
**Performance standards in building —
Definition and calculation of area and
space indicators**

*Normes de performance dans le bâtiment — Définition et calcul des
indicateurs de surface et de volume*

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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 9836 was prepared by Technical Committee ISO/TC 59, *Buildings and civil engineering works*, Subcommittee SC 3, *Functional/user requirements and performance in building construction*.

This second edition cancels and replaces the first edition (ISO 9836:1992), with added clauses.

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Introduction

The surface area and volume indicators derived from measuring spaces in buildings can be used to compare aspects of value, such as the proportion of space or volume which can be utilized functionally. As approximate values for planning, they can be a basis for further developments.

Reference to surface area and volume indicators when assessing buildings, which either already exist or which are in the planning stage, indirectly indicates certain economic characteristics of the buildings. Thus the relationship between the area taken up by the building and the usable area indicates whether the building costs and materials have been used to their best advantage.

In the same way, the relationship between the area of the building envelope and the usable area shows the extent to which basic savings have been made on the envelope and the running costs of the heating and air conditioning systems.

As far as the determination of the economic performance of whole buildings is concerned, surface area and volume indicators contain basic data for calculation and comparison of capital costs and for running costs and maintenance. They give a basis for the minimization of running costs by limiting the amount of space and the cost of individual materials. For example, if the area of the external walls is small compared to the usable area, this would indicate not only relatively low energy costs but also relatively low cleaning and maintenance costs for facades.

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Performance standards in building — Definition and calculation of area and space indicators

1 Scope

This International Standard deals with the definition and calculation of surface area and volume indicators.

In defining area measurement, this International Standard uses three measurement concepts:

- a) the intra-muros and extra-muros concept used in many parts of the world;
- b) the wall centre method of measurement used in many parts of the world;
- c) variations on these methods to comply with certain national laws, or for particular types of buildings.

The surface area and volume indicators defined in this International Standard are intended for practical use, as a basis for measuring various aspects of the performance of buildings or as a planning aid. In other words, they should enable judgement to be made on functional, technical and economic aspects of buildings.

This International Standard is intended to be used when establishing:

- specifications for the geometric performance of a building and its spaces (e.g. in design, purchasing procedures, etc., or in building regulations where appropriate);
- technical documentation relating to the performance of whole buildings prepared by designers, contractors and manufacturers;
- the amount of floor area that will not be effectively available for the placement of an individual's workplace, furniture, equipment, or for circulation;
- evaluation, comparison or control of the properties of a building which are connected to its geometric performance.

Although, as stated above, there are a variety of methods of area measurement around the world depending on the country and/or types of buildings, all measuring methods are not necessarily of practical use because of inability to identify real area (e.g. the wall centre method of measurement). Thus this International Standard specializes in the measurement solely for practical use.

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 6707-1, *Building and civil engineering — Vocabulary — Part 1: General terms*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 6707-1 and the following apply.

3.1

surface area indicators

amounts of certain types of area (e.g. usable area) and the relationship between different types of area (e.g. area occupied by structure/usable area)

3.2
volume indicators

amounts of certain types of volume (e.g. net volume) and the relationship between different types of volume (e.g. gross volume/net volume)

NOTE An example of a relationship indicator of volume is gross volume/net volume.

3.3
mixed surface area and volume indicator

indicator relating a type of volume to a type of area (e.g. gross volume/usable area) and a type of area to a type of volume

NOTE 1 Clause 5 gives further definitions of the different surface area and volume indicators, together with the appropriate calculation methods.

NOTE 2 An example of a mixed relationship indicator is area of building envelope/net volume.

3.4
building loss feature

feature or element of a building in which a portion of the floor area is not available for an individual's activities, or for furniture, equipment or circulation

NOTE 1 Examples of places in which a portion might not be available because of a building loss feature are workplaces, corridors, etc.

NOTE 2 A building loss feature may be a physical element such as a column, or the configuration of an element such as the curve of a wall, or the configuration of a fire escape route which is mandated by regulation but not needed for normal circulation.

3.5
effective building loss area

portion of the floor area that is not physically occupied by building material yet is not fully available for an individual's activities, or for furniture, equipment or for circulation, because of a building loss feature

NOTE Examples of places in which a portion might not be available because of a building loss feature are workplaces, corridors, etc.

3.6
actual building loss area

portion of the floor area that is not available for an individual's activities, or for furniture, equipment or for circulation, because it is physically occupied by a building loss feature, or is required to be vacant by law or regulation, or by a lease

NOTE Examples of places in which a portion might not be available because of a building loss feature are workplaces, corridors, etc.

