International Standard 6241

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION•МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ•ORGANISATION INTERNATIONALE DE NORMALISATION

Performance standards in building — Principles for their preparation and factors to be considered

Normes de performance dans le bâtiment — Principes d'établissement et facteurs à considérer

First edition — 1984-05-01

UDC 69.001.3 **Ref. No. ISO 6241-1984 (E)**

Descriptors : buildings, standards, performance, presentation.

Price based on 10 pages

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been authorized 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 6241 was developed by Technical Committee ISO/TC 59, *Building construction,* and was circulated to the member bodies in December 1982.

It has been approved by the member bodies of the following countries:

Australia	Hungary	Norway
Belgium	India	Portugal
Bulgaria	Iran	Romania
Canada	Israel	South Africa, Rep. of
Czechoslovakia	Italy	Spain
Egypt, Arab Rep. of	Korea, Dem. P. Rep. of	Sweden
Finland	Korea, Rep. of	United Kingdom
France	Netherlands	
Germany, F.R.	New Zealand	

The member body of the following country expressed disapproval of the document on technical grounds:

Denmark

Printed in Switzerland

Performance standards in building — Principles for their preparation and factors to be considered

0 Introduction

The development of performance standards for building involves work at all levels from fundamental to specific. The aim is to define the performance required of whole buildings, parts of buildings and building products in terms of the functional requirements of their users.

The work includes the preparation of :

a) fundamental (level 1) standards on the general principles of defining performance requirements and of establishing standard methods for their evaluation, such as ISO 6240 and ISO 7162[1];

b) fundamental standards on the means of expression by which user requirements can be communicated, such as ISO 6242[2];

c) fundamental standards concerning the definition of agents relevant to building performance, such as ISO 6243[3];

d) wide-ranging and specific (levels 2 and 3) standards for the performance of particular types of building or product and on methods for assessing individual performance attributes. These would be prepared by committees responsible for the particular items.

This International Standard is a guide to level 1 standards, intended primarily to assist standards committees in their work by stating the general principles for drafting performance standards for building. It includes four tables aimed at identifying the main factors to be considered in their elaboration, i.e.

a) the user requirements (table 1);

b) the possible uses of the buildings and their spaces (table 2);

c) the building sub-systems of which the product is a part (table 3);

d) the agents, of any nature and origin, which are relevant to the performance of the product in use (table 4).

These tables may also serve to arrange the items given in the standards; it is particularly recommended that the performance of a product is stated in the order of the user requirements which it has to meet.

The tables are not exhaustive. Their relationship to current classification systems for building documentation is indicated.

1 Scope

This International Standard lays down general principles for the preparation of performance standards in building. It complements ISO 6240 by listing factors to be considered for performance standards.

2 Field of application

This International Standard is intended to assist standards committees concerned with the performance of whole buildings, of parts of buildings (components, assemblies and sub-systems) and of the spaces within and around buildings.

The principal uses envisaged are :

a) as a basis for the preparation of performance standards;

b) as an *aide-mémoire* for drafting particular standards.

3 Reference

ISO 6240, *Performance standards in building — Contents and presentation.*

4 Definitions

For the purpose of this International Standard, the following definitions apply:

4.1 user: Person, animal or object which a building is designed to accommodate.

1) ISO 7162, *Performance standards in building — Contents and format of standards for evaluation of performance.* (In course of preparation.)

2) ISO 6242, *Building performance — Expression of functional requirements of users — Thermal comfort, air purity, acoustical comfort, visual comfort and energy saving in heating.* (In course of preparation.)

3) ISO 6243, *Climatic data for building design — Definitions and symbols.* (In course of preparation.)

4.2 agent: Whatever acts on a building or parts of a building.

4.3 user requirement: Statement of need to be fulfilled (by a building).

4.4 performance: Behaviour (of a product) related to use.

NOTE — A product may mean a building as a whole or any part of it.

4.5 performance requirement: User requirement expressed in terms of the performance of a product.

4.6 (building) sub-system: Part of a building fulfilling one or several of the functions needed to meet the user requirements.

4.7 component: Product manufactured as a distinct unit to serve a specific function (or functions).

4.8 assembly: Aggregate of components used together.

