
**Tovarniško izdelane izolacijske sendvič plošče z obojestranskim kovinskim
oplaščenjem - 5. del: Metode izračuna - Merila za določanje kombinacij učinkov in
obsega**

Factory-made double skin metal faced insulating sandwich panels - Part 5: Design
methods - Determination criteria for combining actions and spans

Werkmäßig hergestellte Sandwich-Elemente mit beidseitigen Metalldeckschichten - Teil
5: Berechnungsmethoden - Bestimmungskriterien für die Kombination von Einwirkungen
und Spannweiten
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Panneaux sandwichés isolants à deux parements métalliques manufacturés - Partie 5 :
Méthodes de calcul - Critères de détermination pour les combinaisons des actions et des
portées

Ta slovenski standard je istoveten z: prEN 14509-5

ICS:

91.100.60	Materiali za toplotno in zvočno izolacijo	Thermal and sound insulating materials
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Factory-made double skin metal faced insulating sandwich panels - Part 5: Design methods - Determination criteria for combining actions and spans

Panneaux sandwichés isolants à deux parements métalliques manufacturés - Partie 5 : Méthodes de calcul - Critères de détermination pour les combinaisons des actions et des portées

Werkmäßig hergestellte Sandwich-Elemente mit beidseitigen Metalldeckschichten - Teil 5: Berechnungsmethoden - Bestimmungskriterien für die Kombination von Einwirkungen und Spannweiten

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

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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prEN 14509-5:2021 (E)

European foreword

This document (prEN 14509-5:2021) 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

This document covers Annex E in EN 14509:2013 and will be replaced for steel faced sandwich panels by EN 1993-7 when this Eurocode for design of steel faced sandwich panels will be published. For sandwich panels with other metal faces, this document will be used.

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prEN 14509-5:2021 (E)**1 Scope**

This document specifies design methods for combination of actions and spans for factory made double skin metal faced insulating sandwich panels (hereafter sandwich panels). The sandwich panels are for use 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 14509-1:2021, Clause 1 and for structural sandwich panels in prEN 14509-2:2020, Clause 1.

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 1990:2002,¹ *Eurocode — Basis of structural design*

EN 1993-1-3:2006,² *Eurocode 3 — Design of steel structures — Part 1-3: General rules — Supplementary rules for cold-formed members and sheeting*

EN 1999-1-4:2007,³ *Eurocode 9 — Design of aluminium structures — Part 1-4: Cold-formed structural sheeting*

EN 10143:2006, *Continuously hot-dip coated steel sheet and strip — Tolerances on dimensions and shape*

prEN 14509-1:2021, *Factory made double skin metal faced insulating sandwich panels — Part 1- Self-supporting applications*

prEN 14509-2:2020, *Factory made double skin metal faced insulating sandwich panels — Part 2- Structural applications* <https://standards.iteh.ai/catalog/standards/sist/143b1578-d951-4adb-b3d5-3da9ef05a549/osist-pren-14509-5-2021>

prEN 14509-3:2020, *Factory made double skin metal faced insulating sandwich panels — Part 3: Test methods for determining mechanical strength, building physical behaviour and durability*

prEN 14509-4:2020, *Factory made double skin metal faced insulating sandwich panels — Part 4: Test methods for fixing of panels and for determining restraining effect on substructure*

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**bending moment capacity**

maximum bending moment recorded during a test on an individual panel

¹ As impacted by EN 1990:2002/A1:2005 and EN 1990:2002/AC:2010.

² As impacted by EN 1993-1-3:2006/AC:2009.

³ As impacted by EN 1999-1-4:2007/AC:2009 and EN 1999-1-4.

3.1.2**bending resistance**

characteristic value of bending moment capacity determined on the basis of a test series

3.1.3**bond**

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

3.1.4**ceiling**

covering over an internal area

3.1.5**core**

layer of material, having thermal insulating properties, which is bonded between two metal faces

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.

3.1.6**edge, longitudinal edge**

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

3.1.7**face, facing**

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

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3.1.8**flat facing**

facing without any rolled or pressed profile, or raised strengthening rib

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3.1.9**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.

3.1.10**lightly profiled facing**

facing with a rolled or pressed profile not exceeding 5 mm in depth

3.1.11**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

3.1.12**wrinkling strength**

characteristic value of wrinkling stress

prEN 14509-5:2021 (E)**3.1.13****wrinkling stress**

stress in the compressed face of a panel undergoing failure in bending where the failure mode takes the form of a “wrinkle” extending over the full width of the panel near the section of maximum bending moment

3.2 Symbols and subscripts

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

3.2.1 Symbols

The following symbols apply to this document

- A* cross-sectional area
- B* overall width of the panel, flexural rigidity

Note 1 to entry: *A*, cross sectional area and *B*, flexural rigidity may apply either to the full width of a panel (e.g. in EN 14509-3:2021 when interpreting test results) or to a unit (metre) width of panel when carrying out design calculations or preparing load tables.

