BRITISH STANDARD

BS EN
1051-1:2003

Glass in building — Glass blocks and glass pavers —

Part 1: Definitions and description

The European Standard EN 1051-1:2003 has the status of a British Standard

ICS 81.040.20; 91.100.25

BSI
British Standards

National foreword

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The UK participation in its preparation was entrusted by Technical Committee B/520, Glass and glazing in building, to Subcommittee B/520/1, Basic and transformed glass products, which has the responsibility to:

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 29 April 2003

Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 13 and a back cover.

The BSI copyright date displayed in this document indicates when the document was last issued.

Amendments issued since publication

Amd. No.	Date	Comments

ISBN 0 580 41738 7

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 1051-1

January 2003

ICS 81.040.20; 91.100.25

English version

Glass in building - Glass blocks and glass pavers - Part 1: Definitions and description

Glas in Bauwesen - Glassteine und Betongläser - Teil 1: Begriffe und Beschreibung

This European Standard was approved by CEN on 21 November 2002.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

Ref. No. EN 1051-1:2003 E

Contents

Foreword

This document (EN 1051-1:2003) has been prepared by Technical Committee CEN/TC 129 "Glass in building", the secretariat of which is held by IBN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by July 2003, and conflicting national standards shall be withdrawn at the latest by July 2003.

Annexes A and B are normative. Annex C is informative.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

Glass blocks are used for the construction of building elements such as non-load bearing walls. In these applications they are required to only support their own weight, parallel to the visible faces, and horizontal loads generated by wind and impacts, perpendicular to the visible faces.

Glass pavers are used for the production of reinforced concrete panels incorporating glass panels. These panels are used in horizontal applications and may be capable of taking vehicular traffic. They can be regarded as a non-structural component; i.e. they carry their own weight and any imposed load perpendicular to the visible areas.

1 Scope

This European Standard specifies form/shape, dimensional tolerances and the material characteristics of glass blocks and glass pavers for use in buildings.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to apply (including amendments).

EN 196-1:1994, *Methods of testing cement – Part 1: Determination of strength.*

EN 197-1, *Cement - Part1: Composition, specifications and conformity criteria for common cements.*

EN 572–1, *Glass in building - Basic soda lime silicate glass products – Part 1: Definitions and general physical and mechanical properties.*

EN ISO 7500-1, *Metallic materials - Verification of static uniaxial testing machines - Part 1: Tension/compression testing machines (ISO 7500-1:1999).*

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

3 Terms and definitions

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

3.1
glass blocks

moulded airtight, hollow glass bodies for use in vertical applications, e.g. walls

NOTE Glass blocks are usually manufactured by fusing or bonding together two or more units under applied pressure to form an airtight seal.

3.2
glass pavers

moulded glass bodies, either solid or hollow, for use in non-vertical applications, e.g. floors

NOTE Glass pavers can be produced as a single piece, or by fusing or bonding together two or more units to form an airtight seal.

3.3
visual faults
faults that alter the visual quality of the glass. They include spot faults, opaque inclusions and linear/extended faults

3.4
spot faults
transparent/translucent faults, e.g. bubbles, etc., that are in the glass

3.5
opaque inclusions
opaque bodies, e.g. refractory, frit, etc., which are either in the glass or on the surface

3.6
linear/extended faults
these faults can be on or in the glass, in the form of deposits, marks or scratches that occupy an extended length or area

4 Material

4.1 Glass composition

Glass blocks and glass pavers shall be manufactured from soda lime silicate glass conforming to EN 572-1.

4.2 Edge treatment

Edge coating(s), when applied, shall be compatible with and bonded to the glass blocks and glass pavers.

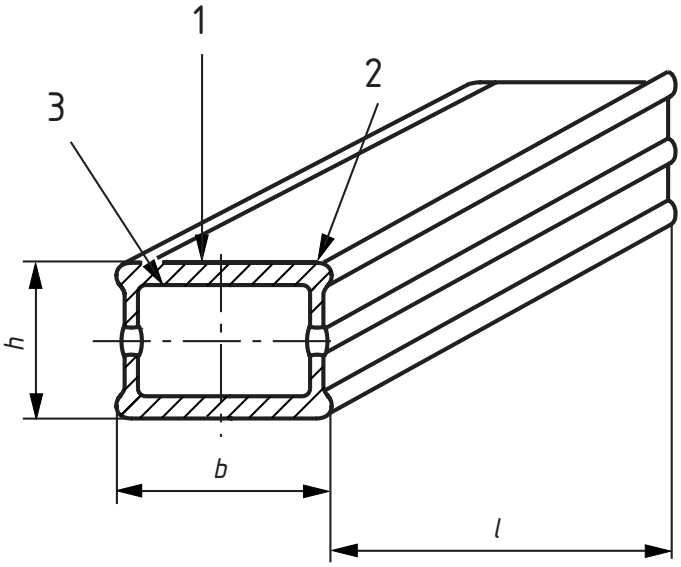
5 Dimensional requirements

5.1 General

Glass blocks and glass pavers are specified by their form/shape, dimensions and mass (rather than thickness).

