Statement of Verification

BREG EN EPD No.: 000568 Issue 01

This is to verify that the

Environmental Product Declaration

provided by:

SFS Group Schweiz AG

is in accordance with the requirements of:

EN 15804:2012+A2:2019

and

BRE Global Scheme Document SD207

This declaration is for:

1 kg of mechanical fastener solutions for industrial buildings

Company Address

SFS Group Schweiz AG
Division Construction
Roofing & Cladding
Rosenbergsaustrasse 10
CH-9435 Heerbrugg

Signed for BRE Global Ltd	Emma Baker Operator	27 February 2024 Date of this Issue
27 February 2024 Date of First Issue		26 February 2029 Expiry Date

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Environmental Product Declaration

EPD Number: 000568

General Information

EPD Programme Operator	Applicable Product Category Rules
BRE Global Watford, Herts WD25 9XX United Kingdom	BRE Environmental Profiles 2013 Product Category Rules for Type III environmental product declaration of construction products to EN 15804+A2 PN 514 Rev 3.1
Commissioner of LCA study	**LCA consultant/Tool**
SFS Group Schweiz AG Division Construction Roofing & Cladding Rosenbergsaustrasse 10 CH-9435 Heerbrugg	BRE LINA A2 Nadja Mughal - SFS Group Schweiz AG
Declared/Functional Unit	**Applicability/Coverage**
1 kg of mechanical fastener solutions for industrial buildings	Product Average.
EPD Type	**Background database**
Cradle to Gate with Module C and D	Ecoinvent 3.8

Demonstration of Verification
CEN standard EN 15804 serves as the core PCR [a]
Independent verification of the declaration and data according to EN ISO 14025:2010 ☐Internal ☒ External
(Where appropriate [b])Third party verifier: Pat Hermon
a: Product category rules b: Optional for business-to-business communication; mandatory for business-to-consumer communication (see EN ISO 14025:2010, 9.4)

Comparability
Environmental product declarations from different programmes may not be comparable if not compliant with EN 15804:2012+A2:2019. Comparability is further dependent on the specific product category rules, system boundaries and allocations, and background data sources. See Clause 5.3 of EN 15804:2012+A2:2019 for further guidance

Information modules covered

Product			Construction		Use stage							End-of-life					Benefits and loads beyond the system boundary
					Related to the building fabric					Related to the building							
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4		D
Raw materials supply	Transport	Manufacturing	Transport to site	Construction – Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction demolition	Transport	Waste processing	Disposal		Reuse, Recovery and/or Recycling potential
☑	☑	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☑	☑	☑		☑

Note: Ticks indicate the Information Modules declared.

Manufacturing site(s)

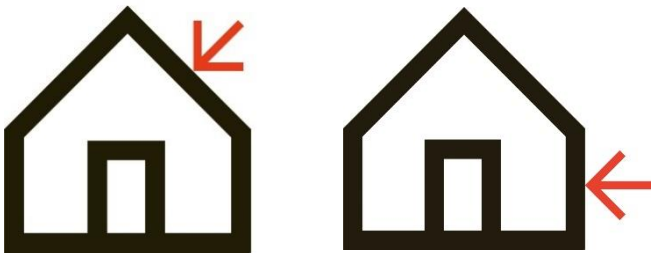
SFS Group Schweiz AG
Division Construction
Roofing & Cladding
Rosenbergsaustrasse 10
CH-9435 Heerbrugg

Construction Product:

Product Description

SFS mechanical fasteners stand for reliable, durable, and value-added solutions in the industrial roofing and cladding industry. The fasteners are crafted precisely and engineered for resilience; these SFS fasteners are crucial in ensuring the structural integrity and longevity of industrial buildings. For new construction, renovations, and distribution centres, the SFS mechanical fasteners are the go-to choice for ensuring superior strength and endurance for roofing and cladding needs. With the SFS fasteners, elevate your construction projects with unparalleled performance, durability and peace of mind. SFS fasteners are self-drilling or self-tapping screws made of stainless steel or carbon steel with anticorrosion coating. The fastening screws are normally completed with sealing washers consisting of a metal washer and an EPDM seal.

The main application areas are on roofing and cladding based on different substrucres:



These fasteners come in various sizes and find applications in different scenarios, such as sandwich panels, metal cladding, side lapping, solar panels, fibre cement boards, etc. Depending on the specific usage, the length, diameter, and the requirement for washers and EPDM may vary. In this EPD, the total production quantity (including carbon steel, Stainless steel, and EPDM) of fasteners has been taken to conduct a LCA analysis and the declared unit is 1 kg of fasteners.

