



ENSURING THE EXPERTISE TO GROW SOUTH AFRICA

Industrial Engineering Code of Practice

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Document No.:	Revision No.:	Effective Date:	
Subject: Industrial Code of Practice			
Compiler:	Approving Officer:	Next Review Date:	Page 2 of 19

TABLE OF CONTENTS

DEFINITIONS	4
ABBREVIATIONS.....	5
1. INTRODUCTION	7
1.1 Scope	7
2. PURPOSE	8
3. APPLICABLE LEGISLATIVE FRAMEWORK.....	8
4. ETHICAL VALUES.....	Error! Bookmark not defined.
5. INDUSTRIAL ENGINEERING WORK.....	9
5.1 Nature of Industrial Engineering Work	9
5.2 Range of Industrial Engineering Problems and Activities.....	9
5.3 Industrial Engineering Sub-disciplines	13
5.4 Categories of Registration	13
6. INDUSTRIAL ENGINEERING COMPETENCY REQUIREMENTS.....	13
6.1 General Requirements	13
6.2 Criteria for Assessment of Competency.....	14
7. INDUSTRIAL ENGINEERING GOOD PRACTICE	14
7.1 General Good Practice.....	14
7.2 Health, Safety and Environment.....	15
7.3 Ethical Considerations	16
7.4 Standards and Codes of Practice.....	16
7.5 Industrial Engineering Data	16
7.6 Reporting	17
7.7 Quality and Risk Management	17
8. ADMINISTRATION	18

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Document No.:	Revision No.:	Effective Date:	
Subject: Industrial Code of Practice			
Compiler:	Approving Officer:	Next Review Date:	Page 3 of 19

9. INTERPRETATION AND COMPLIANCE	18
9.1. Interpretation	18
9.2 Compliance	18
10. FURTHER INFORMATION	18

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When downloaded for the ECSA Document Management System, this document is uncontrolled and the responsibility rests with the user to ensure that it is in line with the authorised version on the database. If the 'original' stamp in red does not appear on each page, this document is uncontrolled.

Document No.:	Revision No.:	Effective Date:	
Subject: Industrial Code of Practice			
Compiler:	Approving Officer:	Next Review Date:	Page 4 of 19

DEFINITIONS

In this Code, any word or expression defined in the Act has that meaning and, unless the context dictates otherwise:

Act means the Engineering Profession Act, 46 of 2000.

Candidate means a person who is registered in terms of Section 19 (2) (b) of the Act.

Category of registration means the categories of registration provided for in Section 18 (1)(a) of the Act, i.e. Professional Engineers, Professional Engineering Technologists, Professional Certificated Engineers and Professional Engineering Technicians.

Code of conduct means the code of conduct for registered persons in terms of Act

Competent Person means a person who has the required knowledge, training, experience and, where applicable, qualifications, specific to the work or task being performed; provided that where appropriate qualifications and training are registered in terms of the provisions of the National Qualification Framework Act, 67 of 2008, those qualifications and that training are regarded as the required qualifications.

Council means the Engineering Council of South Africa established in terms of Section 2 of the Act.

Engineering work means the work identified in terms of Section 26 of the Act.

Registered person means a person registered with the Engineering Council of South Africa in terms of the Act under one of the categories referred to in Section 18.

Risk means the effect of uncertainty on the objectives of a design and is expressed in terms of a combination of the consequences of an event and the likelihood of occurrence.


Industrial engineer means a Professional Engineer registered in terms of 18. (1) (a) (i) of the Act who has experience specifically in the sub-discipline of Industrial Engineering.

Industrial engineering technologist means a Professional Engineering Technologist registered in terms of 18. (1) (a)(i) of the Act who has experience specifically in the sub-discipline of Industrial Engineering;

Industrial engineering technician means a Professional Engineering Technician registered

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Document No.:	Revision No.:	Effective Date:	
Subject: Industrial Code of Practice			
Compiler:	Approving Officer:	Next Review Date:	Page 5 of 19

in terms 18. (1) (a)(i) of the Act who has experience specifically in the sub-discipline of Industrial Engineering;


Industrial engineering work means Engineering Work identified identified in terms of Section 26 of the Act specifically in the discipline of Industrial Engineering.

