

PUBLICLY
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SPECIFICATION

ISO/PAS
22539

First edition
2007-12-15

User guidance to ISO 15928 — Houses — Description of performance

*Lignes directrices pour l'utilisateur de l'ISO 15928 — Constructions
d'habitation — Description des performances*

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Reference number
ISO/PAS 22539:2007(E)

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Published in Switzerland

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of document:

- an ISO Publicly Available Specification (ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50 % of the members of the parent committee casting a vote;
- an ISO Technical Specification (ISO/TS) represents an agreement between the members of a technical committee and is accepted for publication if it is approved by 2/3 of the members of the committee casting a vote.

An ISO/PAS or ISO/TS is reviewed after three years in order to decide whether it will be confirmed for a further three years, revised to become an International Standard, or withdrawn. If the ISO/PAS or ISO/TS is confirmed, it is reviewed again after a further three years, at which time it must either be transformed into an International Standard or be withdrawn.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO/PAS 22539 was prepared by Technical Committee ISO/TC 59, *Building construction*, Subcommittee SC 15, *Performance criteria for single family attached and detached dwellings*.

Introduction

Traditionally, the construction of single-family houses has been a local or regional on-site activity, dominated by local builders and local forms of building control, with the latter often based on prescriptive codes and local practices. The approach to the regulation of buildings has shifted to a performance-based approach, reinforced by national commitments made in terms of the World Trade Organisation's Technical Barriers to Trade Agreement. Initiatives to standardize requirements at a national or federal level have also contributed to this shift to the performance-based approach.

There are locations where, due to cost constraints and rationalization of production, limited local resources, or where innovation is encouraged, markets have developed for standardized products in relation to the construction of houses. This is reflected in the increasing mass production of houses according to standardized designs. In some situations, this leads to the supply of houses assembled from sub-assemblies manufactured off-site, with on-site activity limited to site preparation, foundation construction, connection of services, and the assembly of the sub-assemblies. There has also been a growing international trade in housing, particularly where demands exceed the capacity of local resources to deliver, such as following disasters or as a result of rapid local population growth and development.

Because different countries, and often different regions within a country, have different ways of specifying their requirements in documents such as codes, standards and technical regulations, it can be very difficult for manufacturers to determine what exactly is required, and very difficult for purchasers to know whether what is being offered meets the requirements. This has led to a need for an internationally agreed form of communication, which will enable the various parties to exchange information using a common language. The ISO 15928 series is designed to provide this common language. The basis of this language is the specification of the requirements in terms of required performance, rather than in the form of prescriptive solutions that tend to be limited to local forms of construction. The objective of the ISO 15928 series is to define performance parameters for a range of attributes of houses.

The standard is not concerned with specifying the required **levels** of performance or the details of the methods of evaluation. The specification of the required levels of performance is the prerogative of the users, while the detailing of the methods of evaluation is the role of International Standards or other national or regional standards.

A major driver for the development of these standards has been the directive from the World Trade Organization (WTO) regarding the reduction of technical barriers to trade through the use of international performance-based standards and regulations. Although the primary purpose of the ISO 15928 series is to facilitate international trade for housing, its applicability is not limited to this. Anticipated users of the standards are expected to include the following factors:

- Purchasing organizations and specifiers, as an efficient and effective way of defining their needs in terms of the various parameters described in the standards.
- Regulating authorities, as an efficient and effective method of specifying their minimum performance requirements in terms of the parameters described in the standards.
- Designers, who will need to relate the performance requirements expressed in terms of the parameters in ISO 15928 to the detailed design standards and design methods used in the design of the houses.
- Certifiers, who will need to determine that the actual constructed house will meet the performance levels expressed in terms of the parameters described in these standards.
- Technical assessment organisations tasked with the establishment of the fitness for use and continuing quality of innovative housing systems that deviate from established standard specifications.

- Lending organizations that incorporate performance requirements in their conditions for providing loans.
- Insurers who base their premiums and policy conditions in part on the certified performance levels of houses.
- Researchers and product developers who need to describe, in quantitative terms, the performance of housing systems or components thereof that are researched or developed.

This user manual is intended to provide these potential users with information on the background to the standards, and how it is intended that they be used.

