

ENVIRONMENTAL PRODUCT DECLARATION

as per ISO 14025 and EN 15804



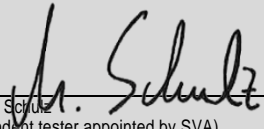
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**Double skin steel faced sandwich panels with a core made of polyurethane
IFBS**

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1. General Information

<p>IFBS</p> <hr/> <p>Programme holder IBU - Institut Bauen und Umwelt e.V. Panoramastr. 1 10178 Berlin</p> <hr/> <p>Declaration number EPD-IFBS-20130172-CBG1-EN</p> <hr/> <p>This Declaration is based on the Product Category Rules: Double skin metal faced sandwich panels, 07-2013 (PCR tested and approved by the independent expert committee [SVA])</p> <hr/> <p>Issue date 12.09.2013</p> <hr/> <p>Valid to 11.09.2018</p> <hr/> <p> Prof. Dr.-Ing. Horst J. Bossenmayer (President of Institut Bauen und Umwelt e.V.)</p> <hr/> <p> Prof. Dr.-Ing. Hans-Wolf Reinhardt (Chairman of SVA)</p>	<p>Double skin steel faced sandwich panels with a core made of polyurethane</p> <hr/> <p>Owner of the Declaration IFBS Europark Fichtenhain A 13a 47807 Krefeld</p> <hr/> <p>Declared product / Declared unit 1m² prefabricated double skin steel faced sandwich panels with a insulating core made of polyurethane rigid foam</p> <hr/> <p>Scope: The purpose of this document is limited to continuously produced sandwich panels with face sheets made of steel that are manufactured by member companies of IFBS. Data has been provided by 9 member companies of IFBS for the year 2011. These companies represent between 80% and 100% of IFBS members producing sandwich panels. Production volume of these companies is about 80% to the German market. The owner of the declaration shall be liable for the underlying information and evidence.</p> <hr/> <p>Verification</p> <p>The CEN Norm EN 15804 serves as the core PCR</p> <p>Independent verification of the declaration and data according to ISO 14025</p> <p><input type="checkbox"/> internally <input checked="" type="checkbox"/> externally</p> <hr/> <p> Matthias Schuler (Independent tester appointed by SVA)</p>
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2. Product

2.1 Product description

Prefabricated double skin steel faced sandwich panels with a core made of polyurethane, for load-bearing, self-supporting and non-supporting application in roof, wall and ceiling structures.

The profiled internal and external steel sheets are made of a core of steel, which is protected against corrosion with zinc and organic coatings. The thermal insulating core material is made of polyurethane according to /DIN EN 13165/ with sealing tapes according /DIN 18542/. The core is linked on both sides with resistance to shear forces to the profiled steel sheets.

The LCA is based on vertical averaging of the specific producer datasets under consideration of the respective yearly production amounts.

2.2 Application

Application as covering component in roof and wall structures mainly for static loads.

Sandwich panels in wall and roof applications overtake tasks of the building physics, especially sound, heat and moisture safely. They perform simultaneously the function of air tightness of the building envelope.

2.3 Technical Data

Technical specifications for sandwich panels with a core of polyurethane are given in:

- /DIN EN 14509/
- /DIN EN 13165/
- general technical approvals for sandwich panels released by the manufactures

Constructional data

Name	Value			Unit
	40	100	160	
Density of the insulation	41-43			kg/m ³
Thickness of the element. When the outer layers are flat, this is the overall height of the element (D); on heavily profiled elements this is the consistent core thickness without profile (dc)	40	100	160	mm
Thickness of the outer layer	0,6	0,6	0,6	mm
Thickness of the inner layer	0,5	0,5	0,5	mm
Calculation value for	0,0242	0,0242	0,0242	W/(mK)

Name	Value			Unit
	40	100	160	
thermal conductivity of the insulation				
Heat transfer coefficient of the total Element incl. heat bridges due to overlap and fixing elements	0,5850	0,2537	0,1529	W/(m ² K)
Weight	10,6	12,8	15,7	kg/m ²

2.4 Placing on the market / Application rules

Double skin steel faced sandwich panels for self-supporting application must comply with the Regulation (EU) No 305/2011 taking into account the harmonised technical specification /DIN EN 14509/; they may be put on the market only with the Declaration of Performance and the CE-mark. For the application of the products the national regulations apply.