5.2 Available forms/shapes

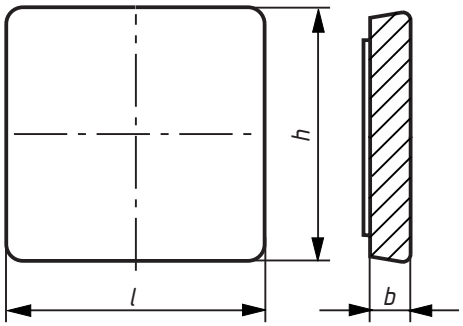
Glass blocks and glass pavers are manufactured in square, rectangular and circular forms/shapes. Examples of the available forms/shapes are shown for glass blocks in Figure 1 and for glass pavers in Figure 2.



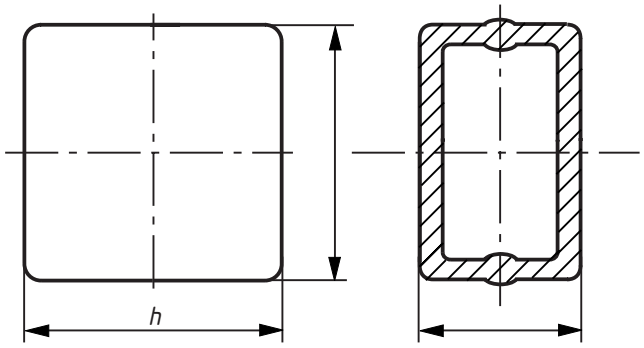
Key
1 External face
2 Edge profile
3 Internal face

Figure 1 — Glass blocks (examples)

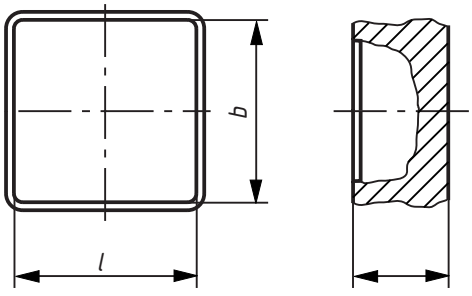
Form A : square, solid



Form B : square, hollow



Form C : square, open and rectangular



Form D : circular

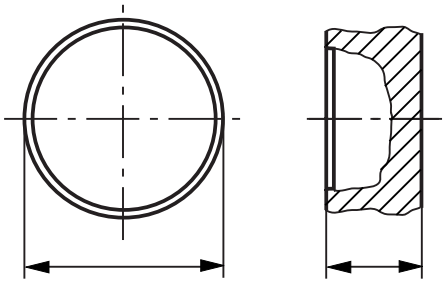


Figure 2 — Glass pavers (examples)

5.3 Dimensions

The dimensions of the most commonly available forms/shapes of glass blocks and glass pavers are given in annex C.

5.3.1 Tolerances on dimensions

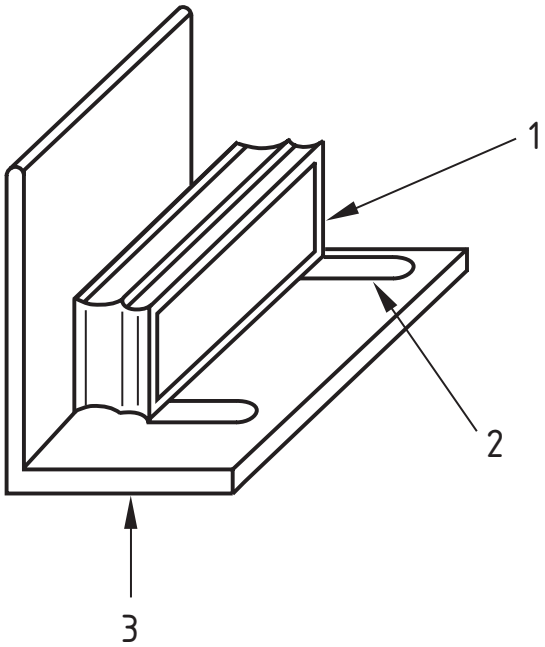
5.3.1.1 Measure the dimensions, of the specimens, using a sliding calliper or another measuring device with an accuracy of not less than 0,1 mm. The following dimensions shall be measured:

- for square and rectangular faced glass blocks and glass pavers, measure the length (l) and width (b) of the faces and the height (h) at the four corners;
- for circular faced glass pavers, measure the diameter (d) of the faces in two perpendicular directions and measure the height (h) at the edge.