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User guidance to ISO 15928 — Houses — Description of performance

1 Scope

This Publicly Available Specification provides user guidance to ISO 15928, which provides the framework within which performance specifications for houses can be developed.

The ISO 15928 series is confined to buildings occupied for residential purposes which may be separated or linked horizontally, but not linked vertically, which have their own access and do not share any common space.

2 Objective of the ISO 15928 series

The objective of the ISO 15928 series is to identify the methods that will be used to describe the performance of houses. Each standard relates to a separate housing attribute. The standards do not specify levels of performance and are not intended to replace national building code standards or technical regulations¹⁾, but to provide a standardized framework to enable documents and regulations to be developed. The standards do not provide design methods and/or design criteria.

Based on the framework provided by these ISO 15928 standards, users can describe their requirements in standardized performance terms. Additionally, the suppliers and constructors will be able to respond by describing the performance of their products in a similar manner. The purpose of these standards is to provide a standardized system that can be used to specify performance requirements and performance levels, or to rate houses in terms of a range of attributes²⁾.

The series when completed will address the principal attributes (the performance characteristic which identifies a basic user need being addressed by an individual performance standard) in houses, to facilitate the evaluation of the design and construction of houses in the international trading of houses or their sub-systems, and in developing quality systems for houses.

1) In this document, the terms Building Code, Standards and Technical Regulations are generic terms describing the local requirements. The actual terminology used varies internationally.

2) World Trade Organisation (WTO) *Agreement on technical barriers to trade* (WTO 1997) Clause 2.8 states that 'Whenever appropriate, members shall specify technical regulations based on product requirements in terms of performance, rather than design or descriptive characteristics'.

Paragraph 2 of Article V (Technical Specifications) of the World Trade Organisation's Plurilateral Agreement on Government Procurement requires that technical specifications, where appropriate, be in term of performance rather than design or descriptive characteristics.

3 Performance-based standards

3.1 General approach advocated in International Standards

ISO 6240 requires that each performance requirement shall be defined in terms of a function which is to be fulfilled, together with the properties on which verification and assessment will be based, and that each requirement shall have specified methods of assessment or verification of performance values, as follows;

- the means (measurement, calculation, test or method of examination) by which the achieved performance of the component or assembly will be assessed or verified;
- the means of predicting the performance over time of the component or assembly.

ISO 6241 (1984) (*Performance standards in building — Principles for their preparation and factors to be considered*) suggests that the method of assessment or verification of each performance requirement may be made by means of a test, calculation or judgment.

ISO 15928 is consistent with the requirements of both ISO 6240 and ISO 6241.

3.2 Framework for performance provided in ISO 15928

The performance-based approach advocated in the ISO 15928 series has a hierarchy that starts with a user need for each house attribute, followed by a performance description and performance parameters. (See Figure 1.)

Each part of ISO 15928 establishes, in respect of a range of housing attributes:

- user requirements (design objectives) (see Annex B);
- performance descriptions (see Annex B);
- the principles for describing performance;
- the parameters for quantifying performance; and
- the evaluation methods for confirming that the nominated performance will be achieved.

NOTE ISO 15928 provides the framework within which performance specifications for houses can be developed (see Annex C).

