
Glass in building — Glass blocks — Specification and test methods

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

STANDARDSISO.COM : Click to view the full PDF of ISO 21690:2021



STANDARDSISO.COM : Click to view the full PDF of ISO 21690:2021



COPYRIGHT PROTECTED DOCUMENT

© ISO 2021

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword.....	iv
Introduction.....	v
1 Scope.....	1
2 Normative references.....	1
3 Terms and definitions.....	1
4 Symbols.....	2
5 Types of glass block.....	2
5.1 Categories.....	2
5.2 Shapes of glass block.....	3
5.3 Surface aspect and treatment.....	3
6 Dimensional tolerances.....	4
6.1 Methods.....	4
6.2 Hollow glass block face thickness.....	4
6.3 External dimensions.....	4
7 Irregularities inherent to the production of hollow glass block.....	4
7.1 Dimensional irregularities measurement method.....	4
7.1.1 Welded seam protrusion.....	4
7.1.2 Twisting or misalignment.....	5
7.1.3 Face depressions or bulge.....	5
7.2 Dimensional irregularities limitation.....	5
8 Appearance for hollow glass blocks.....	6
8.1 Method.....	6
8.2 Appearance requirements.....	6
9 Mechanical properties.....	7
9.1 Compressive strength of hollow glass blocks.....	7
9.2 Applied load test.....	7
10 Thermal shock resistance for hollow glass blocks.....	7
Annex A (normative) Mechanical resistance test procedures.....	8
Annex B (informative) Mechanical resistance test procedures — Thermal shock test procedures.....	11
Bibliography.....	12

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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

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

This second edition cancels and replaces the first edition (ISO 21690:2006), which has been technically revised.

The main changes compared to the previous edition are as follows:

- Clause 5 in the previous edition on materials has been deleted;
- the external dimensions has been changed to one value $\pm 1,5$ mm in [6.3](#);
- the dimensional irregularities twisting Δt or misalignment Δm have been changed to not exceed 1,5 mm in [7.2](#);
- subclause 6.2.2 in the previous edition on visual irregularities has been changed to [Clause 8](#) on the appearance for hollow glass blocks, including its test method and requirement;
- the compressive strength minimum value in the previous edition subclause 6.3.1 has been changed from 6,0 N/mm² to 4,4 N/mm² in [9.1](#);
- [Clause 10](#) on thermal shock resistance for hollow glass blocks, with a 40 °C temperature falling, has been added;
- subclause 6.3.3 in the previous edition on thermal properties has been deleted;
- subclause 6.3.4 in the previous edition on radiation properties has been deleted.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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).

STANDARDSISO.COM : Click to view the full PDF of ISO 21690:2021

STANDARDSISO.COM : Click to view the full PDF of ISO 21690:2021

Glass in building — Glass blocks — Specification and test methods

1 Scope

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

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 48-2, *Rubber, vulcanized or thermoplastic — Determination of hardness — Part 2: Hardness between 10 IRHD and 100 IRHD*

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

ISO 7500-1, *Metallic materials — Calibration and verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Calibration and verification of the force-measuring system*

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

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

gap

visible interspaces between two half glass parts caused by welding during the *hollow glass block* (3.1) production

3.5

glass dreg

glass fragments left inside of the *hollow glass block* (3.1)

3.6

scissors track

marks caused by shearing molten glass

3.7

drip mark

mark on the glass block surface caused by a glass drip in the mould

3.8

press head mark

inner surface appearance blemish during the stamping forming process caused by a press head

3.9

mould mark

outer surface appearance blemish caused by mould during the stamping forming process

4 Symbols

For the purpose of this document, the symbols and designations given in [Table 1](#) apply.