3.7
perimeter encroachment

form of building loss feature which prevents effective use of floor area near a wall or other geometrically regular building form

NOTE Examples of a perimeter encroachment include: pilaster, convector, baseboard heating unit, and radiator.

4 Units

Surface area and volume indicators are obtained by measuring the plan and elevation of the building. Their units of measurement differ according to the type of calculation (m^2 : m^3 : m^2/m^2 : m^3/m^3 : m^2/m^3 : m^3/m^2).

5 Intra-muros calculation methods and list of indicators for geometric performance

5.1 Surface areas

NOTE See Figure 1.

5.1.1 Calculation principles

5.1.1.1 Surfaces which are horizontal or vertical are measured by their actual dimensions. For calculations of area and space, inclined planes are measured by their vertical projection onto an (imaginary) horizontal plane or vertical plane as appropriate. For calculations of heat gain or loss, the actual exposed surface area shall be used instead of the projected area.

5.1.1.2 The surface areas are expressed in square metres, to two decimal places.

5.1.2 Covered area

5.1.2.1 The covered area is the area of ground covered by buildings in their finished state.

5.1.2.2 The covered area is determined by the vertical projection of the external dimensions of the building onto the ground.

The following are not included in covered area:

- construction or parts of construction not projecting above the surface of the ground;
- secondary components, e.g. external staircases, external ramps, canopies, horizontal sun-shields, roof overhangs, street lighting;
- the areas of outdoor facilities, e.g. greenhouses and outhouses.

5.1.3 Total floor area

5.1.3.1 The total floor area of a building is the total area of all floor levels. Floor levels may be storeys which are either completely or partially under the ground, storeys above ground, attics, terraces, roof terraces, service floors or storage floors (see Figure 1).

It is necessary to distinguish between:

- a) floor areas which are enclosed and covered on all sides;
- b) floor areas which are not enclosed on all sides up to their full height, but which are covered, such as recessed balconies;
- c) floor areas which are contained within components (e.g. parapets, fascias, hand-rails), but which are not covered, such as open balconies.

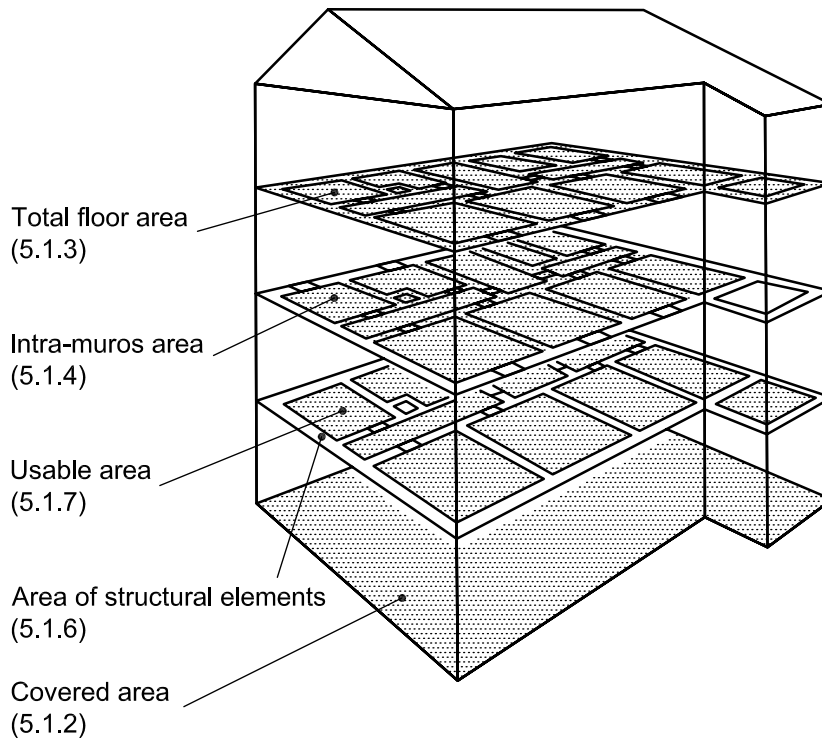


Figure 1 — Presentation of principal areas
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5.1.3.2 The total floor area of each level is obtained from the external dimensions of the enclosing elements, at floor height, above and below ground. These elements include finishes, claddings and parapets.