5 Principles for the preparation of performance standards

5.1 Objectives

Performance standards, which are generally wide-ranging documents, define specific behaviour of whole buildings, parts of buildings or spaces within and around them.

When dealing with components, they permit different products as solutions in alternative designs or materials (for example, windows of wood, steel, aluminium or plastics). Performance standards define requirements without imposing restrictions on the form or materials of the solutions. It has to be stressed that performance standards are aids to, but not substitutes for, design.

5.2 Types of application

The need is foreseen for coherent sets of performance standards dealing with different types of subject, such as

a) performance standards for whole buildings, for example performance requirements and methods of assessment for thermal comfort;

b) performance standards for spaces in buildings, for example performance requirements for bathrooms;

c) performance standards for sub-systems, for example loadbearing structural systems or electrical and mechanical services;

d) performance standards for components, joints or building assemblies, for example for a window (component), for a joint between façade and floor (joint), for a finished façade (assembly).

In general, performance standards may also be established for any material intended to serve a specific function in the building, the performance being defined for the material when formed into a product considered in its conditions of use *in situ*, for example a tile, a pipe for water distribution.

Other standards or documents which are complementary to performance standards may describe the details of products that provide solutions to the performance requirements laid down (see 7.2).

5.3 Contents

Performance standards should include statements about :

a) performance requirements (expressed as ranges of values or grades) for buildings or their parts under specified conditions and referring to :

1) related user requirements (see 6.1),

2) agents relevant to building performance, such as climate, site conditions, occupancy characteristics or design consequences (see 6.4);

b) methods of assessing each performance characteristic, including performance over time referring to the requirements and agents, as for a).

The user requirements and the agents relevant to performance should be expressed using standard means of expression and units of measurement with, where applicable, scales of values or grades. In this respect, reference should be made to ISO 6242 and ISO 6243. [See footnotes 2) and 3) to clause 0.]

The contents of, and the order of the clauses in, performance standards should comply with ISO 6240.

It may be convenient for methods of assessment to be given in documents separate from the performance standards to which they relate. The contents and presentation of standards or parts of standards defining methods of assessment should comply with ISO 7162. [See footnote 1) to clause 0.]

5.4 Methods of assessment or verification

5.4.1 General

The method of assessment or verification of each performance requirement may be by means of a test, calculation or judgement.

In all cases, reliability and performance over time will need to be included in the assessment.

5.4.2 Test

A test provides a basis for assessing the satisfaction of functional requirements of a building, a sub-system, a component or assembly by direct measurement or other means of determination under either real conditions of use or conditions appropriately correlated to use, for example

a) by the measurement of the overall resultant temperature of a room;

b) by the record of the evacuation time of a building;

c) by the record of the cracks occurring in a wall under load to determine its serviceability limit state;

d) by post-occupancy inspection.

5.4.3 Calculation

A calculation indicates the extent of satisfaction of functional requirements by means of a theoretical model of behaviour, for example

a) the calculation of the overall resultant temperature of a room from its thermal properties, its airtightness, its heat input from heating appliances and external environmental conditions;

b) the estimation of the evacuation time of a building from the occupancy of its rooms and the sizes and arrangement of escape routes;

c) the calculation of the serviceability limit state of a wall, based on the strength of its materials and its stress distribution.

5.4.4 Judgement

A judgement or appraisal can permit the extent of satisfaction of performance requirements to be assessed on the basis of experience of similar cases and conditions or compliance with well-established solutions.

5.4.5 Choice of method

In most cases, and particularly when developing or checking a design before construction, it will be possible to determine whether a building as a whole satisfies its user requirements from a calculation or an assessment based on the performance of its parts.

However, in some situations (for example with an innovative design, or when reappraising an existing building) or for some performance requirements (for example ventilation, acoustics), the extent of satisfaction of user requirements may need to be assessed in part by direct measurement or test of the building itself, or of a sample or prototype.

The choice of a method of assessment or verification depends also on the level of accuracy appropriate to the relative importance and the order of priority of the performance requirement.

6 Factors to be considered in performance standards

6.1 User requirements (table 1)

6.1.1 Table 1 lists the user requirements, which the building should satisfy, in various categories. They apply to spaces within (or around) buildings considered independently of their location and design.