If it is necessary to depart from the requirements of /DIN EN 14509/, such as in the case of supporting sandwich panels, a German general technical approval is required for placing on the market and the use. Then the applicability must be attested with the national conformity mark (Ü-Zeichen).

2.5 Delivery status

Sandwich panels will be ordered project- and object related, produced with a width of 1 meter and the ordered length

Order and delivery unit: square metre [m²].

2.6 Base materials / Ancillary materials

Composition of the sandwich panels:

material	Thickness of the element		
	40	100	160
Steel sheet	84%	67%	57%
Thermal insulation core	16%	33%	43%

Steel according /DIN EN 10169/:

S 280 GD to S 320 GD

Metallic coating according /DIN EN 10346/:

Zinc Z 275, coating 275 g/m². The zinc layer has a content of at least 99 weight percent zinc and a typical thickness of 20 µm.

Organic coating according /DIN EN 12944-1/ (DIN 55634):

Polyester (SP), coil coating, 25 µm on the application side and max.15 µm on the back side.

Thermal insulation core according /DIN EN 13165/:

rigid polyurethane foam made of isocyanate and polyole.

The panels contain sealing tapes (amount on total weight < 0,6%) according DIN 18542.

No REACH materials included.

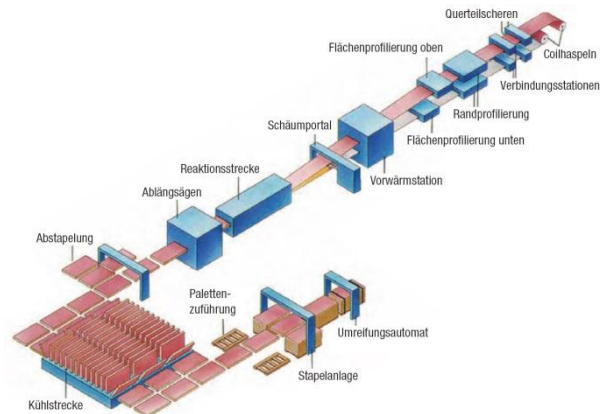
2.7 Manufacture

The production of sandwich panels is on continuously operating production facilities. The production speed is depending on the thickness at 4 to 8 m/min.

The rollforming process of the two steel faces starts on the winches. The profile types are related to a defined number of rolls, the higher the profiles the higher the number of rolls. The profiling process runs inside out, starting in the middle.

PU sandwich panels are made by introducing the liquid polyurethane components within the subsequent foaming station, the foaming of the core. The element thickness is fixed by revolving steel plate conveyors. After leaving the reaction zone, the elements are cut to the ordering length. Following the elements through a cooling section into an automatically stacking system where they are stacked into transport and assembly compatible packages. The process ends here.

The protection foil will be added adhesive in the beginning of the rollforming process.



Pic. 1: Producing a sandwich panel

2.8 Environment and health during manufacturing

No measures relating to safety, health and environment protecting during the manufacturing process extending beyond national guidelines are known.

2.9 Product processing/Installation

The sandwich panels will be dropped of at the intended location on the application site manually or with the aid of lifting equipment or cranes. Prior to the installation / finalisation the protective film must be removed.

The mounting of sandwich panels to the substructure must refer to the national approval /Z-14.4-407/ or relevant European technical approvals. The required holes for mounting either pre-drilled or the connecting elements intersect the wellbore during the setting process using drill bits.

Careful planning limit cuts and shears on the construction site to a minimum. For technical correct construction site cuts shears, electric metal shears, nibbler, special stitch, circular or chain saws or oscillating multi-cutters have to be used. The used blades must be suitable for the use, working without spark or heat. If cuts have to be done with angle grinder or plasma cutters the coil coated surface has to be protected against injury. At risk of corrosion (e.g. outdoor areas), a post-treatment of the cut surfaces is required.

For use in an airtight and heat-insulating building envelope sealant strips according to DIN 18542 and insulation made of polyurethane or mineral wool are in use. There are appropriate EPDs available published by the different manufacturers of insulation and sealant strips.

The IFBS guidelines for lightweight metal construction have to be observed during the design and execution process (www.ifbs.de)

2.10 Packaging

Transport and delivery runs on packaging racks made of wood. The packages will be foiled to avoid damage and dirt. The edges will be contributed with slides made of metal, plastics or wood.

The packages can be handled with stacker or cranes. Packaging materials shall be collected separately for recycling.

2.11 Condition of use

The substantial composition during the use phase refers to the composition during the manufacture.