The following fastener are in the scope of this EPD:

Application	Fastener code
Sandwich Panel	SXC5, SXC16, SX16, CXCW, SDC5, SDC14, SDTW, DDC5, DDC12, and SDT5
Side Lapping	SDL1, CXLW, SXL2, SL2, SLG-S, CDL, and DD2
Flashing	SD1 and SX2
Solar	CX and CD
Clamp Fastening	SXL3
Liner Tray	SXD3 and SDRT2
Metal Cladding	SX3, SX5, SX14, SX20, SXW, SW2, SD6, SD14, SD20, SW-T, SW3-T, DD4, DD5 and DD12
Metal Deck	SD6-H15, SD14-H15, SD20-H15, CDM, SL2-H15 and SL3-H15
Tapper	TDA, TDB, TDC, and MDW
Fibre Cement	SCFW, SCF3, and SCF12
Single-play Panel	SXP2, SXP5, SXP14, SDP3 and SDP14
Standing Seam	SXK2 and SXK3

Note: The average weight of each fasteners listed at the end of the document.

The following product is shown as a reference (e.g., SXC16-S19-5.8) that the fasteners are completed with high quality EPDM sealing washer for long-term weather sealing.

Technical Information

Property	Value, Unit
A European Assessment Document, or EAD for short, is a harmonised technical specification developed by EOTA	Conforms
ETAs represent evidence of the technical suitability of a construction product in line with the EU member states' Construction Products Regulation (CPR). An ETA is issued for a construction product which is not covered by a harmonised EU standard for the application concerned. The issue of such an approval allows the product manufacturer to use the CE mark on construction products and free access to all contracting states within the European marketplace	
Service life	>25 years
Extended service lifespans are also known. It is essential to emphasize that the application of mechanical fastener strictly aligns with technical regulations	

All the technical product details for each mechical fastener can also be found on the local websites.

Note: Technical properties of all the fasterners which are listed in scope is assessed within this average EPD.

Main Product Contents

Material/Chemical Input	%
Stainless Steel / Carbon steel	95-97%
EPDM	0-3%

Note: Product contents of all the fasterners which are listed in scope is assessed within this average EPD.