The performance requirements apply to the building fabric and its sub-systems. They are derived from the user requirements by taking account of the building location and initial design decisions.

The requirements are the same, but they are expressed differently; for example, in the case of thermal comfort in winter:

— user requirement: a minimum internal air temperature of 20 °C shall be achieved on all but 3 days per year, on average;

— performance requirement: a minimum internal air temperature of 20 °C shall be achieved when the daily mean outside air temperature is −2 °C or above (assuming this to be the low extreme reached or surpassed on an average of 3 days per year on a particular site).

6.1.2 Table 1 is a master list, so that in any one case only a selection of the requirements will apply. For product standardization, the list serves as an *aide-memoire* to identify the functions of buildings; a product may contribute to satisfying one or more of these requirements, according to the role assigned to it.

6.1.3 For particular needs, table 1 may be complemented by categories relating to :

— the user requirements which may not be expressed quantitatively, i.e. aesthetic, cultural or sociological;

— the requirements of other bodies, such as the builders (tolerances, buildability, etc.) or the component manufacturers (dimensional coordination).

All these requirements may also be classified according to other criteria, for example the authority which specifies them: regulatory requirements, standards, town planning, owner's decisions, etc.

6.2 Uses of buildings and spaces (table 2)

6.2.1 Table 2 lists the primary uses to which rooms, spaces or whole buildings may be put. The categories of use or occupancy are denoted by their common name, or the activity carried out.

A space may be named according to its main use while additionally serving secondary uses, for example a garage (transport) also used for storage, maintenance, as a workshop, etc. Similarly, buildings may include secondary uses, for example a housing block with ground floor shops; a hospital containing office spaces, catering spaces, etc.

The uses are listed in the order of the CI/SfB classification.[1)]

6.2.2 The uses will affect the selection and order of importance of the user requirements in table 1 that are relevant to the standard.

1) CI/SfB *Construction Indexing Manual*, RIBA Publications Limited, London, 1976.

The principal purpose of table 2 is to denote classes to which specific levels for one or more user requirements (table 1) and, in some cases, specific values of the agents (table 4) will correspond.

6.2.3 The table should not be used without also considering whether the order of size of spaces should affect the development of the standard or standards which are being drafted. It may be convenient to give separate consideration to :

a) external spaces, for example courtyard, terrace;

c) medium-size spaces, for example office, classroom;

b) large single spaces, for example sports hall, auditorium;

d) small spaces, for example bedroom, bathroom;

e) small spaces for equipment etc., for example cupboard, larder, clearways for pipes and ducts.

Other classifications of spaces or buildings may sometimes be useful in defining the application of standards, based, for example, on aspects of safety, privacy, health, ownership or other factors.

6.3 Sub-systems of the building fabric (table 3)

6.3.1 Table 3 lists the physical parts of the building fabric in terms of sub-systems which exclude furniture and furnishings. This approach is based on the consideration of function only, being independent of any particular method, material or order of constructing the building.

A sub-system may be formed of components and assemblies distributed throughout the whole building (for example heating and ventilation services). Conversely, a component or assembly may be part of one, two or more sub-systems (for example, a façade unit may be a part of the loadbearing structure, of the envelope, of the heating and ventilation services, of the electrical services, etc.).

Thus, a component or assembly does not necessarily correspond exactly to a "functional" sub-system of the building. It may perform all, or only some of the functions of the sub-system. It may also contribute to two or more sub-systems simultaneously. Examples of common components, elements or assemblies which perform the functions of each sub-system are given in brackets. Reference is also made to the SfB classification.[1)]

6.3.2 Table 3 serves in particular as an *aide-memoire* for programming the standardization of products or performance evaluation methods.

6.3.3 For particular needs, the building may also be subdivided according to other criteria, for example by components, according to the trades involved, by stages in the building process, etc.

6.4 Agents relevant to building performance (table 4)

6.4.1 Table 4 lists the agents relevant to the performance of buildings and their constituent parts.

The basis of the table is the listing of agents according to their origin and to their nature, as follows :

a) Origin of agents

1) external to the building envelope

— atmospheric : natural
man-made

— ground : natural
man-made

2) internal to the building envelope

— building occupancy
— building design consequences

The external agents as well as the occupancy agents are imposed on the building by its environment. The building design consequences are to be considered as imposed on the components, since the rest of the building is a part of the environment of the component.

b) Nature of agents

— mechanical
— electromagnetic
— thermal
— chemical
— biological

Depending on the performance influenced, the agents are to be considered separately or in combination with each other.

