INTERNATIONAL STANDARD

ISO 21690

First edition
2006-07-01

Glass in building — Glass blocks — Specification and test methods

Verre dans la construction — Briques de verre — Spécification et méthodes d'essai

Reference number
ISO 21690:2006(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

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 21690 was prepared by Technical Committee ISO/TC 160, *Glass in building*, Subcommittee SC 1, *Product considerations*.

Introduction

Light transmitting glass blocks are used for the construction of building elements both in non-load bearing walls and load bearing horizontally spanning panels.

Glass blocks for non-load bearing walls carry only their own weight and withstand horizontal forces such as those generated by the wind. Glass block walls and horizontally spanning panels do not carry any forces generated by the building.

Glass blocks used for the construction of horizontally spanning panels (e.g. floors, vaults and domes) carry their own weight and any other imposed loads (e.g. pedestrian or vehicular traffic).

Glass in building — Glass blocks — Specification and test methods

1 Scope

This International Standard specifies requirements for the properties of glass blocks used for the construction of non-load-bearing walls and horizontally spanning panels. This International Standard also specifies test methods used to verify these properties for square, rectangular and circular glass blocks.

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 48, *Rubber, vulcanized or thermoplastic — Determination of hardness (hardness between 10 IRHD and 100 IRHD)*

ISO 9050:2003, *Glass in building — Determination of light transmittance, solar direct transmittance, total solar energy transmittance, ultraviolet transmittance and related glazing factors*

ISO 12567-1:2000, *Thermal performance of windows and doors — Determination of thermal transmittance by hot box method — Part 1: Complete windows and doors*

ISO 15099:2003, *Thermal performance of windows, doors and shading devices — Detailed calculations*

EN 998-2, *Specification for mortar for masonry — Part 2: Masonry mortar*

EN 10002-2, *Metallic materials — Tensile testing — Part 2: Verification of the force measuring system of the tensile testing machine*

ASTM D2047, *Standard Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine*

3 Terms and definitions

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

3.1
hollow glass block
two pressed glass bodies fused together to form an airtight seal enclosing a cavity

3.2
dished glass block
pressed glass body having a concave face

3.3
solid glass block
one piece cast or pressed glass body without a concave face

3.4

manufacturing methods

3.4.1

automated production line

glass block formed or shaped from hot glass by mechanical pressure between a mould and a plunger

3.4.2

non-automated production line

glass block formed or shaped from hot glass by pressure between a mould and a plunger but not as part of an automated production line

3.4.3

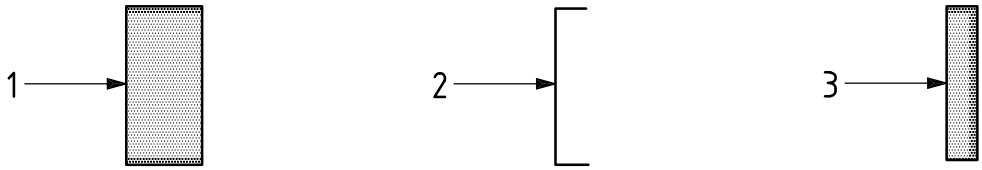
cast production line

glass block formed or shaped from hot glass by pouring hot glass into a mould

4 Types of glass block

4.1 Categories

The three categories of glass block shown in Figure 1 shall be used for construction of non-load bearing walls and horizontally spanning panels.



Key

1 hollow
2 dished
3 solid

Figure 1 — Categories of glass block

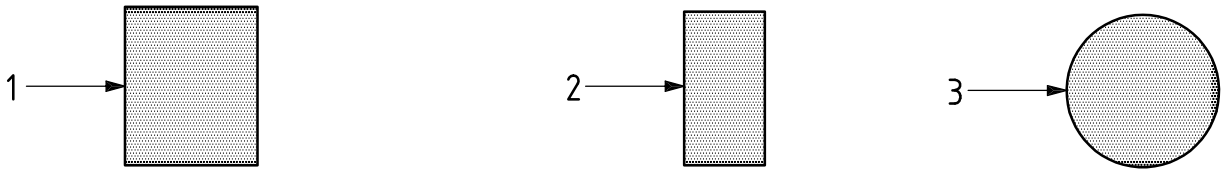
4.2 Shapes of glass block

It shall be acceptable for the three types of glass blocks to be manufactured in different shapes (for examples, see Figure 2).

