Type III Environmental Product Declaration No. 407/2023

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Steel structures

Owner of the EPD:

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ITB is the verified member of The European Platform for EPD program operators and LCA practitioner www.eco-platform.org

Basic information

This declaration is the Type III Environmental Product Declaration (EPD) based on EN 15804+A2 and verified according to ISO 14025 by an external auditor. It contains the information on the impacts of the declared construction materials on the environment and their aspects verified by the independent body according to ISO 14025. Basically, comparison or evaluation of EPD data is possible only if all the compared data were created according to EN 15804+A2.

Life cycle analysis (LCA): A1-A5, C1-C4 and D modules in accordance with EN 15804
(Cradle-to-Gate with options)
The year of preparing the EPD: 2022
Product standard: EN 1090-1 and 2
Service Life: 100 years
PCR: ITB-PCR A
Declared unit: 1 ton
Reasons for performing LCA: B2B
Representativeness: Polish, European, 2021/2022

MANUFACTURER

The company KSH (previously Konstrukcje Stalowe Hyżyk) based in Śrem (Poland) started its activity in 1978, starting the first works in its machine park. It has been operating in its current legal form since 2008. Since then, the plant has been constantly developing, expanding the range of products and services offered, and the projects completed on time allow to increase the group of satisfied domestic and foreign customers. KSH specializes in designing, manufacturing, anti-corrosion protection and assembly of steel structures of buildings. The company has experience in implementing such projects as: production and storage halls, industrial and energy facilities, public utility facilities (airports, stations, shopping malls, sports centers), infrastructural facilities (bridges, flyovers, viaducts and footbridges, acoustic screens), military facilities, specialized constructions (traverses, cranes, feeders). The company supplies manufactured steel structures to the domestic and European markets. For the building industry company offers an extended range of materials which include the section steel and steel elements like: steel poles as a supporting structure, beams, steel structures for industrial construction, light steel structures, steel frames and frames, beams, structures according to customer needs, a full range of solutions is available to meet specific performance specifications.

PRODUCTS DESCRIPTION AND APPLICATION

The steel products covered by this EPD have a number of different applications in construction sector. The actual technical documents related to the products are available on website https://steel.ksh.pl/en/range-of-products-and-services. Set of products covered by this EPD is shown in Table 1.

Table 1. Construction steel products offered by KSH Steel Sp. z o.o.

Product type	Grade	Standard
Plates, I-sections, flat bars, bars, channels, angles, T-bars.	S235/S355	EN 1090-2
Steel beams and columns	S235/S355	EN 1090-2
Construction sections	S235/S355	EN 1090-2

Selected products (Table 1) are commonly used as: steel beams, main structure, angle bars, pipes, bars, backings, braces, purlins, transoms, adapters, braces, parapets, trusses, diagonals, frames, brackets, trusses, hangers, pillars, balustrades, stairs, ladders, bolts, supports, connectors, girders, brackets, fittings, belts, platforms, bolts, skylights, handles, trusses, replacements and struts, suspensions and other structural elements within the scope of a given construction.

LIFE CYCLE ASSESSMENT (LCA) – general rules applied

Unit

The declared unit is 1 ton.

System boundary

The life cycle analysis of the declared products covers “Product Stage” A1-A3, A4-A5, C1-C4+D modules in accordance with EN 15804 and ITB PCR A (cradle to gate with options). Energy and water consumption, emissions as well as information on generated wastes were inventoried in manufacturing plant and were included in the calculation. It can be assumed that the total sum of omitted processes does not exceed 2% of all impact categories. In accordance with EN 15804+A2, machines and facilities (capital goods) required for the production as well as transportation of employees were not included in LCA.

Allocation

The allocation rules used for this EPD are based on general ITB’s document PCR A. Production of the covered steel products is a tree process (as presented in Figure 1) conducted in the manufacturing plant located in Śrem (Poland). Input and output data from the production is inventoried and allocated to the production on the mass basis. The declaration covers a wide range of products. Their production resources and processing stages are basicly similar, so it is possible to average the production by product weight.

System limits

Minimum 99.0% input materials and 100% energy consumption (electricity, LPG, other) were inventoried in a processing plant and were included in the calculation. In the assessment, all significant parameters from gathered production data are considered, i.e. all material used per formulation, utilized thermal energy, and electric power consumption, direct production waste and available emission measurements. Tires consumption for transport was not considered. Selected input substances with a percentage share of less than 0.1% of total mass were excluded from the calculations. The packaging products (wooden pallets) are included.

