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Steel structures



Owner of the EPD:

Zekon Sp. z o. o.
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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: 2023

Product standard: EN 1090-1, EN 1090-2, EN 1990

Service Life: 50 years

PCR: ITB-PCR A

Declared unit: 1 ton

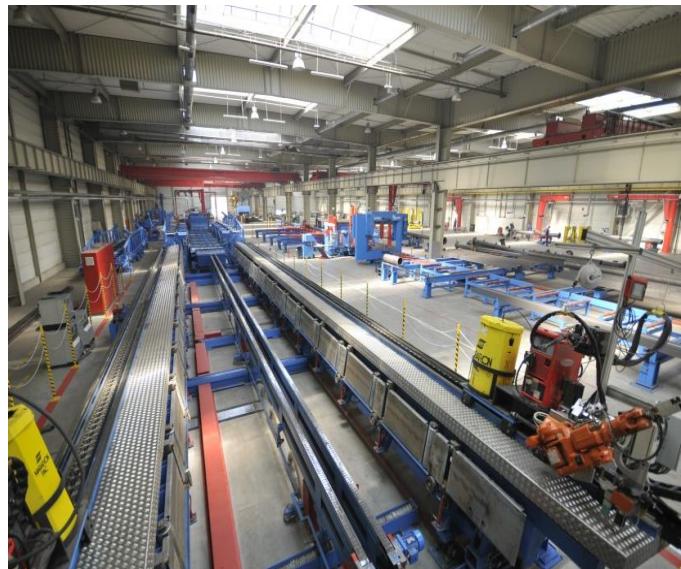
Reasons for performing LCA: B2B

Representativeness: Polish, European, 2022

MANUFACTURER

ZEKON Sp. z o.o. derived from the well-known Austrian Zeman group based in Vienna, was established 30 years ago. With the name Zekon Sp. z o. o. has been associated since 2008.

- Zekon is a company that prefabricates steel structures for industrial halls, power plant, cement plant, waste incineration plant warehouses, sports and commercial facilities. It also deals with steel structures in the energy and petrochemical sectors. The Zekon company has its headquarters and manufacturing plant in Ruda Śląska (Poland). Zekon undertaken a large number of projects in Poland, as well as in European and world countries such as e.g. USA, Ghana or Mali. Steel constructions in Poland, made in cooperation with the Zekon company, include: the PKP railway station in Katowice, the PKP railway station in Łódź, the PKP railway station in Gliwice as well as the MCK in Katowice or the stadium in Tychy. Thanks to modern machines and devices, Zekon has the ability to prefabricate structurally very complex elements while maintaining high quality requirements while ensuring the delivery deadlines. Steel structures are manufactured in a hall with an area of 9,500 m² (190m x 50m). Anti-corrosion protection is applied in a modern paint shop with an area of 750 m² with a 4-zone ventilation system that allows painting/drying construction elements for four different projects at the same time. The production capacity is about up to 1700 Mg/month. Factory in Ruda Śląska produces on the basis of : I-beams with corrugated web SIN, hot rolled sections, welded sections, and cold-formed sections.



The entire production process from the beginning of the company's existence has been based on electronic data transmission.

This applies to both workshop documentation and data transmission to production machines. Dedicated software from the Belgian company VVTW is used to manage production processes. The company has an internal computer network used to exchange data between individual departments, record and analyze production data and generate the necessary documents. The existing IT system also ensures the storage and archiving of documents, documentation and data.

Production lines operating in the company:

- robotic production line for SIN profiles
- SBA robotic production line for assembly and welding of steel structures
- saw drill
- burners - plasma and autogenic
- preparation sheet metal strips
- steel profile drilling line

They are programmed and managed centrally from the Production Preparation Department. The exchange of inquiries, offers, documentation and data with external customers takes place via the Internet.

PRODUCTS DESCRIPTION AND APPLICATION

EPD no 454/2023 covers steel structures of industrial halls, warehouses, sports and commercial facilities manufactured by Zekon. Product's standard length is 12 m, max length up to 24 m, with steel class EXC4, EXC3, EXC2, EXC1 in accordance with PN EN 1090-1 and 2. Anti-corrosion: painting or hot dip galvanization in accordance with standard EN ISO 1461:2023-02. The welding processes carried out are supervised in accordance with the provisions of the Welding Quality System Book in accordance with the requirements of the PN-EN ISO 3834-2 standard. The necessary technical documentation of covered products is available for download at the link <https://www.zekon.pl/pl/sin-system/dokumenty-do-pobrania/>

LIFE CYCLE ASSESSMENT (LCA) – general rules applied

Unit

The declared unit is 1 ton of steel product (averaged).

