
**Tovarniško izdelane izolacijske sendvič plošče z obojestranskim kovinskim
oplaščenjem - 4. del: Preskusne metode za pritrjevanje plošč na podkonstrukcijo
in za določanje učinka zadrževanja na podkonstrukciji**

Factory-made double skin metal faced insulating sandwich panels - Part 4: Test methods
for fixing of panels to substructure and for determining restraining effect on substructure

Werkmäßig hergestellte Sandwich-Elemente mit beidseitigen Metalldeckschichten - Teil
4: Prüfverfahren zur Befestigung von Paneelen an der Unterkonstruktion und zur
Bestimmung der Rückhaltewirkung (auf die Unterkonstruktion)

Panneaux sandwichés isolants à deux parements métalliques manufacturés - Partie 4:
Méthodes d'essai pour les assemblages des panneaux à la sous-structure et pour la
détermination de l'effet de retenue sur la sous-structure

Ta slovenski standard je istoveten z: prEN 14509-4

ICS:

91.100.60	Materiali za toplotno in zvočno izolacijo	Thermal and sound insulating materials
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en,fr,de

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

DRAFT
prEN 14509-4

August 2021

ICS 91.100.60

English Version

Factory-made double skin metal faced insulating sandwich panels - Part 4: Test methods for fixing of panels to substructure and for determining restraining effect on substructure

Panneaux sandwichés isolants à deux parements métalliques manufacturés - Partie 4: Méthodes d'essai pour les assemblages des panneaux à la sous-structure et pour la détermination de l'effet de retenue sur la sous-structure

Werkmäßig hergestellte Sandwich-Elemente mit beidseitigen Metalldeckschichten - Teil 4: Prüfverfahren zur Befestigung von Paneelen an der Unterkonstruktion und zur Bestimmung der Rückhaltewirkung auf die Unterkonstruktion

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 128.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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European foreword

This document (prEN 14509-4:2021) has been prepared by Technical Committee CEN/TC 128 “Roof covering products for discontinuous laying and products for wall cladding”, the secretariat of which is held by NBN.

This document is currently submitted to the CEN Enquiry.

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Introduction

The principles for determination of declared values of the characteristics to be expressed are given in prEN 14509-1 for self-supporting applications and in FprEN 14509-2 for structural applications.

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1 Scope

This document specifies test methods for determination of characteristics for fixing of factory-made double skin metal faced insulating sandwich panels (hereafter referred to as sandwich panels) to substructure and for stabilization of substructure. Sandwich panels are used in elements for both self-supporting and structural applications in roofs, in external and internal walls (including partitions) and in ceilings in buildings as well as those in cold store applications.

NOTE The description of self-supporting sandwich panels is given in prEN 14509-1 and for structural sandwich panels in FprEN 14509-2.

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.

EN 1990, *Eurocode - Basis of structural design*

EN 1993-1-3:2006, *Eurocode 3 - Design of steel structures - Part 1-3: General rules - Supplementary rules for cold-formed members and sheeting*¹

EN 13165, *Thermal insulation products for buildings - Factory made rigid polyurethane foam (PU) products - Specification*

FprEN 14509-2:2021, *Factory made double skin metal faced insulating sandwich panels - Part 2: Structural applications*

prEN 14509-3:2021, *Factory made double skin metal faced insulating sandwich panels - Part 3: Test methods for determining mechanical strength, building physical behaviour and durability*

prEN 14509-5:2021, *Factory made double skin metal faced insulating sandwich panels - Part 5: Design methods. Determination criteria for combing actions and spans*

3 Terms, definitions, symbols, subscripts and abbreviations

3.1 Terms and definitions

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

3.1.1

bond, bonding

adhesion between the face(s) and the core normally provided by an adhesive

3.1.2

ceiling

covering over an internal area

3.1.3

core

layer of material, having thermal insulating properties, which is bonded between two metal faces, thickness of metal face minus thickness of metal and organic coating

¹ As impacted by EN 1993-1-3:2006/AC:2009.