Modules A1 and A2: *Raw materials supply and transport*

The modules A1 and A2 represent the extraction and processing of raw materials (mainly steel elements) and transport to the production site. The steel input are semi-products commonly used to produce prefabricated elements, skeleton frames, steel structures. Steel used comes from a specific suppliers (75% covered by EPDs) producing steel with EAF technology and partly BOF. For A2 module (transport) European averages for fuel data are applied. A2 is based on producer’s transport declaration.

Module A3: *Production*

The product specific manufacturing process line is presented in Figure 1, an input steel/semi-product is processed to a dedicated shape. Electricity are consumed in the process. The part of the product are galvanized using hot-dip and immersion methods, and painted. In the production process, technical gases and materials for welding elements are used (and included).

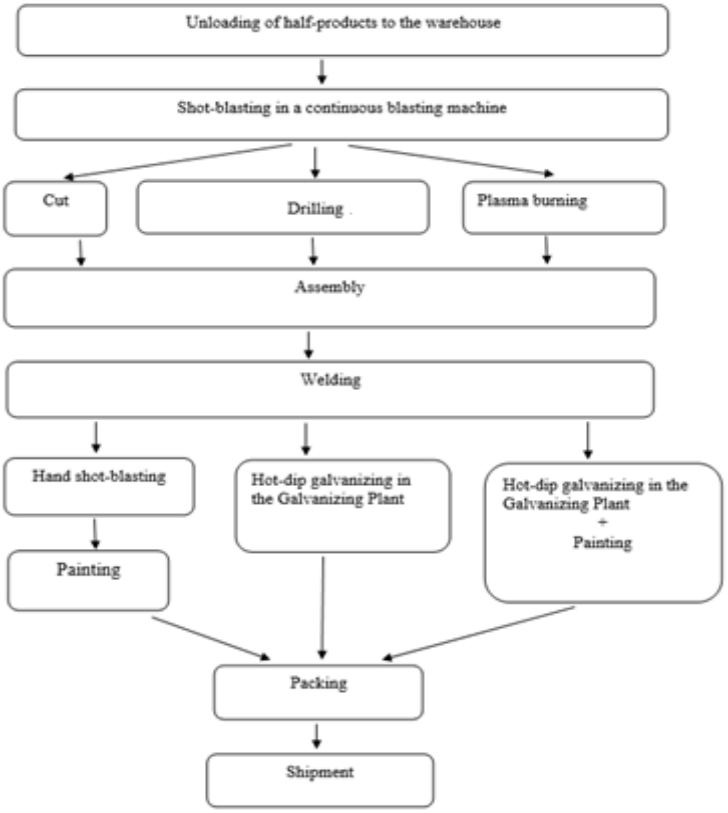

Fig. 1. A basic scheme of the steel product manufacturing process

Module A4-A5: Transport to construction site, installation

Transport to the customer over a distance of 700 km was assumed, > 16t lorry, EURO 5, with a 100% load capacity (35 l/100 km oil consumption). Installation is carried out using a crane and electrical equipment.

Modules *C1-C4 and D: End-of-life (EOL)*

Due to the fact that the declaration covers a wide range of steel products for various purposes and usage scenarios, it is not possible to directly specify the de-construction technology and the amount of energy for disassembly in C1 module (so this module is very generic based on literature). In the adapted end-of-life scenario, the de-constructed steel products are transported to a steel mill distant by 100 km on > 16t lorry EURO 5 where are used as steel scrap to produce a new steel. The recycling potential of C3 module is 98% and it is assumed that only 2% of the products will end up in a landfill – C4 module (Table 2). Module D presents credits resulting from the recycling of the steel scrap, calculated in accordance with the approach developed by World Steel Association.

Table 2. End-of-life scenario for the steel products

Material	Material recovery	Recycling	Landfilling
Steel scrap	100%	98%	2%

Electricity at end-of-life (module C) has been modelled using an average Polish electricity mix as the location where the product reaches end-of-life is unknown.

Data collection period

The data for manufacture of the declared products refer to period between 01.09.2021 – 01.10.2022 (1 year). The life cycle assessments were prepared for Poland and Europe as reference area.