NOTE Other shapes can be manufactured but test procedures are not covered by this International Standard.

4.3 Patterns

The inner and or outer surfaces of the glass blocks may be smooth, sandblasted, etched or embossed with a pattern.



Key

1 square
2 rectangular
3 circular

Figure 2 — Shapes

5 Materials

5.1 Glass composition

Glass blocks shall be manufactured from soda lime silicate glass whose composition conforms to Table 1.

Table 1 — Glass chemical composition

Chemical	%
Silicon dioxide, SiO_2	69 to 75
Calcium oxide, CaO	5 to 12
Sodium oxide, Na_2O	12 to 16
Magnesium oxide, MgO	0 to 6
Aluminium oxide, Al_2O_3	0 to 3

It shall be acceptable for trace elements of other substances to also be present. The glass material shall be clear or body tinted.

Where the composition requirements of this subclause are met, the expectancy of normal durable performance in use is anticipated.

5.2 Edge coating

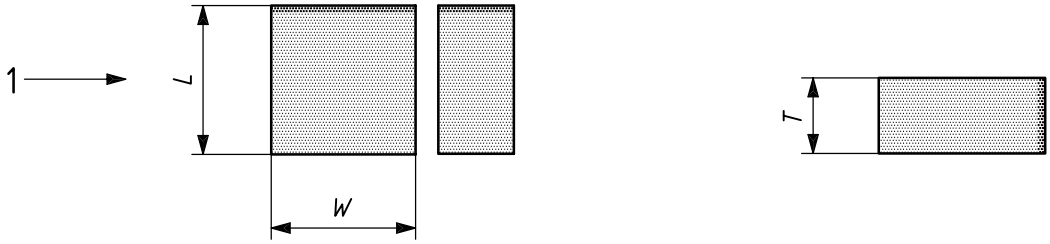
Edge coating, where used, shall be compatible with and bond to the glass blocks.

6 Requirements

6.1 Dimensional tolerances

6.1.1 Glass block face thickness

The face thickness should be not less than 3 mm (see Figure 3).



Key

1 hollow

Figure 3 — Dimensions

6.1.2 External dimensions

See Table 2 for the dimensional tolerances length (L), width (W), and thickness (T) of the glass blocks shown in Figure 3.

The length and width dimension shall be calculated from the largest dimension of the block and shall be measured in accordance with 7.5.

Table 2 — Dimensional tolerances for glass blocks

Dimensions in millimetres

Automated production	**Hollow**	**Dished, solid**
$L, W <$ 100	$\pm$1	$\pm$1
100 $\leqslant L, W <$ 200	$\pm$1,5	$\pm$1,5
$L, W >$ 200	$\pm$2	N/A
$T <$ 100	$\pm$1,5	N/A
$T \geqslant$ 100	$\pm$2	N/A
$T <$ 20	N/A	$\pm$0,5
$T \geqslant$ 20	N/A	$\pm$1
Non-automated production	**Hollow**	**Dished,solid**
$L, W \leqslant$ 100	$\pm$1	$\pm$1
100 $\leqslant L, W <$ 200	$\pm$1,5	$\pm$1,5
$T <$ 30	$\pm$1	$\pm$1
Cast production	**Hollow**	**Dished, solid**
100 $\leqslant L, W <$ 200	N/A	$\pm$1,5
20 $\leqslant T \leqslant$ 30	N/A	$\pm$1
30 $\leqslant T \leqslant$ 75	N/A	$\pm$2
$T >$ 75	N/A	$\pm$3,5
NOTE N/A is not applicable.		