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Note 1 to entry: Panels with special edge details in the longitudinal joints may utilize different core materials from the main insulating core (e.g. for improved fire performance) if these edge details do not influence on mechanical performance of the panel.

3.1.4**edge, longitudinal edge**

side of the panel where adjacent panels join together in the same plane

3.1.5**face, facing**

flat, lightly profiled or profiled thin metal sheet firmly bonded to the core

3.1.6**joint**

interface between two panels where the meeting edges have been designed to allow the panels to join together in the same plane

Note 1 to entry: The joint may incorporate interlocking parts that enhance the mechanical properties of the system as well as improving the thermal, acoustic and fire performance and restricting air movement.

Note 2 to entry: The term 'joint' does not refer to a junction between cut panels or a junction where the panels are not installed in the same plane.

3.1.7**lamella**

core material consisting of mineral wool that has been cut and orientated with the fibres perpendicular to the facings prior to bonding

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3.1.8**sandwich panel**

building product consisting of two metal faces positioned on either side of a core that is a thermally insulating material, which is firmly bonded to both faces so that the three components act compositely when under load

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3.2 Symbols, subscripts and abbreviations

For the purposes of this document, the following symbols, subscripts and abbreviations apply.

3.2.1 Symbols

B overall width of the panel/specimen,

C ratio

D overall thickness of the panel

E modulus of elasticity

F force, load, support reaction

G shear modulus

L span, distance, width of support (L_s)

M bending moment

Q load

R resistance

S	shear rigidity
V	shear force
b	width of test specimen
d	depth of face profile or stiffeners, depth of core (d_c)
e	distance between centroids of faces, base of natural logarithms ($e = 2,718\ 282$)
f	strength, yield stress
h	height of profile
k	parameter, correction factor
l	length
m	mass
n	number of tests, number of screws, number of webs
t	thickness of face sheet
w	deflection, displacement
δ	deviation
ϕ	angle
γ	shear strain
φ	creep coefficient

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3.2.2 Subscripts

A	rotational stiffness ($C_{D,A}$)
C	core
D	expressed value, rotational stiffness (C_D)
F	face
adj	adjusted
$arcsin$	trigonometric function (inverse of sine function, \sin^{-1})
$arctan$	trigonometric function (inverse of tangent function, \tan^{-1})
c	compression
d	design
e	external, additional thickness of main profiles (Δe)
eff	effective
end	end support
i	internal
i, j	index

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<i>int</i>	internal support
<i>m</i>	material
<i>nom</i>	nominal
<i>o</i>	upper face
<i>obs</i>	observed (e.g. result)
<i>rep</i>	repeated ($F_{Rtk,rep}$)
<i>Rtk</i>	characteristic (5%-fractile) value (F_{Rtk})
<i>s</i>	support (L_s = support width), stiffeners, surface (R_{s1})
<i>t</i>	tension, time
<i>tol</i>	tolerance (normal or special)
<i>tr</i>	traffic (C_{tr})
<i>u</i>	ultimate (F_u)
<i>l</i>	lower face
<i>v</i>	shear
<i>0</i>	basic value, unit width, time (e.g. $t = 0$)
<i>1</i>	upper face
	supporting member
<i>2</i>	lower face
$\varphi_{\theta,t}$	effect of creep on core module ($E \varphi_{\theta,t}$)

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3.2.3 Abbreviations

EPS	expanded polystyrene
MW	mineral wool
PU	rigid polyurethane foam (the abbreviation PUR includes polyisocyanurate foam (PIR))
PF	phenolic foam
ULS	ultimate limit state
XPS	extruded polystyrene foam

4 Testing of the resistance of fixings of sandwich panels to supporting structures**4.1 General****4.1.1 Type of fixings and panel families**

This document covers the resistance of fixing of panels to supporting structures and the failure modes in the sandwich panel. It does not cover the failure of the fastener itself or failure of the fixing in the supporting structure. Thus, the failure mode for tension is generally a pull-through failure of the visible fixing and the failure mode of the hidden fixing a failure of the joint or of the load spreading plate (if

applicable). A pull-through failure is used as a common name for these failure modes. In addition, the shear failure mode of fixing is covered by this document.

