

SINTEF Building and Infrastructure confirms that

Sandwich panel SPA

has been found to be fit for use in Norway and to meet the provisions regarding product documentation given in the regulation relating to the marketing of products for construction works (DOK) and regulations on technical requirements for building works (TEK), with the properties, fields of application and conditions for use as stated in this document

1. Holder of the approval

Ruukki Construction Oy
Panuntie 11
00620 Helsinki

2. Product description

Sandwich panel SPA are a family of mineral wool core sandwich panels with coated steel sheets on both sides. The core and the panel facings are joined together with a solid adhesive bond, and the panels are connected to each other with a tongue- and groove joints in both the sheets and the core, see Figure 1. Elastic sealing strips are installed in the grooves of the joints for tightness.

The panels are available in seven thickness classes as given in table 1. The standard modular of the panel is 1200 mm and the maximum length is 13 500 mm. The weight of the panel varies from 17 to 39 kg/m². Sandwich panel SPA are available in four types, categorized by application, see table 1.

- E for external walls
- I for internal walls
- F for Fire structures
- S for structures requiring special strength.

The term *ENERGY* refers to airtight energy efficient panel structures and *E LIFE* refers to sustainable external wall panels, respectively.

Table 1 Types and thicknesses of Sandwich panel SPA

Thickness class	80	100	125	150	175	200	230
Nominal thickness mm	80	97	125	152	174	198	232
SPA E Energy				x	x	x	x
SPA E Life Energy				x		x	x
SPA E Life				x		x	x
SPA E	x	x	x	x	x	x	x
SPA F Energy				x		x	x
SPA F	x	x	x	x	x	x	x
SPA I	x	x	x	x	x	x	x
SPA S Energy				x		x	x
SPA S	x	x	x	x	x	x	x

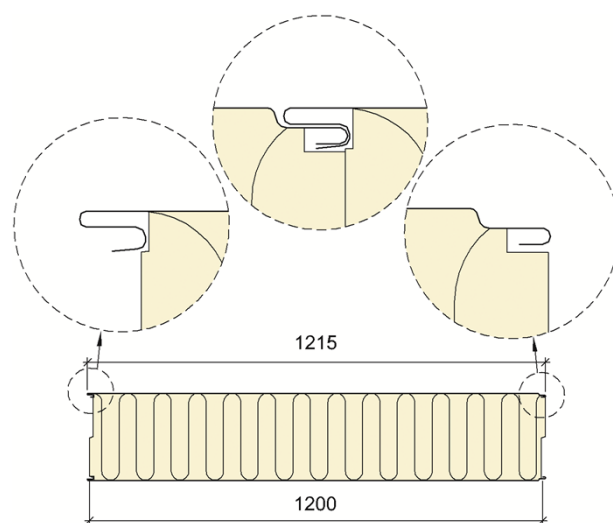


Fig. 1
Cross section of Sandwich panels SPA, type SPA80, SPA125, SPA150, SPA175, SPA200 and SPA230.

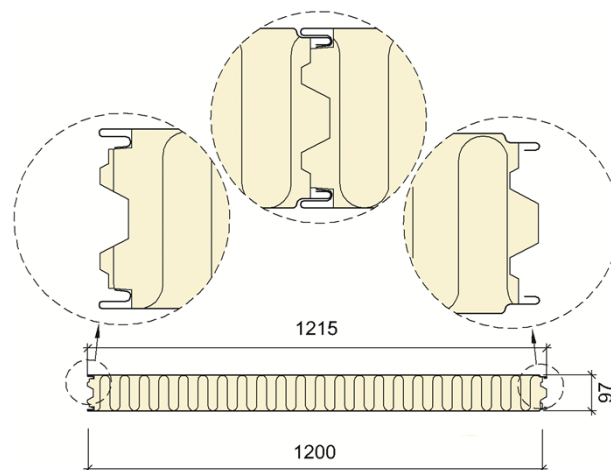


Fig. 2
Cross section of Sandwich panel SPA, type SPA100.