Data quality

The data selected for LCA originate from ITB-LCI questionnaires completed by KSH Steel using the inventory data, ITB and Ecoinvent v.3.9 database. No specific data collected is older than five years and no generic datasets used are older than ten years. The representativeness, completeness, reliability, and consistency are judged as good. The background data for the processes comes from the following databases: Ecoinvent v.3.9 (welding process, galvanizing process, transport, energy carriers, heat, diesel, paints, other) and KOBiZE (Polish electricity mix and combustion factors for fuels). For steel input materials a specific EPDs were used (covering 75% of input data) and for 25% is generic. KOBiZE data is supplemented with Ecoinvent data on the national electricity mix impact where no specific indicator data is provided. Specific (LCI) data quality analysis was a part of the input data verification. The time related quality of the data used is valid (5 years).

Assumptions and estimates

The impacts of the representative of the steel products were aggregated using weighted average.

Calculation rules

LCA was performed using ITB-LCA tool developed in accordance with EN 15804+A2. Emission of greenhouse gases was calculated using the IPCC 2013 GWP method with a 100-year horizon. Emission of acidifying substances, Emission of substances to water contributing to oxygen depletion, Emission of gases that contribute to the creation of ground-level ozone, Abiotic depletion, and ozone depletion emissions where all calculated with the CML-IA baseline method

Additional information

Polish electricity mix used is 0.698 kg CO_2/kWh (KOBiZE).

LIFE CYCLE ASSESSMENT (LCA) – Results

Declared unit

The declaration refers to declared unit (DU) – 1 ton of the specific steel structures manufactured by KSH Steel Sp. z o.o.

Table 3. System boundaries for the environmental characteristic of the steel structures

Environmental assessment information (MD – Module Declared, MND – Module Not Declared, INA – Indicator Not Assessed)																
Product stage			Construction process		Use stage							End of life				Benefits and loads beyond the system boundary
Raw material supply	Transport	Manufacturing	Transport to construction site	Construction-installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction 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**
MD	**MD**	**MD**	**MD**	**MD**	**MND**	**MND**	**MND**	**MND**	**MND**	**MND**	**MND**	**MD**	**MD**	**MD**	**MD**	**MD**

Table 4. Life cycle assessment (LCA) results of the steel products manufactured by KSH Steel Sp. z o.o. – environmental impacts (DU: 1 ton)

Indicator	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Global Warming Potential	eq. kg CO_2	1.40E+03	1.84E+01	3.89E+02	1.80E+03	4.25E+01	6.98E+04	6.98E+00	8.34E+00	1.64E+01	1.06E-01	-4.09E+02
Greenhouse gas potential - fossil	eq. kg CO_2	1.37E+03	1.83E+01	3.49E+02	1.74E+03	4.25E+01	6.85E+04	0.00E+00	8.31E+00	1.63E+01	1.05E-01	-4.00E+02
Greenhouse gas potential - biogenic	eq. kg CO_2	-9.55E+00	6.25E-02	3.99E+01	3.04E+01	3.98E-01	2.00E+03	0.00E+00	2.84E-02	5.57E-02	2.68E-04	-1.29E+01
Global warming potential - land use and land use change	eq. kg CO_2	3.35E+01	7.18E-03	1.98E-01	3.37E+01	4.57E-02	2.40E+01	0.00E+00	3.26E-03	6.39E-03	9.94E-05	-3.97E-01
Stratospheric ozone depletion potential	eq. kg CFC 11	1.98E-05	4.23E-06	2.14E-05	4.54E-05	2.69E-05	1.40E-03	0.00E+00	1.92E-06	3.77E-06	4.26E-08	2.78E-05
Soil and water acidification potential	eq. mol H+	9.67E+00	7.42E-02	4.38E+00	1.41E+01	4.72E-01	7.60E+02	5.30E-02	3.37E-02	6.61E-02	9.90E-04	-4.17E+00
Eutrophication potential - freshwater	eq. kg P	1.13E+00	1.23E-03	6.00E-01	1.73E+00	7.82E-03	1.30E+02	0.00E+00	5.59E-04	1.10E-03	9.81E-06	-5.42E-01
Eutrophication potential - seawater	eq. kg N	1.47E+00	2.24E-02	3.55E+00	5.05E+00	1.43E-01	1.10E+02	0.00E+00	1.02E-02	2.00E-02	3.45E-04	-4.21E-01
Eutrophication potential - terrestrial	eq. mol N	1.27E+01	2.44E-01	8.31E+00	2.13E+01	1.56E+00	9.30E+02	0.00E+00	1.11E-01	2.18E-01	3.77E-03	-2.21E+00
Potential for photochemical ozone synthesis	eq. kg NMVOC	4.73E+00	7.48E-02	1.72E+00	6.53E+00	4.76E-01	2.60E+02	0.00E+00	3.40E-02	6.67E-02	1.10E-03	7.34E-01
Potential for depletion of abiotic resources - non-fossil resources	eq. kg Sb	2.06E-03	6.48E-05	7.83E-03	9.95E-03	4.12E-04	3.34E-01	1.77E-07	2.95E-05	5.77E-05	2.42E-07	1.68E-02
Abiotic depletion - fossil fuels	MJ	1.45E+04	2.71E+02	5.32E+03	2.01E+04	1.73E+03	1.16E+06	0.00E+00	1.23E+02	2.42E+02	2.89E+00	-5.92E+03
Water deprivation potential	eq. m^3	3.03E+02	1.25E+00	7.57E+02	1.06E+03	7.99E+00	2.40E+04	0.00E+00	5.70E-01	1.12E+00	9.16E-03	-1.45E+01