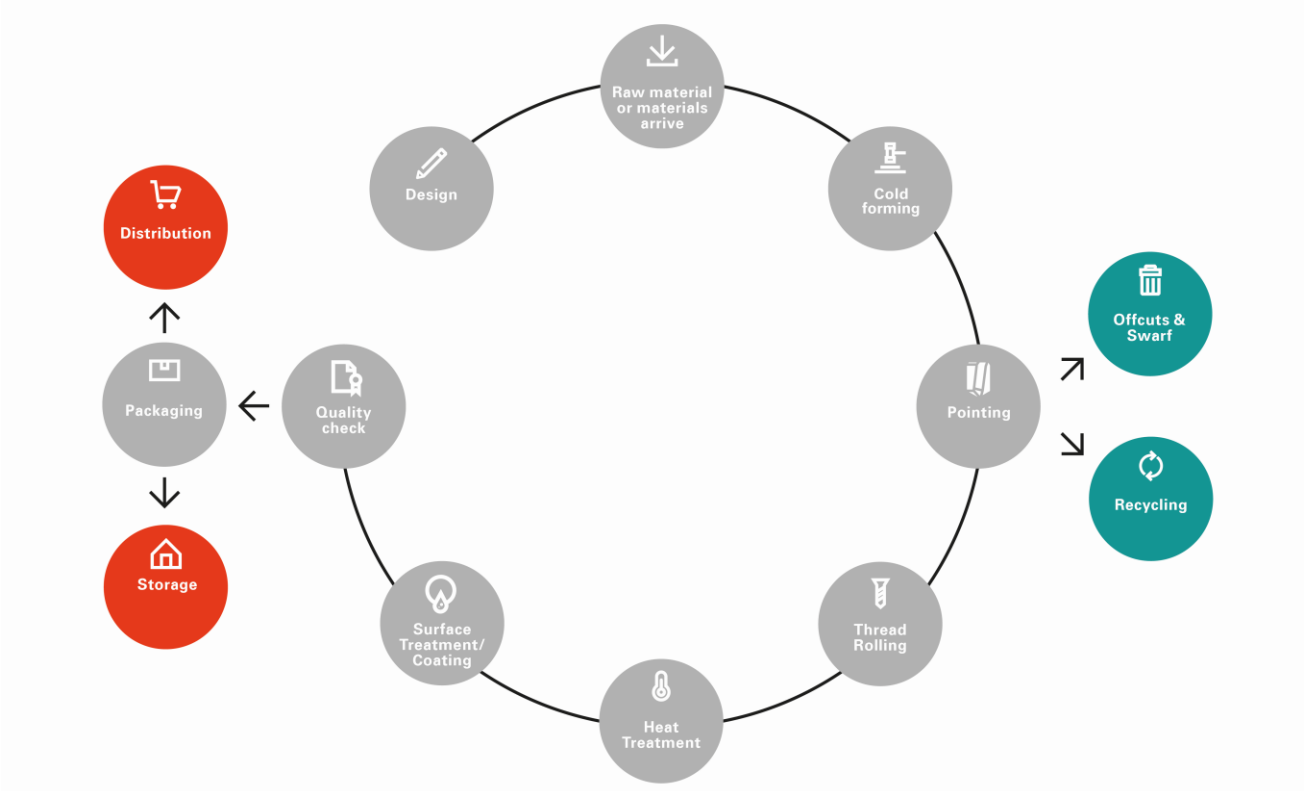
Manufacturing Process

Journey of SFS Fastener Manufacturing from raw materials to secure connections

In the heart of an industrial hub lies a factory dedicated to producing crucial components that hold our world together. Fastener manufacturing is a multi-step process; it begins with material selection, then designing the fastener and starts with shaping techniques like cold forming, pointing and thread rolling.

Offcuts refer to the excess material trimmed or cut away during the shaping process of fasteners, while swarf consists of the small metal particles or chips during machining operations. Overall SFS has an efficient management of offcuts and swarf to optimize the material usage, minimizing waste and ensuring a cost-effectiveness in production. The offcuts and swarf are collected, segregating different material types for recycling

Fasteners go through a heat treatment to enhance their durability. Throughout the journey of the fastener, the guardians of quality ensure precision, such as inspection tests and dimensional checks and guarantee that each fastener meets the highest SFS quality standards. Finally, the finished fasteners are packaged for distribution and ready for duty, showing strength and reliability for diverse applications.



Construction Installation

The purpose of mechanical fasteners is to secure metal sheeting or sandwich panels onto metal or timber substructures. These materials can function as wall or roof cladding or serve as load-bearing elements. The fasteners are also suitable for attaching to other thin gauge metal members. Their intended use covers both indoor and outdoor applications, with fasteners designed for external environments with ≥ C2 corrosion made of stainless steel according to EN ISO 12944-2. Additionally, the use includes connections with predominantly static loads (e.g., wind loads, dead loads). It's important to note that the fastening screws are not intended for re-use.

End of Life

Deconstruction / Dismantling Scenario:

Dismantling mechanical fasteners from industrial buildings in roofs or facades is a precise process and essential for renovations, repair, or deconstruction. This systematic approach uses specific tools to remove fasteners without compromising the structural integrity. Firstly, prioritise safety by equipping workers with appropriate personal protective equipment. Ensure the work area is secure and communicate ongoing dismantling activities. Assess and plan the removal process and be mindful of their placement and the impact on the building structure.

The use of specialized tools like power drills or screw extractors to ensure a careful extraction and avoid structural damage. Apply controlled force to avoid damaging the surrounding materials or the building structure. After the fasteners are removed, the material disassembly starts, such as metal sheets or sandwich panels. Finally, the underlay structure must be inspected and repaired for safety reasons. The energy used to dismantle the fasteners is not included in this analysis because energy consumption for the overall demolition significantly outweighs the negligible energy consumption associated with fastener removal. Initiating the removal process by systematically unscrewing and extracting fasteners using the selected tools. Power drill is the only tool used to dismantle the screws. Scenario in regard to the dismantling process that on the jobsite 10 power drills are used to dismantle 1kg fasteners. 10Ah avg. (power drill) x 10 power drill x 8 hours. After dismantling, 100% of the fastener are recovered that is 1kg of fasteners go into further processing.

End-of Life scenario:
Once the fasteners recovered from the demolition, at its end of life, fasteners will go into the pre-processing stage i.e., end-of-life management process which involves sorting and recycling, which includes melting the steel down and reforming it into new stainless-steel products. This sustainable practice contributes to resource conservation and reduces the demand for new raw materials. 1kg mechanical fastener which comprised of 95-97% of steel and 0-3% of EPDM has a capacity of recoverable and recyclable so therefore 100% of the fasteners will be recovered from the deconstruction sector and given the high recyclability of steel the 95% of steel is recycled and remaining 5% is considered as natural lost during the processing and it will be ended in landfilling. In some scenarios the EPDM the separation process is challenging, so 3% of EPDM can't be recovered and will end up in landfills.