ABBREVIATIONS

Abbreviation	Meaning
3D	3 Dimensional
ANYSYS	Analysis System
ArchiMate	Architecture Animate
CAD	Computer Aided Designing
CPD	Continuing Professional Development
CRM	Customer Relationship Management
DMAIC	Define, Measure, Analyze, Improve and Control
DoDAF	Department of Defense Architecture Framework
DSTG	Discipline Specific Training Guide
ECSA	Engineering Council of South Africa
FAST	Function Analysis Systems Technique
FMEA	Failure Modes and Effects Analysis
GERAM	Generalized Enterprise Reference Architecture and Methodology
IDEF	Integrated DEFinition Methods
ISO	International Organization for Standardization
JIT	Just In Time
MoDAF	Ministry of Defense Architecture Framework
PDCA	Plan, Do Check, Act
PDSA	Plan, Do, Study, Act
PERT	Project Evaluation and Review Technique
PIN	Percentage of Industry Sales
PMBOK	Project Management Body of Knowledge
Pr Eng	Professional Engineer
PRINCE2	Projects in Controlled Environments

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Document No.:	Revision No.:	Effective Date:	
Subject: Industrial Code of Practice			
Compiler:	Approving Officer:	Next Review Date:	Page 6 of 19

Pr Tech Eng	Professional Engineering Technologist
Pr Cert Eng	Professional Certificated Engineer
Pr Techni Eng	Professional Engineering Technician
QFD	Quality Function Deployment
RCA	Root Cause Analysis
Reg Eng Tech	Registered Engineering Technician
SABS	South African Bureau of Standards
SAIIE	Southern African Institute for Industrial Engineering
SANS	South African National Standards
SOP	Standard Operating Procedures
SysML	Systems Modelling
TPM	Total Productive Maintenance
TQM	Total Quality Management
TWI	Training Within Industry
UAF	Unified Architecture Framework
UML	Unified Modeling Language
VSM	Value Stream Mapping

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Document No.:	Revision No.:	Effective Date:	
Subject: Industrial Code of Practice			
Compiler:	Approving Officer:	Next Review Date:	Page 7 of 19

1. INTRODUCTION

This Code of Practice has been developed by the Engineering Council of South Africa (ECSA) to supplement the Code of Conduct for Registered Persons in conjunction with the Southern African Institute for Industrial Engineering (SAIIE). Section 27 of the Engineering Profession Act (Act 46 of 2000) 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, failure to do so constitutes improper conduct. Codes of Conduct regulate behaviour while Codes of Practice regulate Engineering practice.

Section 18(1) of the Act provides for the registration of professionals and candidates in four categories of registration, namely Professional Engineers, Professional Technologists, Professional Technicians, Professional Certificated Engineers and registration in Specified Categories as prescribed by council. Section 18 (2) prohibits persons so registered from practising in a category other than that in which they are registered.

In line with these requirements, this Code of Practice classifies Engineering Work in the sub-discipline of Industrial Engineering in terms of its complexity and stipulates the category of registration and the level of competence required for the execution of such work.


The Code also details the ethical values and professional standards which ECSA expects all registered persons to adhere to as prescribed under the Code of Conduct for registered persons in terms of the Act.

1.1 Scope

- a) This Code applies to the discipline of Industrial Engineering.
- b) This Code has reference to the Act, overarching Code of practice for the performance of Engineering Work, competency standard for registration in Professional Categories (R-02-STA-PE/PT/PCE/PN) and other relevant ECSA policy documents.
- c) It classifies Industrial Engineering Work according to the complexity of the problem, nature of the environment, the methods employed, the risks involved and the consequences of failure.
- d) It sets out the level of competence required from persons registered in any of the

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Document No.:	Revision No.:	Effective Date:	
Subject: Industrial Code of Practice			
Compiler:	Approving Officer:	Next Review Date:	Page 8 of 19

categories of registration provided for in Section 18(1) of the Act for the performance of Industrial Engineering Work of varying complexities.