2.12 Environment and health during use

The loss of zinc refers to the local micro climate conditions. The division into categories is according to /DIN EN 12944-2/ and depends on surface depending loss of mass.

Adverse effects emanating from double skin steel faced sandwich panels are not known.

2.13 Reference service life

Double skin steel faced sandwich panels with the use in lightweight metal constructions must withstand a term of protection of at least 15 years. The term of protection is the period until first slight renewals in the surface are needed, only if there is no need of frequently inspections and service.

The term of protection depends on the location, weather conditions and the quality of the coating.

Double skin steel faced sandwich panels exhibit an estimated service life of 40 – 45 years depending on the use conditions.

2.14 Extraordinary effects

Fire

/DIN 4102/ or /DIN EN 13501/ apply.

Details to fire protection classification will be found in the Declaration of Performance or the considered German General Technical Approvals for sandwich panels of the respective manufacturers.

Water

No risks for the environment and living organisms are known under unforeseeable water effects.

Mechanical destruction

No risks for the environment and living organisms are known under unforeseeable mechanical destruction.

Re-use phase

The cover sheets of the sandwich panels can be released from the core and collected, reused or recycled after dismantling. The core of polyurethane is used in process heat generation.

2.15 Disposal

The disposal code for thin walled profiled sheets made of steel, protected with zinc coatings refer to the German List of Wastes Ordinance (/AVV/) and European waste Index (EWC):

17 04 05 – Iron and steel

17 06 04 – Insulation material

2.16 Further information

Please find further technical information about products, static calculation, engineering and execution in the IFBS guidelines for lightweight metal construction (www.ifbs.de).

3. LCA: Calculation rules

3.1 Declared Unit

The declared unit is 1m² of sandwich panel. The averaging is done vertically based on the specific primary data.

Declared unit

PU 40 mm	Value	Unit
Declared unit	1	m ²
Surface weight	10,6	kg/m ²
Conversion factor to 1 kg	1/10,6	-
PU 100 mm	Value	Unit
Declared unit	1	m ²
Surface weight	12,8	kg/m ²
Conversion factor to 1 kg	1/12,8	-
PU 160 mm	Value	Unit
Declared unit	1	m ²
Surface weight	15,7	kg/m ²
Conversion factor to 1 kg	1/15,7	-

3.2 System boundary

Type of the EPD: cradle to gate - with options

Production stage (modules A1-A3) includes processes that provide materials and energy input for the system, manufacturing and transport processes up to the factory gate, as well as waste processing.

For the end of life it is assumed that the steel proportion is recycled with credit for the recycling potential declared in module D and the PU proportion is incinerated (module C4) with credit given for energy substitution in module D.

3.3 Estimates and assumptions

For the end of life it is assumed that the steel proportion is recycled (with losses within the recycling process of 5%) and the PU proportion is incinerated. Credit is given for the recycling potential of steel and energy substitution from waste incineration. In the end of life it is considered that the steel sheet contains a certain amount of recycled steel, thus no credit is given at the end of life for the amount of recycled steel entering load free the system.

3.4 Cut-off criteria

In the assessment, all available data from production are considered, i.e. raw materials used, utilised thermal energy, and electric power consumption. Thus also material and energy flows contributing less than 1% of mass or energy are considered. It can be assumed that the total sum of neglected processes does not exceed 5% of energy usage and mass. The manufacturer provided data on the transport

expenditure for all relevant material flows. Machines and facilities required during production are neglected.

3.5 Background data

For life cycle modelling of the considered products, the GaBi Software System for Life Cycle Engineering, developed by PE INTERNATIONAL AG, has been used to model the product systems considered in this assessment. All relevant background datasets are taken from the /GaBi 6/ software database (last revision of datasets less than 6 years). The datasets from the GaBi database are documented in the online documentation.

3.6 Data quality

The data quality can be described as good. The primary data collection has been done thoroughly, all relevant flows are considered. Technological, geographical and temporal representativeness is given.

3.7 Period under review

The period under review is 2011.

3.8 Allocation

In most cases the assessed production sites use the same assembly line to produce different product types. The allocation of material and energy to produce the declared product was determined by the participants during the data collection process. The products considered in this EPD are considered to be homogenous and qualitatively comparable over time. Specific information on allocation within the background data is given in the GaBi datasets documentation.

3.9 Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to EN 15804 and the building context, respectively the product-specific characteristics of performance, are taken into account.

