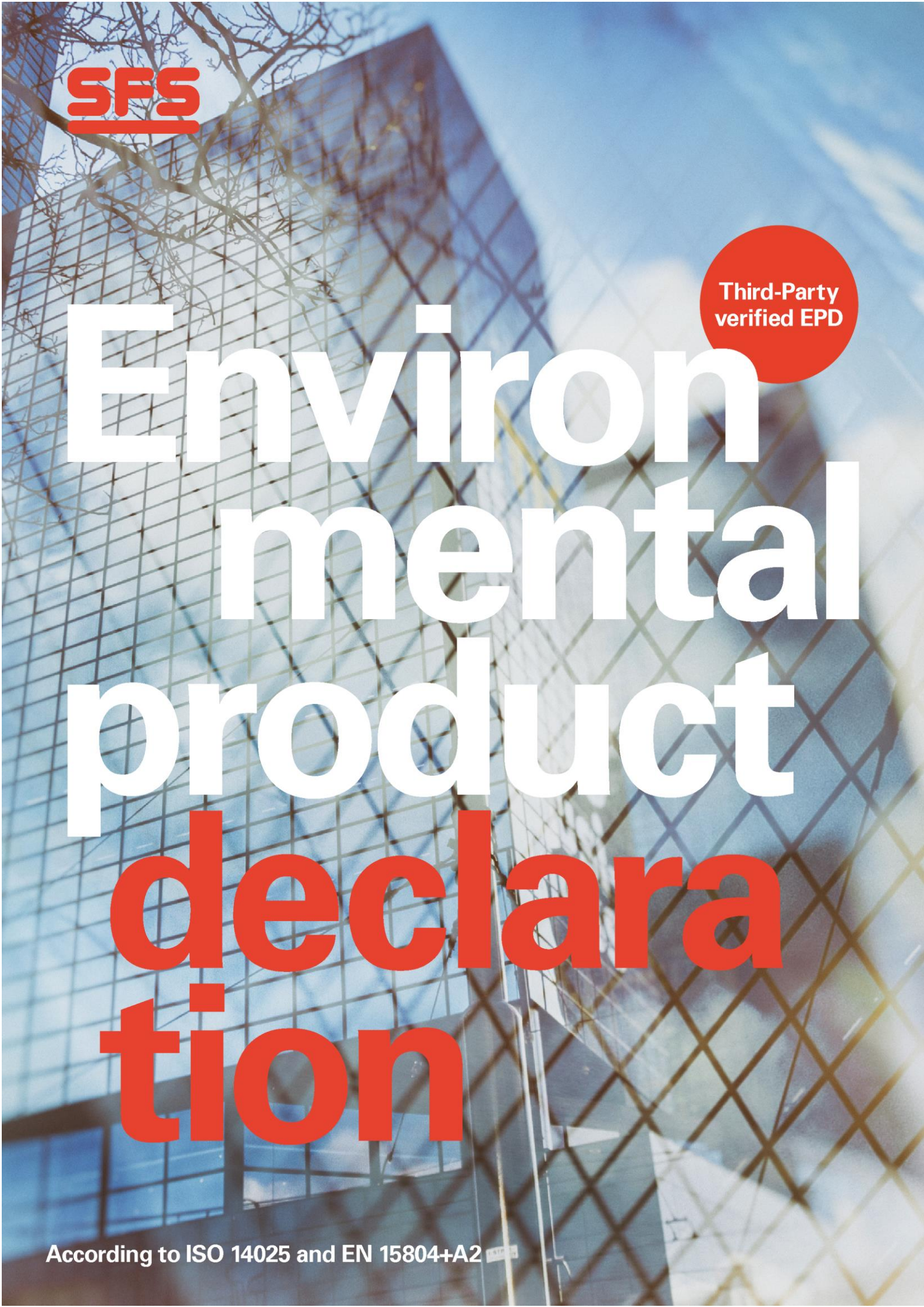
SFS
Third-Party verified EPD
Environmental product declaration
According to ISO 14025 and EN 15804+A2

Environmental product declaration
according to ISO 14025 and EN 15804+A2

Fixing Elements for Building Components



Verification and validity

Programme holder:	SFS Group Schweiz AG	Date of issuance:	10.01.2025
Declaration owner:	SFS Group Schweiz AG	Validity:	10.01.2030
Declaration number:	SFS-25-01		

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+A2 and the building context, respectively the product-specific characteristics of performance, are taken into account.