- e) This Code stipulates requirements for the practice of Industrial Engineering Work and provides a statement of recognised good practice.
- f) Where a Code, Act or Policy is referenced the latest version thereof shall apply.

2. PURPOSE

The purpose of this Code of Practice is to ensure that any person undertaking Industrial Engineering work meets the prescribed requirements when practising and executing Industrial Engineering work within the jurisdiction of the Act. This Code also sets appropriate levels of competence, regulating the execution of Industrial Engineering work and specifying technical standards and best practices. Among others, this Code of Practice ensures that:

- a) Registered persons apply their specialised knowledge within their competence and skill in accordance with all relevant legislation;
- b) All Industrial Engineering Work is performed by a competent person and uniform competency and conduct standards apply to all registered persons;
- c) Industrial Engineering Work is performed in accordance with generally accepted norms and standards of the Industrial Engineering profession;
- d) Registered persons apply innovation in a responsible and appropriate manner within their category;
- e) Registered Persons apply their specialised knowledge and skill within their respective area of competence to ensure that engineering practice is appropriate, applicable, acceptable, affordable and sustainable; and
- f) Registered Persons encourage innovation, promote social upliftment where possible in all aspects of Industrial Engineering and set examples within the profession.


3. APPLICABLE LEGISLATIVE FRAMEWORK

This Code should be read in conjunction with the following:

- a) Engineering Profession Act 46 of 2000;
- b) Code of Conduct;
- c) Occupational Health and Safety Act 85 of 1993;
- d) Overarching Code of Practise for the Performance of Engineering Work;
- e) Identification of Engineering Work Regulations;

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Document No.:	Revision No.:	Effective Date:	
Subject: Industrial Code of Practice			
Compiler:	Approving Officer:	Next Review Date:	Page 9 of 19

- f) all other relevant legislation.

5. INDUSTRIAL ENGINEERING WORK

5.1 Nature of Industrial Engineering Work

Due to the dynamic nature of the profession, the diverse range of industries in which Industrial Engineers could be employed and the diverse range of sub-disciplines and specialised skills characterising the profession, it is virtually impossible to define a set of predetermined training paths for the Industrial Engineer. Instead of predetermined paths, a set of guiding principles is proposed whereby Candidates can shape the course of their careers.

- a) The performance of Industrial Engineering Work requires solving industrial engineering problems and engaging in industrial engineering activities.
- b) Industrial Engineering Work encompasses a number of Industrial Engineering sub-disciplines, each dealing with a specific body of knowledge.
- c) Depending on the level of complexity, Industrial Engineering Work is carried out by registered persons possessing different levels of competence as typified by the various categories of registration given in Section 18(1) of the Act.
- d) Due to a common grounding in the mathematical and physical sciences, there are areas of overlap among the various sub-disciplines of Industrial Engineering as well as overlaps with other professions. These overlaps generally occur at a basic level and divergence increases with the degree of specialisation.


5.2 Range of Industrial Engineering Problems and Activities

For the purposes of this code, Engineering problems and activities are classified as complex, broadly defined, well-defined and specifically defined problems. The basis of the classification of engineering problems is given in the **R-02-STA-PE/PT/PCE/PN** and **R-02-STA-SC** documents available on the ECSA website.

Industrial engineering work may in terms of **Table 1**, be classified as work executed in one or

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Document No.:	Revision No.:	Effective Date:	
Subject: Industrial Code of Practice			
Compiler:	Approving Officer:	Next Review Date:	Page 10 of 19


more of the Fields/Areas in Column 2, involving one or more of the activities listed in Column 3 and making use of one or more of the Methods/Tools in Column 4. **Table 1** is just a guideline and not an exhaustive list of Fields/areas, Activities or Methods/Tools.