Specification of the materials in Sandwich panel SPA are given in table 2.

Table 2
Material specifications for Sandwich panel SPA

Component	Specification
Steel sheets with coating	From SSAB Europa Oy: Galvanized structural steel of type <i>SSAB Colour Coated Steel</i> of grade S280GD+Z according to standard EN 10346. The standard amount of zinc on the external and internal face is Z275 and Z100, respectively. Coating: On external facing: HIARC, HIARC MAX, PURAL, POL25 according to EN 10169. On internal facing: POL 25, HIARC, PURAL according to EN 10169. For special applications, food-safe laminates are available. The reverse sides of the steel faces have epoxy backing coat.
Mineral wool	Structural stone wool CES 50C (denoted as code W5 in this Technical approval), CES50CS100 (W2) and CES75F (W3) from Paroc according to EN 13162. Structural glass wool Isover LIFE-PAN (W10) from Saint-Gobain Rakennustuotteet Oy according to EN 13162.
Adhesive	Loctite UK 8596 (resin) / UK 5400 (hardener) from Henkel Norden Oy.
Joint sealing	EPDM sealing strip from Trelleborg Sealing Profiles.

The detailed design of the element construction is described in the document “*Standard Construction Details for Sandwich panel SPA belonging to SINTEF Technical Approval No. 20459*”. The version of the construction details which at any time is filed by SINTEF Building and Infrastructure is a formal part of the approval.

3. Fields of application

Sandwich panel SPA is intended used as self supporting wall structures. The panels are not loadbearing for vertical loads. Sandwich panel SPA S is also intended used as ceiling structures.

The panels can be used in buildings classified as Risk Class 1-6 and Fire Class 1-3 as described in TEK.

4. Properties

4.1 Mechanical properties

The nominal thickness of the steel facings is 0.50, 0.60 or 0.70 mm. Table 3 gives the steel thickness to be used in design, reduced by the thickness of the zinc layer. The characteristic yield strength and modulus of elasticity for the steel faces are $f_y = 280$ MPa and $E_s = 210\,000$ MPa, respectively.

Table 3
Steel thickness to be used in design

Nominal thickness mm	Thickness to be used in design mm
0.50	0.485
0.60	0.560
0.70	0.660

Calculation of the load resistance of the panels shall be performed according to NS-EN 14509, NS-EN 1990 and NS-EN 1991 and the design temperature difference between the faces shall be determined according to EN 1991-1-5.

The material factors given in Table 4 and the characteristic mechanical properties given in Table 5 may be used to determine the design capacities.

Table 4
Materials factors, γ_M , according to EN 14509

Material property	Mineral wool grade	Limit state	
		Ultimate	Serviceability
Core shear	W2	1.50	1.10
	W3	1.29	
	W5	1.48	
	W10	1.22	
Core compression	W2	1.40	1.10
	W3	1.29	
	W5	1.34	
	W10	1.38	
Steel faces, wrinkling	W2	1.25	1.10
	W3	1.28	
	W5	1.34	
	W10	1.25	
Steel faces, yielding	all	1.10	1.00
Fasteneres, tension or shear	all	1.33	1.00

Table 5
Mechanical characteristics for Sandwich panel SPA

Type of panel	Thickness class	Wrinkling strength MPa ¹	Tensile strength MPa	Shear strength MPa		Shear modulus Core MPa	Compressive strength, Core MPa	Density, Core kg/m ³	Distribution parameter k ³
				Short term	Long term ²				
SPA E SPA E Energy SPA I	all	115	0.100	0.049	n.a.	3.8	0.060	85	1.05
SPA F SPA F Energy	all	130	0.150	0.054	n.a.	2.5	0.095	115 (120 ⁴)	0.79
SPA S SPA S Energy	80	165	0.150	0.100	0.070	6.8	0.115	120	0.85
	100			0.100	0.070				
	125			0.100	0.070				
	150			0.085	0.059				
	175			0.081	0.056				
	200			0.076	0.053				
SPA E Life SPA E Life Energy	150	105	0.100	0.045	n.a.	2.5	0.056	58	0.75
	200		0.100	0.040	n.a.		0.054		0.59
	230		0.095	0.036	n.a.		0.056		0.59