The standard EN 15804+A2 serves as the core PCR

Independent verification of the declaration and data according to ISO 14025:2010

Internally ☐	Externally ☒

Name and signature of the verifier



Matthias Klingler, Pawis GmbH, Zürich

1 Product

1.1 Product definition

Application	Product
Window Installation in the load bearing wall	FB, SPTR, FC
Cantilevered Window Installation within the insulation zone	JB-D®, JB-D® PLUS
"Fall-resistant" Window Installation	JB-D®/FA PLUS
Fixing of threshold	JB-A
Cantilevered Window Installation within the insulation zone and fixing of threshold	JB-W, JB-W/XL
Structural steel on steel applications	nonut® TDBL
Fixing of lightweight steel systems	SDL-F
Fixing of wood-based boards to steel substructure	SC2, SC3, SC4, SC5, SC6, SC8-HP

Fasteners

The fasteners covered in this EPD are made from carbon steel and stand for value added solutions of mechanical fixings, designed for specific applications of Building Component.

Table 1: Technical properties of the declared fasteners

Property	Product type	Value, Reference
Material	FB, SPTR-V, FC, TDBL, SDL-F, SC	carbon Steel
Coating	FB, SPTR-V, FC, TDBL, SDL-F, SC	galvanic or zinc flake coated
ETA	TDBL®	ETA.11/0191 of 1. June 2022
German technical approval	SC	Z-14.4-872 of 18. February 2021
Certifications	FB,	Ift certified, RC3 proved

***All technical product details for each product type can be found on the local SFS website.**
Design values for the FB product are listed in the SFS Compendium

Angle brackets and bracket systems

The angle brackets and bracket system of the JB product family covered in this EPD are made from carbon steel and are galvanised or zinc flake coated.

Two of the brackets for the mounting of a building component in the insulation layer are combined with a small plastic piece.

Table 2: Technical properties of the declared angle brackets and bracket systems

Property	Product type	Value, Reference
Material	JB-D® family JB-W family, JB-A	carbon Steel S235
Coating	JB-D® family JB-W family, JB-A	galvanic or zinc flake coated
German technical approval	JB-D® PLUS, JB-D®/FA PLUS	Z-14.4-806 of 27. June 2024
Certifications	JB-D® family, JB-W family, JB-A	Ift certified, RC2 proved

***All technical product details for each product type can be found on the local SFS website.**
Design values of all products are listed in the SFS Compendium

1.2 Production sites/producers for which the EPD is representative

The products are produced in either SFS production sites or in cooperation with external partners around the globe. The declared values represent 100 % of the production in 2023.

1.3 Composition of the product

The products are produced from carbon steel.
The products do not contain any substances included in the "Candidate List of Substances of Very High Concern for Authorisation" if their content exceeds the limits for registration by the European Chemicals Agency (ECHA) (accessed 18.11.2024).

The products are delivered packed in PE-bags in wire cases or cardboard boxes on reusable pallets and secured with polyethylene film.

1.4 Production

The core of fastener production is a reciprocating die in which the fastener is rolled at extremely high pressure between two flat dies - one of which remains stationary. This process embosses the thread onto the fastener and can produce hundreds of fasteners per minute.

After production, the fasteners are case hardened. Case hardening is the carburizing, hardening and tempering of a steel workpiece. The aim of case hardening is to achieve a soft and tough core with a hard surface of the material. The surface layer of the workpiece is enriched with carbon in a suitable carburizing medium (mix of gases) and then quenched. This improves the mechanical properties of the component surface layer (e.g. wear).

The angle brackets and bracket systems are produced from galvanized coils and are essentially pressed into shape and punched. Two components also come with a small plastic part to support the building component.

1.5 Additional information on the release of hazardous substances into indoor air, soil and water during the use phase

There are no horizontal standards on the measurement of the release of regulated substances from construction products with harmonised test methods for the effects on indoor air, soil and water during the use phase.

2 Calculation rules for the life cycle assessment

2.1 Declared unit

The declared unit is 1 kg of fasteners.
The declared unit is 1 kg of angle brackets and bracket systems used in building components.

2.2 Reference service life

Due to the wide range of applications, no reference service life is specified. The expected service life of fixing elements for building components is generally dependent on their use. The prevailing external influences can greatly affect the service life. As a default value, an average service life of >25 years can be assumed in line with service lives of building components; however, much longer service lives are also known. It is important to ensure that the products are used in accordance with the technical specifications.

2.3 Biogenic carbon

Table 3 contains the information on biogenic carbon content of the product and the packaging material at factory gate.

Table 3: Information describing the biogenic carbon content at the factory gate

Name	Value	Unit
Biogenic carbon content in product	0	kg C
Biogenic carbon content in accompanying packaging	0.31 (brackets) 0.40 (fasteners)	kg C

2.4 System boundary

A life cycle assessment type „cradle to gate with options, with modules C1–C4, and module D (A1–A3, C1–C4, D and additional modules. The additional modules may be A4 and/or A5)" is calculated.

The system boundary of the EPD follows the modular approach according to EN 15804+A2. The modules covered in this EPD can be identified in Table 4.