Life Cycle Assessment Calculation Rules

Declared / Functional unit description.

1 kg of mechanical fastener for industrial buildings

System boundary

This is a cradle-to-gate with modules C and D LCA, reporting all production life cycle stages of modules A1 to A3 and end of life stages C1-C4, and D in accordance with EN 15804:2012+A2:2019 and BRE 2021 Product Category Rules (PN 514 Rev 3.1).

Data sources, quality and allocation

The datasets are derived from Ecoinvent v3.8, and the LCA tool used was BRE LINA A2. In this EPD, the mechanical fastener has been calculated per 1kg, allowing the end-user to assess the impacts of the fasteners they use. Typically, these fasteners are produced in two different factories, though the geography of individual factories are different, so each site production information have been taken for this LCA analysis and the end-user have no option on selecting the individual site impacts, so the weighted average results has been taken from the analysis. The quality of data from vendor's orders is accurate, allocations are based on averages over the year period covering (01/01/2022 – 31/12/2022). The original data collection form has been used while doing an LCA analysis, there was no uplift in the given data. In both the manufacturing sites, other products are manufactured in addition to the mechanical industrial fastener, therefore allocation of fuel consumption, water consumption & discharge, and waste emissions was required, and this has been done according to the provisions of the BRE PCR PN514 3.1 and EN 15804 i.e., by using the mass allocation.

ISO14044 guidance. **Quality Level**	**Geographical representativeness**	**Technical representativeness**	**Time representativeness**
Very Good	Data from area under study.	Data from processes and products under study. Same state of technology applied as defined in goal and scope (i.e., identical technology).	n/a
Very Good	n/a	n/a	There is approximately 1-2 years between the Ecoinvent LCI reference year, and the time period for which the LCA was undertaken.

Secondary data has been obtained for all other upstream and downstream processes that are beyond the control of the manufacturer (i.e., raw material production) from the Ecoinvent 3.8 database. All Ecoinvent datasets are complete within the context used and conform to the system boundary and the criteria for the exclusion of inputs and outputs, according to the requirements specified in EN15804. Specific European have been selected from the Ecoinvent LCI for this LCA.

Manufacturer uses the national grid electricity, on-site solar electricity; some of the electricity from solar has been used for production and for other commercial usages. To confirm that, they have submitted the contract with their solar agent and attached to the LCA report, and natural gas for production, so therefore the most recent consumption mix has been used for the LCA modelling (Ecoinvent 3.8).

The emission factor for the first manufacturer, which uses national grid electricity, is 0.082 kgCO2 eq/kWh. For solar panels, it is 0.079 kgCO2eq/kWh, and for natural gas, it is 0.256 kgCO2 eq/kWh.

The second manufacturer also uses national grid electricity and natural gas for production. Therefore, the emission factor for national grid electricity is 0.657 kgCO2eq/kWh, and for natural gas, it is 0.256 kgCO2 eq/kWh.

The quality level of time representativeness is also Very Good as the background LCI datasets are based on ecoinvent v3.8 which was compiled in 2021. Therefore, there is less than 5 years between the ecoinvent LCI reference year and the time period for which the LCA was undertaken.

Cut-off criteria

All inputs or outputs have been included and all raw materials, transport, energy, water use and wastes, are included, except packaging and direct emissions to air, water and soil, which are not measured. Upstream extraction and/or processing of inputs are included within the use of the background datasets within LINA.

LCA Results

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing environmental impacts									
			GWP-total	GWP-fossil	GWP-biogenic	GWP-luluc	ODP	AP	EP-freshwater
			kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg CFC11 eq	mol H^+ eq	kg $(PO_4)^{3-}$ eq
Product stage	Raw material supply	A1	AGG	AGG	AGG	AGG	AGG	AGG	AGG
	Transport	A2	AGG	AGG	AGG	AGG	AGG	AGG	AGG
	Manufacturing	A3	AGG	AGG	AGG	AGG	AGG	AGG	AGG
	Total	A1-3	3.58E+00	3.65E+00	-7.44E-02	2.48E-03	3.64E-07	1.79E-02	1.38E-03
Construction process stage	Transport	A4	MND	MND	MND	MND	MND	MND	MND
	Construction	A5	MND	MND	MND	MND	MND	MND	MND
97% - Recycling & 3% - Landfill									
End of life	Deconstruction, demolition	C1	9.11E-01	8.80E-01	2.90E-02	2.09E-03	4.39E-08	4.72E-03	8.82E-04
	Transport	C2	1.31E-02	1.31E-02	1.22E-05	5.34E-06	3.08E-09	7.44E-05	8.85E-07
	Waste processing	C3	5.30E-02	5.30E-02	1.87E-05	5.28E-06	1.13E-08	5.50E-04	1.64E-06
	Disposal	C4	5.72E-04	5.68E-04	2.68E-06	5.59E-07	1.98E-10	5.04E-06	1.15E-07
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-1.33E+00	-1.33E+00	-3.31E-03	-1.07E-03	-6.89E-08	-5.90E-03	-6.28E-04