6.2 Production irregularities inherent to glass block

6.2.1 Dimensional irregularities

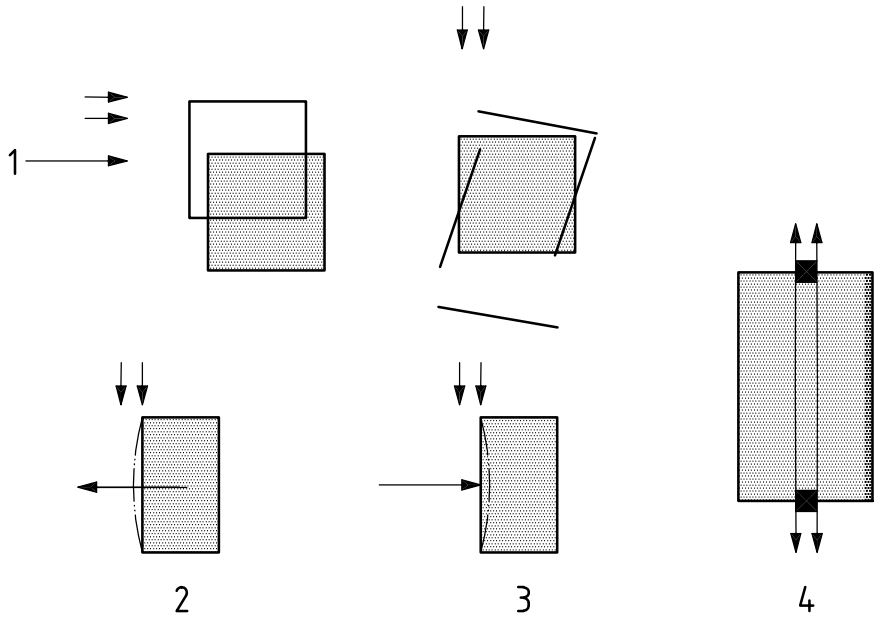
Dimensional irregularities are inherent to pressed and cast glass blocks and shall be permitted subject to the following limitations. See Figure 4 for a graphical example of each irregularity.

a) Twisting or misalignment shall not exceed 0,8 mm per 100 mm of each edge length measured in accordance with Clause 7.

b) Bulge shall not exceed 2 mm measured in accordance with Clause 7.

c) Depression shall not exceed 1 mm measured in accordance with Clause 7.

d) Welded seams should not protrude beyond edge profile of the block measured in accordance with Clause 7. Welded seams shall be tightly sealed with no voids or openings.



Key

1	misalignment
2	bulge
3	depression
4	high seal

Figure 4 — Dimensional irregularities

6.2.2 Visual irregularities

6.2.2.1 Small bubbles, opaque inclusions and surface marks shall be permitted but shall not be visible when examined as specified in 7.1.

6.3 Mechanical resistance

6.3.1 Compressive strength

The minimum compressive strength of hollow glass block specimens tested in accordance with the method given in A.1 shall be not less than 6 N/mm^2.

6.3.2 Applied load test

The minimum average compressive strength of hollow, dished and solid glass block specimens tested in accordance with the method given in A.2 shall be not less than 15 kN.

6.3.3 Thermal properties

Thermal transmittance (U value) is dependent on the glass block type and method of construction. Performance is relevant only for glass block built as a completed panel and shall be determined in accordance with ISO 15099:2003 and ISO 12567-1:2000.

6.3.4 Radiation properties

Light transmittance, reflectance and solar energy is relevant only for glass blocks built as a completed panel and shall be determined in accordance with ISO 9050:2003.

7 Test methods

7.1 Bubbles, inclusions, surface marks

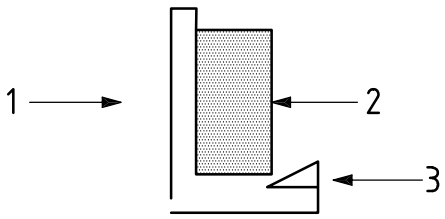
Glass blocks shall be visually examined from a distance of 1,5 m while being back lit by a diffused light source rated at 430 lm/m^2 to 540 lm/m^2. The light source shall be directed at right angles to the surface of the block.

