MASS BALANCE PRODUKT INFORMATION

Owner of the Document	**Unger Stahlbau Ges.m.b.H.**
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Document number	MBA-UNG-0001
Issue date	29.11.2024
Valid to	28.11.2026

Steel²Zero rolled profile constructions

Unger Stahlbau Ges.m.b.H.

www.ibu-epd.com

General Information

Unger Stahlbau Ges.m.b.H.

Steel^{2}Zero rolled profile constructions

Programme holder
IBU – Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

Owner of the Declaration
Unger Stahlbau Ges.m.b.H.
Steinamangererstraße
7400 Oberwart
Austria

Declaration number
MBA-UNG-0001

Declared product / declared unit
1 t Steel^{2}Zero rolled profile constructions

Verification

The standard *EN 15804* serves as the core PCR
Independent verification of the document and data according to *ISO 14025:2011*
[ ] internally [x] externally

Dipl.-Ing.Hans Peters
(chairman of Institut Bauen und Umwelt e.V.)

RA Florian Pronold
(Managing Director Institut Bauen und Umwelt e.V.))

Matthias Klingler
(Independent verifier)

Product

Product description/Product definition
This declaration refers to 1 ton of Steel^{2}Zero structural steel. It covers constructions made from structural steel sections produced via the EAF route using 100 % scrap and green electricity. The scrap and green electricity are allocated to the pre-materials based on a mass balance approach.

For the placing on the market of the product in the European Union/European Free Trade Association (EU/EFTA) (with the exception of Switzerland) Regulation (EU) No. 305/2011 (CPR) applies. The product needs a declaration of performance taking into consideration

EN 10025-1, Hot rolled products of structural steels - Part 1: General technical delivery conditions

EN 10210-1, Hot finished structural steel hollow sections - Part 1: General

EN 10219-1, Cold formed welded structural hollow sections of non-alloy and fine grain steels - Part 1: Technical delivery conditions

and the CE-marking.
For the application and use the respective national provisions apply.

Application
The constructions are used for bolted, welded and otherwise connected building structures, bridges and other structures or in steel composite constructions. Examples of this are:

- Single-storey buildings (industrial halls and warehouses)
- Multi-storey buildings (offices, residential buildings, stores, parking garages, high-rise buildings, etc.)
- Traffic and pedestrian bridges
- Other structures (power stations, stadiums, convention centers, airports, train stations, etc.)

Technical Data
This document is valid for Steel^{2}Zero rolled profile constructions made from structural steel sections of different steel grades and different forms of delivery produced via the EAF route using 100 % scrap and green electricity.

Specific information on dimensional tolerances, structural data and mechanical and chemical properties can be found in standards *EN 10025-1, EN 10210-1 & EN 10219-1.*

Constructional data

Name	Value	Unit
Density	7850	kg/m^{3}
Modulus of elasticity	210000	N/mm^{2}
Thermal expansion coefficient	12	$10^{-6}K^{-1}$
Thermal conductivity	48	W/(mK)
Melting point	1536	°C
Shear modulus	81000	N/mm^{2}

Performance data of the product in accordance with the declaration of performance with respect to its essential characteristics according to

EN 10025-1, Hot rolled products of structural steels - Part 1: General technical delivery conditions

EN 10210-1, Hot finished structural steel hollow sections - Part 1: General

EN 10219-1, Cold formed welded structural hollow sections of non-alloy and fine grain steels - Part 1: Technical delivery conditions

Base materials/Ancillary materials
Structural steels are non-alloy or low-alloy steel products with a carbon content between 0 and 0.6 %. Iron is the main component of steel profiles. The proportion of other elements is significantly lower. The exact chemical composition varies depending on the type of steel.

The declared construction consists of rolled profiles produced via the EAF route (100 % scrap-based) using green electricity. The use of only scrap and green electricity is allocated to the rolled profiles based on a mass balance approach. The annual average proportionately considers the coating (<0.001 t/t) and galvanizing (<0.001 t/t) of the structures.

