ENSURING THE EXPERTISE TO GROW SOUTH AFRICA

Code of Practice for the Performance of Mechanical Engineering Work

R-02-COP-MEC

Revision 0: 25 August 2022
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DEFINITIONS

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


**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

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>API</td>
<td>American Petroleum Institute</td>
</tr>
<tr>
<td>ASHRAE ENGINERS</td>
<td>American Society of Heating, Refrigerating And Air-Conditioning</td>
</tr>
<tr>
<td>ASME</td>
<td>American Society of Mechanical Engineers</td>
</tr>
<tr>
<td>ASTM</td>
<td>American Society for Testing and Materials</td>
</tr>
<tr>
<td>BSI</td>
<td>British Standards Institution</td>
</tr>
<tr>
<td>CAD</td>
<td>Computer-Aided Design</td>
</tr>
<tr>
<td>CAM</td>
<td>Computer-Aided Manufacturing</td>
</tr>
<tr>
<td>CFD</td>
<td>Computational Fluid Dynamics</td>
</tr>
<tr>
<td>COP</td>
<td>Code of Practice</td>
</tr>
<tr>
<td>ECSA</td>
<td>Engineering Council of South Africa</td>
</tr>
<tr>
<td>FEA</td>
<td>Finite Element Analysis</td>
</tr>
<tr>
<td>IFE</td>
<td>The Institution of Fire Engineers</td>
</tr>
<tr>
<td>ISO</td>
<td>International Standard Organization</td>
</tr>
<tr>
<td>SANS</td>
<td>South African National Standards</td>
</tr>
<tr>
<td>SAE</td>
<td>Society of Automotive Engineers</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Qualification</th>
<th>Level of Descriptors</th>
<th>Supervision</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEng/BSc Eng/MEng</td>
<td>Solving complex engineering problems and performing complex engineering activities</td>
<td>Pr.Eng</td>
</tr>
<tr>
<td>BTech/ BEng Tech Eng/Advanced Diploma</td>
<td>Solving broadly defined engineering problems and performing broadly defined engineering activities</td>
<td>Pr.Eng, Pr.Tech Eng</td>
</tr>
<tr>
<td>National Diploma</td>
<td>Solving well-defined engineering problems and performing well-defined engineering activities</td>
<td>Pr.Eng, Pr.Tech Eng Pr.Techni Eng</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Area/Field</th>
<th>Methods/Techniques</th>
<th>Category of registration</th>
<th>Level descriptor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering Design</td>
<td>Collecting and analysing data from tests on prototype, modifying design (improve existing components and systems), computer-aided design and simulation, finite element analysis (FEA)</td>
<td>Pr.Eng</td>
<td>Solving complex engineering problems and performing complex engineering activities</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pr.Tech Eng</td>
<td>Solving broadly defined engineering problems and performing broadly defined engineering activities.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pr.Cert Eng</td>
<td>Solving broadly defined engineering problems and</td>
</tr>
</tbody>
</table>
### Subject: Code of Practice for the Performance of Mechanical Engineering Work

**Compiler:** M Hlalukana  
**Approving Officer:** MB Mtshali  
**Next Review Date:** N/A

<table>
<thead>
<tr>
<th>Area/Field</th>
<th>Methods/Techniques</th>
<th>Category of registration</th>
<th>Level descriptor</th>
</tr>
</thead>
</table>
| Reverse Engineering of mechanical components | Design codes and standards  
Design process  
Approval of design drawings | Pr, Techni. Eng | Solving well-defined engineering problems and performing well – defined engineering activities |
| | | Candidates | Solving engineering problems and engineering activities under supervision |
| | 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 troubleshooting 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 |
### Code of Practice for the Performance of Mechanical Engineering Work

**Subject:**
Code of Practice for the Performance of Mechanical Engineering Work

**Compiler:** M Hlalukana

**Approving Officer:** MB Mtshali

**Effective Date:** 25/08/2022

### Table 3: Specified category performed by Mechanical Engineering Practitioners

<table>
<thead>
<tr>
<th>Specified Category</th>
<th>Reference Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire Protection Systems design</td>
<td>R-05-FPSRD-SC</td>
</tr>
<tr>
<td>Lifting Machinery Inspectors</td>
<td>R-05-LMI-SC</td>
</tr>
</tbody>
</table>

**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>
<thead>
<tr>
<th>Specified Category</th>
<th>Reference Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire Protection Systems design</td>
<td>R-05-FPSRD-SC</td>
</tr>
<tr>
<td>Lifting Machinery Inspectors</td>
<td>R-05-LMI-SC</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Level of experience</th>
<th>Level of supervision</th>
<th>Responsibility</th>
<th>Allowable risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Novice</td>
<td>Direct and frequent supervision</td>
<td>Provide assistance and support for engineering activities</td>
<td>Low</td>
</tr>
<tr>
<td>Intermediate</td>
<td>General supervision</td>
<td>Guide and provide input for engineering activities</td>
<td>Medium</td>
</tr>
<tr>
<td>Competent</td>
<td>Work independently</td>
<td>Oversee and guide engineering activities</td>
<td>High</td>
</tr>
</tbody>
</table>

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

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

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).

![Risk Matrix Diagram](image-url)  

**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

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
REFERENCES


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


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.
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).

................................. .................................
Business Unit Assistant Manager  Date

................................. .................................
Acting Executive: RPS  Date

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