International Standard

ISO 17880

Cellular plastics — Self-supporting metal faced sandwich panels

Plastiques alvéolaires — Panneaux sandwich à parements métalliques autoportants

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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Contents

Page

Foreword

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This document was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 10, *Cellular plastics*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document has been developed with cellular plastics as the core. It has been eventually modified to include other materials, such as mineral wool.

Cellular plastics — Self-supporting metal faced sandwich panels

1 Scope

This document specifies requirements for factory made, self-supporting, double skin metal-faced insulating sandwich panels where the insulating core materials are intended to be but not limited to cellular plastics and mineral wool as defined below.

The sandwich panels are intended for discontinuous laying in the following applications:

a) roofs and roof cladding;

b) external walls and wall cladding.

The insulating core materials covered by this document are rigid polyurethane foam (PUR), polyisocyanurate foam (PIR), expanded polystyrene foam (EPS), extruded polystyrene foam (XPS), phenolic foam (PF) and mineral wool. Sandwich panels with edge details that utilize different materials from the main insulating core are included in this document. Sandwich panels used in outdoor cold storage applications are included in this document.

This document does not cover the following:

— sandwich panels with a declared thermal conductivity for the insulating core material greater than 0,06 W/m·K at 10 °C, or greater than 0,06 W/m·K at 23 °C;

— sandwich panels consisting of two or more clearly defined layers of different insulating core materials (multi-layered);

— sandwich panels consisting of more than one metal sheet per face;

— sandwich panels with perforated facing(s);

— curved sandwich panels;

— indoor cold storage applications.

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.

ISO 354:2003, *Acoustics — Measurement of sound absorption in a reverberation room*

ISO 717-1, *Acoustics — Rating of sound insulation in buildings and of building elements — Part 1: Airborne sound insulation*

ISO 834-1, *Fire-resistance tests — Elements of building construction — Part 1: General requirements*

ISO 834-4, *Fire-resistance tests — Elements of building construction — Part 4: Specific requirements for loadbearing vertical separating elements*

ISO 834-5, *Fire-resistance tests — Elements of building construction — Part 5: Specific requirements for loadbearing horizontal separating elements*

ISO 834-8, *Fire-resistance tests — Elements of building construction — Part 8: Specific requirements for non-loadbearing vertical separating elements*

ISO 834-9, *Fire-resistance tests — Elements of building construction — Part 9: Specific requirements for non-loadbearing ceiling elements*

ISO 845, *Cellular plastics and rubbers — Determination of apparent density*

ISO 1182, *Reaction to fire tests for products — Non-combustibility test*

ISO 1716, *Reaction to fire tests for products — Determination of the gross heat of combustion (calorific value)*

ISO 4898, *Rigid cellular plastics — Thermal insulation products for buildings — Specifications*

ISO 6270-1, *Paints and varnishes — Determination of resistance to humidity — Part 1: Condensation (single-sided exposure)*

ISO 6361-2, *Wrought aluminium and aluminium alloys — Sheets, strips and plates — Part 2: Mechanical properties*

ISO 6361-3, *Wrought aluminium and aluminium alloys — Sheets, strips and plates — Part 3: Strips: Tolerances on shape and dimensions*

ISO 6892-1, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature*

ISO 6946, *Building components and building elements — Thermal resistance and thermal transmittance — Calculation methods*

ISO 8145, *Thermal insulation; mineral wool board for overdeck insulation of roofs — Specification*

ISO 8301, *Thermal insulation — Determination of steady-state thermal resistance and related properties — Heat flow meter apparatus*

ISO 8302, *Thermal insulation — Determination of steady-state thermal resistance and related properties — Guarded hot plate apparatus*

ISO 9229, *Thermal insulation — Vocabulary*

ISO 9445-2:2009, *Continuously cold-rolled stainless steel — Tolerances on dimensions and form — Part 2: Wide strip and plate/sheet*

ISO 10140-1:2021, *Acoustics — Laboratory measurement of sound insulation of building elements — Part 1: Application rules for specific products*

ISO 10140-2:2021, *Acoustics — Laboratory measurement of sound insulation of building elements — Part 2: Measurement of airborne sound insulation*

ISO 10211, *Thermal bridges in building construction — Heat flows and surface temperatures — Detailed calculations*

ISO 10456, *Building materials and products — Hygrothermal properties — Tabulated design values and procedures for determining declared and design thermal values*

ISO 11654, *Acoustics — Sound absorbers for use in buildings — Rating of sound absorption*

ISO 11925-2, *Reaction to fire tests — Ignitability of products subjected to direct impingement of flame — Part 2: Single-flame source test*

ISO 12468-1, *External exposure of roofs to fire — Part 1: Test method*

ISO/TR 12468-3, *External exposure of roofs to fire — Part 3: Commentary*

ISO 12491, *Statistical methods for quality control of building materials and components*

ISO 13784-1:2014, *Reaction to fire test for sandwich panel building systems — Part 1: Small room test*