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+A2 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 v1.6. Prefabrication of steel structures is a line process (as presented in Figure 1) conducted in the manufacturing plant located in Ruda Śląska (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 basically 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, foils) 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. Steel used comes from a specific suppliers (95% 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 (LCI).

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 (including welding). Electricity are consumed in the process. The part of the product are galvanized using hot-dip and immersion methods, and painting. In the production process, technical gases and materials for welding elements are used (and included).

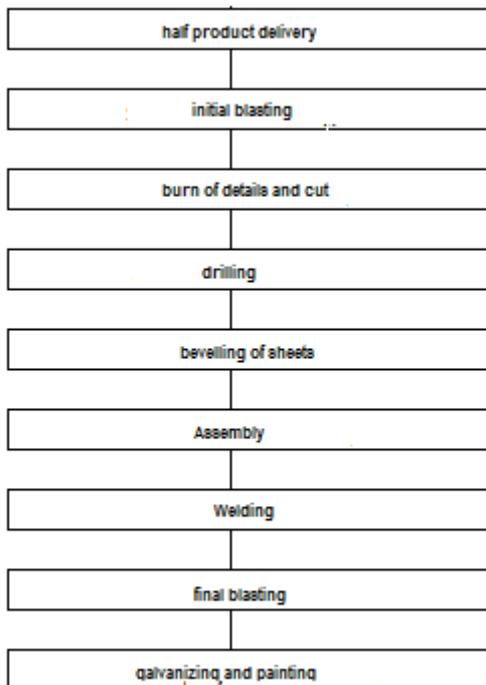


Fig. 1. A basic scheme of the steel product manufacturing process

Module A4-A5: Transport to construction site

Transport to the customer over a distance of 500 km was assumed, > 16t lorry, EURO 5, with a 100% load capacity (35 l/100 km oil consumption). -

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 exact amount of energy for disassembly in C1 module (so this module is assessed as 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 steel scrap approach developed by World Steel Association.

Table 1. End-of-life scenario for the steel products

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

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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 01.01.2022 – 01.12.2022 (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 Zekon 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 95% of input data) and for 5% 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 CO₂/kWh (KOBiZE). The products do not provide any emissions or negative impact on health.

LIFE CYCLE ASSESSMENT (LCA) – Results

Declared unit

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

Table 2. System boundaries for the environmental characteristic of the steel elements

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

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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

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Table 3. Life cycle assessment (LCA) results of the steel products manufactured by Zekon 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	1.29E+03	8.34E+00	1.24E+02	1.42E+03	8.34E+01	6.10E+01	0.00E+00	1.67E+01	1.64E+01	1.06E-01	-6.20E+02
Greenhouse gas potential - fossil	eq. kg CO ₂	1.30E+03	8.31E+00	1.19E+02	1.43E+03	8.31E+01	6.00E+01	0.00E+00	1.66E+01	1.63E+01	1.05E-01	-6.08E+02
Greenhouse gas potential - biogenic	eq. kg CO ₂	-1.20E+01	2.84E-02	4.71E+00	-7.25E+00	2.84E-01	1.00E+00	0.00E+00	5.68E-02	5.57E-02	2.68E-04	-1.24E+01
Global warming potential - land use and land use change	eq. kg CO ₂	3.76E-01	3.26E-03	2.67E-01	6.46E-01	3.26E-02	1.20E-02	0.00E+00	6.52E-03	6.39E-03	9.94E-05	-4.23E-01
Stratospheric ozone depletion potential	eq. kg CFC 11	6.33E-05	1.92E-06	1.65E-05	8.17E-05	1.92E-05	7.00E-07	0.00E+00	3.85E-06	3.77E-06	4.26E-08	2.00E-05
Soil and water acidification potential	eq. mol H ₊	9.89E+00	3.37E-02	1.16E+01	2.15E+01	3.37E-01	9.35E-01	5.30E-02	6.75E-02	6.61E-02	9.90E-04	-4.99E+00
Eutrophication potential - freshwater	eq. kg P	1.48E+00	5.59E-04	1.05E-01	1.59E+00	5.59E-03	6.50E-02	0.00E+00	1.12E-03	1.10E-03	9.81E-06	-6.32E-01
Eutrophication potential - seawater	eq. kg N	1.54E+00	1.02E-02	5.74E-01	2.12E+00	1.02E-01	3.46E-01	0.00E+00	2.04E-02	2.00E-02	3.45E-04	-6.01E-01
Eutrophication potential - terrestrial	eq. mol N	1.43E+01	1.11E-01	4.93E+01	6.37E+01	1.11E+00	3.66E+00	0.00E+00	2.22E-01	2.18E-01	3.77E-03	-4.18E+00
Potential for photochemical ozone synthesis	eq. kg NMVOC	5.00E+00	3.40E-02	6.40E-01	5.67E+00	3.40E-01	9.19E-01	0.00E+00	6.80E-02	6.67E-02	1.10E-03	-2.92E-01
Potential for depletion of abiotic resources - non-fossil resources	eq. kg Sb	2.56E-03	2.95E-05	3.83E-02	4.09E-02	2.95E-04	1.67E-04	1.77E-07	5.89E-05	5.77E-05	2.42E-07	1.32E-02
Abiotic depletion - fossil fuels	MJ	1.58E+04	1.23E+02	1.96E+03	1.79E+04	1.23E+03	5.80E+02	0.00E+00	2.47E+02	2.42E+02	2.89E+00	-7.70E+03
Water deprivation potential	eq. m ³	3.06E+02	5.70E-01	1.18E+02	4.24E+02	5.70E+00	1.23E+01	0.00E+00	1.14E+00	1.12E+00	9.16E-03	-5.25E+01