Table 5. Life cycle assessment (LCA) results of the steel products manufactured by KSH Steel Sp. z o.o. – additional impacts indicators (DU: 1 ton)

Indicator	Unit	A1	A2	A3	A4-A5	C1-C2	C3	C4	D
Particulate matter	disease incidence	INA	INA	INA	INA	INA	INA	INA	INA
Potential human exposure efficiency relative to U235	eg. kBq U235	INA	INA	INA	INA	INA	INA	INA	INA
Potential comparative toxic unit for ecosystems	CTUe	INA	INA	INA	INA	INA	INA	INA	INA
Potential comparative toxic unit for humans (cancer effects)	CTUh	INA	INA	INA	INA	INA	INA	INA	INA
Potential comparative toxic unit for humans (non-cancer effects)	CTUh	INA	INA	INA	INA	INA	INA	INA	INA
Potential soil quality index	dimensionless	INA	INA	INA	INA	INA	INA	INA	INA

Table 6. Life cycle assessment (LCA) results of the steel products manufactured by KSH Steel Sp. z o.o.- the resource use (DU: 1 ton)

Indicator	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Consumption of renewable primary energy - excluding renewable primary energy sources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA	INA	INA
Consumption of renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA	INA	INA
Total consumption of renewable primary energy resources	MJ	1.83E+03	3.89E+00	3.91E+02	2.23E+03	2.48E+01	8.60E+04	1.52E-07	1.77E+00	3.47E+00	2.51E-02	-5.86E+02
Consumption of non-renewable primary energy - excluding renewable primary energy sources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA	INA	INA
Consumption of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA	INA	INA
Total consumption of non-renewable primary energy resources	MJ	1.57E+04	2.71E+02	5.39E+03	2.13E+04	1.73E+03	1.16E+06	0.00E+00	1.23E+02	2.42E+02	2.89E+00	-7.12E+03
Consumption of secondary materials	kg	7.80E+02	9.10E-02	3.19E+00	7.84E+02	5.79E-01	1.06E+02	0.00E+00	4.14E-02	8.11E-02	6.07E-04	6.09E+02
Consumption of renewable secondary fuels	MJ	1.27E+03	1.00E-03	8.38E-03	1.27E+03	6.38E-03	5.91E-01	9.00E-13	4.56E-04	8.93E-04	1.59E-05	-1.29E+03
Consumption of non-renewable secondary fuels	MJ	2.30E-01	0.00E+00	3.00E+00	3.23E+00	0.00E+00	9.39E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-2.35E-01
Net consumption of freshwater resources	m^3	6.92E+00	3.41E-02	1.51E+02	1.58E+02	2.17E-01	3.15E+02	0.00E+00	1.55E-02	3.04E-02	3.16E-03	-1.50E+00

Table 7. Life cycle assessment (LCA) results of the steel products manufactured by KSH Steel Sp. z o.o.– waste categories (DU: 1 ton)