GWP-total = Global warming potential, total;
GWP-fossil = Global warming potential, fossil;
GWP-biogenic = Global warming potential, biogenic;
GWP-luluc = Global warming potential, land use and land use change;

ODP = Depletion potential of the stratospheric ozone layer;
AP = Acidification potential, accumulated exceedance; and
EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing environmental impacts									
			EP-marine	EP-terrestrial	POCP	ADP-mineral &metals	ADP-fossil	WDP	PM
			kg N eq	mol N eq	kg NMVOC eq	kg Sb eq	MJ, net calorific value	m^3 world eq deprived	disease incidence
Product stage	Raw material supply	A1	AGG	AGG	AGG	AGG	AGG	AGG	AGG
	Transport	A2	AGG	AGG	AGG	AGG	AGG	AGG	AGG
	Manufacturing	A3	AGG	AGG	AGG	AGG	AGG	AGG	AGG
	Total (Consumption grid)	A1-3	3.97E-03	4.02E-02	1.85E-02	4.83E-05	6.84E+01	1.42E+00	2.38E-07
Construction process stage	Transport	A4	MND	MND	MND	MND	MND	MND	MND
	Construction	A5	MND	MND	MND	MND	MND	MND	MND
97% - Recycling and 3% - Landfill									
End of life	Deconstruction, demolition	C1	8.24E-04	7.16E-03	1.95E-03	8.82E-07	1.90E+01	6.33E-01	1.40E-08
	Transport	C2	2.69E-05	2.94E-04	8.42E-05	4.40E-08	2.02E-01	9.74E-04	1.45E-09
	Waste processing	C3	2.44E-04	2.67E-03	7.34E-04	2.72E-08	7.26E-01	1.68E-03	1.47E-08
	Disposal	C4	1.74E-06	1.90E-05	5.52E-06	1.61E-09	1.45E-02	6.58E-04	1.01E-10
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-1.40E-03	-1.34E-02	-6.00E-03	-1.56E-05	-1.44E+01	-6.23E-01	-1.11E-07

EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment;
EP-terrestrial = Eutrophication potential, accumulated exceedance;
POCP = Formation potential of tropospheric ozone;
ADP-mineral&metals = Abiotic depletion potential for non-fossil resources;
ADP-fossil = Depletion potential of the stratospheric ozone layer;
WDP = Water (user) deprivation potential, deprivation-weighted water consumption; and
PM = Particulate matter.

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing environmental impacts							
			IRP	ETP-fw	HTP-c	HTP-nc	SQP
			kBq U^{235} eq	CTUe	CTUh	CTUh	dimensionless
Product stage	Raw material supply	A1	AGG	AGG	AGG	AGG	AGG
	Transport	A2	AGG	AGG	AGG	AGG	AGG
	Manufacturing	A3	AGG	AGG	AGG	AGG	AGG
	Total (Consumption grid)	A1-3	7.70E-01	8.78E+01	1.40E-08	6.70E-08	1.84E+01
Construction process stage	Transport	A4	MND	MND	MND	MND	MND
	Construction	A5	MND	MND	MND	MND	MND
97% - Recycling & 3% - Landfill							
End of life	Deconstruction, demolition	C1	5.21E-01	9.36E+00	2.25E-10	7.55E-09	2.73E+00
	Transport	C2	1.04E-03	1.60E-01	6.38E-12	1.84E-10	1.72E-01
	Waste processing	C3	3.27E-03	4.25E-01	1.64E-11	3.08E-10	9.25E-02
	Disposal	C4	6.63E-05	9.75E-03	3.41E-13	6.48E-12	3.26E-02
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-7.54E-02	-4.12E+01	-1.04E-08	-4.34E-08	-4.72E+00

IRP = Potential human exposure efficiency relative to U235;
ETP-fw = Potential comparative toxic unit for ecosystems;
HTP-c = Potential comparative toxic unit for humans;
HTP-nc = Potential comparative toxic unit for humans; and
SQP = Potential soil quality index.