Table 4: Information on the system boundary

Information on system boundary (X = covered in LCA; MND = module not declared; MNR = module not relevant)																
Raw material supply	Transport	Production	Transport	Construction/ Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction	Transport	Waste treatment	Disposal	Reuse, recycling, recovery potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	MND	(X)	MND	MND	MNR	MNR	MNR	MND	MND	X	X	X	X	X

(X) for module A5: only the disposal of packaging is considered, not the installation as such
(X) for module C1: in analogy to module A5, inputs and outputs related to de-installation are disregarded.

Production stages A1 to A3 include the extraction of raw materials and the provision of energy for the manufacture of the declared products. For recycled scrap as the main input for production, the system boundary is defined where the steel scrap from the upstream product system is available as sorted steel scrap (see also COUNCIL REGULATION (EU) No 333/2011).

The products are delivered to the construction site ready to be installed. In Modul A5, manual installation is assumed; electricity consumption related to electric drilling is neglected.

The combustible packaging material (PE-foil, wood) is assumed to be transported 50 km with a municipal waste collection service by 21 metric ton lorry to an incineration plant with an efficiency R1 <0.6; the recovered energy is declared as exported energy; for its quantification (according to CEWEP energy report III) an efficiency of 25.6% is assumed for the production of heat and 13.0% for the production of electricity (always referring to the lower heating value of the waste).

Cardboard is recycled; it is assumed that these fractions reach end-of-waste state after having been sorted and transported (as a conservative choice) to a recycler over 50 km with a municipal waste collection service by 21 metric ton lorry.

Modules B1 to B7 are not relevant for the declared products. The indicator values of Modules B1 to B7 are thus 0 and not declared specifically in the EPD.

In the end-of-life, the recycling of the steel fixing elements (as part of the recycling of building components) is declared.

In Module C2 the fixations are transported with a lorry 16–32 metric ton, fleet average for Switzerland to a sorting plant over 50 km.

In Module C3, the recovered fixations – together with the recovered building component – are sorted in a sorting plant. The recovered metal parts reach the end-of-waste state here; the plastic piece (as part of two bracket systems) are incinerated in a municipal waste incineration plant with energy recovery.

Module C4 is not relevant for the assumed end-of-life scenario.

Module D contains the benefits and loads beyond the system boundary related to the recycling of metals, which result from the treatment of recycled materials from the point of end-of-waste status to the point of substitution (as loads) and the substitution of primary resources (as benefits).

It also includes the benefits and loads related to the energy recovery from plastic wastes in a municipal waste incineration plant (MWIP) as modelled in Module A5 and Module C3 (for brackets/bracket systems only).

Only net flows leaving the product system are considered in module D. The recycled content and the assumed processing losses are documented in the tables containing the modelling of module D. These parameters are used to estimate the input of secondary material and compare it with the output flows of the corresponding material.

The following Table 4 summarises the end-of-life scenario.

Table 4: Information on declared end-of-life scenarios

Processes	**Parameter unit expressed per functional/declared unit of components, products or materials (specified by type of material)**
Collection process specified by type	1.0 kg of fasteners collected separately (together with the deconstructed building component) 1.004 kg of angle brackets/bracket systems collected separately (together with the deconstructed building component)
	0 kg collected with mixed construction waste
Recovery system specified by type	0 kg for re-use
	1.0 kg of steel for recycling
	0 kg for energy recovery (from secondary material)
Disposal specified by type	0.004 kg of plastic part of angle brackets/bracket systems for waste treatment with energy recovery 0 kg of steel for landfilling
Assumptions for scenario development, (e.g. transportation)	Transport to sorting plant: lorry with a payload of 16–32 metric tons over 50 km; For angle brackets/bracket systems only: transport of recovered plastic parts to a MWIP: lorry with a payload of 16–32 metric tons over 50 km.

2.3 Further assumptions and remarks

The production data covers the production year 2023. Datasets from the life cycle assessment database ecoinvent v3.10 were used as background data for the life cycle assessment.

At one production site, certified “green” electricity is used; for the other production sites, the country-specific residual mix has been used.

2.4 Cut-off rules

All data were taken into account that resulted from the data collection procedure in the plant. Thus, the following were considered:

- all inputs used according to the bill of materials,
- all material inputs related to production wastes
- fuel inputs for the production of thermal energy,

- electricity consumption from the grid,
- treatment of production waste (including direct material losses and additional waste flows reported by the company,
- airborne emissions (derived from the input of gases for case hardening),
- water consumption from the grid,
- waste water treatment,
- transport distances and transport means for all relevant inputs into production as well as for waste treatment.

The following processes were considered to be insignificant or not related to the production process:

- fuel consumption for internal transport,
- the production and disposal of reusable bins and multi-use pallets, i.e., transport packaging of raw materials,
- machinery and infrastructure at the production site,
- expenses for the general management, research & development, administration and marketing.

Airborne emissions need not be measured by the company and no respective information was available.

