INTERNATIONAL STANDARD

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Timber structures — Structural insulated panel walls — Test methods

Structures en bois — Murs en panneaux isolants structurels — Méthodes d'essai

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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 22452 was prepared by Technical Committee ISO/TC 165, *Timber structures*.

Introduction

The objective of this International Standard is to provide the means for the structural testing of structural insulated panel (SIP) walls.

It includes tests for tensile bonding strength of the panels, ageing, shear, vertical load performance, horizontal in-plane performance and out-of-plane bending performance. A creep test has been included in the annex for information (and trial). The tests applicable to panels for particular applications are presented, the test requirements, including laboratory conditions, are given and the numbers of samples to be tested and the reporting of results are specified.

This International Standard is not intended for quality control testing or for conformity assessment.

Timber structures — Structural insulated panel walls — Test methods

1 Scope

This International Standard specifies test methods for determining the structural properties of double-sided, wood-based, load-bearing structural insulated panels (SIPs) for use in walls.

It is applicable to SIPs having

— two face layers, at least one of which is a wood-based structural panel, and

— a core made of a thermally insulating material having sufficient shear strength to cause the face layers to act together structurally.

NOTE 1 Gypsum-based structural boards are commonly used as a face layer.

NOTE 2 Panels can contain internal framing or bracing.

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.

ASTM C393/C393M-06, *Standard Test Method for Core Shear Properties of Sandwich Constructions by Beam Flexure*

ASTM D7446-09, *Standard Specification for Structural Insulated Panel (SIP) Adhesives for Laminating Oriented Strand Board (OSB) to Rigid Cellular Polystyrene Thermal Insulation Core Materials*

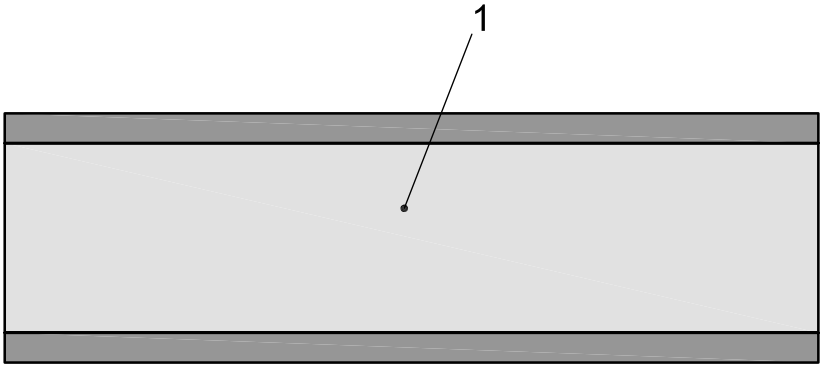
3 Terms and definitions

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

3.1
structural insulated panel
SIP
panel with two load-bearing skins, one bonded to each face of a rigid, lightweight, homogenous core material with sufficient shear strength to cause the face layers to act together structurally

See Figure 1.

NOTE The homogenous core is made of one material with no internal joints requiring bonding.



Key

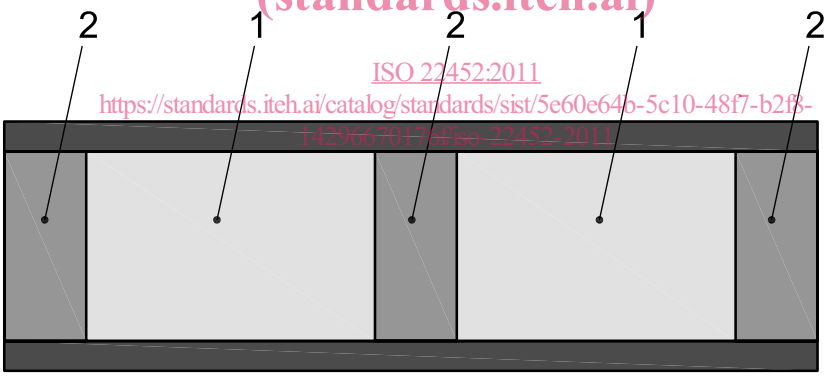
1 rigid core

Figure 1 — Cross-section of structural insulated panel

3.2
double-skin box with structural core-type structural insulated panel
panel with a rigid core surrounded by a structural frame, with or without internal ribs, and two skins mechanically fastened and/or bonded to the frame and core, forming a closed box

See Figure 2.

NOTE The skins, core and frame are all load-bearing.



Key

1 core

2 internal structural frame

Figure 2 — Structural insulated panel with internal structural frame

3.3
slabstock
core material which is pre-formed into slabs of thickness equal to the required depth of the core and then bonded with a suitable adhesive

NOTE The length and width of a slab of core material are less than or equal to the length and width of the SIP.