Table 1: Industrial Engineering Work

Number (Column 1)	Field/ Area (Column 2)	Activities (Column 3)	Methods/ Tools (Column 4)
1	Asset Management	<ul style="list-style-type: none"> • Total lifecycle management • Strategic management • Data management • Maintenance planning & scheduling Materials management 	RCAs FMEAs Maintenance strategies, SABS/SANS 55111/2020,55001/2020, 55002/2020
2	Business Engineering	<ul style="list-style-type: none"> • Strategic Positioning • Alignment and Transformation (facilitating a common vision across stakeholders) • Assessing the status quo • Validating various scenarios • Eliciting critical success factors and measuring the current and perceived ideal business against such. 	Data modelling & visualisation platforms (tableau, R, Power BI, R4Apps)
3	Data Analytics	<ul style="list-style-type: none"> • Statistical modelling and Data mining. • Descriptive and predictive and prescriptive analysis utilising data mining, • Time series, • Forecasting and machine learning • Optimisation and simulation. 	Statistical modelling, Computer science/ programming, Operations research and optimisation
4	Engineering Economics	<ul style="list-style-type: none"> • Financial planning • Evaluation of alternative solutions • Feasibility studies execution • Develop and implement performance measurement standards 	Present/Future Worth Analysis, Annual Worth Analysis, Rate of Return Analysis, Benefit/Cost Analysis, Breakeven Analysis, Cost Estimation, Depreciation Methods,

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Document No.:	Revision No.:	Effective Date:	
Subject: Industrial Code of Practice			
Compiler:	Approving Officer:	Next Review Date:	Page 11 of 19

Number (Column 1)	Field/ Area (Column 2)	Activities (Column 3)	Methods/ Tools (Column 4)
		<ul style="list-style-type: none"> Project and contract management 	Sensitivity Analysis, Cash Flows
5	General Management	<ul style="list-style-type: none"> People management Financial management Planning & forecasting Resource management Organising Leading Controlling Strategy development and execution Productivity management Communication management Technology management Digital transformation Risk management 	Strategy planning and methodologies, Decision-making tools, Balanced scorecard, Benchmarking, Employee engagement surveys, Customer relationship management, Change management, Agile methodologies, Data analytics,
6	Lean Operations & 6 Sigma	<ul style="list-style-type: none"> Continuous improvements Product development 	PDCA/ PDSA, DMAIC, KATA, KAIZEN, VSM, TWI, TPM
7	Manufacturing & Production Engineering	<ul style="list-style-type: none"> Continuous Improvement Root Cause Analysis Process scheduling Raw material analysis Plant maintenance Quality control and measurement Metrology Green manufacturing 	Root Cause Analysis, Kaizen, 5S, Six Sigma
8	Project Management	<ul style="list-style-type: none"> Project definition Project planning and scheduling Cost estimation and budgeting Project quality management Project risk management Project execution and control 	PMBOK, PRINCE2, LEAN, Network diagrams, Critical Path, Gantt charts, Theory of constraints methods PERT Lifecycle costing

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Document No.:	Revision No.:	Effective Date:	
Subject: Industrial Code of Practice			
Compiler:	Approving Officer:	Next Review Date:	Page 12 of 19

Number (Column 1)	Field/ Area (Column 2)	Activities (Column 3)	Methods/ Tools (Column 4)
9	Quality	<ul style="list-style-type: none"> • Quality of service • Value addition • Process quality • Process and variation control • Product quality, functionality and design. • Quality of systems and technology • Processes alignment • Quality of design projects and programs • Quality Management Systems • Policies and procedures 	ISO 9000/9001, Total Quality Management (TQM), Failure Analysis, Weibull analysis, Failure Modes and Effects, Fault Tree Analysis, Event tree analysis, Markov state analysis, Reliability block diagram, QFD
10	Supply Chain and Logistics Management	<ul style="list-style-type: none"> • CRM • Forecasting • Distribution • Inventory management • Logistics • Procurement • SOP • Sustainability • Demand side forecasting 	Aggregate scheduling, Inventory management, Scheduling, JIT, Distribution Network Models, Algorithms, Graph Theory, Operations research
11	Systems and Reliability Engineering	<ul style="list-style-type: none"> • Requirement's engineering • System architecting • System decomposition and aggregation • Element and component design • System implementation and integration • Verification and validation • Program and project management • System lifecycle management • Stakeholder engagement and knowledge elicitation • Systems thinking • Systems science • General systems theory • Trade-off studies • Determination of systems efficiencies, etc., 	Model-Based Systems Engineering, Functional and logical decomposition, Object-orientated systems engineering, DoD systems design and analysis, SysML, UML, IDEF, ArchiMate, UAF, DoDAF, MoDAF, GERAM, Capella, Petri Nets, Causal Loops, Simulink etc.