5.3.1.2 Measure the squareness of the corners of square and rectangular faced glass blocks and glass pavers to an accuracy of 1°.

5.3.1.3 Measure depressions and bulges on the visible surfaces of samples with an upright steel rule and a tapered ruler, or another device, to an accuracy of 0,1 mm.

5.3.1.4 Measure glass blocks, of forms B and E, and glass pavers, of form B, that are made from pressed parts fused or bonded together using a measurement plate as shown in Figure 3 or with measuring devices of at least equal accuracy. Measure to an accuracy of 0,1 mm.



Key
1 Glass block
2 Tapered wedge
3 Measurement plate

Figure 3 — Method of measuring form B and E glass blocks and glass pavers

5.3.2 Allowable tolerances on dimensions

5.3.2.1 Glass blocks and glass pavers are classified according to their dimensional tolerances.

When measured, according to 5.3.1.1, the dimensions of glass blocks and glass pavers shall be acceptable for the appropriate class if they comply with the tolerances in Table 1.

Table 1 — Dimensional tolerances for glass blocks/glass pavers

Class of glass block/paver	Tolerance (mm)
I	± 1,0
II	± 1,5
III	± 2,0

5.3.2.2 When measured, according to 5.3.1.2, square and rectangular faced glass blocks and glass pavers shall be acceptable when the squareness of the corners is $90^{\circ} \pm 2^{\circ}$.

5.3.2.3 When measured, according to 5.3.1.3, glass blocks and glass pavers shall be acceptable as follows:

- the bulges on the visible surface are ≦ 2,0 mm;
- the depressions on the visible surface are ≦ 1,0 mm;
- the seal does not protrude above the edges of the block/paver.

NOTE For the determination of allowable bulges/depressions the outer edges of the visible face are ignored.

5.3.2.4 When measured, in accordance with 5.3.1.4, the non-alignment of the pressed edges of the glass blocks and glass pavers shall be acceptable as follows:

- differences of 1,0 mm per 100 mm of edge up to a maximum of 2,0 mm, for square/rectangular shaped blocks/pavers;
- differences of 0,8 mm per 100 mm length at the seal where two sections of glass block/paver are fused or bonded together.

5.4 Mass

The nominal mass of the glass block or glass paver shall be given.

The nominal mass of the most commonly available forms/shapes of glass blocks and glass pavers are given in annex C.

5.4.1 Tolerance on mass

Determine the mass of the glass block or glass paver by weighing, e.g. by using an electric balance. The mass shall be measured to an accuracy of 10 g.

Determine the mass of each specimen twice and calculate an average value from these measurements. The average value shall be quoted rounded to one decimal place.

5.4.2 Allowable tolerances on mass

When measured, in accordance with 5.4.1, the average mass of the glass block/paver shall be within ± 10 % of the nominal mass.

6 Compression strength and breakage load requirements

6.1 General

Compressive strength and breakage load tests shall be carried out using compressive test equipment of at least class 2, in accordance with EN ISO 7500-1.

Test specimens shall be stressed to breakage point with the load increasing steadily at a rate of 0,2 MN/m² to 0,4 MN/m² per second.

6.2 Glass blocks

When glass blocks are tested, in accordance with annex A, they shall comply with the following:

- average value of compressive strength 7,0 N/mm^2

  and

- minimum single value of compressive strength 6,0 N/mm^2

6.3 Glass pavers

When glass pavers are tested, in accordance with annex B, the compressive strength shall comply with Table 2.

Table 2 — Compressive strength of glass pavers

Category	Compressive strength when tested according to annex B	
	Average value kN	Minimum single value kN
G F None	160 40 12	120 30 8

7 Optical requirements

One quality level is considered for glass blocks and glass pavers in this standard. This is determined by evaluation of the visual faults, e.g. spot faults, opaque inclusions and linear/extended faults.

7.1 Method of observation and measurement

The glass block/paver to be examined is illuminated in conditions approximating to diffuse daylight. The specimen is lit from underneath and viewed at an approximate distance of 3 m at right angles to the visible face of the glass block or glass paver.