7.2 Welded seam protrusion

Glass blocks shall be checked for protrusion of seam above edge profile using a steel straight edge or method of equal or greater accuracy.

7.3 Twisting or misalignment

The degree of twisting or misalignment between the two sealed glass bodies shall be measured by use of a measuring plate and taper gauge (see Figure 5).



Key

1 measuring plate
2 glass block
3 wedge

Figure 5 — Misalignment measurement hollow type units

7.4 Face depressions or bulge

Depressions or bulges shall be measured using a steel straight edge, depth gauge and sliding calliper.

7.5 Face dimensions, glass block thickness

Face dimension and block thickness shall be measured using a sliding calliper. Length and width shall be measured at the midpoint of each side. For square or rectangular blocks, thickness shall be measured at four points and square at four corners. For round blocks, the diameter shall be measured at two points at right angles to each other.

7.6 Slip resistance

Slip resistance is relevant only for glass blocks built as a completed panel and shall be determined in accordance with ASTM D2047.

8 Marking

Packages containing glass blocks conforming to this International Standard shall be clearly marked with the following:

a) manufacturer's name, mark or symbol;

b) “GV” for glass block used in vertical applications, “GH” for glass block used in horizontal applications, “GVH” for glass block used in both vertical and horizontal applications;

c) manufacturer's product type or name, if relevant;

d) nominal dimensions (length, width and thickness);

e) number of pieces in the package;

f) reference to this International Standard, that is ISO 21690; and

g) production-tracking code.

Annex A
(normative)

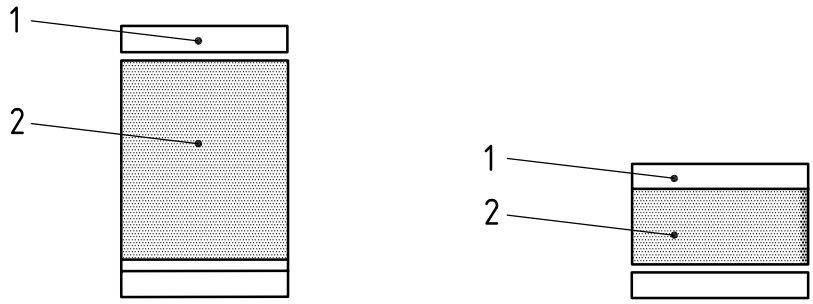
Mechanical resistance test procedures

A.1 Compressive strength hollow glass block

A.1.1 Preparation

Two opposing edges of each block shall be capped with cement mortar (see Figure A.1). Each capping layer shall have an overall thickness of (10 ± 2) mm measured from the outer edge profile. The cement mortar shall conform to EN 998-2 and shall have a minimum cured compressive strength of 12 N/mm^2.

The capped samples shall be stored at (20 ± 2) °C and have a humidity of 60 % to 70 % for a period of 7 days prior to testing.



Key

1 mortar

2 glass block

Figure A.1 — Compressive strength tests hollow glass block in vertical application

A.1.2 Procedure

Perform the testing on five representative samples.

Carry out the testing with test equipment conforming to EN 10002-2. Stress the test specimens to the breaking point at a steadily increasing load rate of 0,2 MN/m^2/s to 0,4 MN/m^2/s.

Test hollow glass block with the load applied parallel to the block faces $L \times W$ and perpendicular to the edges of the block $L \times T$. For rectangular blocks, apply the load perpendicular to the long edge of the unit (see Figure 5).

A.2 Mechanical resistance test procedures

A.2.1 Principle

The test enables the mechanical strength of the glass blocks being tested using a 50 mm steel punch having a semi-spherical head flattened at the end in order to provide a flat surface, 12 mm in diameter.