Recesses and projections for structural or aesthetic purposes and profiling are not included if they do not alter the net floor area (5.1.5). Covered floor areas which are not enclosed or are partially enclosed and have no enclosing elements [e.g. areas in accordance with 5.1.3.1 b)] are calculated according to the vertical projection of the outer limit of the covering components.

Net floor area is not determined for the following spaces (see 5.1.5.4):

- voids between the ground and the underside of the building, e.g. crawlways;
- space inside ventilated roofs;
- roofs not subjected to foot traffic other than for maintenance purposes.

5.1.3.3 The total floor area is calculated separately for each floor level. Areas with varying storey height within one floor level (e.g. large halls, auditoria) are also calculated separately.

5.1.3.4 If the floor areas are added together, the proportions of the different areas (according to 5.1.3) shall be distinguishable in order to enable the evaluation, comparison and separate calculation of the volumes.

5.1.3.5 The total floor area is made up of the net floor area (5.1.5) and the area taken up by the structure (see 5.1.6). This is diagrammed in Figure 2.

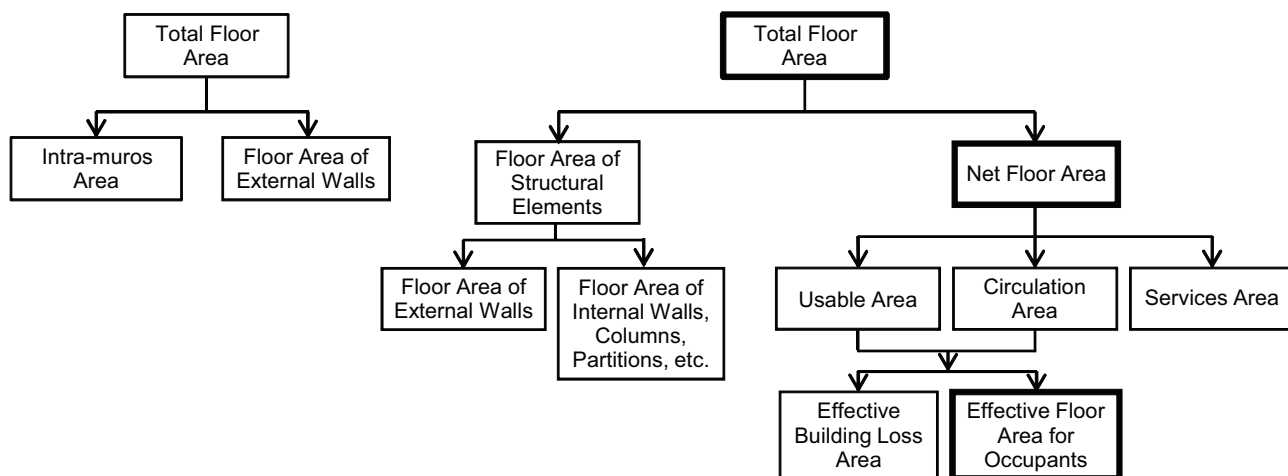


Figure 2 — Components of total floor area

5.1.4 Intra-muros area

5.1.4.1 The intra-muros area is the total floor area (5.1.3) less the floor area taken up by the external walls (floor area of the building envelope).

5.1.4.2 The intra-muros area is determined separately for each floor level. The calculation principles established for the total floor area (5.1.3) and for the area taken up by the external walls (5.1.6) apply equally. The intra-muros area is obtained by subtracting the area taken up by the external walls from the total floor area.

5.1.4.3 The intra-muros area includes the net floor area (5.1.5) and the area taken up by the internal walls.

5.1.5 Net floor area

5.1.5.1 The net floor area is the area between (within) the enclosing elements (see also 5.1.3.2).

5.1.5.2 The net floor area is determined separately for each floor level and is sub-divided according to 5.1.3.1. It is calculated from the clear dimensions of the finished building at floor height, excluding skirtings, thresholds, etc.

Covered floor areas that are not enclosed, or only partially enclosed and have no enclosing elements [areas mentioned in 5.1.3.1 b)] are determined by the vertical projection of the outer limit of the covering components. Areas with varying storey height within one floor level (e.g. large halls and auditoria) are calculated separately.

5.1.5.3 Also included in the net floor area are demountable components such as partitions, pipes and ducts.

5.1.5.4 The floor areas of structural elements, door and window recesses, and niches to recesses in the elements enclosing the area are not included in the net floor area.

5.1.5.5 The net floor area is divided into:

- usable area (5.1.7);
- services area (5.1.8); and
- circulation area (5.1.9).