3.4
bonded
condition of components of a structural insulated panel in which they are bonded to each other by adhesive or where foams used for cores are foamed *in situ* and become self-adhesive while expanding and curing so that they bond automatically to the enveloping components

4 Symbols

a, b, c	distances, in millimetres (mm)
B	width of full panel, in millimetres (mm)
F	load, in newtons (N)
F_{max}	maximum load, in newtons (N)
F_u	ultimate load, in newtons (N)
$F_{max,est}$	estimated maximum load, in newtons (N)
F_v	vertical load, in newtons (N)
D	panel thickness, in millimetres (mm)
F_g	self load of loading element, in newtons (N)
F_{g1}	self load of panel, in newtons (N)
F_{g2}	applied permanent load, in newtons (N)
F_l	lever arm load, in newtons (N)
F_p	loading plate and rod load, in newtons (N)
F_Q	variable load, in newtons (N)
H	height of full panel, in millimetres (mm)
L	span, in millimetres (mm)
l	length of panel sample, in millimetres (mm)
R	stiffness, in newtons per millimetre (N/mm); strength, in newtons per millimetre (N/mm)
T	loading time, in seconds (s)
T_r	recovery time, in seconds (s)
b	width of panel sample, in millimetres (mm)
d_c	depth (thickness) of core, in millimetres (mm)
e	depth between the centroids of the faces, in millimetres (mm)
f_{ct}	tensile strength of core material, in newtons per square millimetre (N/mm^2)
f_{cv}	shear strength of core material, in newtons per square millimetre (N/mm^2)
t_1, t_2	overall thickness of the face in millimetres (mm)
w	deformations, in millimetres (mm)
w_t	total deflection under constant load at time t, in millimetres (mm)
w_0	initial static deflection under constant load and temperature, in millimetres (mm)
η	factor of less than unity modifying $F_{max,est}$
ν	panel racking deformation, in millimetres (mm)

5 Product evaluation

5.1 Tests applicable to panel construction

The following test regimes are applicable to the panel construction:

a) tensile testing on the core and its bonding to faces;

b) ageing test;

c) shear strength of the solid core and its bonding to faces.

5.2 Tests applicable to wall panels

The following test regimes are applicable to the wall panel:

a) vertical load (stiffness and strength);

b) horizontal in-plane load (racking stiffness and strength);

c) out-of-plane bending (stiffness and strength).

6 Structural testing

6.1 Conditioning

6.1.1 Standard conditioning

Where standard conditioning is required for the tests specified in 6.2 to 6.8, the test pieces used shall be conditioned to constant mass in an atmosphere of relative humidity of (65 ± 5) % and temperature of (20 ± 2) °C. Constant mass is deemed to be attained when the results of at least three successive weighings indicate that the moisture content has stabilized to within ±0,5 % for at least a 48 h period.

If the conditions of the testing room are not the same as those in the conditioning chamber, the test pieces shall remain in the conditioning chamber until testing.

6.1.2 Alternative conditionings

Where test pieces are not conditioned or are conditioned differently from the procedure given in 6.1.1, the alternative shall be described in the test report.

When required or appropriate, results may be corrected to reflect conditioning according to 6.1.1. The procedure for adjusting structural properties shall be technically sound and shall be recorded in the test report.

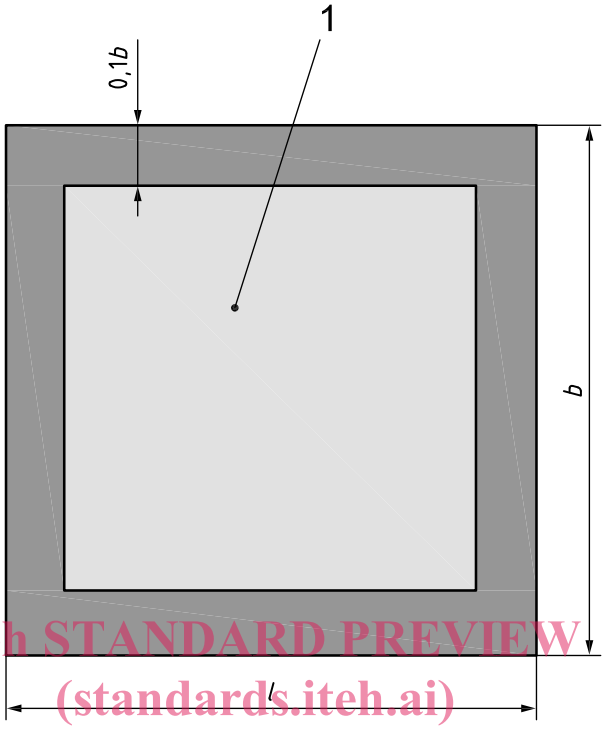
6.2 Tensile test on core material and bonding between faces and core

6.2.1 Specimen size and sampling

The depth of the specimen shall be equal to the panel thickness, D. The width, b, shall be 150 mm and the length, l, shall be 150 mm (see Figure 3).