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Document No.:	Revision No.:	Effective Date:	
Subject: Industrial Code of Practice			
Compiler:	Approving Officer:	Next Review Date:	Page 13 of 19

Number (Column 1)	Field/ Area (Column 2)	Activities (Column 3)	Methods/ Tools (Column 4)
		<ul style="list-style-type: none"> • Availability and Reliability 	
12	Value Management, Engineering, & Analysis	<ul style="list-style-type: none"> • Value Improvement practices • Technology selection • Process simplification • Reliability simulation & modelling • Customising standards and specifications • Energy optimisation 	PIN Analysis- Perspective Modelling analysis, FAST Diagramming, 3D CAD

5.3 Industrial Engineering Sub-disciplines

The Industrial Engineering sub-disciplines recognised by ECSA are provided in the Discipline Specific Training Guide (DSTG), **R-05-IND-PE**, **R-05-IND-PT** and **R-05-IND-PN** for each category of registration and can be found on the ECSA website.

5.4 Categories of Registration

Industrial Engineering professionals' category of registration is determined by the Council in terms of Section 18(1) of the Act. The categories of registration include:


- Professional Engineer (PrEng) registered in terms of Section 18(1)(a)(i) of the Act;
- Professional Engineering Technologist (PrTechEng) registered in terms of Section 18(1)(a)(ii) of the Act;
- Professional Engineering Technician (PrTechniEng) registered in terms of Section 18(1)(a)(iv) of the Act;
- Specified Category Practitioner registered in terms of Section 18(1)(c) of the Act;
- A candidate registered in terms of Section 18(1)(b) of the Act.

6. INDUSTRIAL ENGINEERING COMPETENCY REQUIREMENTS

6.1 General Requirements

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Document No.:	Revision No.:	Effective Date:	
Subject: Industrial Code of Practice			
Compiler:	Approving Officer:	Next Review Date:	Page 14 of 19

- a) All Industrial Engineering Work shall be carried out by a competent Industrial Engineering registered person who is qualified by virtue of knowledge, training, experience and applicable qualifications to perform such work.
- b) All registered persons shall confine their performance of Industrial Engineering Work to the areas in which they are competent, subject to the provisions of (a) above.
- c) All registered persons shall undertake continuing professional development (CPD) or independent learning activities sufficient to maintain and extend their competence in line with current good practice in the industry.
- d) Registered Persons' competence and the nature of the work they are competent to perform should be assessed in terms of the criteria applicable to them.

6.2 Criteria for Assessment of Competency

The criteria for assessing competency is defined in the ECSA Competency Standard for Registration in Professional Categories as PE/PT/PCE/PN (**R-02-STA-PE/PT/PCE/PN**) and **R-02-STA-SC**.

7. INDUSTRIAL ENGINEERING GOOD PRACTICE

7.1 General Good Practice


All work carried out or services rendered shall be:

- a) In accordance with accepted norms and standards of Industrial Engineering,
- b) In an ethical and responsible manner in accordance with the Code of Conduct,
- c) Within the area of competency with honesty, fidelity and integrity,
- d) In accordance with the Labour Relations Act (Act 66 of 1995) as amended,
- e) In accordance with the Protection of Personal Information Act (Act 4 of 2013) as amended,
- f) Any other applicable legislation.

Prior to taking a role in Industrial Engineering, the Industrial Engineering registered persons shall ensure that he or she possesses the competencies required to undertake

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Document No.:	Revision No.:	Effective Date:	
Subject: Industrial Code of Practice			
Compiler:	Approving Officer:	Next Review Date:	Page 15 of 19

the work.

Prior to undertaking any task, the Industrial Engineering registered person shall ascertain and document:

- a) the purpose of the activities;
- b) the approach that will be used in the execution of activities;
- c) the performance requirements for the activities;
- d) any statutory, regulatory or other requirements that may pertain to the activities.