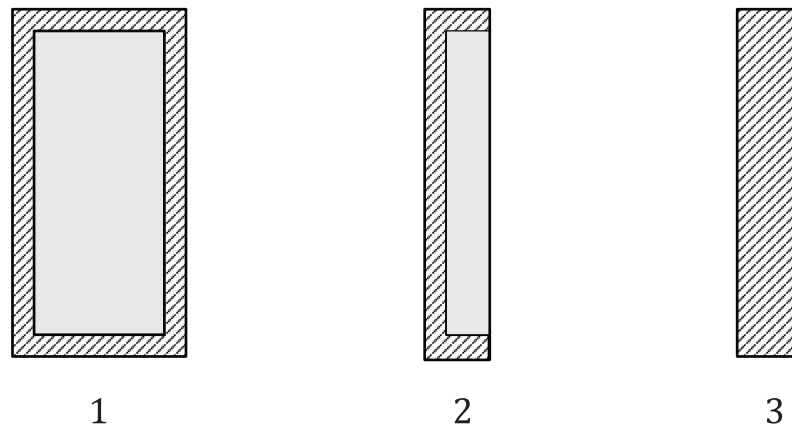
Table 1 — Symbols and designations

Symbols	Designation	Unit	References
T_f	Face thickness of the hollow glass block	mm	Figure 3
L	Length	mm	Figure 3
W	Width	mm	Figure 3
D	Diameter	mm	Figure 3
T	Thickness	mm	Figure 3
Δt	Twisting difference value	mm	Figure 5
Δm	Misalignment difference value	mm	Figure 5
Δb	Bulge difference value	mm	Figure 5
Δd	Depression difference value	mm	Figure 5
Δs	Seam protrusion		Figure 5

5 Types of glass block

5.1 Categories

The three categories of glass block shown in [Figure 1](#) can be used for construction of non-load bearing walls and horizontally spanning panels.

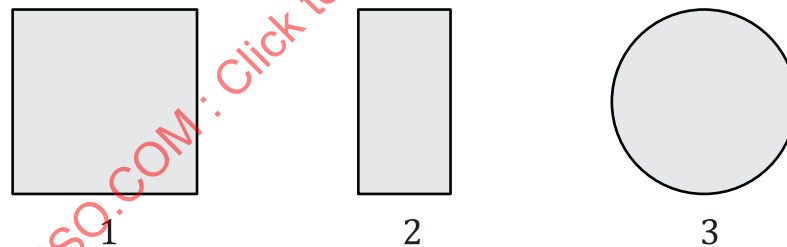
**Key**

- 1 hollow glass block
- 2 dished glass block
- 3 solid glass block

Figure 1 — Categories of glass block**5.2 Shapes of glass block**

Glass blocks belonging to any of the categories mentioned in 5.2 can be manufactured in different shapes (e.g. see Figure 2).

NOTE Other shapes can be manufactured but test procedures for those shapes are not covered by this document.

**Key**

- 1 square
- 2 rectangular
- 3 circular

Figure 2 — Shapes of glass block**5.3 Surface aspect and treatment**

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

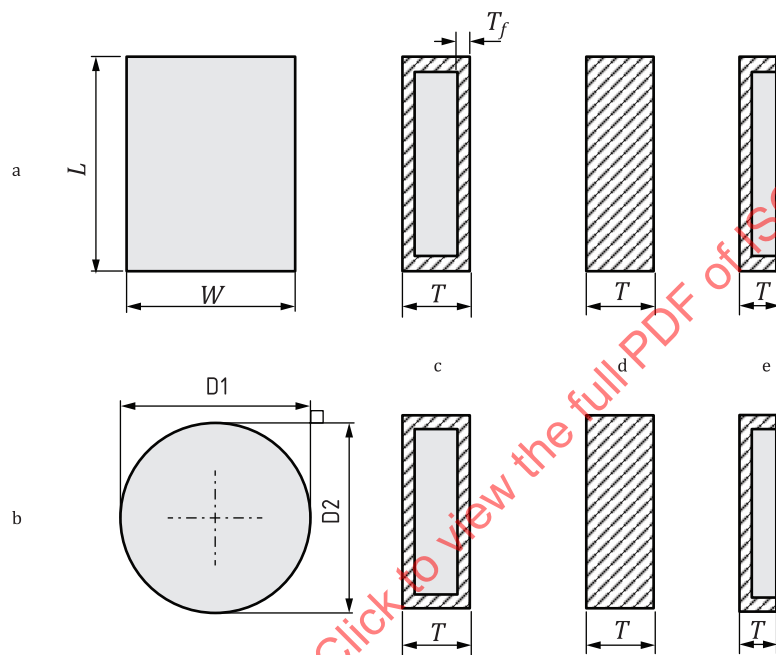
6 Dimensional tolerances

6.1 Methods

Face dimension and block thickness shall be measured using a sliding caliper. Length and width shall be measured at the midpoint of each side. For square or rectangular blocks, thickness shall be measured at four corners. For round blocks, measure two diameters which cross into a right angle to each other.