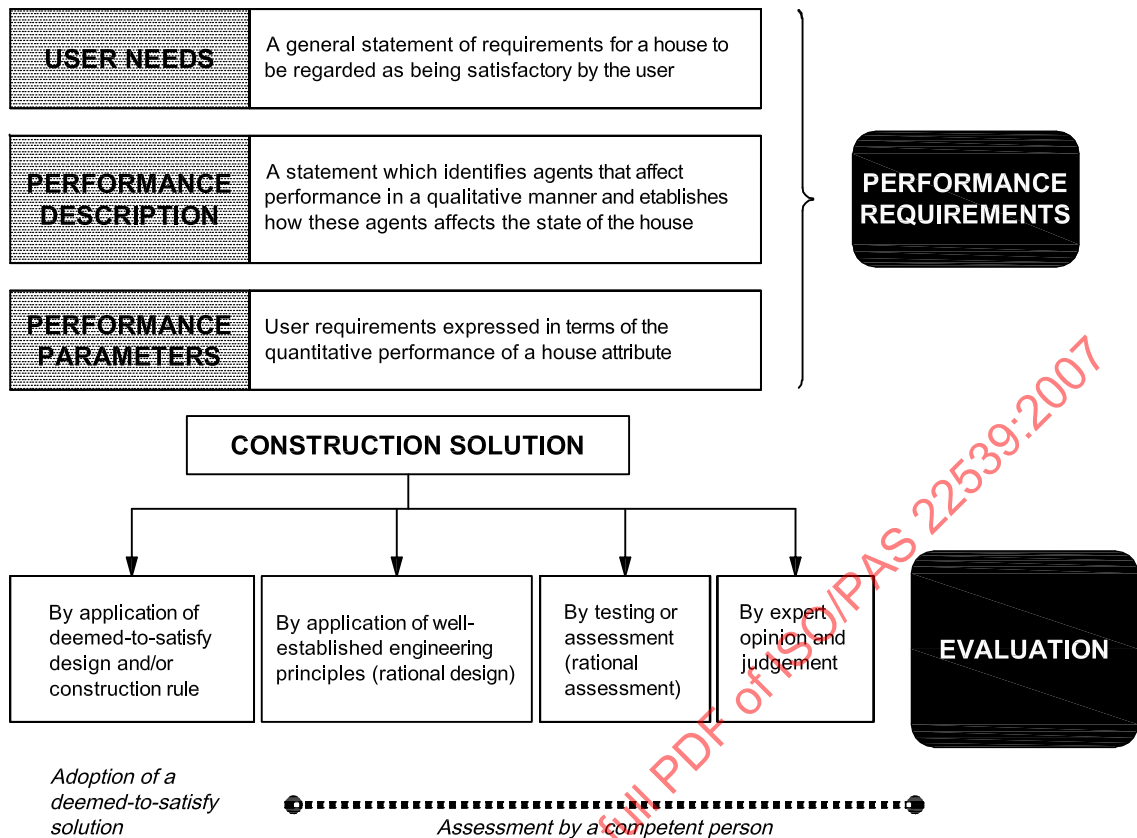


Figure 1 — Performance-based approach to the specification of houses as advocated by ISO 15928

3.3 Performance-based regulatory frameworks for buildings

The Nordic five-level structure, which is illustrated in Figure 2, has had a significant influence on the development of performance-based building regulations