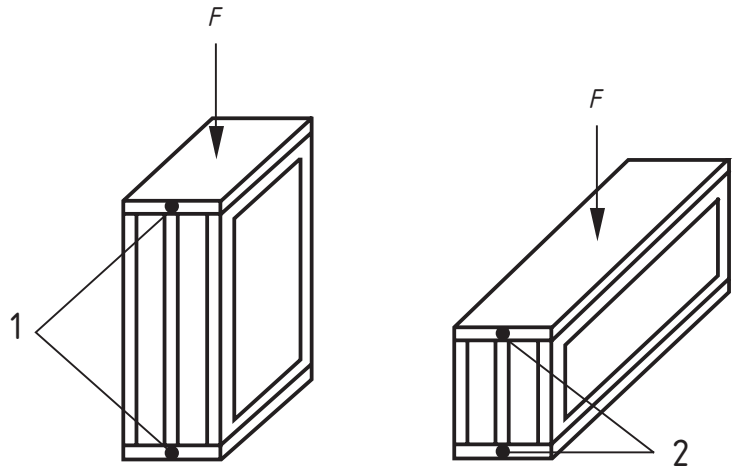
7.2 Acceptance level

Visual faults shall be permitted as long as they are not visible when viewed in accordance with 7.1.

Annex A
(normative)

Compressive strength test for glass blocks

A.1 The bearing surfaces of glass blocks (see Figure A.1) shall be covered with cement mortar to produce parallel bearing surfaces for the test. The thickness of this levelling layer shall be 10 mm ± 2 mm, when measured at the outer glass edges.



Key
1 Levelling mortar
2 Levelling mortar

Figure A.1 - Glass block compressive strength test method

A.2 The layer of levelling mortar shall be produced in accordance with EN 196-1:1994, 5.1.3 and 6.1. A portland cement (CE 1) of compressive class 42,5 in accordance with EN 197-1 shall be used.

A.3 After the application of the levelling layer, the test specimens shall be stored prior to testing at a temperature of 23 °C ± 5 °C and a relative humidity between 60 % and 70 %.

A.4 The testing of the compressive strength shall be carried out after the levelling layer has aged for 7 d ± 2 h (see EN 196–1:1994, 8.4).

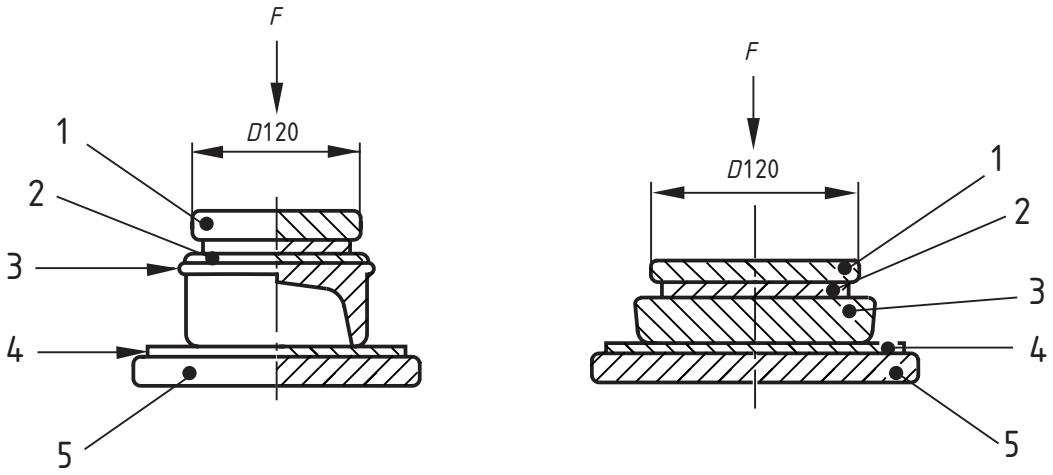
A.5 When the glass block breaks the highest applied load measured shall be used to calculate the compressive strength.

Annex B
(normative)

Compressive strength test for glass pavers

B.1 The compressive strength test for glass pavers shall be carried out perpendicularly to the visible faces of the glass pavers.

B.2 The test shall be carried out using the set up as shown in Figure B.1.