6.2 Hollow glass block face thickness

The face thickness T_f shall be not less than 3,0 mm (see [Figure 3](#)).



Key

- a Square or rectangular.
- b Circular.
- c Hollow.
- d Solid.
- e Dished.

Figure 3 — Dimensions of glass block

6.3 External dimensions

The dimensional tolerances length (L), width (W), and thickness (T) of the glass blocks as shown in [Figure 3](#) shall not exceed $\pm 1,5$ mm.

7 Irregularities inherent to the production of hollow glass block

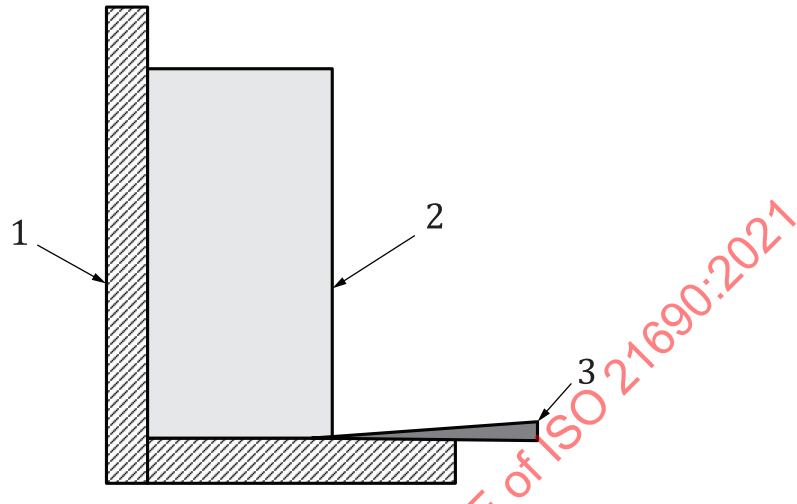
7.1 Dimensional irregularities measurement method

7.1.1 Welded seam protrusion

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

7.1.2 Twisting or misalignment

The sample is put on the measuring plates with a vertical angle as shown in [Figure 4](#). Let one side of the glass block stick close to the vertical plate. The degree of twisting or misalignment between the two sealed glass bodies should be measured by a feeler gauge (see [Figure 4](#)).



Key

- 1 measuring plate
- 2 glass block
- 3 feeler gauge

Figure 4 — Misalignment measurement hollow type units

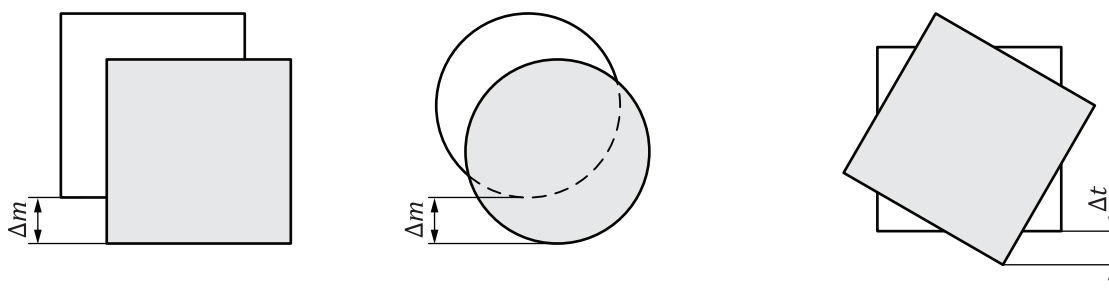
7.1.3 Face depressions or bulge

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

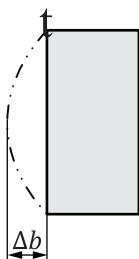
7.2 Dimensional irregularities limitation

Dimensional irregularities are inherent to pressed and cast glass blocks and shall be permitted subject to the following limitations. See [Figure 5](#) for a graphical example of each irregularity.