ISO 13784-2:2020, *Reaction-to-fire tests for sandwich panel building systems — Part 2: Test method for large rooms*

ISO 13785-1, *Reaction-to-fire tests for façades — Part 1: Intermediate-scale test*

ISO 13785-2, *Reaction-to-fire tests for façades — Part 2: Large-scale test*

ISO 13943, *Fire safety — Vocabulary*

ISO 14857, *Thermal performance in the built environment — Determination of air permeance of building materials*

ISO 16163, *Continuously hot-dipped coated steel sheet products — Dimensional and shape tolerances*

ISO 22111, *Bases for design of structures — General requirements*

ISO 29465, *Thermal insulating products for building applications — Determination of length and width*

ISO 29466, *Thermal insulating products for building applications — Determination of thickness*

ISO 29469, *Thermal insulating products for building applications — Determination of compression behaviour*

ISO 29470, *Thermal insulating products for building applications — Determination of the apparent density*

ISO 29765, *Thermal insulating products for building applications — Determination of tensile strength perpendicular to faces*

EN 508-1, *Roofing products from metal sheet — Specification for self-supporting products of steel, aluminium or stainless steel sheet — Part 1: Steel*

EN 1172, *Copper and copper alloys — Sheet and strip for building purposes*

EN 1396, *Aluminium and aluminium alloys — Coil coated sheet and strip for general applications — Specifications*

EN 1990:2002 + A1:2005 + A1:2005/AC:2010, *Eurocode - Basis of structural design*

EN 10088-1, *Stainless steels — Part 1: List of stainless steels*

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

EN 10169, *Continuously organic coated (coil coated) steel flat products — Technical delivery conditions*

EN 10204, *Metallic products - Types of inspection documents*

EN 12865, *Hygrothermal performance of building components and building elements — Determination of the resistance of external wall systems to driving rain under pulsating air pressure*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 9229, ISO 13943 and the following 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
auto-adhesive bond
self-adhesion of the core to the face(s) occurring automatically without the use of an adhesive

Note 1 to entry: This technique is used for producing sandwich panels by foaming.

3.2
bending moment capacity
maximum bending moment recorded during a test on an individual panel

3.3
bending resistance
characteristic value of bending moment capacity determined on the basis of a test series

3.4
bond
bonding
adhesion between the face(s) and the core normally provided by an approved adhesive

3.5
core
layer of material, having thermal insulating properties, which is bonded between two metal faces, creating a sandwich panel

3.6
durability
ability of the panel to withstand the environmental effects and accommodate the consequent decrease in mechanical strength with time caused by factors such as temperature, humidity, freeze-thaw cycles and their various combinations

3.7
edge
longitudinal edge
side of the panel where adjacent panels join together in the same plane

3.8
face
facing
flat, lightly profiled or profiled thin metal sheet firmly bonded to the core

3.9
flat face
face without any rolled or pressed profile or raised strengthening rib

3.10
lightly profiled face
face with a rolled or pressed profile not exceeding 5 mm in depth

3.11
profiled face
face with a rolled or pressed profile exceeding 5 mm in depth

3.12
incompletely bonded panel
panel in which one or both faces is incompletely bonded

3.13
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 can 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.

3.14
lamella
core material consisting of mineral wool that has been cut and orientated with the fibres perpendicular to the facings prior to bonding

3.15
lightly profiled facing
facing with a rolled or pressed profile not exceeding 5 mm in depth

3.16
pre-manufactured
pre-formed
component or material that is supplied to the manufacturer ready for direct incorporation into the sandwich panel as a core

3.17
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

3.18
self-supporting sandwich panel
panel capable of supporting, by virtue of its materials and shape, its self-weight and in the case of panels fixed to spaced structural supports all applied loadings (e.g. snow, wind, internal air pressure), and transmitting these loadings to the supports

3.19
shift
period of production during a working day, normally 6 h to 8 h but can be less

3.20
side lap
folded area of one or both facing materials along the longitudinal edge of the panel which engages with the adjacent panel to form an interlocking or overlapping joint

3.21
wrinkling strength
characteristic value of *wrinkling stress* (3.22)

