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Code of Practice for the Performance of Mechanical Engineering Work

R-02-COP-MEC

Revision 0: 25 August 2022

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ECSA

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

DEFINITIONS

Act means the Engineering Profession Act, 46 of 2000 as amended.

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 ECSA.

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.

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.

ABBRIVIATIONS

API	American Petroleum Institute
ASHRAE ENGINEERS	American Society of Heating, Refrigerating And Air-Conditioning
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
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

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 this document refers 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 the Overarching Code of Practice, 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; it 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 Persons. 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 practising 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 practice.

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 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. These 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.

5.1 Engineering qualifications and supervision of work

It is highly recommended that all Mechanical Engineering Work be undertaken by a registered Mechanical Engineering Practitioner. In cases where work is to be performed by an unregistered Mechanical Engineering Practitioner, it recommended that the following work allocation be under the supervision of a registered Mechanical Engineering Practitioner:

Table 1: Engineering qualifications and supervision of work

Qualification	Level of Descriptors	Supervision
BEng/BSc Eng/MEng	Solving complex engineering problems and performing complex engineering activities	Pr.Eng
BTech/ BEng Tech Eng/Advanced Diploma	Solving broadly defined engineering problems and performing broadly defined engineering activities	Pr.Eng Pr.Tech Eng
National Diploma	Solving well-defined engineering problems and performing well–defined engineering activities	Pr.Eng, Pr.Tech Eng Pr.Techni Eng

5.2 Category of registration and level of descriptors

Table 2 below represents Mechanical Engineering Work, category of registration and level of descriptors for engineering activities or problems.

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

- level of an engineering problem
- level of an engineering activity.

Moreover, each category of registration has three level descriptors for engineering activities and problems to consider: complex engineering activities/problems, broadly defined engineering problems and well-defined engineering problems.

Table 2: 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)	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

Area/Field	Methods/Techniques	Category of registration	Level descriptor
	Design codes and standards Design process Approval of design drawings		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 and technical risk assessment, components classification, manufacturing process, quality assurance and control, manufacturing analysis	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
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

CONTINUES ON PAGE 258 OF BOOK 3

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Area/Field	Methods/Techniques	Category of registration	Level descriptor
		Candidates	Solving engineering problems and engineering activities under supervision
Manufacturing Engineering	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

NB: Any mechanical engineering work not listed in Table 2 or in this Code of Practice should also comply with the category of registration and level descriptors.

5.3 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 wishes to perform such specified category should comply with Table 3 below:

Table 3: Specified category performed by Mechanical Engineering Practitioners

Specified Category	Reference Number
Fire Protection Systems design	R-05-FPSRD-SC
Lifting Machinery Inspectors	R-05-LMI-SC

Medical Equipment Maintainer	R-05-MEM-SC

5.4 Overlaps

Apart from Table 3 above, Mechanical Engineering has emerging specialties, such as pressure vessels and welding engineering. All Mechanical Engineering Practitioners who wish to perform such should comply with the respective industry and standard practices.

Moreover, in this Code, Mechanical Engineering Practitioner shall work with other engineering disciplines as per the **Overarching Code of Practice for Performance of Engineering work** as amended to ensure that confusion is minimised regarding which engineering discipline should perform certain tasks.

5.5 Professional Certificated Engineers

Mechanical Engineering Practitioners who wish to register and operate and/or practise as Professional Certificated Engineers shall obtain the Government Certificate of Competency as Mechanical Engineers, as recognised by the **Act**.

In addition, Mechanical Engineering Practitioners shall comply with respective legal requirements and the requirements of this Code of Practice when performing Mechanical Engineering Work.

6. MECHANICAL ENGINEERING 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, as well as any other requirement contemplated in the Act, and –

- be registered with ECSA in the appropriate professional registration category applicable to the level of service performed

- 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 as per **section 5.3** above, such as those related to fire protection systems, lifting machinery and medical equipment, Mechanical Engineering Registered Persons must comply with the relevant competency requirements imposed by ECSA.

6.2 Competency evaluation

Mechanical Engineering Registered Persons' level of experience should also meet or exceed the requirements of the risk competency model shown in Table 4, 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.

Table 4: Competency model

Level of experience	Level of supervision	Responsibility	Allowable risk
Novice	Direct and frequent supervision	Provide assistance and support for engineering activities	Low
Intermediate	General supervision	Guide and provide input for engineering activities	Medium
Competent	Work independently	Oversee and guide engineering activities	High

6.3 Categories of risks

Table 5 below defines level of risk associated with above competency model.

Table 5: Level of risk associated with the competency model

Level of risk	Impact of risk			Risk matrix value
	Safety (People)	Environment (Spillage/Pollution)	Reputation (Company)	
Low	Minor injury No lost time	Minor	• Warning • No media coverage	1–5
Medium	Result in permanent disability	Major	• Major financial penalties • Local media coverage	6–12
High	Result in fatalities	Catastrophic	• Hefty financial penalties • International media coverage	15–25

These risk values are based on the 5 by 5 risk matrix (Figure 1) and calculated as follows e.g. Impact x Probability (5 x 5 = 25 – High Risk).