The types of fixing of panels to supporting structure covered by this document are:

- visible fixings;
- hidden fixings.

NOTE 1 Combinations of these fixing types are also possible.

For the fixing of panels to supporting structure, failure modes in supporting structure and fastener shall be determined separately. However, they are outside the scope of this document.

The test series of a fixing may cover a family of the structural sandwich panel products and one fastener type which is to be defined in the declaration of resistance values.

Panels with variation in the properties listed below can be included in the same family as long as the panel with weakest combination of the properties is tested.

A family of panels is defined by:

- profiling:
 - in the faces for visible fixings;
 - in the longitudinal joint for hidden fixings;
- material and grade of face material;
- type of longitudinal joint;
- the same type of core material;
- panel thickness;
- thickness (inner and outer) of sheets;
- type and amount of adhesive.

One type or group of fasteners is defined by and shall be listed in connection to characteristics to be expressed:

- material of fastener;
- a fastener whose length will vary;
- same number and position (edge distance and distance between fasteners when more than one fastener is used) of fasteners;
- washer type and material;
- washer sealant;
- head diameter and type of head of the fastener:
 - the thread of the fastener;
 - the diameter of the shaft of the fastener;

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— geometry and material type and grade of load spreading plate, if relevant.

The end distance and the distance between the fixings may be varied in the test series, which shall then be taken into account in the analysis of the test results. In all the cases, the minimum edge distance envisaged between the fixing and the edge of the panel shall be tested. The influence of the centre-to-centre distance of the fixing shall be tested, when critical.

Tests have to be done for both static and cyclic loading for tensile resistance.

The series of the tests of the fixings give a set of test results for the determination of the characteristic resistance. The test results shall be adjusted to correspond to the nominal strength of the material components used in the sandwich panel.

Historical data can be used for declaration if the principles given in this clause are followed.

The values for the fixing to be expressed are based on resistance values in ultimate limit state (ULS) only.

NOTE 2 To reduce the range of tests for visible fixings, it is possible to perform all the tests with flat or lightly profiled faced sandwich panels of a panel family. It is also possible for visible fixings to do only tests on small scale tests on only the sheet-material without the possible influence of the core bedding.

NOTE 3 Typically the end or edge distance in a test series correspond to either the minimum end distance used in practice or the location of the fixing at an intermediate support. The fastener placed close to each other can have interactions in the tensile resistance. Therefore, the influence of the centre-to-centre distance of the fastener needs to be studied.

NOTE 4 If the EAD specification of a fixing has all the information for a fastening (e.g. visible fixing with screws), within pull-through and pull-out resistance, shear resistance and max. relative displacement between the internal and external face at the head of a fastener and material safety factor, then no additional tests are needed.

NOTE 5 Because of the complexity of the testing and calculation of the test results it is advised to have the tests done by an experienced testing party and an experienced party for interpretation of the results.

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If not otherwise specified for serviceability limit state, no notable plastic deformation is allowed.

4.1.2 Test reports

The test report shall contain:

- the description of the test specimen:
 - thicknesses and grade of the face material;
 - the type of core material and its reference;
 - the thickness and the span of the panel and the test arrangements (2 or 3 supports);
 - the description of the fixing including the material properties and geometry of the fixing part (i.e. load distribution plate, etc.), the position and the number of fasteners;
 - the distance between the end of the panel and the fastener;
 - the detailed geometry of the longitudinal joint of the panel;
- the description of the test:
 - the cycles used in the tests with maximum and minimum loads;
 - the ultimate load;