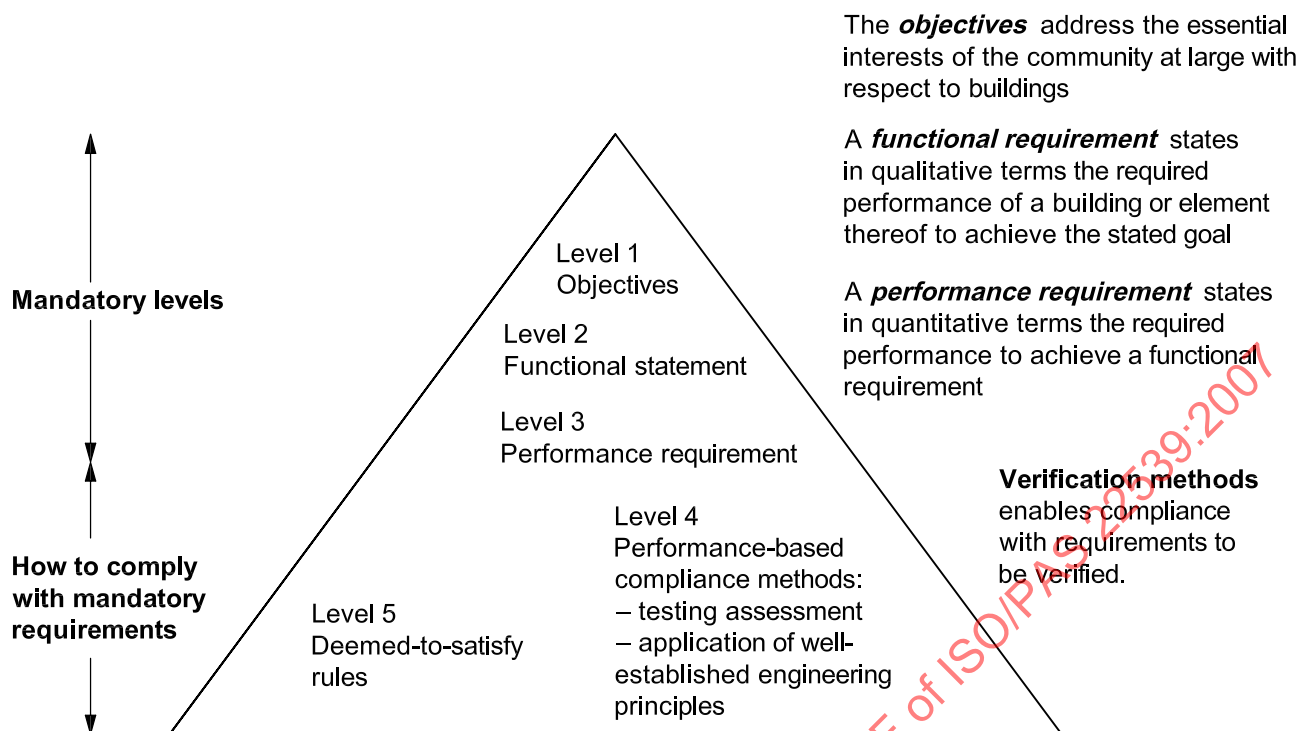


Figure 2 — Nordic five-level structure for performance-based codes

3.4 Relationship between ISO 15928 and performance-based regulatory frameworks

ISO 15928 has adopted a modified form of the Nordic model to performance-based standards as shown in Figure 1. The common descriptions applied in the systems based on the Nordic model are compared with those contained in ISO 15928 (see Table D.1 of Annex D).

4 Structure of the ISO 15928 series

4.1 General

This Clause provides information and background on the structure of the ISO 15928 series. An example of the structure of clauses is provided in Annex A.

Each standard follows the same basic format, only differing in applications specific to the attribute in question.

The format comprises the following major clauses.

- a) Scope, normative references and definitions.
- b) Performance specification, comprising
 - user needs,
 - performance description, and
 - principles for describing performance.

c) Parameters for description of performance:

- for example, for structural safety, parameters for describing actions and parameters for describing resistance.

d) Evaluation.

e) Annexes for Commentary and Bibliography.

The following subclauses show how this format is applied in the first part of the ISO 15928 series, *Structural safety*.

4.2 Scope, normative references and definitions

4.2.1 Scope

The Scope of each part of the ISO 15928 series is a brief statement of content and its relationship with other parts.

4.2.2 Normative references

Normative references are those documents, usually other International Standards, which are an integral part of the standard.

4.2.3 Definitions

The definitions are, as far as possible, consistent with current International Standards and are included in each part.

4.3 User needs

The needs of the user are the key to the use of the standards. This clause sets out, in definitive terms, what the user's expectations are.

For example, in ISO 15928-1, the structural safety user needs are described as follows:

“the risk of collapse or other kind of severe damage resulting from structural failure, which may affect the life safety of the house occupants, or people in its vicinity, shall not exceed a level acceptable to the user”

In ISO 15928-1, it is pointed out in the commentary on this subclause, that the acceptable level of performance will vary from user to user. In this case, the anticipation is that, in terms of structural safety, the people inside the house would not want to be hurt by structural collapse and those outside by flying debris. Additionally, there is, of course, concern for the potentially high cost of repairs in the event of structural failure.

4.4 Performance description

This clause introduces the method by which the required performance will be described.

For example, in the case of structural safety, it is expressed in terms of the capacity of the whole house and its parts, with an appropriate degree of reliability, to maintain their resistance and equilibrium under all actions likely to occur during its design working life.

In the commentary, it is indicated that the degree of reliability is up to the user. There will, of course, be external constraints (such as building regulations), but the appropriate degree of reliability can be judged with due regard to the possible consequences of failure and the expense level of effort and procedures necessary to reduce the risk of failure.

4.5 Principles for describing performance

This clause simply states the principles under which the performance will be described.

For example, in the case of structural safety, it is by nominating the required structural actions (e.g., wind, earthquake, etc.) and the resistance of the structure under those actions.

4.6 Parameters for the description of performance

A group of variables used to quantitatively describe the performance.

