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Building environment design — Indoor environment — General principles

Conception de l'environnement des bâtiments — Environnement intérieur — Principes généraux

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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.

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 16813 was prepared by Technical Committee ISO/TC 205, *Building environment design*.

Introduction

This International Standard gives the general principles of building environment design and has been prepared for building designers, i.e. architects, environmental designers and building system designers, as well as building clients, contractors, government officials, and academic staff.

The aim is to assist these groups in applying an effective design process in the pursuit of high-quality indoor environment for the occupants, while also seeking to protect the environment for the future generations. This International Standard provides the framework for sustainability issues to be taken into account in the design constraints from the very early stages of building design and requires the design drawings and specifications to be evaluated at every design stage according to the criteria provided by other relevant standards.

Building environment design — Indoor environment — General principles

1 Scope

This International Standard establishes the general principles of building environment design taking into account healthy indoor environment for the occupants, and protecting the environment for future generations. This International Standard promotes an approach in which the various parties involved in building environmental design collaborate with one another to provide a sustainable building environment. The unique features of the design process are articulated by the following aims:

— to provide the constraints concerning sustainability issues from the initial stage of the design process, including building and plant life cycle together with owning and operating costs to be considered at all stages in the design process;

— to assess the proposed design with rational criteria for indoor air quality, thermal comfort, acoustical comfort, visual comfort, energy efficiency and HVAC system controls at every stage of the design process;

— to make iterations between decisions and evaluations of the design throughout the design process.

The building environment design involves not only architectural design associated with environmental quality but also environmental system design associated with effective controls. This International Standard is applicable to building environment design for new construction and the retrofit of existing buildings.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 15686-1, *Buildings and constructed assets —Service life planning — Part 1: General principles*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
acoustic comfort
reaction of occupants to the indoor acoustical environment, described in terms of sound pressure level and audibility

3.2
competent person
person who is capable of relating and understanding all the design parameters involved in the design of the building and its associated services

3.3
computer analysis
detailed examination to quantify the effects of the proposed building design in terms of energy requirements and the indoor environment

NOTE Ideally by hourly computer simulation on annual basis during the lifetime of the building.

3.4
assumptions
set of descriptions that are required to be considered by the designer if the actual requirements are difficult to identify at the design decision-making stage

3.5
building environment design
course of action to be taken in building design, involving architectural and environmental system design of the building, its parts or its building service components

NOTE Sustainability issues are considered as being significant in building environment design.

3.6
building system control
measures taken to ensure the system operates in accordance with the specified conditions

3.7
commissioning
sequence of events that ensure the building and the HVAC systems are functioning in accordance with the design parameters for the building lifetime

3.8
constraints
fixed items including the requirements of local building regulations, health and occupational legislation, and design fundamentals that are required to be met during the design process

3.9
design aids
set of guidelines used for conceptual details and final designs for the indoor environment, based on the requirements whether or not expressed by the client and stakeholders

3.10
design concept
set of fundamental thoughts for the project starting at the design work stage taking into account the constraints

3.11
design criteria
set of descriptions based on a particular environmental element and the associated system controls used for assessing the presented design

EXAMPLE Examples of environmental elements are indoor air quality, thermal, acoustical and visual comfort, energy efficiency and electromagnetic fields.

3.12
design parameters
set values of the internal environmental conditions to be achieved regardless of the changing external environmental conditions

3.13
design process
course of actions performed to produce a set of design drawings and specifications describing the functions for which a building has the potential to provide

NOTE Any changes in the building environment design after iterations of decisions and evaluations of the design have been made are required to be analysed until the final design stage is achieved.

3.14
detail design
design developed during the third stage of the design process based on the approved evaluation of the schematic design

3.15
document
written description of the essential factors of every design stage to be retained for future information

3.16
energy conservation
measures applied to reduce building energy use without seriously influencing the global environment and to provide the environment that achieves the design criteria

3.17
energy efficiency
measures that ensure the building and system function in accordance with the design parameters by the efficient use of energy

3.18
evaluation
sub-process to assess the proposed design with regard to the design criteria at each of the design stages

3.19
final design
design of the final stage of the design process based on the approved evaluation of the design detail

3.20
global cost
life cycle cost plus social cost for sustainability, all costs related to the measures deemed necessary to ensure the efficient running of the building, including the energy and other conservation issues that can apply

See ISO 15686-1.