With this approach also mass and energy flows below 1 percent of total mass and energy flows caused by the declared products were included in the assessment.

Beyond that, no material or energy flows were neglected that would have been known by the persons responsible for the project and that could have been expected to contribute significantly to the environmental indicators declared. Thus, it can be assumed that the total contribution of the neglected processes is not higher than 5% of the declared impact categories.

Therefore, the criteria for the exclusion of inputs and outputs according to EN 15804, clause 6.3, are complied with.

3 Results of the life cycle assessment

The following table summarises the results of the life cycle assessment for the declared unit of **1 kg of fasteners used in building components**.

		A1-A3 Production	A4 Transport to con-struction site	A5 Installation	C1 Decon-struction	C2 Transport in EoL	C3 Waste treat-ment	C4 Disposal	D Loads and benefits
Parameters describing environmental impacts									
Global warming potential - total (GWP-total)	kg CO_2 eq	4,91E+00	MND	-1,40E-01	0,00E+00	9,51E-03	1,33E-03	0,00E+00	-1,21E+00
Global warming potential - fossil fuels (GWP-fossil)	kg CO_2 eq	5,05E+00	MND	6,18E-03	0,00E+00	9,50E-03	1,28E-03	0,00E+00	-1,22E+00
Global warming potential - biogenic (GWP-biogenic)	kg CO_2 eq	-1,46E-01	MND	1,46E-01	0,00E+00	6,58E-06	4,53E-05	0,00E+00	3,56E-03
GWP from land use and land use change (GWP-luluc)	kg CO_2 eq	1,08E-02	MND	4,45E-07	0,00E+00	3,15E-06	3,72E-06	0,00E+00	-3,93E-05
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC11 eq	4,22E-08	MND	1,06E-10	0,00E+00	1,89E-10	2,24E-11	0,00E+00	-3,86E-09
Acidification potential, accumulated exceedance (AP)	mol H^+ eq	2,69E-02	MND	2,69E-05	0,00E+00	1,98E-05	6,83E-06	0,00E+00	-4,69E-03
Eutrophication, fraction of nutrients reaching freshwater end compartment (EP-freshwater)	kg P eq	2,68E-04	MND	1,13E-08	0,00E+00	7,41E-08	1,15E-07	0,00E+00	-5,22E-05
Eutrophication, fraction of nutrients reaching marine end compartment (EP-marine)	kg N eq	5,20E-03	MND	1,21E-05	0,00E+00	4,63E-06	1,14E-06	0,00E+00	-9,62E-04
Eutrophication, accumulated exceedance (EP-terrestrial)	mol N eq	6,74E-02	MND	1,32E-04	0,00E+00	5,13E-05	1,28E-05	0,00E+00	-1,14E-02
Formation potential of tropospheric ozone photochemical oxidants (POCP)	kg NMVOC eq	2,22E-02	MND	5,53E-05	0,00E+00	3,29E-05	4,16E-06	0,00E+00	-3,89E-03
Abiotic depletion potential for non-fossil resources (ADPE)	kg Sb eq	3,14E-05	MND	3,36E-09	0,00E+00	3,09E-08	2,66E-09	0,00E+00	-1,08E-05
Abiotic depletion potential for fossil resources (ADPF)	MJ	5,53E+01	MND	6,72E-02	0,00E+00	1,34E-01	2,94E-02	0,00E+00	-1,10E+01
Water (user) deprivation	m^3 depriv.	2,09E+00	MND	8,78E-05	0,00E+00	5,55E-04	3,23E-04	0,00E+00	-1,00E-01
Parameters describing resource use									
Renewable primary energy as energy carrier (PERE)	MJ (Hu)	1,27E+01	MND	1,91E-02	0,00E+00	2,26E-03	6,57E-03	0,00E+00	-7,11E-01
Renewable primary energy resources as material utilization (PERM)	MJ (Hu)	1,87E-02	MND	-1,87E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Total use of renewable primary energy resources (PERT)	MJ (Hu)	1,27E+01	MND	4,12E-04	0,00E+00	2,26E-03	6,57E-03	0,00E+00	-7,11E-01
Non-renewable primary energy as energy carrier (PENRE)	MJ (Hu)	3,54E+01	MND	1,33E-02	0,00E+00	1,12E-02	2,07E-02	0,00E+00	-9,04E+00
Non-renewable primary energy as material uti. (PENRM)	MJ (Hu)	1,16E-02	MND	-1,16E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Total use of non-renewable primary energy resources (PENRT)	MJ (Hu)	3,54E+01	MND	1,65E-03	0,00E+00	1,12E-02	2,07E-02	0,00E+00	-9,04E+00
Use of secondary material (SM)	Kg	2,95E-01	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	8,21E-01
Use of renewable secondary fuels (RSF)	MJ (Hu)	0,00E+00	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Use of non-renewable secondary fuels (NRSF)	MJ (Hu)	0,00E+00	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Use of net fresh water (FW)	m^3	2,02E-04	MND	1,03E-08	0,00E+00	2,53E-08	6,25E-10	0,00E+00	-4,41E-06
Other environmental information describing waste flows									
Hazardous waste disposed (HWD)	kg	2,89E-04	MND	4,01E-07	0,00E+00	9,00E-07	4,92E-08	0,00E+00	-1,26E-04
Non-hazardous waste disposed (NHWD)	kg	5,01E-01	MND	3,42E-04	0,00E+00	6,45E-03	5,95E-05	0,00E+00	-3,46E-02
Radioactive waste disposed (RWD)	kg	1,28E-04	MND	1,32E-08	0,00E+00	7,49E-08	3,62E-07	0,00E+00	2,28E-05