The Industrial Engineering registered person shall take account of the likely variation in input parameters and the accuracy of the models or methods used and shall consider all likely.

All calculations shall be independently checked, either by another suitably qualified registered person or by alternative calculation methods.

Prior to approving any work, or signing any completion certificate, the Industrial Engineering registered person shall ensure sufficient detailed checks or inspections to warrant such approval. Where the checks or inspections were limited in any way or carried out by a third party, the approval shall be qualified accordingly.

7.2 Health, Safety and Environment


All Industrial Engineering work shall be done in accordance with:

- a) Occupational Health and Safety Act as amended,
- b) National Environmental Management Act as amended,
- c) Any other applicable legislation.

Cognisance should be taken of health and safety requirements from planning to completion of work.

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Document No.:	Revision No.:	Effective Date:	
Subject: Industrial Code of Practice			
Compiler:	Approving Officer:	Next Review Date:	Page 16 of 19

The environmental impact of all Industrial Engineering work should be assessed and appropriate measures are taken to minimise such impacts or to remediate areas so impacted.

The Industrial Engineering Registered Person shall involve relevant expertise when identified impacts are outside their area of expertise.

The client shall immediately be notified of any condition that is observed which may compromise the health and safety of persons or the environment.

7.3 Ethical Considerations

Registered Persons shall comply with the Code of Conduct.

Cognisance should be taken of any potential social and cultural impacts of the Industrial Engineering work on the communities within which work is conducted.

The client shall immediately be notified of any condition that is observed which may result in social or cultural impacts.

7.4 Standards and Codes of Practice


All Industrial Engineering work shall be done in accordance with accepted norms and standards. Any deviation from such norms and standards shall be clearly stated.

7.5 Industrial Engineering Data

Sufficient Quantitative or Qualitative data is required for all Industrial Engineering tasks. Industrial Engineering registered persons should ensure that the data used is adequate for the intended purpose. Where this is not the case, additional data should

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Document No.:	Revision No.:	Effective Date:	
Subject: Industrial Code of Practice			
Compiler:	Approving Officer:	Next Review Date:	Page 17 of 19

be obtained, or the work should be based on parameter values selected such that the occurrence of less favourable values is unlikely.

Data analysis should be presented in sufficient detail to allow independent assessment of the data.

7.6 Reporting

During the planning of an activity, the Industrial Engineering registered person should ascertain the purpose for which the activity is required and the nature of the proposed activity. The Industrial Engineering registered person shall ensure that the proposed activity is capable of yielding the information required for that purpose.

The Industrial Engineering registered person should advise the client of the effect of any restrictions placed on the activity that are likely to adversely affect the accuracy or adequacy of the data obtained. This information may be presented as a single report or in two separate reports: a factual report and an interpretive report. All assumptions shall be clearly documented as well as the reason for the specific assumption.


7.7 Quality and Risk Management

Industrial Engineering registered person shall implement quality and risk management systems covering all aspects of their work, appropriate to the nature and size of the work.

Quality and risk management systems must be reviewed on a regular basis. Compliance with the quality and risk management systems should be audited at least annually. Organisations undertaking Engineering Work should consider external certification, such as ISO 9001 and ISO 14001.

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Document No.:	Revision No.:	Effective Date:	
Subject: Industrial Code of Practice			
Compiler:	Approving Officer:	Next Review Date:	Page 18 of 19

8. ADMINISTRATION

- a) The Council shall be responsible for the administration of this Code, including its publication, maintenance and distribution.
- b) The Council shall ensure that this Code and all amendments thereto are available on the ECSA Website and shall upon request, provide a copy thereof.
- c) The Council shall take all reasonable steps to introduce this Code to the general public.

9. INTERPRETATION AND COMPLIANCE

9.1. Interpretation

- a) The word “shall” 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

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Document No.:	Revision No.:	Effective Date:	
Subject: Industrial Code of Practice			
Compiler:	Approving Officer:	Next Review Date:	Page 19 of 19

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