NOTE The purpose of this test is to determine the critical failure mechanism, in core or glue line of the SIP.

The test specimens should be sampled from a range of positions covering the width and length of the panel, including the centre and edge of the sampling area, shown in Figure 3. The outer 10 % of the panel perimeter is excluded from testing.



Key

1 sampling area
b panel width
l panel length

Figure 3 — Specimen sampling from panel

6.2.2 Conditioning

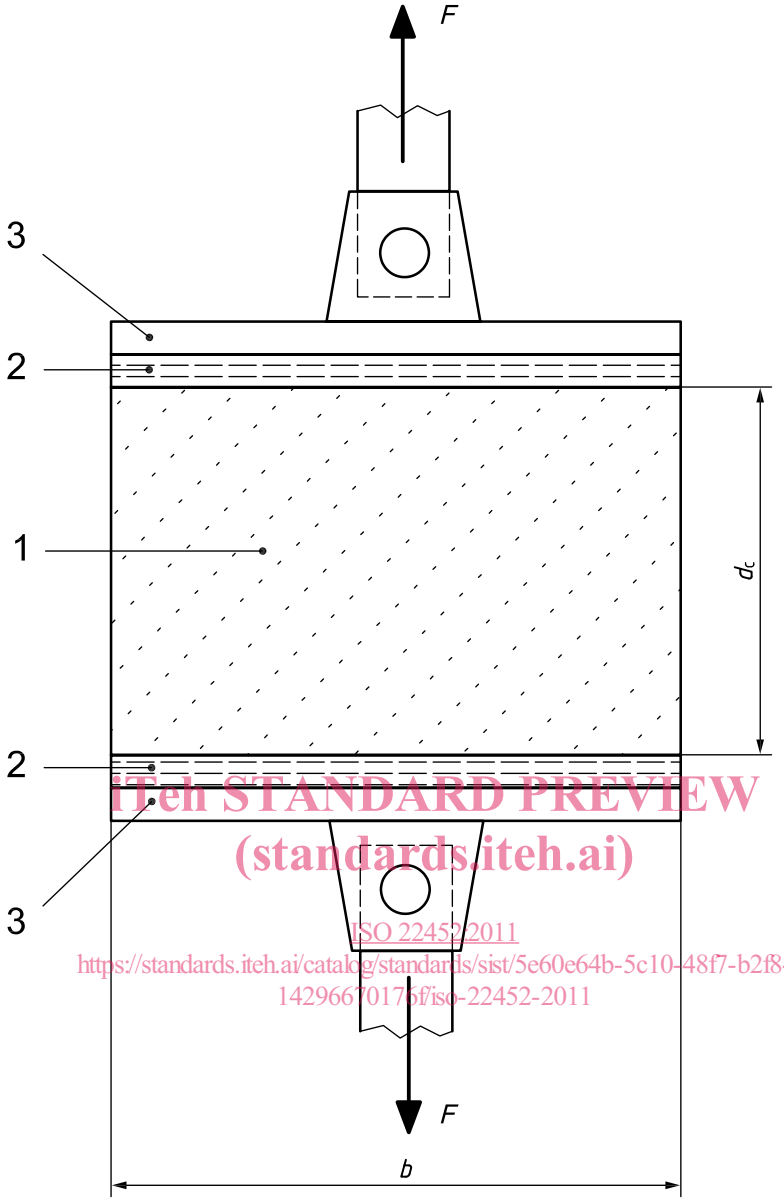
Specimens shall be conditioned either in accordance with 6.1 or to a specified elevated temperature.

Specimens shall be tested immediately after removal from the conditioning chamber when performing an elevated temperature test.

Testing at an elevated temperature may be appropriate for certain applications, and performance of the panel unit should be verified at these conditions. If uncertain of in-service temperature levels, elevated temperature test specimens should be conditioned at 80 °C for at least 4 h. No further temperature measurement is required after conditioning.

6.2.3 Loading method and test procedure

Specimens shall be bonded, using a suitable adhesive, to platens of sufficient stiffness to ensure a uniform tensile stress over the area of specimen. When conditioned according to 6.1, platens shall be bonded to the specimen after conditioning. Specimens of square cross-section shall be prepared in accordance with Figure 4.



Key

1 core
2 panel face
3 load-distributing platen

Figure 4 — Test arrangements in core tension test

The load, F, shall be applied in increments or continuously so as to reach maximum load in a period of 1 min to 5 min.

For SIPs with OSB (oriented strand board) and polystyrene thermal insulation core materials, ASTM D7446-09, 13.2, should be referred to and considered for use, as appropriate.

NOTE This test is not intended for paper-faced lining materials.