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Tovarniško izdelane izolacijske sendvič plošče z obojestranskim kovinskim oplaščenjem - 5. del: Metode izračuna

Factory-made double skin metal faced insulating sandwich panels - Part 5: Design methods

Werkmäßig hergestellte Sandwich-Elemente mit beidseitigen Metalldeckschichten - Teil 5: Berechnungsmethoden

Panneaux sandwichs isolants à deux parements métalliques manufacturés - Partie 5 : Méthodes de conception

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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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
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (prEN 14509-5:2026) 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.

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.

In prEN 14509-3:2026, methods for the determination of characteristics given in this document are given.

In prEN 14509-4:2026, methods for the determination of fixing performance of panels and restraining effect on supporting structures are given.

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 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.

This document covers uniformly distributed loads, line loads perpendicular to the span over the full width of the panel and thermal gradients, it gives no information about normal forced axially loaded sandwich panels, torsional loaded sandwich panels or sandwich panels as a part of a diaphragm.

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 1990-1, *Eurocode — Basis of structural and geotechnical design — Part 1: New structures*

EN 1991-1-3, *Eurocode 1 — Actions on structures — Part 1-3: Snow loads*

EN 1991-1-4, *Eurocode 1 — Actions on structures — Part 1-4: Wind actions*

EN 1991-1-5, *Eurocode 1 — Actions on structures — Part 1-5: Thermal actions*

EN 1993-1-3:2024, *Eurocode 3 — Design of steel structures — Part 1-3: Cold-formed members and sheeting*

EN 1993-1-4:2025, *Eurocode 3 — Design of steel structures — Part 1-4: Stainless steel structures*

EN 1998-1:2005, *Eurocode 8: Design of structures for earthquake resistance — Part 1: General rules, seismic actions and rules for buildings*

EN 1999-1-4:2023, *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 14509-3:2026, *Factory made double skin metal faced insulating sandwich panels — Part 3: Test methods for determining mechanical strength, building physical behaviour and durability*

prEN 14509-4:2026, *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

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 Terms and definitions

3.1.1
bending moment capacity
maximum bending moment recorded during a test on an individual panel

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

3.1.7
face
flat, lightly profiled or profiled thin metal sheet firmly bonded to the core

3.1.8
flat face
face without any rolled or pressed profile, or raised strengthening rib

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 improve the thermal, acoustic and fire performance and restrict 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 face
face with a rolled or pressed profile not exceeding 5 mm in depth

3.1.11
profiled face
face with a rolled or pressed profile exceeding 5 mm in depth

3.1.12
line loads perpendicular to the span
loads that are applied on the whole width of the panel with a load application length corresponding to the minimum support width Ls according to EN 14509 (all parts)

3.1.13
sandwich panel
building product consisting of two metal faces positioned on either side of a core, which is firmly bonded to both faces so that the three components act compositely when under load

3.1.14
wrinkling strength
characteristic value of wrinkling stress

3.1.15
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, subscripts and abbreviations

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 A, cross sectional area and B, flexural rigidity, can apply either to the full width of a panel (e.g. in prEN 14509-3:2026 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
L	span, distance
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

Σ sum

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 14509-3:2026, 4.11, 4.5.3 in this document used for 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 6, 7, 10, 11 design formulae)

γ partial safety factor, load factor (γ_F)

φ creep coefficient

θ parameter (Table 5, 6, 7 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

lt long-term (storage loads, temperature loads in cold-storage rooms)

mt	medium-term (snow loads)
nom	nominal
s	support (L_s = support width), surface (R_{s1})
st	short-term (wind, temperature loads from climate actions)
supp	support
t	time
tol	tolerance (normal or special)
0	basic value
1	external face, upper face
2	internal face, lower face

3.2.3 Abbreviations

SLS	serviceability limit state
ULS	ultimate limit state

4 Determination criteria for combining actions and spans

4.1 General

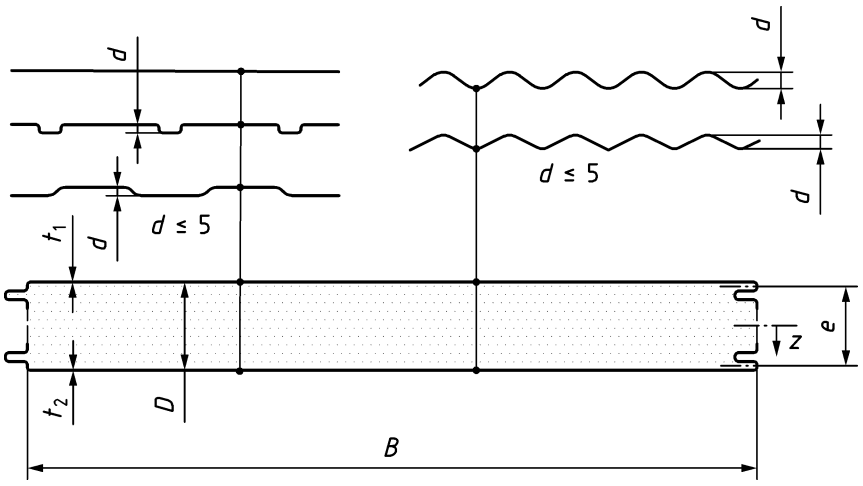
This clause concerns provisions that the designer has to take into account, if not otherwise specified and which are not yet included in the relevant Eurocodes.

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

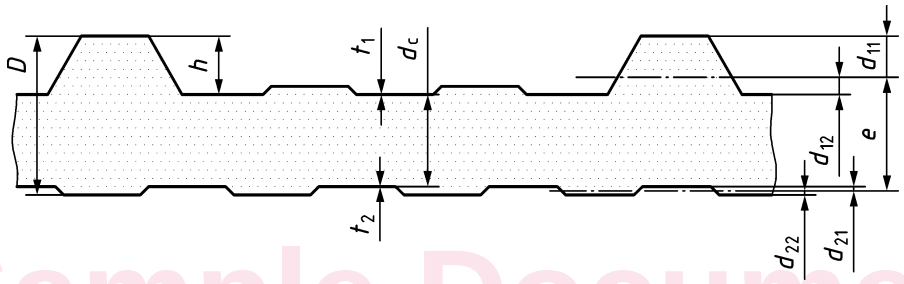
4.2 Specifications

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_{11}, d_{12}, A_{F1}, I_{F1}	E_{F1}, α_{F1}	B_{F1}
Core	d_C	E_C, G_C	S
Face 2	t_2, d_{21}, d_{22}, A_{F2}, I_{F2}	E_{F2}, α_{F2}	B_{F2}

4.2.2 Sign convention

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

Compressive forces and stresses are positive. Downward loads are positive.

Downward deflections are positive.

4.3 Principles of design procedure

The design values E_d of the effects of the actions shall be calculated and shall be compared with the design values of the corresponding resistance R_d or the relevant serviceability criterion C_d taking into account the appropriate material partial factors γ_M.

It shall be verified by means of calculation that the Formulae (1) to (4) are satisfied using the procedures in 4.5 to 4.8.