4. LCA: Scenarios and additional technical inform

The following technical information is a basis for the declared modules.

End of life (C1-C4)

Name	Value			Unit
	40mm	100mm	160mm	
Recycling	8,9	8,6	8,9	kg
Energy retrieving	1,7	4,2	6,8	kg
Landfilling	0	0	0	kg

5. LCA: Ergebnisse

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES	
Raw material supply	Transport	Manufacturing	Transport	Construction-installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recycling-potential	
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D	
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 m² Sandwich panel

		PU 40 mm			PU 100 mm			PU 160 mm		
Parameter	Unit	A1 - A3	C4	D	A1 - A3	C4	D	A1 - A3	C4	D
GWP	[kg CO ₂ -Äq.]	26,0	3,8	-15,1	32,8	9,3	-17,3	40,1	15,0	-20,5
ODP	[kg CFC11-Äq.]	8,23E-06	3,77E-11	3,04E-10	2,01E-05	9,34E-11	-7,56E-10	3,20E-05	1,5E-10	-1,77E-09
AP	[kg SO ₂ -Äq.]	0,092	0,002	-0,055	0,103	0,004	-0,060	0,119	0,006	-0,069
EP	[kg PO ₄ ³⁻ -Äq.]	8,65E-03	3,85E-04	-4,54E-03	1,05E-02	9,53E-04	-4,84E-03	1,27E-02	1,54E-03	-5,44E-03
POCP	[kg Ethen-Äq.]	1,29E-02	1,04E-04	-7,95E-03	1,55E-02	2,57E-04	-8,24E-03	1,84E-02	4,14E-04	-9,05E-03
ADPE	[kg Sb-Äq.]	1,71E-03	2,63E-08	-5,02E-07	1,70E-03	6,51E-08	-7,02E-07	1,75E-03	1,05E-07	-9,31E-07
ADPF	[MJ]	369,1	0,9	-149,0	528,5	2,3	-183,0	705,6	3,7	-226,0
Caption	GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non fossil resources; ADPF = Abiotic depletion potential for fossil resources									

RESULTS OF THE LCA - RESOURCE USE: 1 m² Sandwich panel

		PU 40 mm			PU 100 mm			PU 160 mm		
Parameter	Unit	A1 - A3	C4	D	A1 - A3	C4	D	A1 - A3	C4	D
PERE	[MJ]	18,2	-	-	21,3	-	-	26,5	-	-
PERM	[MJ]	0	-	-	0	-	-	0	-	-
PERT	[MJ]	18,2	0,1	-0,2	21,3	0,1	-3,6	26,5	0,2	-7,0
PENRE	[MJ]	338,8	-	-	441,0	-	-	556,9	-	-
PENRM	[MJ]	47,5	-	-	112,3	-	-	182,4	-	-
PENRT	[MJ]	386,3	1,1	-147,0	553,3	2,6	-188,0	739,3	4,2	-238,0
SM	[kg]	0	-	-	0	-	-	0	-	-
RSF	[MJ]	0	0	0	0	0	0	0	0	0
NRSF	[MJ]	0	0	0	0	0	0	0	0	0
FW*	[m ³]	-	-	-	-	-	-	-	-	-
Caption	PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non renewable primary energy excluding non renewable primary energy resources used as raw materials; PENRM = Use of non renewable primary energy resources used as raw materials; PENRT = Total use of non renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non renewable secondary fuels; FW = Use of net fresh water									

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1 m² Sandwich panel

		PU 40 mm			PU 100 mm			PU 160 mm		
Parameter	Unit	A1 - A3	C4	D	A1 - A3	C4	D	A1 - A3	C4	D
HDW*	[kg]	-	-	-	-	-	-	-	-	-
NHDW*	[kg]	-	-	-	-	-	-	-	-	-
RWD*	[kg]	-	-	-	-	-	-	-	-	-
CRU	[kg]	0	-	0	0	-	0	0	-	0
MFR**	[kg]	0	-	8,1	0	-	7,8	0	-	8,2
MER	[kg]	0	-	1,7	0	-	4,2	0	-	6,8
EEE [Typ1]	[MJ]	0	5,56	-	0	13,8	-	0	22,2	-
EET [Typ2]	[MJ]	0	15,3	-	0	37,9	-	0	61,1	-
Caption	HDW = Hazardous waste disposed; NHDW = Non hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy									

*The inventories do not support the methodological approach for the declaration of water and waste indicators. The material amounts, displayed with these inventories contribute significantly > 3% (referring to the mass of the declared unit). The indicators are not declared (decision of IBU advisory board 2013-01-07).