3.22
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

4 Symbols and abbreviated terms

4.1 Symbols

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

A	cross-sectional area of the specimen determined from the measured dimensions
A_C	cross sectional area of the core based on measured depth d_c
A_c	area of the carrier
A_{F1}	measured area of cross-section of the top face based on measured metal thickness;
A_{F2}	measured area of cross-section of the bottom face based on measured metal thickness;
A_{glue}	area of facing sheet in square metres (m^2)
B	bending stiffness, overall width of the panel/specimen
B_F	flexural rigidity of the face(s)
B_{min}	minimum width of uncut core material across a line of cut ends
B_{obs}	bending stiffness with t_{obs} and e_{obs}
B_S	flexural rigidity of the sandwich part
C	ratio, design value of a serviceability criterion
C_d	limiting design value of the relevant serviceability criterion expressed as the maximum serviceability limit state design stress or limit on deflection taking into account the material partial factor for serviceability limit state design γ_M
C_{tr}	spectrum adaptation term calculated with A-weighted urban traffic noise
D	overall depth of the panel
E	modulus of elasticity, design value of the effect of an action
E_C	mean of the characteristic values of the tensile and compressive moduli of the core material
E_{Cc}	compressive E-modulus of the core
E_{Ct}	tensile E-modulus of the core
E_{F1}	E-modulus of the top face
E_{F2}	E-modulus of the bottom face
F	force, load, support reaction
F_G	self-weight of the panel
F_{lin}	load at the end of the linear part of the load-deflection curve
F_{Ri}	test value of reaction capacity
F_u	ultimate load
G	shear modulus, permanent action

G_C	shear modulus of the core
$G_{C,\,red}$	reduced shear modulus of the core
G_k	characteristic value of the permanent action
I	moment of inertia
I_F	moment of inertia of the profiled face(s) (sum if both faces are profiled)
I_S	moment of inertia of the sandwich part (see Annex E)
L	span, distance,
L_s	width of support plate
M	bending moment
M_{Du}, M_{Su}	Bending moments at ultimate limit state to determine σ_{yr}
M_u	bending moment capacity
N	axial compressive force
Q	variable action
Q_{k1}	characteristic value of the dominant variable action
Q_{ki}	characteristic value of the non-dominant variable action i ($I > 1$)
R	resistance
$R_{adj,i}$	test result modified to correspond to the design values of metal thickness
R_{DUR}, R_{24}	tensile strength
R_G	degree of reflection relative to magnesium oxide = 100 %
R_k	characteristic resistance
$R_{obs,i}$	result of test number I
R_{se}	external surface resistance (m^2K/W)
R_{si}	internal surface resistance (m^2K/W)
R_w	sound reduction index
S	shear rigidity, value of a load effect, characteristic value of an action
S_{ki}	characteristic value of an action
T	temperature
U	thermal transmittance value of the panel,
$U_{d,s}$	thermal transmittance value of the panel including the influence of the panel joints
V	shear force
a	distance apart of clips

b	width of test specimen, width of plate, width of ribs/valleys, bowing
b_c	width of the clips
d	depth of face profile or stiffeners,
d_C	nominal thickness of the core (ignoring the thickness of the facings) and the geometry of the main profiles), see Figure A.18 and Figure A.19
d_d	design thickness of the panel
d_S	depth of stiffeners
e	distance between centroids of faces, base of natural logarithms (e = 2,718 282)
e_e	additional thickness of the external face
e_i	additional thickness of the internal face
e_{obs}	distance between the faces on basis of measured geometry
f	strength, yield stress , reduction factor
f_C	mean compressive strength of the core
f_{Cc}	compressive strength of the core
f_{Ct}	cross panel tensile strength
f_{Cv}	shear strength of the core
$f_{Cv,\,red}$	reduced shear strength of the core
f_{joint}	thermal transmittance contribution factor
$f_{joint,\,c}$	thermal transmittance contribution factor with clip
$f_{joint,\,nc}$	thermal transmittance contribution factor without (no) clip
f_y	design yield stress
$f_{y,obs}$	measured yield stress
h	height of profile
h_{glue}	thickness of adhesive in millimetres (mm)
k	correction factor, distribution parameter
k_v	reduction factor for cut ends in pre-formed cores
l	length, deviation
m	mass
$m_{adhesive}$	amount of adhesive in grams per square metre (g/m^2) from measurements during production
m_c	mass of the carrier
m_{a+c}	mass of the carrier and adhesive

m_{glue}	amount of adhesive in grams per square metre (g/m^2) from measurements on a manufactured panel
m_1	mass of facing + glue in grams (g)
m_2	mass of facing in grams (g)
n	number of tests, number of screws, number of webs
p	pitch of profile
q	live load
r	radius, parameter
s	length of web (s_{w1})
t	thickness of face sheet
t_{ni}	nominal thickness of the internal facing
t_{ne}	nominal thickness of the external facing
t_{nom}	nominal thickness of the steel sheet
t_{obs}	measured thickness
t_{zinc}	total thickness of the zinc layers (or similar protective coating)
t_1	thinnest, tested face thickness
t_2	thicker face thickness
v	variance factor
w_i	cover width
w_B	bending deflection
w_b	is the deflection caused by the elastic extension of the faces (without shear deformation)
w_S	shear deflection
w_t	is the deflection measured at time t
w_u	ideal displacement at ultimate load based on the linear part of the deflection curve
w_0	is the deflection caused by the elastic extension of the faces (without shear deformation)
x, y, z	coordinates
x_{des}	predicted value by the design expression
x_p	5 %-fractile value of population x
x_n	test result
α	coefficient of thermal expansion
α_w	sound absorption
β	design parameter