1) Both external and internal facing, in ambient or elevated temp

2) Creep coefficient factor for ceiling panels is 0.40 for 2000 h and 0.45 for 100 000 h

3) k is used in the calculation of the support reaction capacity (EN 14509, eq. E.5 and E.6). The values for k are based on mean test values.

4) For SPA F thickness class 100, the core density is 120 kg/m³. n.a. – Not applicable/available.

4.2 Properties related to fire

The panels have reaction to fire class A2-s1,d0 in accordance with NS-EN 13501-1.

Fire resistance for the panels are given in Table 6. The fire resistance is tested in accordance with EN 1364-1 and is classified in accordance with EN 13501-2..

Table 6
Fire resistance and span lengths for Sandwich panels SPA walls

Panel type	Fire resistance	Maximal span horizontal/vertical orientation						
		m						
		Panel thickness mm						
		80	100	125	150	175	200	80
SPA E Life	EI 45	-	-	-	12/-	-	12/-	12/-
	EI 60	-	-	-	11/-	-	11/-	11/-
SPA E Life Energy ¹⁾	EI 45	-	-	-	12/-	-	12/-	12/-
	EI 60	-	-	-	11/-	-	11/-	11/-
SPA E	EI 30	12 ¹⁾ /-	9.3 ¹⁾ /11.9 ¹⁾	12 ¹⁾ /12 ¹⁾	12/12	12/12	12/12	12/12
	EI 60	12 ¹⁾ /-	9.3 ¹⁾ /11.1 ¹⁾	11.1 ¹⁾ /12 ¹⁾	12/12	12/12	12/12	12/12
	EI 90	-	- / 10.5 ¹⁾	- / 11.2 ¹⁾	12/12	12/12	12/12	12/12
	EI 120	-	-	- / 11.1 ¹⁾	12/11.9	12/11.9	12/11.9	12/11.9
	EI 180	-	-	-	4/4	4/4	4/4	4/4
SPA E Energy ¹⁾	EI 30	-	-	-	12/12	12/12	12/12	12/12
	EI 60	-	-	-	12/12	12/12	12/12	12/12
	EI 90	-	-	-	12/12	12/12	12/12	12/12
	EI 120	-	-	-	12/11.9	12/11.9	12/11.9	12/11.9