		A1-A3 Production	A4 Transport to con-struction site	A5 Installation	C1 Decon-struction	C2 Transport in EoL	C3 Waste treat-ment	C4 Disposal	D Loads and benefits
Other environmental information describing output flows									
Components for re-use (CRU)	kg	0,00E+00	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for recycling (MFR)	kg	0,00E+00	MND	0,00E+00	0,00E+00	0,00E+00	1,00E+00	0,00E+00	0,00E+00
Materials for energy recovery (MER)	kg	0,00E+00	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported electrical energy (EEE)	MJ	0,00E+00	MND	3,49E-03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported thermal energy (EET)	MJ	0,00E+00	MND	8,83E-03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Additional optional indicators describing environmental impacts)									
Potential incidence of disease due to PM emissions (PM)	disease inc.	3,82E-07	MND	6,67E-10	0,00E+00	6,96E-10	3,85E-11	0,00E+00	-7,89E-08
Potential Human exposure efficiency relative to U235 (IRP)	kBq U-235 eq	9,91E-02	MND	1,16E-05	0,00E+00	6,17E-05	2,51E-04	0,00E+00	1,34E-02
Potential comparative toxic unit for ecosystems (ETP-fw)	CTUe	8,23E+01	MND	2,18E-03	0,00E+00	1,64E-02	1,11E-03	0,00E+00	-8,15E+01
Potential comparative toxic unit for humans - cancerogenic (HTP-c)	CTUh	3,58E-07	MND	8,15E-12	0,00E+00	6,74E-11	2,95E-12	0,00E+00	-3,58E-07
Potential comparative toxic unit for humans - not cancero-genic (HTP-nc)	CTUh	5,81E-08	MND	1,38E-11	0,00E+00	8,39E-11	9,33E-12	0,00E+00	-8,20E-09
Potential soil quality index (SQP)	–	3,08E+01	MND	7,52E-03	0,00E+00	8,07E-02	4,90E-03	0,00E+00	-3,13E+00

Disclaimer 1 – for the indicator "Potential Human exposure efficiency relative to U235": This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – for the indicators "abiotic depletion potential for non-fossil resources", "abiotic depletion potential for fossil resources", "water (user) deprivation potential, deprivation-weighted water consumption", "potential comparative toxic unit for ecosystems", "potential comparative toxic unit for humans – cancerogenic", "Potential comparative toxic unit for humans - not cancerogenic", "potential soil quality index": The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.

The following table summarises the results of the life cycle assessment for the declared unit of **1 kg of steel angle brackets and bracket systems used in building components**