Forms B, C, D and E **Form A**

Ref. N°	Item
1	Stamp
2	Rubber plate
3	Glass sample
4	Rubber plate
5	Base plate

Figure B.1 — Test method for compressive strength of glass pavers

- The steel stamp plate (1) shall be 20 mm thick with rounded edges and have an area of contact of 120 mm × 120 mm.
- On the visible face, of the glass paver, a 120 mm × 120 mm × 10 mm thick rubber plate (2) of hardness 55 IRHD to 65 IRHD, in accordance with ISO 48, shall be uniformly placed.
- The test specimen (3) shall be placed on a 10 mm thick rubber plate (4) of hardness 55 IRHD to 65 IRHD, in accordance with ISO 48.
- In the case of form A glass pavers the rubber plate (4) shall be cut, at least 10 mm wide, so as to support the paver along its entire periphery.
- The base plate (5) shall be sufficiently rigid to resist the applied load (F) without distortion.

B.3 When the glass paver breaks the highest applied load measured shall be used to calculate the compressive strength.

Annex C
(informative)

Form/shape, dimensions and nominal mass of glass blocks

The form/shape, dimensions and nominal mass of the most commonly available glass blocks are given in Table C.1.

The form/shape, dimensions, nominal mass and strength category for the most commonly available glass pavers is given in Table C.2.

Table C.1 — Form/shape, dimensions and nominal mass of glass blocks

Form/shape	Format	Length L (mm)	Width B (mm)	Height H (mm)	Nominal Mass (kg)
B	90 × 80	90	90	80	1,6
B	115 × 80	115	115	80	1,2
B	146 × 80	146	146	80	1,4
B	146 × 98[a]	146	146	98	1,6
B	146 × 98 [a]	146	146	98	2,8
B	190 × 50	190	190	50	2,1
B	190 × 80 [a]	190	190	80	2,5
B	190 × 80 [a]	190	190	80	3,6
B	190 × 100 [a]	190	190	100	2,6
B	190 × 100 [a]	190	190	100	5,1
B	197 × 79	197	197	79	2,2
B	197 × 98 [a]	197	197	98	2,7
B	197 × 98 [a]	197	197	98	3,5
B	197 × 98 [a]	197	197	98	4,6
B	240 × 80	240	240	80	3,9
B	298 × 98	298	298	98	7,0
B	300 × 80	300	300	80	6,8
B	300 × 100	300	300	100	7,0
E	190 × 90 × 80	190	90	80	1,4
E	190 × 90 × 90	190	90	90	1,6
E	190 × 95 × 80	190	95	80	1,3
E	190 × 95 × 100	190	95	100	1,3
E	197 × 95 × 80	197	95	80	1,4
E	197 × 95 × 98	197	95	98	1,6
E	197 × 146 × 80	197	146	80	1,9
E	197 × 146 × 98	197	146	98	2,0
E	240 × 115 × 80	240	115	80	2,1

[a] With equal exterior dimensions, different masses correspond to varying glass thickness

Table C.1 — Form/shape, dimensions, nominal mass and strength category for glass pavers

Form/ shape	Format	Length l (mm)	Width b (mm)	Height h (mm)	Nominal Mass (kg)	Strength Category (see 6.3)
A	93 × 18	93	93	18	0,3	-
A	100 × 28	100	100	28	0,5	G
A	127 × 27	127	127	27	0,8	-
A	152 × 25	152	152	25	1,3	F
A	160 × 30	160	160	30	1,7	F
A	165 × 27	165	165	27	1,3	-
A	194 × 38	194	194	38	3,4	F
A	194 × 76	194	194	76	6,8	G
A	200 × 22	200	200	22	1,9	-
A	300 × 25	300	300	25	4,0	-
B	115 × 80	115	115	80	1,7	F
B	145 × 110	145	145	110	2,6	-
B	190 × 80 [a]	190	190	80	2,5	-
B	190 × 80 [a]	190	190	80	3,1	-
B	190 × 100 [a]	190	190	100	3,5	-
B	190 × 100 [a]	190	190	100	4,8	-
B	220 × 100	220	220	100	4,4	-
C	103 × 77 × 15	103	77	15	0,2	-
C	117 × 60	117	117	60	1,2	F
C	127 × 37	127	127	37	1,0	-
C	145 × 55	145	145	55	1,2	-
C	146 × 51	146	146	51	1,4	-
C	150 × 80 [a]	150	150	80	2,0	F
C	150 × 80 [a]	150	150	80	3,1	G
C	190 × 50	190	190	50	2,4	-
C	195 × 50	195	195	50	2,2	-
C	200 × 50	200	200	50	2,1	-
C	200 × 70	200	200	70	2,5	-
E	300 × 60 × 40	300	60	40	1,3	-
		Diameter, mm				
D	117 × 60	117		60	0,9	F
D	200 × 30	200		30	1,4	-

[a] With equal exterior dimensions, different masses correspond to varying glass thickness.

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