	EI 180	-	-	-	4/4	4/4	4/4	4/4
SPA I	EI 30	12/-	9.3/11.9	12/12	12 ¹⁾ /12 ¹⁾	12 ¹⁾ /12 ¹⁾	12 ¹⁾ /12 ¹⁾	12 ¹⁾ /12 ¹⁾
	EI 60	12/-	9.3/11.1	11.1/12	12 ¹⁾ /12 ¹⁾	12 ¹⁾ /12 ¹⁾	12 ¹⁾ /12 ¹⁾	12 ¹⁾ /12 ¹⁾
	EI 90	-	- / 10.5	- / 11.2	12 ¹⁾ /12 ¹⁾	12 ¹⁾ /12 ¹⁾	12 ¹⁾ /12 ¹⁾	12 ¹⁾ /12 ¹⁾
	EI 120	-	-	- / 11.1	12 ¹⁾ /11.9 ¹⁾	12 ¹⁾ /11.9 ¹⁾	12 ¹⁾ /11.9 ¹⁾	12 ¹⁾ /11.9 ¹⁾
	EI 180	-	-	-	4 ¹⁾ /4 ¹⁾	4 ¹⁾ /4 ¹⁾	4 ¹⁾ /4 ¹⁾	4 ¹⁾ /4 ¹⁾
SPA F	EI 30	12 ¹⁾ /-	12/12	12/12	12/12	12/12	12/12	12/12
	EI 60	12 ¹⁾ /-	11.9/11.5	12/12	12/12	12/12	12/12	12/12
	EI 90	-	8.9/11.3	11.7/12	11.7/12	11.4/12	11.4/12	11.4/12
	EI 120	-	7.4/11.2	10.3/11.7	10.3/11.7	10.6/12	10.6/12	10.6/12
	EI 180	-	-	8.5/-	8.5/-	10.6/12	10.6/12	10.6/12
	EI 240	-	-	-	-	10.6/-	10.6/-	10.6/-
SPA F Energy ¹⁾	EI 30	-	-	-	12/12	-	12/12	12/12
	EI 60	-	-	-	12/12	-	12/12	12/12
	EI 90	-	-	-	11.7/12	-	11.4/12	11.4/12
	EI 120	-	-	-	10.3/11.7	-	10.6/12	10.6/12
	EI 180	-	-	-	8.5/-	-	10.6/12	10.6/12
	EI 240	-	-	-	-	-	10.6/-	10.6/-
SPA S ¹⁾	EI 30	12/-	12/12	12/12	12/12	12/12	12/12	12/12
	EI 60	12/-	11.9/11.5	12/12	12/12	12/12	12/12	12/12
	EI 90	-	8.9/11.3	11.7/12	11.7/12	11.4/12	11.4/12	11.4/12
	EI 120	-	7.4/11.2	10.3/11.7	10.3/11.7	10.6/12	10.6/12	10.6/12
	EI 180	-	-	8.5/-	8.5/-	10.6/12	10.6/12	10.6/12
	EI 240	-	-	-	-	10.6/-	10.6/-	10.6/-
SPA S Energy ¹⁾	EI 30	-	-	-	12/12	-	12/12	12/12
	EI 60	-	-	-	12/12	-	12/12	12/12
	EI 90	-	-	-	11.7/12	-	11.4/12	11.4/12
	EI 120	-	-	-	10.3/11.7	-	10.6/12	10.6/12
	EI 180	-	-	-	8.5/-	-	10.6/12	10.6/12
	EI 240	-	-	-	-	-	10.6/-	10.6/-