		A1-A3 Production	A4 Transport to con-struction site	A5 Installation	C1 Decon-struction	C2 Transport in EoL	C3 Waste treat-ment	C4 Disposal	D Loads and benefits
Parameters describing environmental impacts									
Global warming potential - total (GWP-total)	kg CO_2 eq	2,64E+00	MND	1,23E-01	0,00E+00	1,15E-02	1,23E-02	0,00E+00	-1,69E+00
Global warming potential - fossil fuels (GWP-fossil)	kg CO_2 eq	2,76E+00	MND	6,47E-03	0,00E+00	1,15E-02	1,23E-02	0,00E+00	-1,70E+00
Global warming potential - biogenic (GWP-biogenic)	kg CO_2 eq	-1,16E-01	MND	1,16E-01	0,00E+00	7,99E-06	4,61E-05	0,00E+00	4,86E-03
GWP from land use and land use change (GWP-luluc)	kg CO_2 eq	2,10E-03	MND	3,25E-07	0,00E+00	3,83E-06	3,73E-06	0,00E+00	-6,22E-05
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC11 eq	2,99E-08	MND	7,64E-11	0,00E+00	2,29E-10	2,40E-11	0,00E+00	-5,61E-09
Acidification potential, accumulated exceedance (AP)	mol H^+ eq	3,39E-02	MND	1,97E-05	0,00E+00	2,40E-05	8,17E-06	0,00E+00	-6,52E-03
Eutrophication, fraction of nutrients reaching freshwater end compartment (EP-freshwater)	kg P eq	1,25E-04	MND	8,59E-09	0,00E+00	9,00E-08	1,16E-07	0,00E+00	-7,27E-05
Eutrophication, fraction of nutrients reaching marine end compartment (EP-marine)	kg N eq	3,04E-03	MND	8,86E-06	0,00E+00	5,63E-06	1,79E-06	0,00E+00	-1,34E-03
Eutrophication, accumulated exceedance (EP-terrestrial)	mol N eq	1,28E-01	MND	9,71E-05	0,00E+00	6,23E-05	1,99E-05	0,00E+00	-1,58E-02
Formation potential of tropospheric ozone photochemical oxidants (POCP)	kg NMVOC eq	9,75E-03	MND	4,02E-05	0,00E+00	3,99E-05	5,89E-06	0,00E+00	-5,42E-03
Abiotic depletion potential for non-fossil resources (ADPE)	kg Sb eq	9,33E-05	MND	2,47E-09	0,00E+00	3,75E-08	2,83E-09	0,00E+00	-1,51E-05
Abiotic depletion potential for fossil resources (ADPF)	MJ	3,43E+01	MND	4,85E-02	0,00E+00	1,62E-01	3,02E-02	0,00E+00	-1,54E+01
Water (user) deprivation	m^3 depriv.	1,06E+00	MND	7,27E-05	0,00E+00	6,74E-04	3,42E-04	0,00E+00	-1,40E-01
Parameters describing resource use									
Renewable primary energy as energy carrier (PERE)	MJ (Hu)	4,47E+00	MND	3,61E-02	0,00E+00	2,75E-03	6,59E-03	0,00E+00	-1,00E+00
Renewable primary energy resources as material utilization (PERM)	MJ (Hu)	3,58E-02	MND	-3,58E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Total use of renewable primary energy resources (PERT)	MJ (Hu)	4,51E+00	MND	3,05E-04	0,00E+00	2,75E-03	6,59E-03	0,00E+00	-1,00E+00
Non-renewable primary energy as energy carrier (PENRE)	MJ (Hu)	2,14E+01	MND	3,90E-02	0,00E+00	1,35E-02	2,12E-01	0,00E+00	-1,26E+01
Non-renewable primary energy as material uti. (PENRM)	MJ (Hu)	2,25E-01	MND	-3,78E-02	0,00E+00	0,00E+00	-1,91E-01	0,00E+00	0,00E+00
Total use of non-renewable primary energy resources (PENRT)	MJ (Hu)	2,16E+01	MND	1,24E-03	0,00E+00	1,35E-02	2,08E-02	0,00E+00	-1,26E+01
Use of secondary material (SM)	kg	3,44E-01	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	8,34E-01
Use of renewable secondary fuels (RSF)	MJ (Hu)	0,00E+00	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Use of non-renewable secondary fuels (NRSF)	MJ (Hu)	0,00E+00	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Use of net fresh water (FW)	m^3	9,05E-05	MND	7,63E-09	0,00E+00	3,07E-08	2,79E-09	0,00E+00	-6,12E-06
Other environmental information describing waste flows									
Hazardous waste disposed (HWD)	kg	6,83E-04	MND	2,94E-07	0,00E+00	1,09E-06	6,17E-08	0,00E+00	-1,75E-04
Non-hazardous waste disposed (NHWD)	kg	1,77E-01	MND	2,86E-04	0,00E+00	7,84E-03	1,75E-04	0,00E+00	-4,82E-02
Radioactive waste disposed (RWD)	kg	1,21E-04	MND	9,73E-09	0,00E+00	9,10E-08	3,63E-07	0,00E+00	3,10E-05

		A1-A3 Production	A4 Transport to con-struction site	A5 Installation	C1 Decon-struction	C2 Transport in EoL	C3 Waste treat-ment	C4 Disposal	D Loads and benefits
Other environmental information describing output flows									
Components for re-use (CRU)	kg	0,00E+00	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for recycling (MFR)	kg	1,59E-01	MND	1,86E-02	0,00E+00	0,00E+00	1,00E+00	0,00E+00	0,00E+00
Materials for energy recovery (MER)	kg	0,00E+00	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported electrical energy (EEE)	MJ	0,00E+00	MND	8,49E-03	0,00E+00	0,00E+00	2,21E-02	0,00E+00	0,00E+00
Exported thermal energy (EET)	MJ	0,00E+00	MND	2,15E-02	0,00E+00	0,00E+00	5,60E-02	0,00E+00	0,00E+00
Additional optional indicators describing environmental impacts)									
Potential incidence of disease due to PM emissions (PM)	disease inc.	4,20E-07	MND	4,81E-10	0,00E+00	8,46E-10	4,46E-11	0,00E+00	-1,10E-07
Potential Human exposure efficiency relative to U235 (IRP)	kBq U-235 eq	8,52E-02	MND	8,53E-06	0,00E+00	7,49E-05	2,52E-04	0,00E+00	1,80E-02
Potential comparative toxic unit for ecosystems (ETP-fw)	CTUe	1,02E+02	MND	1,68E-03	0,00E+00	1,99E-02	1,35E-03	0,00E+00	-1,13E+02
Potential comparative toxic unit for humans - cancerogenic (HTP-c)	CTUh	4,48E-07	MND	6,43E-12	0,00E+00	8,19E-11	4,17E-12	0,00E+00	-4,97E-07
Potential comparative toxic unit for humans - not cancero-genic (HTP-nc)	CTUh	1,29E-07	MND	1,47E-11	0,00E+00	1,02E-10	1,96E-11	0,00E+00	-1,14E-08
Potential soil quality index (SQP)	–	1,60E+01	MND	5,47E-03	0,00E+00	9,80E-02	5,09E-03	0,00E+00	-4,36E+00