This product/article/at least one partial article contains substances listed in the candidate list (date: 05.06.2024) exceeding 0.1 percentage by mass: **no**

This product/article/at least one partial article contains other CMR substances in categories 1A or 1B which are not on the candidate list, exceeding 0.1 percentage by mass: **no**

Biocide products were added to this construction product or it has been treated with biocide products (this then concerns a treated product as defined by the (EU) Ordinance on Biocide Products No. 528/2012): **no**

Environment and health during use
During production there are no special requirements for safety, environmental protection and health.

An environmental management system in accordance with *ISO 14001* is implemented and certified.

Reference service life
The reference service life is not relevant for the LCA calculation. A reference service life is not declared for the constructions, as they are building products with versatile application possibilities.
The intended use, possible corrosion protection and the maintenance are decisive for the service life.

LCA: Calculation rules

Declared Unit
This document refers to a declared unit of 1 ton Steel²Zero rolled profile constructions made from steel produced via the EAF route using 100 % scrap and green electricity based on a mass-balance approach.

Declared unit

Name	Value	Unit
Declared unit	1	t

This declaration refers to constructions exclusively based on 100% decarbonized steel calculated based on a mass-balance approach.
This mass balance declaration represents additional information complementary to IBU-EPD number EPD-UNG-20240338-IBC1-DE, which declares the conventional production.
The steel constructions are delivered coated (lacquering/galvanizing) or bare. Due to the minor influence of the coating on the carbon footprint of the products, the declared, weighted average is representative for bare and coated constructions.

Available Masses
In the time period considered, Steel²Zero constructions were not yet produced by Unger Stahlbau Ges.m.b.H. Since then, the company purchased steel from the EAF route using 100 % scrap and green electricity and established a material monitoring system of purchased and sold quantities.

System boundary
The life cycle assessment of Steel²Zero rolled profile constructions refers to a cradle-to-gate analysis with modules (A1–A3 + C +D). The following life cycle phases are part of the analysis:

Module A1–A3 | Production stage
The production stage includes the upstream burdens of raw material supply (“green steel”, etc.), their transports and the environmental burdens from the manufacturing of the constructions at the production site in Oberwart (Austria). Steel²Zero structural steel is exclusively made of decarbonized steel produced via the EAF-route. **The calculation considers a mass-balance approach including a virtual allocation of green electricity and scrap input to the decarbonized material.**
Secondary steel used in the production of the pre-materials is considered as burden-free in the calculations. The energy supply at the Unger site is based on 100 % green electricity as well as natural gas.
The packaging of the products is taken into account according to manufacturer specifications.

Module C1 | Deconstruction and demolition
For the end-of-lif-scenario it is considered that the constructions are not joint with other materials and can be deconstructed homogeneously. The associated effort is assumed to be minor and is hence negligible.

Module C2 | Transport
The transport to the disposal of the material is estimated declaring a 50 km radius to the waste processing.

Module C3 | Waste processing
Product flows that reach Module D for recycling leave the product system in C3. Environmental impacts resulting from the grinding and sorting of steel scrap are not included due to the negligible expected environmental impact.

Module C4 | Landfilling
Module C4 declares the environmental impacts incurred by landfilling (5 % of the product).

Module D | Benefits and loads beyond the system boundary

The potential for substituting primary steel with a recycling scenario (95 % of the product) is outlined in Module D.

Allocation
The present life cycle assessment is based on supplier specific LCA results for the purchased steel sections considering a mass-balance approach for steel scrap and green electricity. Due to that, the results are not compliant with *EN 15804+A2*.

All other calculations are consistent with the IBU-EPD for “Walzprofilkonstruktionen”.

Mass balance approach (MBA)
The declared results are based on purchased “green steel” produced via the EAF route using a mass-balance approach for the virtual allocation of 100 % scrap and green electricity. Unger steel monitors purchased and sold quantities including full traceability in its controlling systems. The correctness of the material balances is checked externally.