¹⁾ Panels are not tested. Values are based on panel with similar fire resistance.

4.3 Sound insulation

Lightweight sandwich elements generally have limited sound insulation properties. If there is an indoor sound-level requirement, there may be a need for additional insulation against outdoor noise, for example.

Measured or predicted sound insulation characteristics are given in Table 7.

Table 7
Sound insulation index R_w / spectrum adaption term C_{tr} (dB) for Sandwich panel SPA

Thickness class	80	100	125	150	175	200	230
SPA E Energy				30/-4	31/-3	31/-3	31/-3
SPA E Life Energy				29/-3		29/-4	29/-4
SPA E Life				29/-3		29/-4	29/-4
SPA E	29/-4	29/-4	30/-4	30/-4	31/-3	31/-3	31/-3
SPA F Energy				31/-3		31/-4	31/-3
SPA F	30/-3	30/-3	31/-3	31/-3	31/-4	31/-4	31/-3
SPA I	29/-4	29/-4	30/-4	30/-4	31/-3	31/-3	31/-3
SPA S Energy				31/-3		31/-4	31/-3
SPA S	29/-4	30/-4	31/-3	31/-3	31/-4	31/-4	31/-3

Table 8
Thermal properties for Sandwich panel SPA

Type of panel	Mineral wool characteristics			U-value W/m^2K						
	Type	Declared thermal conductivity λ_D W/mK	Density (kg/m^3)	80	100	125	150	175	200	230
SPA E Energy	W5	0,040	85				0,26	0,23	0,20	0,17
SPA E Life Energy	W10	0,039	58				0,25		0,19	0,16
SPA E Life	W10	0,039	58				0,25		0,19	0,16
SPA E	W5	0,040	85	0,49	0,40	0,31	0,26	0,23	0,20	0,17
SPA F Energy	W2	0,045	115				0,29		0,22	0,19
SPA F	W2 (W3 ¹⁾)	0,045	115 (120 ¹⁾)	0,54	0,45	0,35	0,29	0,25	0,22	0,19
SPA I	W5	0,040	85	0,49	0,40	0,31	0,26	0,23	0,20	0,17
SPA S Energy	W3	0,045	120				0,29		0,22	0,19
SPA S	W3	0,045	120	0,54	0,45	0,35	0,29	0,25	0,22	0,19

¹⁾ For SPA F thickness class 100, the MW grade is W3 with density 120 kg/m^3 .

4.5 Durability

Based on durability testing according to EN 14509 (Annex B DUR2 procedure), and general experience by use of sandwich panels of steel plates with a core of mineral wool, Sandwich panel SPA is considered to have satisfactory durability for the intended use.

5. Environmental aspects

5.1 Chemicals hazardous to health and environment

The product contains no hazardous substances with priority in quantities that pose any increased risk for human health and environment. Chemicals with priority include CMR, PBT and vPvB substances.

4.4 Thermal insulation

The grade, thermal conductivity and density of the mineral wool and the U-values for the panels in accordance with EN 14509:2013 and EN ISO 6946 are given in Table 8.

5.2 Effect on indoor environment

The product is not regarded as emitting any particles, gases or radiation that have a perceptible impact on the indoor climate, or to have any significant impact on health.

5.3 Effect on soil, surface water and ground water

The leaching properties of the product are evaluated to have no negative effects on soil or ground water.

5.4 Waste treatment/recycling

The product shall be sorted as steel-based materials on the building/demolition site. The product shall be delivered to an authorized waste treatment plant for material recovery.

5.5 Environmental declaration

An environmental declaration (EPD) has been worked out according to EN 15804 for Sandwich panel SPA. Environmental indicators are given in Table 9. For complete documentation, see www.ruukki.com.

Table 9

Environmental declaration according to EN 15804 for Sandwich panel SPA (weight 22.4 Kg/m²). Cradle to gate (stage A1-A3). The declared unit is 1m² sandwich panel.

Indicators	Value
Global warming, kg CO ₂ eq.	53.5
Total energy use, MJ	750

6. Special conditions for use and installation

6.1 General

Construction details for the items are to be performed as described in "*Standard Construction Details for Sandwich panel SPA belonging to SINTEF Technical Approval No. 20459*".

6.2 Structural design

Static calculations, showing dimensioning of the elements and requisite fastening to the load-bearing construction, must be prepared for each individual building. This must be performed in accordance with NS-EN 14509, NS-EN 1990 and NS-EN 1991.

Design loads must be defined according to principles in Annex E of NS-EN 14509 in accordance with NS-EN 1990.

Instructions for the execution of connections to other building components, and possible reinforcements around openings, are to be prepared for each individual project.

6.3 Fire safety design

The fire safety design shall be carried out in accordance with TEK for each individual project.

Penetrations and holes through walls with fire resistance must be sealed using products with fire technical documentation and that are suitable for the intended use. The penetrations and seals must not degrade the fire resistance of the walls.

6.4 Thermal insulation design

The thermal insulation design shall be carried out in accordance with TEK for each individual project.

6.5 Sound insulation design

The sound insulation design shall be carried out in accordance with TEK for each individual project.

6.6 Transport and storage

The panels shall be delivered to the building site protected by plastic packaging. The panels must be stored on a level, flat base, and must be protected from rain and direct sunlight. The panels must be protected against mechanical damage caused by striking, jolting and bumping during transport and storage.

6.7 Installation

Shears/tin snips must be employed when cutting panels or steel sheets on site.

The wall panels can be mounted horizontally or vertically. Vertical panels should be installed as full wall height, without any horizontal joints. The panels must be attached to the building's main structural system according to directions based on calculations for the building in question.