A.2.2 Procedure

Perform the testing on five representative samples.

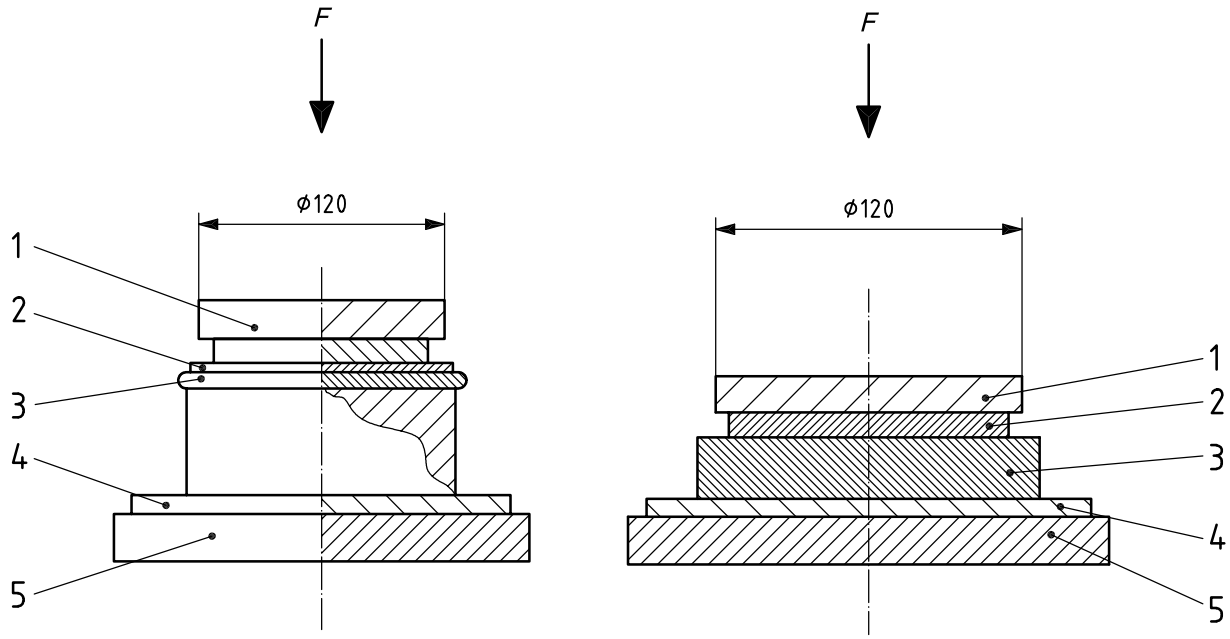
Place the glass block being tested on a steel support plate with a thickness of 12 mm. Place a rubber mat with a thickness of 5 mm and a Shore A hardness value of (60 ± 5) measured in accordance with ISO 48 between the glass block and the support plate (see Figure A.2).

If the glass block being tested is a solid or hollow glass block, select a rubber mat with a hole having the same outline as the ring or collar but 10 mm smaller in diameter than the dimensions of the sample being tested (see Figure A.2).

Place a layer of felt 8 mm thick between the punch and the glass block.

Throughout all the tests, maintain the speed of application of the load at 49 N/s and center the punch on the sample being tested.

Dimensions in millimetres



a) Dished **b) Solid or hollow**

Key

1 mortar
2 layer of felt
3 glass block
4 rubber mat
5 support plate

NOTE For solid blocks, a 20 mm steel square is placed under seating rubber around perimeters

Figure A.2 — Test method for compressive strength of glass pavers

Bibliography

[1] EN 196-1, *Methods of testing cement — Part 1: Determination of strength*

[2] ENV 197, *Cement — Composition, requirements and criteria for conformity*

[3] EN 572-1, *Glass in building — Basic soda lime silicate glass products — Part 1: Definitions and general physical and mechanical properties*

[4] EN 1344, *Clay pavers — Requirements and test methods*

ICS 81.040.20

Price based on 10 pages