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Timber Structures — Structural Insulated Panel roof construction — Test methods

Methodes d'essaies pour panneaux de toit de sandwiches portants(SIPs)

ICS: 91.080.20



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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.

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ISO WD 18402 was prepared by WG 7, Technical Committee ISO/TC 165, Timber structures.

Introduction

This first draft standard was prepared following the initial proposal ISO/TC 165 Document N 738, as approved by Resolution 371, Stockholm, Sweden 2012-09-21.

The objective of the work is to provide an International Standard for the structural testing of structural insulated panel roofs.

This draft includes tests for tensile bonding strength of the panels, ageing, shear, creep performance, horizontal in-plane performance and out-of-plane bending performance. The tests applicable to panels for particular applications are indicated, while the test requirements include laboratory conditions, some advice is given in notes on the numbers of samples to be tested and the reporting of results.

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

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Timber Structures — Structural Insulated Panel Roofs — Test methods

1 Scope

This International Standard specifies test methods for determining, for use in roofs, the structural properties of double sided load bearing structural insulated panels 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 may be used as one face layer

Note 2: Panels may contain internal framing or bracing

Note 3: The performance of panels with non-structural insulation is generally calculable according to design codes such as EN 1995-1-1, or tested according to appropriate standards.

2 Normative references

This International Standard incorporates dated or undated reference, provisions and 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 International Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication applies.

ISO/DIS 21581 Timber Structures - shearwalls - Static and cyclic lateral load testing

- ISO 22452, Timber Structures Structural Insulated Panel Walls Test methods
- ISO 16670 Timber structures -- Joints made with mechanical fasteners -- Quasi-static reversed-cyclic test method
- EN 594, Timber structures Test methods Racking strength and stiffness of timber frame wall panels
- EN 14509 Self-Supporting Double Skin Metal Faced Insulating Panels Factory Made Products Specifications
- ASTM C480, Standard Test Method for Flexure Creep of Sandwich Constructions
- ASTM D1183, Standard Practices for Resistance of Adhesives to Cyclic Laboratory Aging Conditions
- ASTM D7446, Standard Specification for Structural Insulated Panel (SIP) adhesive for laminating Oriented Strand Board (OSB) to Rigid Cellular Polystyrene Thermal Insulation Core materials
- ASTM E72, Standard Test Methods of Conducting Strength Tests of Panels for Building Construction
- ASTM E1803, Standard Test Methods for Determining Strength Capacities of Structural Insulated Panels
- ASTM E455 Standard Test Method for Static Load Testing of Framed Floor or Roof Diaphragm Constructions for Building (replace with ISOTC165 N780 (based on E455) IN DRAFT STATUS)
- ASTM D6815 Standard Specification for Evaluation of Duration of Load and Creep Effects of Wood and Wood-Based Products

3 Terms and definitions

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

3.1 Structural Insulated Panel (SIP)

A 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.



Figure 1 - Cross section of a structural insulated panel

Note: Homogenous core is made of one material with no internal joints requiring bonding.

3.2 Double skin box with structural core type structural insulated panel

A 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. The skins, core and frame all contribute to the load bearing capacity of the panel.



3.3 Slabstock

The core material is pre-formed into slabs of thickness equal to the required depth of the core and then bonded with a suitable adhesive. When the length and width of a slab of core material are less than or equal to the length and width of the SIP they may be internally bonded.

3.4 Bonded

The components of a structural insulated panel may be bonded to each other by adhesive. Alternatively, some foams used for cores are foamed in situ, and are self-adhesive whilst expanding and curing, thus bonding automatically to the enveloping components.

4 Symbols (and abbreviated terms)

 $A_{F1}A_{F2}$ area of cross-section of the faces of the test panel, in square millimetres;

a,b,c distance, in mm

B width of full panel, in mm;

 $E_{F1}E_{F2}$ Young's modulus of faces of the test panel, in N/mm²;

Fload, in N;

 $F_{\rm max}$ maximum load, in N;

 F_{u} ultimate load, in N;

 $F_{\max,est}$ estimated maximum load, in N;

 F_{V} applied vertical load, in N;

- D panel thickness, in mm;
- Δs real shear deformation, in mm
- $\Delta s'$ apparent shear deformation, in mm
- shear modulus of core, in N/mm²; Gc
- G'apparent shear stiffness, in N/mm²
- self weight of loading element F_{g}
- F_{g_1} self weight of the panel in N;
- F_{g_2} applied permanent load, in N;
- F_{lever} weight of lever arm, in N;
- In N; Standards, son and standards, sandards, sandards, sandards, son and standards, sandards, sanda weight of loading plate and rod, in N, F_{plate}

 F_{o} variable load, in N;

Η height of full panel, in mm;

L span, in mm;

Ι length of panel sample, in mm

М mass, in kg;

 M_{U} ultimate moment capacity, in kNm

Р load, in kN

- R stiffness, in N/mm; strength, in N/mm;
- R_U maximum reaction at failure, in kN

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- S_{U} ultimate shear strength, in N/mm
- Т loading time, in seconds
- T_r recovery time, in seconds
- W impact energy, in J;
- b width of panel sample, in mm;
- d_{c} depth (thickness) of core, in mm;
- е depth between the centroids of the faces, in mm;
- f_{cv} shear strength of core material, in N/mm²
- tensile strength of core material, in N/mm² f_{ct}
- t_1, t_2, t_3 overall thickness of the face in mm
- unal standards stand total deflection under vertical diaphragm load, in mm Δt
- W deformations, in mm;
- W_u ultimate deformation, in mm
- w_t total deflection under constant load at time t, in mo
- W_0 initial static deflection under constant load and temperature, in mm;
- $F_{\max,est}$ η factor of less than unity modifying
- panel racking deformation, in mm; v

5 **Product evaluation**

5.1 Tests applicable to the panel construction

The following test regimes described in this standard relate to tests applicable to the panel construction

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indard:

- 1. Tensile test on core and its bond to faces
- 2. Shear strength of solid core and its bond to faces

5.2 Tests applicable to roof panels

The following test regimes described in this standard relate to tests applicable to the roof panel

1. Out of plane bending (stiffness and strength)