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing resource use, primary energy								
			PERE	PERM	PERT	PENRE	PENRM	PENRT
			MJ	MJ	MJ	MJ	MJ	MJ
Product stage	Raw material supply	A1	AGG	AGG	AGG	AGG	AGG	AGG
	Transport	A2	AGG	AGG	AGG	AGG	AGG	AGG
	Manufacturing	A3	AGG	AGG	AGG	AGG	AGG	AGG
	Total (Consumption grid)	A1-3	1.30E+00	2.03E+00	3.32E+00	1.00E+01	2.26E+00	1.23E+01
Construction process stage	Transport	A4	MND	MND	MND	MND	MND	MND
	Construction	A5	MND	MND	MND	MND	MND	MND
97% - Recycling & 3%- Landfill								
End of life	Deconstruction, demolition	C1	3.37E+00	0.00E+00	3.37E+00	1.92E+01	0.00E+00	1.92E+01
	Transport	C2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Waste processing	C3	4.07E-03	0.00E+00	4.07E-03	7.12E-01	0.00E+00	7.12E-01
	Disposal	C4	6.02E-05	0.00E+00	6.02E-05	6.93E-03	0.00E+00	6.93E-03
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

PERE = Use of renewable primary energy excluding renewable primary energy 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 resource

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing resource use, secondary materials and fuels, use of water						
			SM	RSF	NRSF	FW
			kg	MJ net calorific value	MJ net calorific value	m^3
Product stage	Raw material supply	A1	AGG	AGG	AGG	AGG
	Transport	A2	AGG	AGG	AGG	AGG
	Manufacturing	A3	AGG	AGG	AGG	AGG
	Total (Consumption grid)	A1-3	6.54E-04	0.00E+00	0.00E+00	3.57E-02
Construction process stage	Transport	A4	MND	MND	MND	MND
	Construction	A5	MND	MND	MND	MND
97% - Recycling & 3% - Landfill						
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	1.61E-02
	Transport	C2	0.00E+00	0.00E+00	0.00E+00	2.41E-05
	Waste processing	C3	2.79E-04	0.00E+00	0.00E+00	4.14E-05
	Disposal	C4	1.45E-06	0.00E+00	0.00E+00	1.54E-05
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	0.00E+00	0.00E+00	0.00E+00	-1.54E-02

SM = Use of secondary material;
RSF = Use of renewable secondary fuels;
NRSF = Use of non-renewable secondary fuels;
FW = Net use of fresh water

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Other environmental information describing waste categories					
			HWD	NHWD	RWD
			kg	kg	kg
Product stage	Raw material supply	A1	AGG	AGG	AGG
	Transport	A2	AGG	AGG	AGG
	Manufacturing	A3	AGG	AGG	AGG
	Total (Consumption grid)	A1-3	1.96E-02	3.45E-01	5.07E-05
Construction process stage	Transport	A4	MND	MND	MND
	Construction	A5	MND	MND	MND
97% - Recycling & 3% - Landfill					
End of life	Deconstruction, demolition	C1	6.68E-02	4.31E+00	1.40E-04
	Transport	C2	0.00E+00	0.00E+00	0.00E+00
	Waste processing	C3	9.57E-04	6.70E-03	5.01E-06
	Disposal	C4	7.34E-06	1.04E-04	4.63E-08
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	0.00E+00	0.00E+00	0.00E+00

HWD = Hazardous waste disposed;
NHWD = Non-hazardous waste disposed;
RWD = Radioactive waste disposed

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Other environmental information describing output flows – at end of life								
			CRU	MFR	MER	EE	Biogenic carbon (product)	Biogenic carbon (packaging)
			kg	kg	kg	MJ per energy carrier	kg C	kg C
Product stage	Raw material supply	A1	AGG	AGG	AGG	AGG	AGG	AGG
	Transport	A2	AGG	AGG	AGG	AGG	AGG	AGG
	Manufacturing	A3	AGG	AGG	AGG	AGG	AGG	AGG
	Total (Consumption grid)	A1-3	0.00E+00	2.35E-02	0.00E+00	0.00E+00	1.73E-02	-5.14E-02
Construction process stage	Transport	A4	MND	MND	MND	MND	MND	MND
	Construction	A5	MND	MND	MND	MND	MND	MND
97% - Recycling & 3% - Landfill								
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Waste processing	C3	0.00E+00	9.20E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Disposal	C4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