Indicator	Unit	A1	A2	A3	A1-A3	A4	A4	C1	C2	C3	C4	D
Hazardous waste	kg	1.02E+00	3.05E-01	5.07E+00	6.39E+00	1.94E+00	1.20E+01	0.00E+00	1.38E-01	2.71E-01	3.07E-03	-1.03E+01
Non-hazardous waste	kg	3.14E+01	5.41E+00	2.36E+01	6.04E+01	3.44E+01	6.24E+02	0.00E+00	2.46E+00	4.82E+00	4.32E-02	-4.01E+02
Radioactive waste	kg	6.50E-01	2.03E-05	8.52E-03	6.58E-01	1.29E-04	8.70E-01	7.83E-18	9.21E-06	1.81E-05	1.92E-05	-6.49E-01
Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	kg	2.15E+01	8.40E-04	1.50E+02	1.71E+02	5.35E-03	1.20E+00	0.00E+00	3.82E-04	7.49E-04	5.78E-06	0.00E+00
Materials for energy recovery	kg	8.89E+01	6.80E-06	1.39E-04	8.89E+01	4.32E-05	1.05E-02	0.00E+00	3.09E-06	6.05E-06	6.85E-08	0.00E+00

Verification

The process of verification of this EPD is in accordance with ISO 14025 and ISO 21930. After verification, this EPD is valid for a 5-year-period. EPD does not have to be recalculated after 5 years, if the underlying data have not changed significantly.

The basis for LCA analysis was EN 15804 and ITB PCR A
Independent verification corresponding to ISO 14025 (subclause 8.1.3.) ☒ external ☐ internal
External verification of EPD: Halina Prejzner, PhD. Eng. LCA, LCI audit and input data verification: Michał Piasecki, PhD., D.Sc., Eng.

Note: The declaration owner has the sole ownership, liability, and responsibility for the declaration. Declarations within the same product category but from different programmes may not be comparable. Declarations of construction products may not be comparable if they do not comply with EN 15804. For further information about comparability, see EN 15804 and ISO 14025

Signature Not Verified
Dokument podpisany przez
Michał Piasecki ITB
Data: 2023.01.20 11:43:18 CET

Normative references

- ITB PCR A General Product Category Rules for Construction Products
- EN 1090-2:2018 - Execution of steel structures and aluminium structures - Technical requirements for steel structures
- PN-EN 1090-1+A1:2012 - Wykonanie konstrukcji stalowych i aluminiowych -- Część 1: Zasady oceny zgodności elementów konstrukcyjnych
- ISO 14025:2006, Environmental labels and declarations – Type III environmental declarations – Principles and procedures
- ISO 21930:2017 Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services
- ISO 14044:2006 Environmental management – Life cycle assessment – Requirements and guidelines
- ISO 15686-1:2011 Buildings and constructed assets – Service life planning – Part 1: General principles and framework
- ISO 15686-8:2008 Buildings and constructed assets – Service life planning – Part 8: Reference service life and service-life estimation
- EN 15804:2012+A2:2019 Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products
- ISO 14067:2018 Greenhouse gases — Carbon footprint of products — Requirements and guidelines for quantification
- PN-EN 15942:2012 Sustainability of construction works – Environmental product declarations – Communication format business-to-business
- ISO 20915:2018 Life cycle inventory calculation methodology for steel products
- KOBiZE Wskaźniki emisyjności CO_2, SO_2, NO_x, CO i pyłu całkowitego dla energii elektrycznej. December 2021
- World Steel Association 2017 Life Cycle inventory methodology report for steel products

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CERTIFICATE № 407/2022
of TYPE III ENVIRONMENTAL DECLARATION

Product:
Steel structures

Manufacturer:
KSH STEEL Sp. z o.o.
ul. Grunwaldzka 27C, 63-100 Śrem, Poland

confirms the correctness of the data included in the development of
Type III Environmental Declaration and accordance with the requirements of the standard

EN 15804

Sustainability of construction works.
Environmental product declarations.
Core rules for the product category of construction products.

This certificate, issued for the first time on 13th January 2023 is valid for 5 years
or until amendment of mentioned Environmental Declaration

Head of the Thermal Physic, Acoustics and Environment Department
Agnieszka Winkler-Skalna, PhD

INSTYTUT TECHNIKI BUDOWLANEJ

Deputy Director for Research and Innovation
Krzysztof Kuczyński, PhD

Warsaw, January 2023