Disclaimer 1 – for the indicator "Potential Human exposure efficiency relative to U235": This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – for the indicators "abiotic depletion potential for non-fossil resources", "abiotic depletion potential for fossil resources", "water (user) deprivation potential, deprivation-weighted water consumption", "potential comparative toxic unit for ecosystems", "potential comparative toxic unit for humans – cancerogenic", "Potential comparative toxic unit for humans - not cancerogenic", "potential soil quality index": The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.

4 Interpretation

4.1 Fasteners

Figure 1 illustrates the relative contributions of the different modules along the life cycle of the declared products (contribution of modules A1-C4 = 100%) for the assessments according EN 15804+A2.

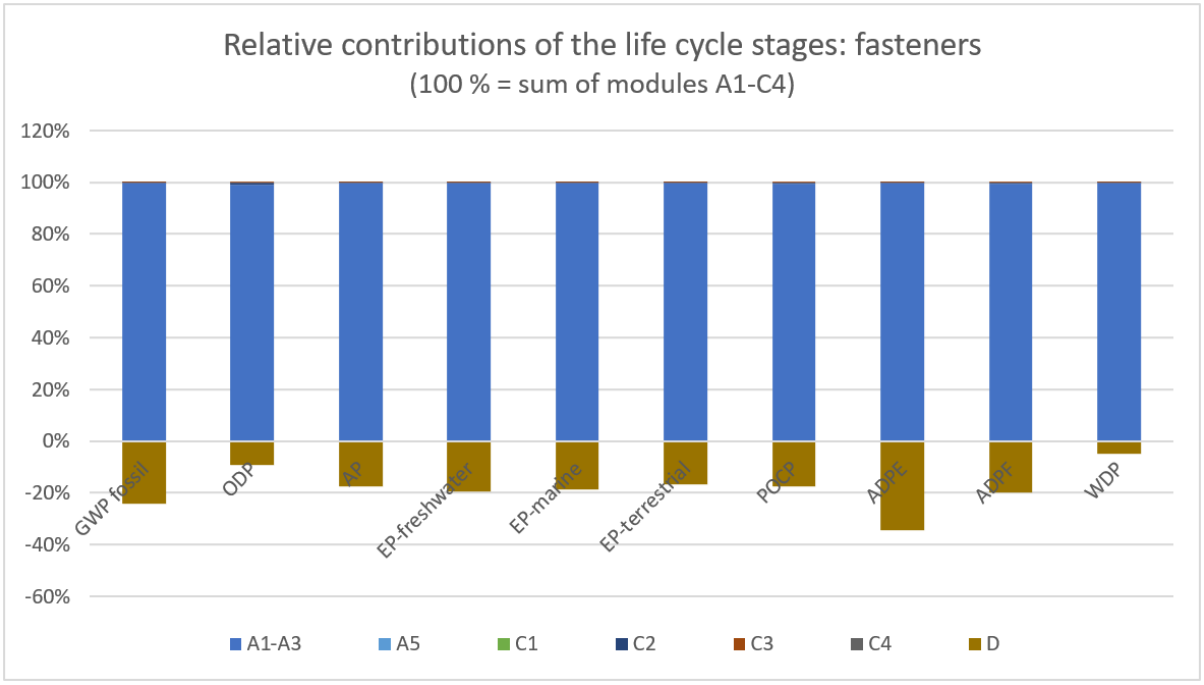

Figure 1: Relative contributions of the different life cycle stages for fasteners according to mandatory impact categories of EN 15804+A2 (modules A1-C4 = 100%)

The LCA is dominated by the manufacture of the product (modules A1-A3). All the other declared modules do not contribute significantly to the mandatory impact categories of EN 15804+A2-

The benefits and burdens outside the product system vary in significance depending on the indicator and fluctuate between -5% and -35%.

