those related to fire protection systems, lifting machinery and medical equipment. Additional codes of practice, specific to the specified

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category, may also apply in these contexts.

#### 4 APPLICABLE LEGISLATIVE FRAMEWORK

Section 27 of the Act empowers the Council to draw up Codes of Practice in addition to codes of conduct and requires all registered persons to comply with such codes.

This Code should be read in conjunction with the Act and related documents, in particular the Code of Conduct for Registered Persons, the Overarching Code of Practice, and the gazetted Identification of Engineering Work.

#### 5 MECHANICAL ENGINEERING WORK

Mechanical engineering is an engineering branch that combines engineering physics and mathematics principles with materials science to design, analyse, manufacture, install, test and maintain mechanical systems and the mechanical elements of multi-disciplinary systems. Mechanical engineering work requires an understanding of core areas that typically include solid body statics and dynamics, materials science, solid mechanics, thermodynamics, fluid dynamics, thermal energy transfer, design methodologies and electrics. In addition, mechanical engineers use tools such as computer-aided design (CAD), computer-aided manufacturing (CAM), finite element analysis (FEA), computational fluid dynamics (CFD), and product lifecycle management. The aforementioned are applied to manufacturing and production plants, process plants, consumer products, industrial equipment and machinery, heating and cooling systems, transport systems, medical devices, military systems, fire protection and others.

The table below represents mechanical engineering work, category of registration and level of descriptors for engineering activities or problems.

As per **R-02-STA-PE/PT/PCE/PN**, the level of descriptors in this Code pertains to the following:


- The level of an engineering problem
- The level of an engineering activity

Moreover, there are three level descriptors for engineering activities and problems to consider

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within each category of registration, namely: Complex engineering activities/problems, broadly defined engineering problems and well-defined engineering problems

Table 1: Mechanical Engineering Work

Area/Field	Methods/Techniques	Category of registration	Level descriptor
Engineering design	Collecting and analysing data from tests on prototype, modifying design( improve existing components and systems), Computer aided design and simulation, Finite Element Analysis(FEA). Design codes and standards. Design process. Approval of design drawings	Pr.Eng	Solving complex engineering problems and performing complex engineering activities.
		Pr.Tech Eng	Solving broadly defined engineering problems and performing broadly defined engineering activities
		Pr.Cert Eng	Solving broadly defined engineering problems and performing broadly defined engineering activities
		Pr.Techni. Eng	Solving well-defined engineering problems and performing well – defined engineering activities
		Candidates	Solving engineering problems and engineering activities under supervision
Reverse Engineering of mechanical components	Visual inspection, Dimensional examination, Data collection, Procurement analysis, Material analysis, Destructive and Non-destructive testing, draughting, FEA, Economic	Pr Eng	Solving complex engineering problems and performing complex engineering activities
		Pr Tech Eng	Solving broadly defined engineering problems and performing broadly defined

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	and Technical risk assessment, components classification, Manufacturing process. Quality Assurance and Control. Manufacturing analysis		engineering activities
		Pr Cert Eng	Solving broadly defined engineering problems and performing broadly defined engineering activities
		Pr Techni Eng	Solving well-defined engineering problems and performing well – defined engineering activities
		Candidates	Solving engineering problems and engineering activities under supervision
Project Engineering/Management	Development of Scope of work, Project Planning, knowledge of Project management tools and Software, determine project requirements, Handing of completed project (project closure requirements). Manage scope changing, project quality, project costs, project risk management. Create and manage plan	Pr Eng	Solving complex engineering problems and performing complex engineering activities
		Pr Tech Eng	Solving broadly defined engineering problems and performing broadly defined engineering activities
		Pr Cert Eng	Solving broadly defined engineering problems and performing broadly defined engineering activities
		Pr Techni Eng	Solving well-defined engineering problems and performing well – defined engineering activities
		Candidates	Solving engineering problems and engineering activities under supervision

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Maintenance Engineering	Establish maintenance philosophy for mechanical systems. Develop scope of work for repairs and refurbishment of components, Inspect and trouble-shooting equipment malfunctioning, develop maintenance budget, classify components and systems, manage budget	Pr Eng	Solving complex engineering problems and performing complex engineering activities
		Pr Tech Eng	Solving broadly defined engineering problems and performing broadly defined engineering activities
		Pr Cert Eng	Solving broadly defined engineering problems and performing broadly defined engineering activities
		Pr Techni Eng	Solving well-defined engineering problems and performing well – defined engineering activities
		Candidates	Solving engineering problems and engineering activities under supervision
Reliability Engineering	Failure Mode and Effect Analysis (FMEA), Data analysis : Reliability modeling and prediction, Six Sigma, statistical process control, risk management, reduce high cost maintenance	Pr Eng	Solving complex engineering problems and performing complex engineering activities
		Pr Tech Eng	Solving broadly defined engineering problems and performing broadly defined engineering activities
		Pr Cert Eng	Solving broadly defined engineering problems and performing broadly defined engineering activities