3.21
indoor air quality
quality of air inside non-industrial buildings, described in terms of odour, chemical and biological pollutants, is related to the ventilation rate, air distribution patterns and pollution sources to ensure human health, olfactory comfort and perceived comfort

3.22
life cycle cost
total costs of a building of or its parts throughout its life, including the costs of planning, design, acquisition, operations, maintenance and disposal, less any residual value

See ISO 15686-1.

3.23
project
course of action necessary to ensure that a new or existing building meets the requirements of its clients and the constraints applied

NOTE A project starts when the client formally or informally requests the architect or building engineer to perform actions to create a building. The project ends when the requirements and constraints set by the client or the project regulations are achieved, or when it is found it is impossible to fulfil the client's requirements and constraints.

3.24
requirements
important but revisable items required by the client as well as the circumstances of a project that the designer should take into account throughout the design process

EXAMPLES Budget, physical dimensions, performance and general sustainability issues.

3.25
schematic design
initial design presented early in the design process based on the design concept

3.26
structure
physical shape, dimensions, and configuration of a building, its parts, or its building service components

3.27
sustainability
maintenance of ecosystem components and functions for future generations, to address economic efficiency, social issues and environmental preservation

3.28
thermal comfort
condition of mind derived from satisfaction with the thermal environment

NOTE Thermal comfort is the combined thermal effect of environmental parameters including air temperature, vapour pressure, air velocity, mean radiant temperature (fixed factors) and clothing and activity level of occupants (variable factors).

3.29
visual comfort
occupant satisfaction with the indoor visual environment, described in terms of illumination level, glare, visibility, reflection and psychological and physiological content with natural and artificial illumination

4 Fundamentals

4.1 General

General principles of indoor environment design allow the clients and designers to provide the desired quality of indoor environment in a sustainable building according to the fundamentals of the design process.

The design process aims to ensure efficient environmental building design providing the specified quality and performance level involving safety, health, comfort, and energy use, as well as sustainability and the philosophy, ethics, and assumptions taken by the people concerned. Building designers should define the goals based on the requirements, constraints and actual conditions to be achieved, integrating the owning and operating costs during the design stage.

4.2 Project information

The available project information that influences the development of design concepts together with constraints and all requirements shall be documented. When assumptions are made in lieu of necessary information related to the standards or regulations for building environment design, with respect to the indoor environment, these assumptions shall be documented. The project information provided by the users of this International Standard that influence the programming, development, and/or the design of building components and the building service systems shall also be documented.

4.3 Framework of generation and verification

Architectural design and building system design are goal-driven activities. The routes necessary to achieve the end result are not straightforward and shall be flexible. In some instances, the assumptions are made under uncertain conditions. Hence, the design process involves the iteration of generation and verification. The generation process is a sub-process where a design solution is synthesized, while the verification process is another sub-process in which the design solution depends on different design criteria.

4.4 Framework of documentation at approval

The evaluation and approval processes shall be documented. The documentation process shall explicitly state what is to be provided by the project. The evaluation and approval process shall demonstrate the stated goals can be achieved. Every document provided shall describe the characteristics planned and verify whether they are actually achieved. Approval should be obtained at each design stage.

The documents issued during this design process must cover the following questions.

— Is the stated definition adequate and feasible?

— Is the environmental design feasible?

— Is the specified structure expected to satisfy the constraints and requirements?

— Is the building capable of providing the quality and performance required?

4.5 Harmonization of architectural and system design

Since architectural design as well as the building system design contributes to the realization of the indoor environment, the general principles of building environment design should be used to harmonize the architectural and system design.

The general principles of building environment design should not restrict creative architectural design. These principles do not predefine the order or precedence of individual tasks in either the architectural or the building system design.

5 Design process

5.1 Stage I — Formulation of project definition

5.1.1 General

The objective of stage I is to clarify the project constraints and requirements. The client defines the constraints and requirements of the building and the required environment. The client might not state some of the constraints and requirements.

All constraints and requirements shall be explicitly described in document I. Consistency of the constraints and requirements shall be approved in the sub-process evaluation I. The approved conditions form the basis of the building project definition.

The approved constraints and requirements can diverge when unknown conditions exist, even though they appear consistent at this stage. In this case, the project definition should be revised to restore consistency.