CRU = Components for reuse;
MFR = Materials for recycling

MER = Materials for energy recovery;
EE = Exported Energy

Scenarios and additional technical information

Scenarios and additional technical information			
Scenario	Parameter	Units	Results
C1 – Deconstruction	Dismantling mechanical fasteners from industrial buildings in roofs or facades is a precise process and essential for renovations, repair, or deconstruction. This systematic approach uses specific tools to remove fasteners without compromising the structural integrity. Firstly, prioritise safety by equipping workers with appropriate personal protective equipment. Ensure the work area is secure and communicate ongoing dismantling activities. Assess and plan the removal process and be mindful of their placement and the impact on the building structure. The use of specialized tools like power drills or screw extractors to ensure a careful extraction and avoid structural damage. Apply controlled force to avoid damaging the surrounding materials or the building structure. After the fasteners are removed, the material disassembly starts, such as metal sheets or sandwich panels. Finally, the underlay structure must be inspected and repaired for safety reasons. The energy used to dismantle the fasteners is not included in this analysis because energy consumption for the overall demolition significantly outweighs the negligible energy consumption associated with fastener removal. Initiating the removal process by systematically unscrewing and extracting fasteners using the selected tools. Power drill is the only tool used to dismantle the screws. Scenario in regard to the dismantling process that on the jobsite 10 power drills are used to dismantle 1kg fasteners. 10Ah avg. (power drill) x 10 power drill x 8 hours. After dismantling,100% of fasteners are recovered that is 1kg of fasteners go into further processing.		
	Electricity used to dismantle the Fasteners - “Electricity average Europe”	MJ	8.28
C2- Transportation	On average, a 100 km distance was considered, as the dismantling companies would be hired in the area 100 km from the site.		
	Transportation to Pre-processing sector	km	100
	Transportation	Road transport	Lorry, 16-32 ton
C3 – Preprocessing	Once the fasteners recovered from the demolition, at its end of life, fasteners will go into the pre-processing stage i.e., end-of-life management process which involves sorting and recycling, which includes melting the steel down and reforming it into new steel products. This sustainable practice contributes to resource conservation and reduces the demand for new raw materials. 1kg mechanical fastener which comprised of 95-97% of steel and 0-3% of EPDM has a capacity of recoverable and recyclable so therefore 100% of the fasteners will be recovered from the deconstruction sector and given the high recyclability of steel the 95% of steel is recycled and remaining 5% is considered as natural lost during the processing and it will be ended in landfilling. In some scenarios the EPDM the separation process is challenging, so 3% of EPDM can’t be recovered and will end up in landfills. Therefore, out of the 97% of steel consumption, 95% will be recycled, i.e., 0.92kg of steel will be recycled at the pre-processing stage, and 5%, i.e., 0.048 kg, will be sent to landfill. Additionally, 0.03kg of the EPDM waste will also end up in landfill		
97% recycling and 3% landfill	Out of the 97% of steel consumption, 95% will be recycled	kg	0.92
	Steel to Landfilling	kg	0.048
	EPDM to landfilling	kg	0.03

Scenarios and additional technical information			
Scenario	Parameter	Units	Results
Module D	“Benefits and loads beyond the system boundary” (module D) accounts for the environmental benefits and loads resulting from steel which is used as raw material in the EAF or BOF and that is collected for recycling at end of life. These benefits and loads are calculated by excluding the pre-existing recycled steel that is used in the primary process. At the end of its working life, 1kg of the product becomes 0.95 kg of scrap steel, as a small percentage will have been lost due to wear; this 95% of the product will be recycled. In order to calculate the benefits of the product at Module D, the pre-existing recycled content will be excluded. The dataset used for A1- raw material input is - "steel, low alloyed", which includes pre-existing steel content, i.e., 0.395kg arising from the original input of scrap steel that should be avoided. Instead, the amount recovered from the original input of steel recovered at C1, i.e., 0.605 kg, should be considered in Module D. Therefore, the benefits of recycling steel have been accounted for in Module D In line with this, 0.605 kg of steel recovered from the demolition sites can be used to offset the impacts of 0.605 kg of virgin steel material in A1, and it is assumed that there is a 100% recycling yield from the recycling process.		

End – user calculation:

The LCA results listed in the tables above is to the processing of 1 kg of fasteners. Consequently, the end-user of this EPD can calculate the impact of each fastener used in the building sector by applying the average weight of the fasteners. In the table below, the fasteners which have been used in the different application has been provided with the average weight in kg’s and the impacts has been calculated by multiplying with the average weight in kilograms.