Additional Information
Number of the EPD acc. to EN15804+A2 for this product or product family: EPD-UNG-20240338-IBC1-DE

Comparability
Basically, a comparison or an evaluation of LCA results 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.

The *MLC* 2023.2 background database in the *LCA FE*-software version 10.7 was used to calculate the LCA.

LCA: Scenarios and additional technical information

Characteristic product properties of biogenic carbon
The declared product does not contain any biogenic carbon.

Information describing the biogenic carbon content at the factory gate

Name	Value	Unit
Biogenic carbon content in accompanying packaging	1.87	kg C
Biogenic carbon content in product	-	kg C

Note: 1 kg of biogenic carbon is equivalent to 44/12 kg of CO_2.

The carbon stored in the packaging was taken into account as "CO_2-neutral". Thus the storage effect of the carbon bound in the packaging is not included in the calculation but is considered as emitted immediately.

Installation into the building (A5)
The end-of-life of packaging materials is not declared in module A5

Name	Value	Unit
Packaging (wood)	3.01	kg
Packaging (cardboard)	1.33	kg
Packaging (steel strip)	0.07	kg

End of life (C1-C4)

Name	Value	Unit
Collected separately waste type (steel)	1000	kg
Recycling (95 %)	950	kg
Landfilling (5 %)	50	kg

Reuse, recovery and/or recycling potentials (D), relevant scenario information

Name	Value	Unit
Net flow	-260	kg

This scenario includes a steel recycling rate of 95 %. Since scrap is purchased in the upstream supply chain for the production of the purchased steel profiles, this is offset against the steel scrap for recycling ("net flow").

LCA: Results

The following table contains the LCA results for a declared unit of 1 t Steel²Zero rolled profile constructions made of steel produced via the EAF route considering a virtual allocation of 100 % scrap and green electricity (mass-balance approach).

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

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-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	MNR	MNR	MNR	MND	MND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1 ton Steel²Zero rolled profile constructions

Core Indicator	Core Indicator	Unit	A1-A3	C1	C2	C3	C4	D
GWP-total	Global warming potential - total	[kg CO_2-Eq.]	6,20E+02	0,00E+00	3,65E+00	0,00E+00	2,31E+00	4,49E+02
GWP-fossil	Global warming potential - fossil fuels	[kg CO_2-Eq.]	6,13E+02	0,00E+00	3,60E+00	0,00E+00	2,34E+00	4,52E+02
GWP-biogenic	Global warming potential - biogenic	[kg CO_2-Eq.]	6,71E+00	0,00E+00	8,24E-03	0,00E+00	-2,89E-02	-2,66E+00
GWP-luluc	GWP from land use and land use change	[kg CO_2-Eq.]	4,43E-01	0,00E+00	3,37E-02	0,00E+00	2,38E-03	6,01E-02
ODP	Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	2,53E-08	0,00E+00	4,74E-13	0,00E+00	3,86E-12	-6,07E-10
AP	Acidification potential, accumulated exceedance	[mol H^+-Eq.]	2,00E+00	0,00E+00	1,29E-02	0,00E+00	7,50E-03	1,11E+00
EP-freshwater	Eutrophication, fraction of nutrients reaching freshwater end compartment	[kg P-Eq.]	1,02E-03	0,00E+00	1,33E-05	0,00E+00	2,12E-06	1,05E-04
EP-marine	Eutrophication, fraction of nutrients reaching marine end compartment	[kg N-Eq.]	5,01E-01	0,00E+00	5,93E-03	0,00E+00	1,88E-03	1,78E-01
EP-terrestrial	Eutrophication, accumulated exceedance	[mol N-Eq.]	5,45E+00	0,00E+00	6,65E-02	0,00E+00	2,07E-02	1,59E+00
POCP	Formation potential of tropospheric ozone photochemical oxidants	[kg NMVOC-Eq.]	4,52E+00	0,00E+00	1,17E-02	0,00E+00	5,90E-03	7,21E-01
ADPE	Abiotic depletion potential for non-fossil resources	[kg Sb-Eq.]	2,34E-02	0,00E+00	2,41E-07	0,00E+00	6,40E-08	2,56E-03
ADPF	Abiotic depletion potential for fossil resources	[MJ]	8,80E+03	0,00E+00	4,96E+01	0,00E+00	3,49E+01	4,49E+03
WDP	Water (user) deprivation potential, deprivation-weighted water consumption (WDP)	[m³ world-Eq deprived]	8,06E+01	0,00E+00	4,40E-02	0,00E+00	-3,18E-02	3,05E+01