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		Pr Techni Eng	Solving well-defined engineering problems and performing well – defined engineering activities
		Candidates	Solving engineering problems and engineering activities under supervision
Manufacturing	Read and interpret manufacturing drawings, develop and approve process quality plans. Quality control, Manufacturing analysis and process, Computer-Aided Manufacturing ( CAM)	Pr Eng	Solving complex engineering problems and performing complex engineering activities
		Pr Tech Eng	Solving broadly defined engineering problems and performing broadly defined engineering activities
		Pr Cert Eng	Solving broadly defined engineering problems and performing broadly defined engineering activities
		Pr Techni Eng	Solving well-defined engineering problems and performing well – defined engineering activities
		Candidates	Solving engineering problems and engineering activities under supervision
Quality Engineering	Develop inspection methods and analyse product quality, Develop process quality plan, check sheets. Quality assurance and control.	Pr Eng	Solving complex engineering problems and performing complex engineering activities
		Pr Tech Eng	Solving broadly defined engineering problems and

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	Identifying and reducing waste, audits. Industrial and quality standards		performing broadly defined engineering activities
		Pr Cert Eng	Solving broadly defined engineering problems and performing broadly defined engineering activities
		Pr Techni Eng	Solving well-defined engineering problems and performing well – defined engineering activities
		Candidates	Solving engineering problems and engineering activities under supervision
Safety Management	Comply with Mine Health and Safety Act, Occupational Health and Safety Act as well as other related acts	Pr Eng	Applicable to all Engineering Practitioners (No limitations)
		Pr Tech Eng	
		Pr Cert Eng	
		Pr Techni Eng	
		Candidates	
Research and development	Review and understand contract requirements, develop systems for file naming and storage methods, research on components and systems functionality, develop 3D model, coordinate with multidisciplinary team, provide manufacturing tolerances	Pr Eng	Solving complex engineering problems and performing complex engineering activities
		Pr Tech Eng	Solving broadly defined engineering problems and performing broadly defined engineering activities
		Pr Cert Eng	Solving broadly defined

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			engineering problems and performing broadly defined engineering activities
		Pr Techni Eng	Solving well-defined engineering problems and performing well – defined engineering activities
		Candidates	Solving engineering problems and engineering activities under supervision
Commissioning	Develop commissioning scope of work and input into planning process. Provide commission engineering services, develop and improve commissioning procedure, quality and maintenance plans, ensure that commissioning quality plans and checks/check sheets are in accordance with that of the Original Equipment Manufacture procedures and specifications. Technical investigation and root cause analysis. Optimize systems and plant	Pr Eng	Solving complex engineering problems and performing complex engineering activities
		Pr Tech Eng	Solving broadly defined engineering problems and performing broadly defined engineering activities
		Pr Cert Eng	Solving broadly defined engineering problems and performing broadly defined engineering activities
		Pr Techni Eng	Solving well-defined engineering problems and performing well – defined engineering activities
		Candidates	Solving engineering problems and engineering activities under supervision
Cost and	Project costing, determine bill	Pr Eng	Solving complex engineering problems and performing complex

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Financial Management	of material required for project. Project risk assessment, budget control, reduce waste		engineering activities
		Pr Tech Eng	Solving broadly defined engineering problems and performing broadly defined engineering activities
		Pr Cert Eng	Solving broadly defined engineering problems and performing broadly defined engineering activities
		Pr Techni Eng	Solving well-defined engineering problems and performing well – defined engineering activities
		Candidates	Solving engineering problems and engineering activities under supervision
Education and Training	Identify the required continuous development profession, recommend and develop courses, evaluate and validate training, mentor others, determine knowledge gaps in direct reports and action accordingly	Pr Eng	Solving complex engineering problems and performing complex engineering activities
		Pr Tech Eng	Solving broadly defined engineering problems and performing broadly defined engineering activities
		Pr Cert Eng	Solving broadly defined engineering problems and performing broadly defined engineering activities
		Pr Techni Eng	Solving well-defined engineering problems and performing well –

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			defined engineering activities
		Candidates	Solving engineering problems and engineering activities under supervision

Note well, any mechanical engineering work not listed on the table above (table 1) or in this Code of Practice should also comply to the category of registration and level descriptors.

### 5.1 Specified Category

Mechanical engineering work may include aspects of work in the specified categories, such as those related to fire protection systems, lifting machinery and medical equipment. Any mechanical engineering practitioner wish to perform such specified category should comply with table 2 below:

Specified Category	Reference Number
a.) Fire Protection Systems design	R-05-FPSRD-SC
b.) Lifting Machinery Inspectors	R-05-LMI-SC
c) Medical Equipment Maintainer	R-05-MEM-SC

### 5.2 Overlaps


Apart from the table 2 above, there are emerging specialty in mechanical engineering such pressure vessels and welding engineering requirements. All mechanical engineering practitioner wish to perform such should comply with the industrial and standards practice.