The use of renewable primary energy is mainly caused by the share of renewable energy in the electricity mix; thus, the production stage is the main driver of this impact category; the same holds also for the use of non-renewable primary energy.

Material use of primary energy is comparably small and related to the use of wooden packaging material and PE-film used during for transport and storage. The material use of primary energy is transferred to its energy use when the materials containing primary energy are incinerated with energy recovery; the material use of primary energy is subtracted from the material use indicator when the materials containing primary energy are recycled.

Non-hazardous waste as the quantitatively most relevant waste flows is mainly caused during mining and processing of metal ores and related to the disposal of road infrastructure; hazardous and radioactive waste are mainly caused by the nuclear power in the electricity mix.

Part of the fastener production is produced with certified “green” electricity; as electricity is one of the significant drivers of the environmental profile, it has to be reminded that the declared values are representative for the year 2023.

4.2 Angle brackets/bracket systems

Figure 2 illustrates the relative contributions of the different modules along the life cycle of the declared products (contribution of modules A1-C4 = 100%) for the assessments according EN 15804+A2.

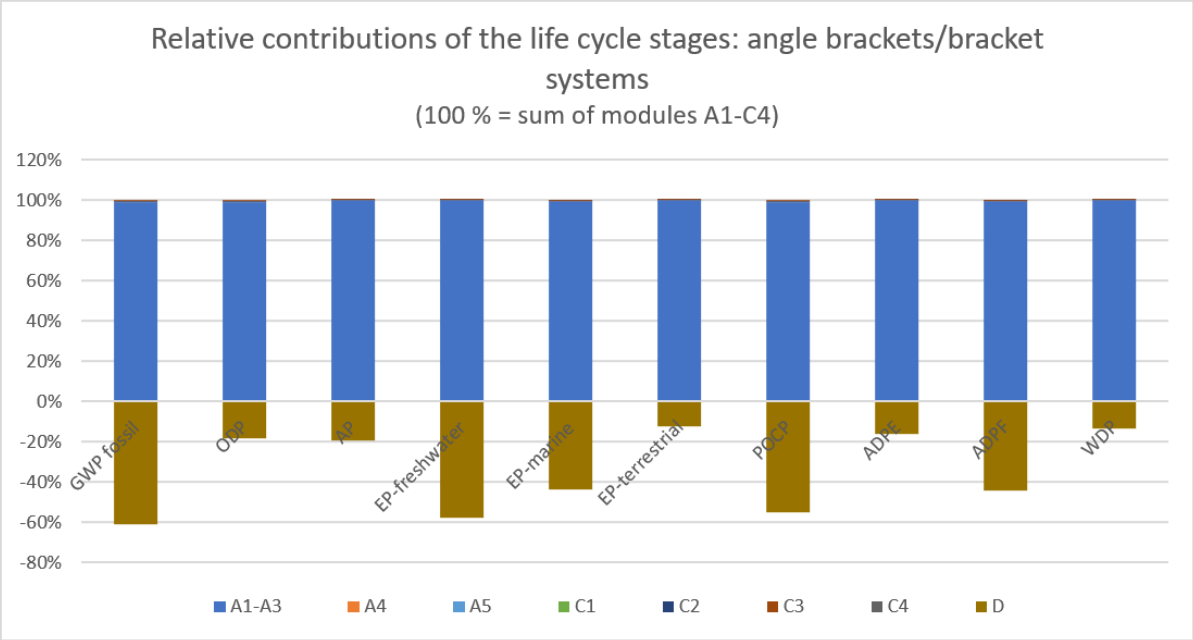

Figure 2: Relative contributions of the different life cycle stages for steel angle brackets and bracket systems as building component according to mandatory impact categories of EN 15804+A2 (modules A1-C4 = 100 %)

The LCA is dominated by the manufacture of the product (modules A1-A3). All the other declared modules do not contribute significantly to the mandatory impact categories of EN 15804+A2-

The benefits and burdens outside the product system vary in significance depending on the indicator and fluctuate between -12% and -61%. This is to the minimal use of recycled steel input for the carbon steel part, which leads to a comparably large net output flow.

The use of renewable primary energy is mainly caused by the share of renewable energy in the electricity mix; thus, the production stage is the main driver of this impact category; the same holds also for the use of non-renewable primary energy.

Material use of primary energy is comparably small and related to the use of wooden packaging material and PE-film used during for transport and storage. The material use of primary energy is transferred to its energy use when the materials containing primary energy are incinerated with energy recovery; the material use of primary energy is subtracted from the material use indicator when the materials containing primary energy are recycled.

Non-hazardous waste as the quantitatively most relevant waste flows is mainly caused during mining and processing of metal ores and related to the disposal of road infrastructure; hazardous and radioactive waste are mainly caused by the nuclear power in the electricity mix.

5 References

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