The agents are listed according to their own nature and not according to the nature of their action on the buildings or components; for example, a thermal agent may have a physical action (for example heating) or a chemical action (for example catalysis); a chemical agent like water also may have a physical action (for example dissolution) or a chemical action (for example hydration); moreover, the agents combined with each other may have additional physical actions (for example wetting followed by freeze-thaw cycles), chemical actions (for example photo-oxidation by atmospheric oxygen and solar radiation) or biological actions (for example spread of roots).

6.4.2 Table 4 serves to list the agents to be taken into account when defining performance and specifying requirements. The agents that apply in any particular situation, and their magnitudes, will depend on the building's situation, form, intended use and the way it is designed to perform. For many

1) CIB Report No. 22 : *The SfB system*, International Council for Building Research Studies and Documentation, Rotterdam, 1973.

purposes, and particularly for standardized products, standard values and standard procedures for determining values will be used.

6.4.3 The agents may also be listed according to their physical state (gas, liquid, solid), to their variation over time (distribution characteristic, duration, rate of variation, frequency, probability of occurrence), etc.

6.5 Performance characteristics of products

The performance characteristics of products are not listed specifically in this International Standard. These will depend on the sub-systems of which the product forms a part (see table 3).

The lists of properties given in CIB Report No. 18[1] can be used as an additional *aide-memoire.* The required performance values, whether for products or for the sub-systems, will depend on the user requirements related to the category of use (tables 1 and 2), on the design of the building (for example its form and orientation) and on the various relevant agents (table 4).

6.6 Uses of the tables

6.6.1 General

Tables 1 to 4 are intended as aids :

a) to the establishing of programmes for drafting performance standards, and

b) to the detailed consideration and structuring of the content of performance standards.

Use of the tables helps to ensure that the scopes of performance standards are unambiguously defined and that account is taken of all factors affecting performance, even in standards with limited scopes.

6.6.2 Programming

When programmes which list performance standards have to be drafted, the items within the tables indicate possible subjects. The tables will also provide the basis for defining the "scope" and "field of application" of these standards.

It is not intended that all items mentioned in the tables should necessarily be dealt with in the standards, but that all should be reviewed as an aid to preparing a complete and well-balanced programme.

6.6.3 Drafting

The tables will be of use as *aides-memoire* for drafting performance standards in accordance with ISO 6240. In particular :

a) the "scope" and "field of application" clauses (see ISO 6240, subclauses 4.1 and 4.2) should be drafted using the categories in tables 2 and 3;

b) the "purpose and context of use" clauses (see ISO 6240, subclause 4.5) should be drafted using tables 1 and 4;

c) in listing "performance requirements" (see ISO 6240, subclause 4.6), it is recommended that the order of the categories in table 1 be followed. The order given in the other tables should be followed when appropriate.

Not all items mentioned in the tables will necessarily be relevant to every standard being drafted; on the contrary, it is expected that standards will concentrate on a small number of requirements which have special importance. However, all items in the tables should be reviewed as an aid to preparing a satisfactory standard.

7 Other aspects of product standards

7.1 Assembly conventions

In addition to performance requirements, a performance standard for a component should be drafted with reference to International Standard conventions, aimed at facilitating the design and the process of building with components, on

a) dimensional coordination and preferred sizes;

b) tolerances and fit;

c) joints.

7.2 Prescriptive standards

Standards describing the design and constituent materials of products should also include performance information, for example the performance values which products may be expected to achieve, when made in accordance with such standards and assessed in accordance with the method of assessment for the corresponding performance standard.

7.3 Relations between standards

The performance standards are the general standards with which any product should comply.

The standards for performance assessment (calculation, test) provide the means of verifying the performance defined by the general standards.

The prescriptive standards define how to design and construct products that satisfy performance standards.

1) CIB Report No. 18 : *Master headings for the arrangement and presentation of information in technical documents for design and construction.* International Council for Building Research Studies and Documentation, Rotterdam, 1983.