The panels are to be fastened to each end support using at least two screws located minimum 30 mm from the end of the panel.

Penetrating fastening screws must be of stainless steel and have washers with EDPM seals, or similar. Other fastening components and fittings/hardware must have satisfactory corrosion protection.

End joints, joint cross, and other joints and connection details to be filled with mineral wool, covered by sealing and by a drained rain shield in the form of flashing in order to achieve two-stage tightening.

Likewise, all panel joints, connection details and joints around windows and doors sealed with adhesive sealing tape or sealant internally to achieve required air tightness. Elastic sealing strips to be used, as required, in the grooves of the joints for tightness.

All fittings are to be fixed with corrosion-protected screws with gasket of EPDM or similar. Window sill should have folded up the ends and tight corners.

6.8 Maintenance

The panels must be cleaned and maintained according to the manufacturer's instructions to achieve intentional durability and appearance.

7. Factory production control

The product is produced by Construction Oy, Mäkeläntie 9, 62900 Alajärvi, FINLAND.

The holder of the approval is responsible for the factory production control in order to ensure that the product is produced in accordance with the preconditions applying to this approval. The manufacturing of the product is subject to continuous surveillance of the factory production control in accordance with the contract regarding SINTEF Technical Approval.

8. Basis for the approval

The technical approval is based on verification of product properties from the following reports:

- VTT Expert Services Ltd: RTE3093/04, *Fire resistance test on a non-loadbearing Rannila Panel 3Lock 100 R75-wall*, dated 2004-10-08.
- VTT Expert Services Ltd: RTE4177/04, *Fire resistance test on a non-loadbearing Rannila Panel 3Lock 125 R50-wall*, dated 2005-01-10.
- VTT Expert Services Ltd: VTT-S-7051-08, *Fire resistance test on a non-loadbearing sandwich panel SPA125W5 wall construction, horizontal installation*, dated 2008-09-25.
- VTT Expert Services Ltd: VTT-S-10265-08, *Fire resistance test on a non-loadbearing sandwich panel SPA100W5 wall construction, horizontal installation*, dated 2008-11-26.
- Exova Warringtonfire: *WE Report No 195090, The fire resistance performance of a specimen of a symmetrical non-loadbearing partition wall assembly, tested in accordance with BS EN 1364-1:1999*, dated 2010-10-21.
- Exova Warringtonfire: *WE Report No 195095 Issue 2, The fire resistance performance of a specimen of a symmetrical non-loadbearing, partition wall assembly, tested in accordance with BS EN 1364-1:1999*, dated 2010-11-22.
- Exova Warringtonfire: *WE Report No 196805, The fire resistance performance of a specimen of a symmetrical non-loadbearing, partition wall assembly, tested in accordance with BS EN 1364-1:1999*, dated 2010-10-26. (SPA 125 I)
- Exova Warringtonfire: *WE Report No 196806, The fire resistance performance of a specimen of a symmetrical non-loadbearing, partition wall assembly, tested in accordance with BS EN 1364-1:1999*, dated 2010-11-03. (SPA 100 I)
- Exova Warringtonfire: *WE Report No 198747, The fire resistance performance of a specimen of a symmetrical non-loadbearing, partition wall assembly, tested in accordance with BS EN 1364-1:1999*, dated 2011-01-27. (SPA 175 F)
- Exova Warringtonfire: *WE Report No 198749, The fire resistance performance of a specimen of a symmetrical non-loadbearing, partition wall assembly, tested in accordance with BS EN 1364-1:1999*, dated 2011-01-27. (SPA 80 I)
- Exova Warringtonfire: *WE Report No 305414, The fire resistance performance of a specimen of a symmetrical non-loadbearing, partition wall assembly, tested in accordance with BS EN 1364-1:1999*, dated 2011-08-30. (SPA 175 F)
- Exova Warringtonfire: *WE Report No 305415, The fire resistance performance of a specimen of a symmetrical non-loadbearing, partition wall assembly, tested in accordance with BS EN 1364-1:1999*, dated 2011-08-30. (SPA 125 F)
- Exova Warringtonfire: *WE Report No 317135, The fire resistance performance of a specimen of a symmetrical non-loadbearing, partition wall assembly, tested in*

accordance with BS EN 1364-1:1999, dated 2012-05-17. (SPA 150 E LIFE)