For example, in the case of structural safety, these parameters cover both the description of the *Actions* and the description of the *Resistance*.

For example, in ISO 15928-1, the standard requires that the parameter for describing the wind performance is the design wind speed.

4.7 Evaluation

Evaluation sets up the framework for demonstration of compliance with the performance requirements. This can be accomplished by a number of means such as:

- analysis;
- testing;
- service experience; or
- a combination of them all.

Where appropriate International Standards are available, these will be referenced.

4.8 Commentary and bibliography

Each of the standards in the series is provided with a comprehensive commentary. The commentary is solely to provide guidance and information on the use and application of the standard. Compliance with the commentary is not a requirement of the standard.

Annex A (informative)

Format for each part of ISO 15928

A.1 Scope

A.2 Normative references

A.3 Definitions

A.4 (Attribute) performance

A.4.1 User needs

A.4.2 Performance descriptions

A.4.3 Principles for describing (attribute) performance

A.5 Parameters for the description of performance

A.6 Evaluation

Annex (including Commentary)

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Annex B (informative)

User needs and performance descriptions for attributes addressed in the ISO 15928 series

The ISO 15928 series will address a range of attributes as tabulated below. Currently, user needs and performance descriptions have been developed for 8 parts.

USER NEED (DESIGN OBJECTIVE)	PERFORMANCE DESCRIPTIONS
Part 1: Structural safety (published)	
The risk of collapse or other kind of severe damage resulting from structural failure, which may affect the life safety of the house occupants, or people in its vicinity, shall not exceed a level acceptable to the user.	The performance description is the capacity of the whole house and its parts, with an appropriate degree of reliability, to maintain their strength and stability under all actions likely to occur during its design working life.
Part 2: Structural serviceability	
The following characteristics of a house, for normal use and conditions, under all expected actions, should be kept within levels acceptable to the user. a) The functioning and appearance of the house and its components. b) The functioning of the occupants in the house. c) The functioning of the equipment in the house. d) The comfort of the occupants. e) The asset value of the house.	The performance description is the ability of the whole house and its parts, with an appropriate degree of reliability, to perform within established parameters under all expected actions for normal use in terms of: a) local damage (including cracking) (which may affect the efficiency and appearance of the house and its components); b) deformation (which may affect the efficient use or appearance of the house or the functioning of the people and equipments); and c) vibration (which may cause discomfort or affect the activity of occupants or the functioning of equipment).
Part 3: Structural durability (Approaching CD stage)	
The structural safety and serviceability performance of the house shall be acceptable to the user over the specified design working life used in ISO 15928-1.	The performance description is the ability of the whole house and its parts with an appropriate degree of reliability, to fulfill its intended safety and serviceability performance in the environment in which it is located over the specified design working life when subject to its intended use in terms of one or more of the following: a) external and internal environmental agents; b) maintenance schedule and specified component design life; c) changes in form or properties

Part 4: Fire safety (proposed as a work item)	
The fire safety performance of a house shall be such that the vulnerability of the house to fire ignition and the time for escape in the event of a fire are at a level acceptable to the user.	The performance description is the ability of the whole house and its parts, with an appropriate degree of reliability, in the event of a fire for: a) fire detection and alarm; b) fire suppression and spread; c) means of escape; and d) external and internal fire behaviour of the building envelope in relation to degree of fire resistance and emission of smoke and toxic gasses.
Part 5: Energy efficiency (to be proposed as a work item)	
The energy consumption of the house, under normal use and conditions, should be kept within levels acceptable to the user, in relation to the following: a) thermal comfort; b) lighting; and c) hotwater services.	The performance description is the ability of the following to conserve energy: a) the building envelope to maintain the indoor environment with or without the use of equipment, with an appropriate degree of reliability, in terms of: 1) the function and use of the house; 2) the geographic location of the house; 3) the direction of solar radiation; and 4) the internal environment; and b) lighting and hot water services.
Part 6: Sustainability (to be submitted as a work item)	
The house over its lifetime, should, within levels acceptable to the user: a) be affordable to access, maintain and live in; b) minimizes the harmful effects on the environment; c) conserve resources; and d) provide employment opportunities in its construction, alteration or refurbishment.	The performance description is the ability of the house to respond to the following: a) economics; b) employment opportunities; c) energy efficiency; d) the biodegradability and non-noxiousness of demolition waste, embodied energy, recyclability, and renewability of construction materials; e) disposal of waste; and f) water efficiency.