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; WDP = Water (user) deprivation potential

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1 ton Steel²Zero rolled profile constructions

Indicator	Indicator	Unit	A1-A3	C1	C2	C3	C4	D
PERE	Renewable primary energy as energy carrier	[MJ]	1,07E+04	0,00E+00	3,61E+00	0,00E+00	3,14E+00	-1,77E+02
PERM	Renewable primary energy resources as material utilization	[MJ]	5,65E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	Total use of renewable primary energy resources	[MJ]	1,07E+04	0,00E+00	3,61E+00	0,00E+00	3,14E+00	-1,77E+02
PENRE	Non-renewable primary energy as energy carrier	[MJ]	8,81E+03	0,00E+00	4,98E+01	0,00E+00	3,50E+01	4,50E+03
PENRM	Non-renewable primary energy as material utilization	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	Total use of non-renewable primary energy resources	[MJ]	8,81E+03	0,00E+00	4,98E+01	0,00E+00	3,50E+01	4,50E+03
SM	Use of secondary material	[kg]	1,32E+03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	-2,60E+02
RSF	Use of renewable secondary fuels	[MJ]	6,67E-25	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	Use of non-renewable secondary fuels	[MJ]	7,84E-24	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	Use of net fresh water	[m³]	2,77E+00	0,00E+00	3,95E-03	0,00E+00	3,94E-04	4,57E+01

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 – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1 ton Steel²Zero rolled profile constructions

Indicator	Indicator	Unit	A1-A3	C1	C2	C3	C4	D
HWD	Hazardous waste disposed	[kg]	-2,15E-06	0,00E+00	1,54E-10	0,00E+00	2,89E-09	3,36E-05
NHWD	Non-hazardous waste disposed	[kg]	4,32E+01	0,00E+00	7,59E-03	0,00E+00	5,01E+01	-5,44E+01
RWD	Radioactive waste disposed	[kg]	1,89E-01	0,00E+00	9,32E-05	0,00E+00	4,06E-04	-4,92E-04
CRU	Components for re-use	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	Materials for recycling	[kg]	0,00E+00	0,00E+00	0,00E+00	9,50E+02	0,00E+00	0,00E+00
MER	Materials for energy recovery	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EEE	Exported electrical energy	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EET	Exported thermal energy	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

Caption	HWD = Hazardous waste disposed; NHWD = 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

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: 1 ton Steel²Zero rolled profile constructions

Indicator	Indicator	Unit	A1-A3	C1	C2	C3	C4	D
PM	Potential incidence of disease due to PM emissions	[Disease Incidence]	ND	ND	ND	ND	ND	ND
IRP	Potential Human exposure efficiency relative to U235	[kBq U235-Eq.]	ND	ND	ND	ND	ND	ND
ETP-fw	Potential comparative toxic unit for ecosystems	[CTUe]	ND	ND	ND	ND	ND	ND
HTP-c	Potential comparative toxic unit for humans - cancerogenic	[CTUh]	ND	ND	ND	ND	ND	ND
HTP-nc	Potential comparative toxic unit for humans - not cancerogenic	[CTUh]	ND	ND	ND	ND	ND	ND
SQP	Potential soil quality index	[-]	ND	ND	ND	ND	ND	ND

Caption	PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); SQP = Potential soil quality index

The additional and optional impact categories according to EN 15804+A2 are not declared, as the uncertainty of these indicators is to be classified as high.