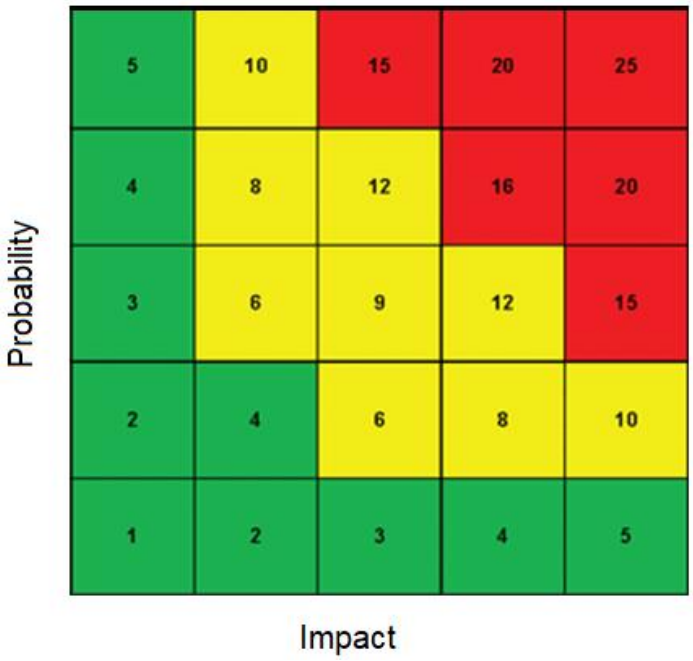

Figure 1: Risk matrix

7. PRACTICE REQUIREMENTS

7.1 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
- in accordance with accepted norms and standards in the industry.

7.2 Compliance to Acts and Regulations

Registered Persons must always ensure compliance with the appropriate acts and associated regulations. Notable national acts that may be applicable to Mechanical Engineering Work include:

- Engineering Profession Act, as amended
- Occupational Health and Safety Act, as amended
- Mine Health and Safety Act, as amended
- National Building Regulations and Building Standards Act, as amended
- National Environment Management Act, as amended.

7.3 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 (considering 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 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 not 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 – American Society for Testing and Materials.

8. 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 amendments thereto 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.

9. INTERPRETATION AND COMPLIANCE

9.1 Interpretation

(a) The word “must” indicates a peremptory provision.

(b) The word “should” indicates a provision directive or informative in character, requiring substantial compliance only.

9.2 Compliance

Failure to comply with a peremptory provision of this Code constitutes improper conduct in terms of the Act. Failure to comply with a directive or informative provision of this Code may constitute improper conduct in terms of the Act if its consequences are significant.

10. FURTHER INFORMATION

Further insights and information can be found in the following publications:

- Engineering Council of South Africa Code of Conduct
- Engineering Council of South Africa Overarching Code of Practice for the performance of Engineering Work.

REFERENCES

Engineering Council of South Africa. Rules of Conduct for Registered Persons Engineering Profession Act, 2000. Board Notice 256 of 2013. Government Gazette No. 37123 of 13 December 2013.

Engineering Qualifications in the Higher Education Qualifications Sub-framework E-23-P.

Identification of Engineering Work Regulations, No. 44333, Government Gazette, 26 March 2021.

Overarching Code of Practice for the Performance of Engineering Work, No. 44333, Government Gazette, 26 March 2021.

R-05-MEC-PE: Discipline Specific Training Guide for Registration as a Professional Engineer in Mechanical Engineering (Section 6).

R-02-STA-PE/PT/PCE/PN: Competency Standard for Registration in Professional Categories as PE/PT/PCE/PN.

Framework for development of ECSA Codes of Practice Revision 1: 29 January 2019.

Structural Engineering Code of Practice.

Geotechnical Engineering Code of Practice.

R-05-FSPRD-SC: Sub discipline – Specific Training Requirements for Candidate Fire Protection System Rational Designers (Fire Specialist).

R-05-MEM-SC: Sub discipline – Specific Training Requirements for Candidate Medical Equipment Maintainers.

R-05-LMI-SC: Sub discipline – Specific Training Requirements for Candidate Lifting Machinery Inspectors.

REVISION HISTORY

Revision number	Revision date	Revision details	Approved by
Rev 0 Draft 1	21 Sep 2021	New document	RPS & Working Group
Rev 0 Draft 2	24 November 2021	Submitted for Comments	CoP Steering Committee
Rev 0 Draft 3	14 December 201	Incorporation of received comments	RPS & Working Group
Rev 0 Draft 4	17 January 2022	Review	ERPS
Rev 0 Draft 5	27 January 2022	Revision of Level 3 on Figure 1	RPS & Working Group
Rev 0 Draft 6	01 February 2022	Recommendation for broader consultation	CoP Steering Committee
Rev 0 Draft 7	02 May 2022	Addressing of comments that were received from the broader consultation	RPS & Working Group
Rev 0 Draft 7	11 May 2022	Presentation before Steering Committee for final recommendation	CoP Steering Committee
Rev 0 Draft 8	11 July 2022	Recommendation for approval via Round-robin	CoP Steering Committee
Rev 0 Draft	13 July 2022	For approval	RPSC
Rev 0 Draft	25 August 2022	Ratification	Council

The Code of Practice for:

Mechanical Engineering

Revision 0 dated 25 August 2022 consisting of 19 pages have been reviewed for adequacy by the Business Unit Assistant Manager and is approved by the Acting Executive: Research, Policy and Standards (**RPS**).

Hlalukana
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Business Unit Assistant Manager

04 October 2022
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Date

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Acting Executive: RPS

04 October 2022
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Date

This definitive version of this policy is available on our website