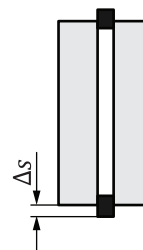
- a) Twisting Δt or misalignment Δm shall not exceed 1,5 mm.
- b) Bulge Δb shall not exceed 2,0 mm.
- c) Depression Δd shall not exceed 1,0 mm.
- d) Welded seams Δs shall not protrude beyond edge profile of the block. Welded seams shall be tightly sealed with no voids or openings.



a) Misalignment



b) Twisting



c) Bulge

d) Depression

e) Seam protrusion

Figure 5 — Dimensional irregularities

8 Appearance for hollow glass blocks

8.1 Method

Glass blocks shall be visually examined from a distance 0,8 m to 1,0 m while being back lit by a diffused light source rated at 430 lm/m² to 540 lm/m². The light source shall be directed at right angles to the surface of the block.

8.2 Appearance requirements

Appearance shall be met the requirements of [Table 2](#).

Table 2 — Permissible blemishes

Defects	Description mm	Number or density of permissible defects
Gap	—	Not permitted
Bubble	$D < 1,0$	Permitted
	$1,0 \leq D < 3,0$	Permitted, but shall not cluster
	$3,0 \leq D$	Not permitted
Opaque inclusions	$D \leq 1,0$	≤ 2
	$D > 1,0$	Not permitted
Glass dreg	$D \leq 1,0$	Permitted
	$1,0 < D \leq 3,0$	≤ 2
	$D > 3,0$	Not permitted
Scratch	$L \leq 30,0$	Permitted
	$L > 30,0$	Not permitted
Continuous small pits	$L \leq 20,0$	Permitted
	$L > 20,0$	Not permitted
For scissors track, drip mark, press head mark and mould mark, the manufacturer shall be consulted. Cluster: maximum 10 flaws in any circular area with a diameter of 100 mm.		

9 Mechanical properties

9.1 Compressive strength of hollow glass blocks

The compressive strength of hollow glass block specimens shall be tested in accordance with [Clause A.1](#) and the minimum compressive strength shall be not less than 4,4 N/mm².

9.2 Applied load test

When glass blocks are only used for glass pavers, the average compressive strength of hollow, dished and solid glass block specimens shall be tested in accordance with [Clause A.2](#) and the minimum average compressive strength shall be not less than 15,0 kN.

10 Thermal shock resistance for hollow glass blocks

For special purpose, thermal shock test should be carried out in accordance with [Annex B](#). No crack or any other damage occurs after a 40 °C temperature falling thermal shock test.

Annex A (normative)

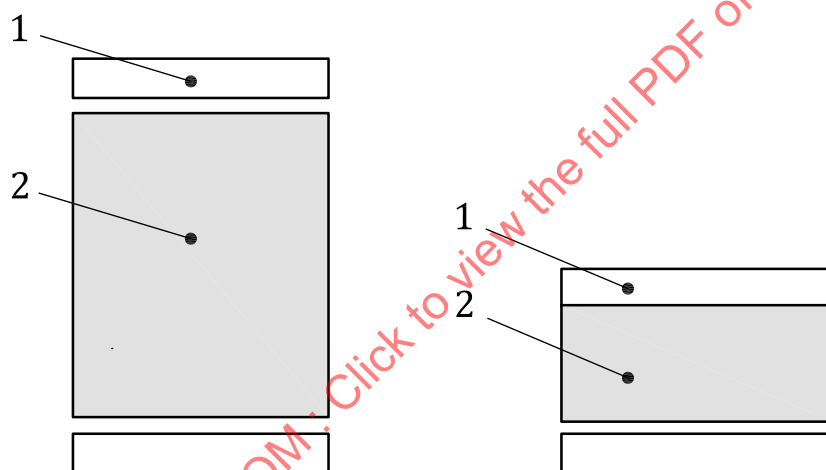
Mechanical resistance test procedures

A.1 Compressive strength of 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 $(20 \pm 2) ^\circ\text{C}$ 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 of 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 ISO 7500-1. Stress the test specimens to the breaking point at a steadily increasing load rate of $0,2 \text{ MN/m}^2/\text{s}$ to $0,4 \text{ MN/m}^2/\text{s}$.