To make from these standards a coherent set, it is necessary to give

a) in the performance standards, reference to the test or calculation standard which may be applied to determine the performance;

b) in the test or calculation standards, reference to the corresponding performance standards;

c) in the prescriptive standards, reference to the performance standards and to the test or calculation standards according to which the performance values given have been assessed.

Table 1 — User requirements

Category	Examples
1 Stability requirements	Mechanical resistance to static and dynamic actions, both individually and in combination. Resistance to impacts, intentional and unintentional abuse, accidental actions. Cyclic (fatigue) effects.
2 Fire safety requirements	Risks of outbreak of fire and of spread of fire. Physiological effects of smoke and heat. Alarm time (detection and alarm systems). Evacuation time (escape routes). Survival time (fire compartmentation).
3 Safety in use requirements	Safety in respect of aggressive agents (protection against explosions, burning, sharp points and edges, moving mechanisms, electrocution, radioactivity, inhalation or contact with poisonous substances, infection). Safety during movements and circulation (limitation of floor slipperiness, unobstructed passage, guard rails, etc.). Security against human or animal intrusion.
4 Tightness requirements	Water tightness (rain, ground water, drinking water, waste water, etc.). Air and gas tightness. Snow and dust tightness.
5 Hygrothermal requirements	Control of air temperature, thermal radiation, air velocity and relative humidity (limitation of variation in time and in space, response of controls). Control of condensation.
6 Air purity requirements	Ventilation. Control of odours.
7 Acoustical requirements	Control of external and internal noise (continuous and intermittent). Intelligibility of sound. Reverberation time.
8 Visual requirements	Natural and artificial lighting (required illuminance, freedom from glare, luminance contrast and stability). Sunlight (insolation). Possibility of darkness. Aspect of spaces and surfaces (colour, texture, regularity, flatness, verticality, horizontality, perpendicularity, etc.). Visual contact, internally and with the external world (links and barriers for privacy, freedom from optical distortion).
9 Tactile requirements	Surface properties, roughness, dryness, warmth, suppleness. Freedom from discharges of static electricity.
10 Dynamic requirements	Limitation of whole body accelerations and vibrations (transient and continuous). Pedestrian comfort in windy areas. Ease of movement (slope of ramps, pitch of staircases). Manœuvrability (operation of doors, windows, controls on equipment, etc.).
11 Hygiene requirements	Facilities for human body care and cleaning. Water supply. Cleanability. Evacuation of waste water, waste materials and smoke. Limitation of emission of contaminants.
12 Requirements for the suitability of spaces for specific uses	Number, size, geometry, subdivision, and interrelation of spaces. Services and equipment. Furnishability, flexibility.
13 Durability requirements	Retention of performance over required service life subject to regular maintenance.
14 Economic requirements	Capital, running and maintenance costs. Demolition costs.

Table 2 — Uses of buildings and spaces

Uses	Examples of spaces	Examples of buildings
1 Transport (of people, goods, fluids, electricity, etc.)	Lift shaft, garage	Railway station, filling station
2 Industry (manual work, production, agriculture, experimentation, etc.)	Workshop, production hall, stable, laboratory	Factory, farm, laboratory building
3 Office, commerce (study, writing, drawing, sale, book-keeping, etc.)	Office, design office, shop	Office building, supermarket
4 Medical care (examination, treatment, operations, etc.)	Operating theatre, consulting room, sick-room, X-ray room, waiting room	Hospital, health centre
5 Recreation (gymnastics, swimming, play, dance, etc.)	Gymnastic hall, swimming pool, sports hall, play room	Sports centre, dance hall
6 Culture (worship, education, meeting, etc.)	Meeting room, showroom, exhibition room, class-room, auditorium, reading room	Congress building, arts centre, church, theatre, school, library, museum
7 Housing (sleeping, dwelling, etc.)	Bedroom, living room	House, block of flats, hotel
8 Circulation	Corridor, stairway	Covered way
9 Catering (cooking, consumption)	Kitchen, dining room	Restaurant
10 Hygiene	Bathroom, WC	Public lavatory
11 Cleaning, maintenance	Laundry, maintenance room	Wash-house
12 Storage	Shed, cloak-room, store room	Warehouse
13 Service	Plant room, meter-room	Guard house
14 Others		