Part 7: Safety, accessibility and usability (possible future work item)	
The following characteristics of a house, for normal use and conditions, should be kept within levels acceptable to the user in respect of the following: — safety in use; — ease of access; — circulation routes; and — spatial geometry.	The performance description is the ability of the whole house, and its parts, to enable occupants to: — reside safely within the house with respect to: — slipping and tripping; — impact with glazing; — protection against explosions; — falls from a height; — equip and furnish rooms for their nominated purpose; — move freely between spaces. In this context, the occupants include children and seniors. Special provisions may be necessary for people with disabilities.
Part 8: Moisture penetration (possible future work item)	
The house over its design working life, should, within levels acceptable to the user, resist the penetration of moisture from whatever cause into the interior of the house.	The performance description is the ability of the whole house and its parts, with an appropriate degree of reliability, to resist the penetration of rain water and the passage of moisture into its interior in respect of the following: a) the roof, walls and floors; and b) rising damp in walls above floor level.
Indoor environment	
Indoor air quality Lighting Ventilation Acoustics Colour and surface textures	
Outdoor environment	
Landscaping Colour and surface textures	
Durability	
Surfaces Non-structural components	
Constructability, maintainability and adaptability	
Transportation to site, erection and occupational health and safety Construction accuracy Stormwater disposal	
Health and hygiene	
Sanitation Water supply Waste removal	
Security	

Annex C (informative)

Example of a procurement specification for houses based on ISO 15928

C.1 Scope

This specification describes and quantifies the required performance for a number of housing attributes associated with a housing project involving the provision of one or more houses which may be separated or linked horizontally, but not linked vertically, which has its own access and does not share any common space.

The specification covers the following attributes of a house:

- a) structural safety
- b)(name attributes addressed by the specification)

C.2 Normative references

The following national and international standards contain provisions which, through reference in this text, constitute provisions of this standard. All standards are subject to revision and reference to a standard is deemed to be a reference to the latest edition of that standard.

C.3 Definitions

For the purposes of this specification, the definitions given in the various parts of ISO 15928 identified in the normative references and the following definitions apply.

C.3.1

components

part of a house that can be identified, such as a floor, wall, etc.

C.3.2

evaluation

confirmation that the nominated performance is achieved

C.3.3

performance

behaviour of houses related to users' needs

C.3.4

performance requirements

qualitative performance criteria which enables the functional requirements to be satisfied for a nominated level

C.3.5

performance description

a statement which identifies agents that affect performance in a qualitative manner and establishes how these agents affect the state of the house

C.3.6

performance parameters

user needs expressed in terms of the quantitative performance of a building attribute

C.3.7**parameters**

a group of variables used to quantitatively describe the performance of an attribute

C.3.8**rational assessment**

assessment of the adequacy of the performance of a solution in relation to requirements by a process of reasoning, calculation and consideration of accepted engineering principles, based on a combination of deductions from available information, research and data, appropriate testing and service experience

C.3.9**rational design**

a process of reasoning and calculation based on the use of a standard or other relevant technical document

C.3.10**specification data**

data that make this standard applicable to a particular housing project

C.3.11**user**

person that a house is designed to accommodate

C.3.12**user needs (design objectives)**

a general statement of requirements for a building that may be regarded as being satisfactory by the user

C.4 Description of the site

The precise location of the site, the amenities available and geographical features which impact on the design or construction of the house are described in the specification data.

C.5 Design and construction requirements

The design and construction of the house shall be such that the user needs and performance descriptions contained in Table 1 are satisfied at the level specified for the associated performance parameters stated in the specification data.