- Exova Warringtonfire: *WE Report No 335448, The fire resistance performance of a specimen of a symmetrical non-loadbearing, partition wall assembly, tested in accordance with BS EN 1364-1:1999*, dated 2014-05-13. (SPA 150 E)
- Exova Warringtonfire: *Report No 305607 Issue 2, Classification of fire resistance performance in accordance with EN 13501-2:2007*, dated 2011-03-25. (SPA div.)
- Exova Warringtonfire: *Report No 318875, Classification of fire resistance performance in accordance with EN 13501-2:2007 +A1:2009*, dated 2012-05-30. (SPA 150 E LIFE)
- Exova Warringtonfire: *Report No 340924, Classification of fire resistance performance in accordance with EN 13501-2:2007 +A1:2009*, dated 2014-05-20. (SPA 150 E)
- Exova Warringtonfire: *Report No 313858, Classification of fire resistance performance in accordance with EN 13501-2:2007 +A1:2009*, dated 2011-12-12. (SPA 125 F, SPA 175 F)
- Exova Warringtonfire: *Report No 199509 Issue 3, Extended application report in accordance with EN 15254-5 and EN 14509*, dated 2011-02-04. (SPA div)
- J. Keränen/V. Hongisto: *Report/5210-2003-17967, Sound insulation measurement and prediction of Rannila Panel Products 2001-2003*, dated 2003-09-04.
- SP Technical Research Institute of Sweden: Ref 3P03783, *Measurement of sound insulation index on panel walls in the laboratory according to ISO 10140-2*, dated 2013-06-05.
- HAMK University of Applied Sciences Sheet Metal Centre: *Report 2012-29, Trisco calculations to sandwich panels*, dated 2012-09-03.
- SINTEF Byggeforsk: *U-values check*, dated 2016-04-15.
- SP Technical Research Institute of Sweden: Ref 3P03481-1, *Determination of air- and water tightness according to EN 14509*, dated 2013-06-18.
- SP Technical Research Institute of Sweden: Ref 3P03481-2, *Determination of air- and water tightness according to EN 14509*, dated 2013-06-18.
- VTT Expert Services Ltd: *Research Reprt no VTT-S-05924-12, DUR2 tests on LifePanel sandwich panels according to B.3 of EN 14509*, dated 2012-09-06.
- Rauta Oyj: *Test Report no 10002, Durability test on Sandwich panel SPA W3 according to EN 14509 B.3 DUR2 - procedure*, dated 2008-09-18.
- Rauta Oyj: *Test Report no 20001, Durability test on Sandwich panel SPA W5 according to EN 14509 B.3 DUR2 - procedure*, dated 2009-02-05.
- Macroplast Polyurethane Adhesives: *Technical report, Ployurethane 2 Component Adhesive Loctite UK 8596 / Hardener UK 5400*, dated 2014-03-10.
- Ritoimisto Ecobio Oy: *Environmental Product Declaration EN 15804 ISO 14025*, dated 2014-10-31.
- Insul: *Sound Insulation Prediction (v8.0.9)*, dated 2016-01-18.

9. Marking

The product is CE marked in accordance with EN 14509:2013.

The approval mark for SINTEF Technical Approval No. 20459 may also be used.

10. Liability

The holder/manufacturer has sole product responsibility according to existing law. Claims resulting from the use of the product cannot be brought against SINTEF beyond the provisions of Norwegian Standard NS 8402.



Approval mark

for SINTEF Building and Infrastructure

A handwritten signature in blue ink that reads "Hans Boye Skogstad".

Hans Boye Skogstad
Approval Manager