Disclaimer 1 – for the indicators 'abiotic depletion potential for non-fossil resources', 'abiotic depletion potential for fossil resources', 'water (user) deprivation potential, deprivation-weighted water consumption'.
The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high as there is limited experience with the indicator

Disclaimer 2 – Mass Balance Approach in the sense of a virtual allocation is not allowed within *EN15804+A2*. The underlaying calculation is oriented on the *EN15804* but uses allocation methods described in the chapter “Mass balance approach (MBA)”. IBU cannot guarantee that this document will be accepted as evidence by third parties.

References

Standards

EN 10025-1
EN 10025-1, Hot rolled products of structural steels - Part 1: General technical delivery conditions

EN 10210-1
EN 10210-1, Hot finished structural steel hollow sections - Part 1: General

EN 10219-1
EN 10219-1, Cold formed welded structural hollow sections of non-alloy and fine grain steels - Part 1: Technical delivery conditions

EN 15804
EN 15804:2012+A2:2019+AC:2021, Sustainability of construction works — Annex — Core rules for the product category of construction products.

ISO 14001
EN ISO 14001:2015, Environmental management systems — Requirements with guidance for use

ISO 14025
EN ISO 14025:2011, Environmental labels and declarations — Type III environmental declarations — Principles and procedures.

Further References

AVV
Waste Catalogue Ordinance (German designation: Abfallverzeichnisverordnung – AVV) of 10 December 2001 (Federal Law Gazette I p. 3379), last amended by Article 1 of the Ordinance of 30 June 2020 (Federal Law Gazette I p. 3005).

Candidate list
List of substances of very high concern (SVHC) for authorisation (ECHA Candidate List), 23.01.2024, published under Article 59(10) of REACH. Helsinki: European Chemicals Agency.

IBU 2021
Institut Bauen und Umwelt e.V.: General Instructions for the Annex programme of Institut Bauen und Umwelt e.V., Version 2.0, Berlin: Institut Bauen und Umwelt e.V., 2021
www.ibu-epd.com

LCA FE
LCA FE 10, LCA for Experts Software System and Database for Life Cycle Engineering. Version 10.7. Sphera, 1992-2023.

MLC
MLC 2023.2, Database for Life Cycle Engineering implemented in LCA for Experts software system. DB v10.7 2023.2. Sphera, 1992-2023. Available at: https://sphera.com/productsustainabilitygabidatasearch/.

Ordinance on Biocide Products
Regulation (EU) No 528/2012 of the European Parliament and of the Council of 22 May 2012 concerning the making available on the market and use of biocidal products.

PCR Part A
Product category rules for building-related products and services. Part A: Calculation rules for the life cycle assessment and requirements for the project report in accordance with EN 15804+A2:2019. Version 1.3. Berlin: Institut Bauen und Umwelt e.V. (eds.), 2022.

PCR: Structural steels
Institut Bauen und Umwelt e.V., 2023. Product category rules for building-related products and services. Part B: Requirements on the EPD for Structural steels. Version 4, 19.10.2023.

Institut Bauen und Umwelt e.V.	**Programme holder** Institut Bauen und Umwelt e.V. Hegelplatz 1 10117 Berlin Germany	Tel Fax Mail Web	+49 (0)30 - 3087748- 0 +49 (0)30 – 3087748 - 29 info@ibu-epd.com **www.ibu-epd.com**
Daxner&Merl sustainability strategy responsibility	**Author of the Life Cycle Assessment** Daxner & Merl GmbH Schleifmühlgasse 13/24 1040 Vienna Austria	Tel Mail Web	+43 676 849477826 office@daxner-merl.com **www. Daxner-merl.com**
UNGER	**Owner of the Declaration** Unger Stahlbau Ges.m.b.H. Steinamangerstraße 163 7400 Oberwart Austria	Tel Mail Web	+43 3352 33524-0 office.at@ungersteel.com **www.ungersteel.com**