** No credit is given for the amount of recycled steel entering load free the system, see explanation in 3.3.

6. LCA: Interpretation

A1-A3: The environmental impact in the product stage is mainly determined by the raw material extraction and processing in A1. Within A1 the main contributors are steel and the basic chemicals for the PU core: isocyanat and polyols. The contribution of the steel sheet is in the categories AP, EP, GWP, POCP and ADPE dominant (>54%). Non-renewable primary energy is determined by the steel (68%) for the 40mm element and PU core (66%) for the 160mm element.

The absolute results for the steel sheet remain comparable for all three thicknesses as the amount of steel is approx. 9kg/m² in all declared products.

The absolute results for the PU core increase with the thickness respectively the amount of PU core material

(between 1,7-6,8kg/m²) in the sandwich panel, a linear correlation between environmental impact and amount of PU core material is identifiable.

Within A1-A3 the modules A2 and A3 are negligible; except for AP and EP the transport related emissions have a contribution of 8-10%.

C4: The environmental impact in C4 is determined by the incineration processes considered as end of life scenario for the PU core.

D: The benefit for the next product system includes the credit for steel recycling as well as substitution of primary fuels for electricity and steam generation from waste incineration plants for the PU core.

7. Requisite evidence

Double skin steel faced sandwich panels in wall and roof application encloses the rooms. The internal skin is in direct contact to the interior.

The measurement of VOC emissions is not postulated by laws. Nevertheless, a study on behalf of IFBS

shows that thin walled profiled sheets with zinc and organic coating accomplish AgBB scheme /AgBB/.

VOC emissions are not relevant for the external skin.

8. References

Institut Bauen und Umwelt e.V., (Ed.):

General principles

for the EPD range of Institut Bauen und Umwelt e.V. (IBU), 2011-06.

PCR Part A

Product Category Rules for Construction Products. Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Background Report, 2013.

PCR Part B

Product Category Rules for Construction Products Part B: Requirements on the EPD for Thin walled profiles and profiled panels of metal, 2013-07.

www.bau-umwelt.com

AgBB, Committee for Health-related Evaluation of Building Products (Ausschuss zur gesundheitlichen Bewertung von Bauprodukten)

AVV: List of Wastes Ordinance of 10 December 2001 (BGBl. I S. 3379), as last amended by Article 5 of the Ordinance of 24 February 2012 (BGBl. I S. 212).

DIN 4102:1998-05, Fire behaviour of building materials and building components

DIN EN ISO 14025:2011-10: Environmental labels and declarations – Type III environmental declarations – Principles and procedures

DIN EN 15804:2012-04: Sustainability of construction works – Environmental Product Declarations – Core rules for the product category of construction products

DIN 18542:2009-07, Sealing of outside wall joints with impregnated sealing tapes made of cellular plastics - Impregnated sealing tapes - Requirements and testing

DIN EN 10169:2012-06, Continuously organic coated (coil coated) steel flat products - Technical delivery conditions

DIN EN 10346:2009-07, Continuously hot-dip coated steel flat products - Technical delivery conditions

DIN EN 13165:2013-03, Thermal insulation products for buildings, Factory made rigid polyurethane foam (PU) products, Specification

DIN EN 13501: 2010-01, Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests

DIN EN 14509:2009-04 Self-supporting double skin metal faced insulating panels, Factory made products, Specifications

DIN EN ISO 12944:1998-07, Paints and varnishes - Corrosion protection of steel structures by protective paint systems

DIN 55634:2010-04. Paints, varnishes and coatings - Corrosion protection of supporting thin-walled building components made of steel

GaBi 6: Software and databasis for Life Cycle Engineering. LBP, University of Stuttgart and PE International. 2013.

GaBi Documentation: Documentation of the GaBi 6 datasets. LBP, University of Stuttgart and PE International. 2013. <http://documentation.gabi-software.com>

Z-14.4-407, Thread-forming screws for fastening of sandwich panels to steel or timber supporting structures


German **General Technical Approvals** for sandwich panels of the respective manufacturers

IFBS Technical rules for lightweight metal construction

REACH - Regulation concerning the Registration , Evaluation , Authorisation and Restriction of Chemicals

Following companies are represented with their products in this EPD



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