- C* design value of a serviceability criterion
- D* overall depth of the panel
- E* modulus of elasticity, design value of the effect of an action
- F* force, load
- G* shear modulus, permanent action
- I* moment of inertia [oSIST prEN 14509-5:2021](https://standards.iteh.ai/catalog/standards/sist/143b1578-d951-4adb-b3d5-3da9ef05a549/osist-pren-14509-5-2021)
- L* span, distance <https://standards.iteh.ai/catalog/standards/sist/143b1578-d951-4adb-b3d5-3da9ef05a549/osist-pren-14509-5-2021>
- M* bending moment
- N* axial compressive force
- Q* variable action
- R* resistance, reflectivity (R_G)
- S* shear rigidity, characteristic value of an action
- T* temperature
- V* shear force
- 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 (prEN 14509-3:2020, 4.11, 4.5.3 in this document: support reaction capacity), correction factor
- n* number of webs
- q* live load
- s* length of web (s_{w1})
- t* thickness of face sheet

v	variance factor
α	coefficient of thermal expansion
β	parameter (Table 10 design formulae)
Φ	angle
γ	partial safety factor, load factor (γ_F)
φ	creep coefficient
θ	parameter (Table 9 design formulae)
σ	bending stress, compressive strength, standard deviation
τ	shear stress
ψ	combination coefficient

3.2.2 Subscripts

The following subscripts apply to this document.

C	core
F	face, action (γ_F)
G	permanent load, degree
M	material (γ_M)
Q	variable action
S	sandwich part of the cross-section
c	compression, core
d	design
i, j	index
k	characteristic value
nom	nominal
s	support (L_s = support width), surface (R_{s1})
t	time
tol	tolerance (normal or special)
0	basic value
1	external face, upper face
2	internal face, lower face

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4 Determination criteria for combining actions and spans

4.1 General

This clause only covers uniformly distributed loads and thermal gradients, it gives no information about single loads on panels.

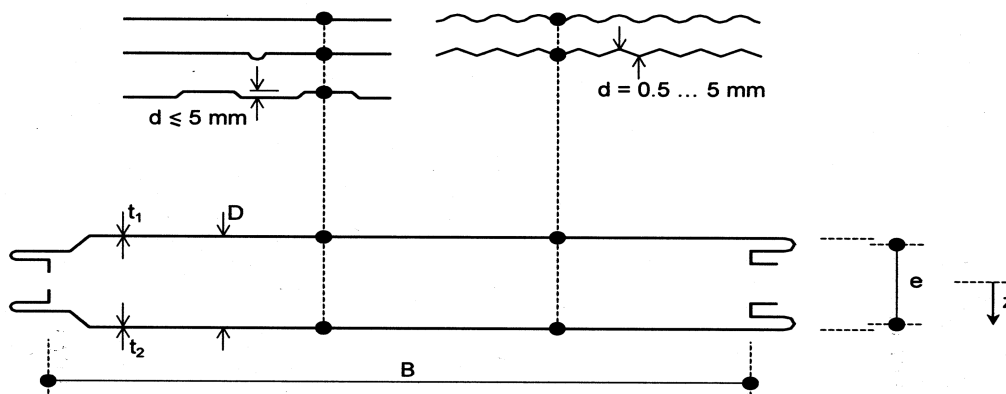
This clause concerns provisions that the designer has to take into account, if not otherwise specified and which are not yet included in the relevant Eurocodes.

The supporting structure shall be sufficiently stiff, to avoid unintended diaphragm actions or composite actions.

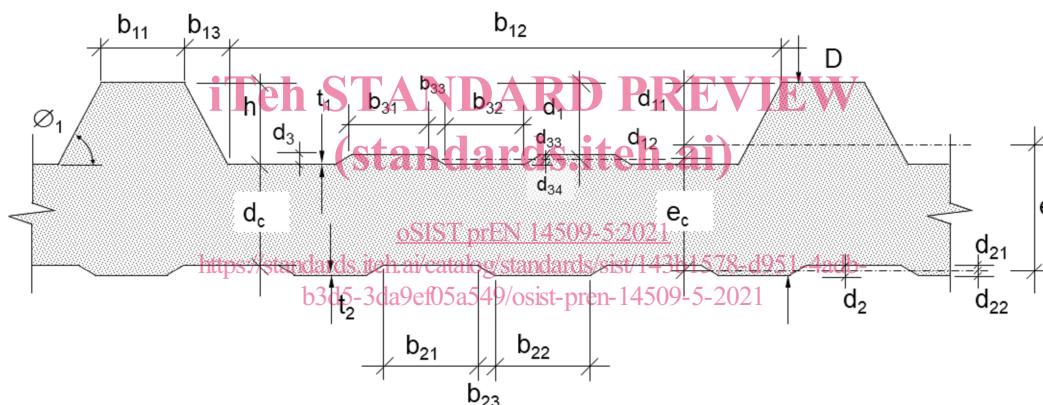
4.2 Definitions

4.2.1 Properties of a sandwich panel

The cross-section and material properties of a sandwich panel shall be as shown in Figures 1 a) and 1 b) and Table 1.



a) flat, lightly profiled or micro profiled face



b) Panel cross-section, profiled face

Figure 1 — Panel cross-sections

Table 1 — Panel properties

Layer	Geometry	Material properties	Structural properties
Face 1	$t_1, d_1, d_{11}, d_{12}, AF_1, IF_1$	E_{F1}, α_{F1}	B_{F1}
Core	d_C	E_C, G_C	S
Face 2	$t_2, d_2, d_{21}, d_{22}, AF_2, IF_2$	E_{F2}, α_{F2}	B_{F2}

4.2.2 Sign convention used in Clause 4

Where relevant, the formulae in this document assume the following sign convention: Bending moments are negative when face 1 is in tension.