For example, the GWP impact of 1 kilograms of fasteners is 3.58E+00, so multiplying with SXC5’s avg. weight of one piece in kg i.e., 0.027x3.58E+00 = 9.65E-02 kgCO2eq.

Sandwich Panel	avg. weight in gram	avg. weight in kg	GWP total of one piece in kg (A1-A3)
SXC5	26.95	0.027	0.0965
SXC16	34.56	0.035	0.1237
SX16	18.40	0.018	0.0644
CXCW	29.98	0.030	0.1073
SDC5	18.63	0.019	0.0667
SDC14	16.45	0.016	0.0589
SDTW	23.38	0.023	0.0837
DDC5	21.37	0.021	0.0765
DDC12	21.48	0.021	0.0769
SDT5	22.03	0.022	0.0789

Side Lapping	avg. weight in gram	avg. weight in kg	GWP total of one piece in kg (A1-A3)
SDL1	3.61	0.004	0.0129
CXLW	3.97	0.004	0.0142
SXL2	6.32	0.006	0.0226
SL2	5.65	0.006	0.0202
SLG-S	5.55	0.006	0.0199
CDL	4.22	0.004	0.0151
DD2	3.29	0.003	0.0118

Metal Cladding	avg. weight in gram	avg. weight in kg	GWP total of one piece in kg (A1-A3)
SX3	6.85	0.007	0.0245
SX5	8.92	0.009	0.0319
SX14	9.91	0.010	0.0355
SX20	7.86	0.008	0.0281
SXW	14.43	0.014	0.0517
SW2	7.29	0.007	0.0261
SD6	6.39	0.006	0.0229
SD14	8.58	0.009	0.0307
SD20	7.20	0.007	0.0258
SW-T	6.43	0.006	0.0230
SW3-T	7.80	0.008	0.0279
DD4	3.76	0.004	0.0135
DD5	5.33	0.005	0.0191
DD12	6.19	0.006	0.022

Tapper	avg. weight in gram	avg. weight in kg	GWP total of one piece in kg (A1-A3)
TDA	19.41	0.019	0.0695
TDB	20.90	0.021	0.0748
TDC	9.90	0.010	0.0354
MDW	26.87	0.027	0.0962

Single-play Panel	avg. weight in gram	avg. weight in kg	GWP total of one piece in kg (A1-A3)
SXP2	2.29	0.002	0.0082
SXP5	7.67	0.008	0.0275
SXP14	7.20	0.007	0.0258
SDP3	5.67	0.006	0.0203
SDP14	7.25	0.007	0.0260

Flashing	avg. weight in gram	avg. weight in kg	GWP total of one piece in kg (A1-A3)
SD1	2.29	0.002	0.008
SX2	2.29	0.002	0.008

Clamp Fastening	avg. weight in gram	avg. weight in kg	GWP total of one piece in kg (A1-A3)
SXL3	6.90	0.007	0.025

Liner Tray	avg. weight in gram	avg. weight in kg	GWP total of one piece in kg (A1-A3)
SXD3	6.90	0.007	0.025
SDRT2	6.90	0.007	0.025

Fibre Cement	avg. weight in gram	avg. weight in kg	GWP total of one piece in kg (A1-A3)
SCFW	29.25	0.029	0.105
SCF3	28.53	0.029	0.102
SCF12	28.54	0.029	0.102

Standing Seam	avg. weight in gram	avg. weight in kg	GWP total of one piece in kg (A1-A3)
SXK2	6.90	0.007	0.0247
SXK3	6.90	0.007	0.0247

Solar	avg. weight in gram	avg. weight in kg	GWP total of one piece in kg (A1-A3)
CX	7.69	0.008	0.028
CD	5.54	0.006	0.020

Metal Deck	avg. weight in gram	avg. weight in kg	GWP total of one piece in kg (A1-A3)
SD6-H15	5.45	0.005	0.0195
SD14-H15	6.16	0.006	0.0221
SD20-H15	7.20	0.007	0.0258
CDM	3.50	0.004	0.0125
SL2-H15	6.10	0.006	0.0218
SL3-H15	7.08	0.007	0.0253

Interpretation of results

The bulk of the environmental impacts and primary energy demand are attributed to the upstream manufacturing process of the Fasteners, covered by information modules A1-A3 of EN15804:2012+A2:2019

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ETA-13/0183 - Fastening screws for sandwich panel

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