Moreover, in this code, the mechanical engineering practitioner shall work with other engineering discipline as per section 7.3 of Overarching Code of Practice for Performance of Engineering work ( Nondumiso to add reference number) . This will ensure that confusion is minimized with regards to which engineering discipline should perform certain task

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### 5.3 Mechanical Certified Practitioners(GCC Engineers)

Any mechanical engineering practitioner wishes to operate as a certified practitioner shall be in the possession of Government Certificate of Competency( GCC), and be registered as Professional Certificated Engineer. For more information refer to section 15 of Identification of Engineering Work Regulations ( Nondumiso to provide the ref No.)

## 6 COMPETENCY REQUIREMENTS

Please refer to the **Overarching Code of Practice** for "General Requirements" and "Requirements for Registered Persons"; and to the gazetted **Identification of Engineering Work** for "Core Competencies Required to Perform Identified Engineering Work".

### 6.1 Competence Required to Perform Mechanical Engineering Work

Any person who performs any mechanical engineering work must comply with the Act, and, in addition to any other requirement contemplated in the Engineering Profession Act

- be registered with ECSA in the appropriate professional registration category applicable to the level of service performed; and
- possess the necessary core competency in the competency areas to perform such core service as a Professional Engineer, Professional Engineering Technologist, Professional Certificated Engineer, Professional Engineering Technician or a Specified Category Practitioner.

In case of performing mechanical engineering work in the specified categories, such as those related to fire protection systems, lifting machinery and medical equipment, the mechanical engineering registered person must comply with the relevant competency requirements imposed by ECSA.

### 6.2 Competency Evaluation

The level of experience of mechanical engineering registered persons should also meet or exceed the requirements of the risk competency model shown in Table 2, in addition to their category of registration with reference to the complexity of the work. In the model, risk may include (where appropriate) risk to the health and safety of people and society, the natural and built environment, property, financial interests and related project timescales.

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Table 2: Competency Model

Level of Experience	Level of Supervision	Responsibility	Allowable Risk
Novice	Direct and frequent supervision	Provide assistance and support for engineering activities	Insignificant to low
Intermediate	General supervision	Guide and provide input for engineering activities	Low to moderate
Competent	Work independently	Oversee and guide engineering activities	Moderate to high

#### PRACTICE REQUIREMENTS

### 6.3 Minimum Practice Requirements

All mechanical engineering work shall be carried out or services rendered:

- in accordance with the requirements of the applicable acts and regulations;
- in an ethical and responsible manner in accordance with the Code of Conduct; and
- in accordance with accepted norms and standards in the industry.

### 6.4 Mechanical Engineering Design

#### 6.5 Overlaps

Refer to IDOEW section 15 and other docs relating to GCC

### 6.6 Records


### 6.7 Compliance to Acts and Regulations

Registered Persons must always ensure compliance with the appropriate acts and associated regulations. Notable national acts which may be applicable to mechanical engineering work include:

- Engineering Profession Act (46 of 2000) as amended
- Occupational Health and Safety Act (85 of 1993) as amended
- Mine Health and Safety Act (29 of 1996) as amended
- National Building Regulations and Building Standards Act (103 of 1977) as amended
- National Environment Management Act (107 of 1998) as amended

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## 6.8 Application of Codes and/or Standards

All mechanical engineering work must be carried out in accordance with the norms of the profession, and these norms are generally represented by the mechanical engineering relevant national and international standards, industry standards, codes of practice and best practice guidelines.

Standards and codes shall be applied as and when required by government regulation, customer or end-user requirements and as an accepted industry norm. It is the duty of the engineering registered person to ensure that all standards and codes used abide by the applicable acts and regulations (taking into account that more than one country's legal frameworks may be relevant). Standards and codes may be used in place of regulations where it can be proven that the requirements of the standard or code meet and/or exceed those prescribed by regulations and/or law. Any deviations from the standards or codes requested by the customer or end-user should be communicated to the appropriate stakeholder, supported by evidence that the deviation will compromise the performance and safety of the system or device.

Various international bodies are recognised and accepted within industry to develop and publish standards related to mechanical engineering, notably:

- SANS – South African National Standards
- ASME – American Society of Mechanical Engineers
- ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers
- ISO – International Standard Organization
- SAE – Society of Automotive Engineers
- API – American Petroleum Institute
- IFE – The Institution of Fire Engineers
- ASTM International

## 7 ADMINISTRATION


The Council shall be responsible for the Administration of this code of practice, including its publication, maintenance and distribution.

The Council shall ensure that the Code of Practice and all amendment there to are available on the ECSA Website and shall upon request, provide a copy thereof.

The Council shall take all reasonable steps to introduce the Code of Practice to the general public.

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## 8 REVISION HISTORY

Revision Number	Revision Date	Revision Details	Approved By
Rev a	23 March 2022	Proposed by the working group to ECSA	

DRAFT

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