Table C.1 — User needs and performance descriptions

Attribute	User need (design objective)	Performance description
Structural safety	The risk of collapse or other kind of severe damage resulting from structural failure, which may affect the life safety of the house occupants, or people in its vicinity, shall not exceed a level acceptable to the user.	The performance description is the capacity of the whole house and its parts, with an appropriate degree of reliability, to maintain their strength and stability under all actions likely to occur during its design working life.
<i>Add further attributes as required</i>	<i>Add further user need (design objective) as required</i>	<i>Add further performance description as required</i>

C.6 Evaluation

C.6.1 Housing solutions

Housing solutions, which are adopted for each attribute, shall be such that it can be demonstrated or predicted with certainty, using one or more of the methods described in Table 2 as provided for in the specification data, that the requirements of 5 are satisfied:

Table C.2 — Methods of demonstrating compliance with performance requirements

Method	Description
1)	Self-certification of compliance with the provisions of national or international standards listed in the specification data
2)	Self-certification of calculation of measurement
3)	Testing in accordance with standards identified in the specification data by an independent and accredited laboratory
4)	The preparation of a rational design in terms of standards and by a defined person identified in the specification data.
5)	The undertaking of a rational assessment by a defined person identified in the specification data.
6)	Certification of compliance by a member body of the World Federation of Technical Assessment Organizations

C.6.2 Reliance

Reliance on service experience in rational assessments shall only be made where there are sufficient numbers of representative examples available, exposed to similar or more severe service conditions, together with adequate documentation.

C.6.3 Testing

Testing shall incorporate, as appropriate, a realistic representation of materials, loading conditions, environmental influences, boundary conditions and construction practices. Testing for evaluating structural serviceability shall be full scale. Testing for evaluating structural response shall be full scale, unless all scale effects can be appropriately estimated.

C.6.4 Assumptions

Assumptions made and the level of reliability of rational designs or rational assessments (or both) shall be such that a peer review of the structural system or part thereof would arrive at a similar conclusion. The manner in which each performance parameter, in respect of each of the attributes, must be documented for compliance auditing.

C.7 Specification data

C.7.1 Description of the site

Provide details of the precise location of the site, the amenities available and geographical features which impact on the design or construction of the house.

C.8 Performance parameters

C.8.1 Structural safety parameters

C.8.1.1 The design working life is in respect of the structural system and non-accessible components and years for repairable or replaceable components.

C.8.1.2 The actions that affect the structural performance of a house are described by means of the representative values as tabulated below.

AGENT	PERFORMANCE PARAMETER
HOUSE STRUCTURE	
Wind actions	Wind pressure derived from ISO 4354 for a wind speed of m/s based on a 3 second gust
Seismic actions	The ground acceleration response spectrum for the site is
Ground conditions and movements	The ground conditions and estimated surface movements are as follows:
STRUCTURAL ELEMENT: ROOF	
Permanent actions	Self-weight of covering, ceilings, structure and geysers, if any.
Imposed actions	In accordance with the provisions of ISO 2103.
Wind actions	Wind pressure derived from ISO 4354 for a wind speed of m/s based on a 3 second gust
Snow actions	The ground snow depth is metres. The snow density is kg/m ³ . The duration of the snow is days per year.
STRUCTURAL ELEMENT: WALLS	
Wind actions	Wind pressure derived from ISO 4354 for a wind speed of m/s based on a 3 second gust
Permanent actions	Self-weight of walls and supported roofs.
Imposed loads	In accordance with the provisions of ISO 2103
STRUCTURAL ELEMENTS: FLOOR LOADS	
Permanent actions	Self-weight of flooring system Finishes
Imposed actions	In accordance with the provisions of ISO 2103

C.8.1.3 The resistance of the structure under the effects of the actions shall be assessed in terms of limit state criteria or allowable stress criteria in accordance with the provisions of the following standards:

IMPORTANT — (list relevant National/International standards)

C.9 Evaluation

C.9.1 Structural safety

C.9.1.1 Methods 1 and 4 to 6 may be used to demonstrate compliance.

C.9.1.2 A Chartered Structural Engineer shall undertake any rational design (method 4 in Table C.2) or rational assessment (method 5 in Table C.2).

C.9.1.3 The following National/International standards shall apply:

Method 1:(list National/International standards).....

Method 4:.....(list National/International standards)

C.10 References

R. B. Watermeyer, R.B. and R. V. Milford, R.V. *The Use of Performance Based Building Codes to Attain Sustainable Housing Objectives: The South African Approach.* (See [7] in the Bibliography.)

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