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 Applied load test

A.2.1 Principle

The test measures the force, F , applied on the face of glass blocks used for pavers using a 120 mm diameter steel punch with a flat surface.

A.2.2 Procedure

Perform the testing on five representative samples.

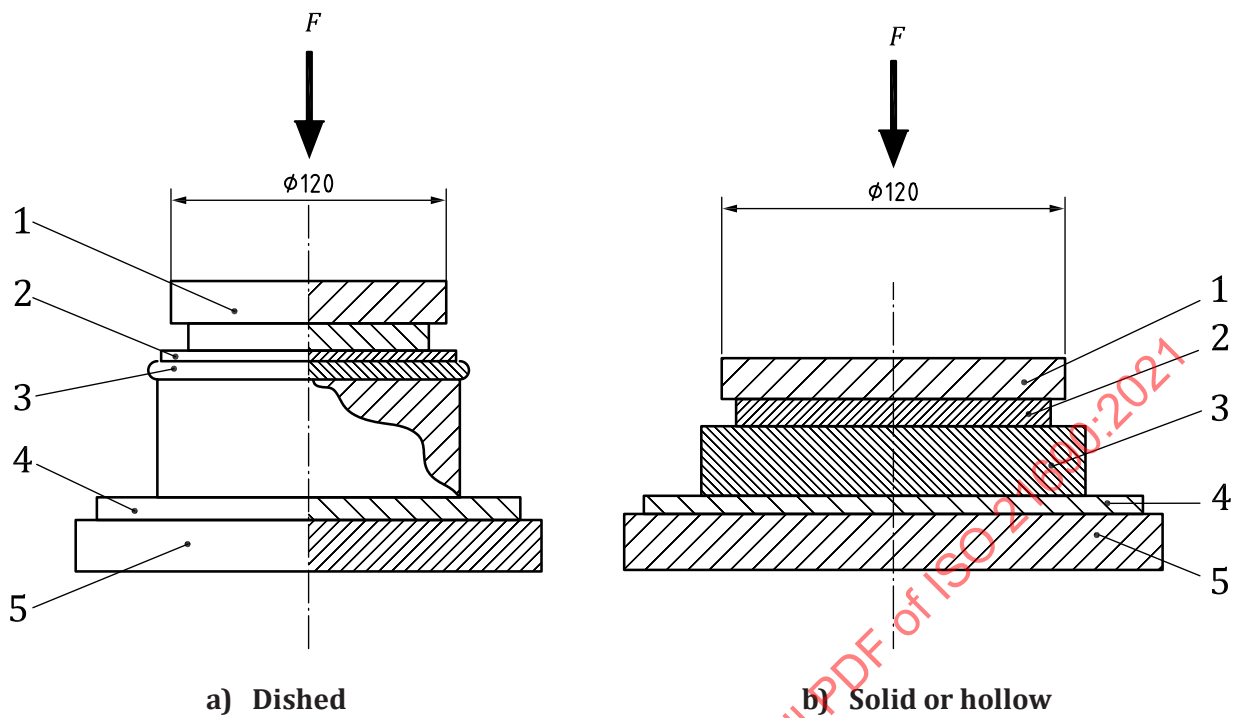
Place the hollow or dished glass block being tested on a steel support plate with a thickness of 12 mm. For solid blocks, a thickness of 20 mm steel square is placed under seating rubber mat around perimeters. Place a rubber mat with a thickness of 5 mm and a Shore A hardness value of (60 ± 5) measured in accordance with ISO 48-2 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 8 mm thick felt between the punch and the glass block.

Throughout all the tests, maintain the speed of application of the load at 49 N/s and centre the punch on the sample being tested. When the glass paver breaks, the highest applied load is measured.

Dimensions in millimetres



Key

- 1 punch
- 2 layer of felt
- 3 glass block
- 4 rubber mat
- 5 support plate
- F testing force

NOTE For solid blocks, a thickness of 20 mm steel square is placed under seating rubber mat (4) around perimeters.

Figure A.2 — Test method for applied load of glass pavers