Table 4. Life cycle assessment (LCA) results of the steel products manufactured by Zekon – 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	eq. 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

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Table 5. Life cycle assessment (LCA) results of the steel products manufactured by Zekon 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										
Consumption of renewable primary energy resources used as raw materials	MJ	INA										
Total consumption of renewable primary energy resources	MJ	2.09E+02	1.77E+00	1.38E+00	2.12E+02	1.77E+01	4.30E+01	0.00E+00	3.54E+00	3.47E+00	0.00E+00	-7.32E+02
Consumption of non-renewable primary energy - excluding renewable primary energy sources used as raw materials	MJ	INA										
Consumption of non-renewable primary energy resources used as raw materials	MJ	INA										
Total consumption of non-renewable primary energy resources	MJ	1.71E+04	1.23E+02	2.11E+03	1.94E+04	1.23E+03	5.82E+02	0.00E+00	2.47E+02	2.42E+02	2.89E+00	-8.84E+03
Consumption of secondary materials	kg	7.97E+02	4.14E-02	3.82E-02	7.97E+02	4.14E-01	5.30E-02	0.00E+00	8.27E-02	8.11E-02	6.07E-04	-6.36E+02
Consumption of renewable secondary fuels	MJ	3.36E+03	4.56E-04	8.77E-05	3.36E+03	4.56E-03	2.95E-04	9.00E-13	9.11E-04	8.93E-04	1.59E-05	-1.29E+03
Consumption of non-renewable secondary fuels	MJ	6.11E-01	0.00E+00	1.72E-03	6.12E-01	0.00E+00	4.70E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-2.35E-01
Net consumption of freshwater resources	m ³	9.42E+00	1.55E-02	3.39E+00	1.28E+01	1.55E-01	1.58E-01	0.00E+00	3.10E-02	3.04E-02	3.16E-03	5.90E-02

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Table 6. Life cycle assessment (LCA) results of the steel products manufactured by Zekon - waste categories (DU: 1 ton)

Indicator	Unit	A1	A2	A3	A1-A3	A4	A4	C1	C2	C3	C4	D
Hazardous waste	kg	2.70E-02	1.38E-01	5.01E-01	6.66E-01	1.38E+00	6.00E-03	0.00E+00	2.77E-01	2.71E-01	3.07E-03	-1.03E+01
Non-hazardous waste	kg	5.97E-01	2.46E+00	1.86E+01	2.16E+01	2.46E+01	3.12E-01	0.00E+00	4.92E+00	4.82E+00	4.32E-02	-3.80E+02
Radioactive waste	kg	1.54E-02	9.21E-06	8.33E-03	2.37E-02	9.21E-05	4.35E-04	7.83E-18	1.84E-05	1.81E-05	1.92E-05	-6.49E+00
Components for re-use	kg	0.00E+00										
Materials for recycling	kg	6.71E-01	3.82E-04	1.67E+00	2.34E+00	3.82E-03	6.00E-04	0.00E+00	7.64E-04	7.49E-04	5.78E-06	0.00E+00
Materials for energy recovery	kg	2.36E-01	3.09E-06	1.42E-06	2.36E-01	3.09E-05	5.25E-06	0.00E+00	6.18E-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

Normative references

- ITB PCR A v 1.6. General Product Category Rules for Construction Products, 2023
- EN 1090-1 Execution of steel and aluminium structures Part 1: Requirements for conformity assessment of structural components
- 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 emisjyjności CO₂, SO₂, NO_x, CO i pyłu całkowitego dla energii elektrycznej. December 2021
- World Steel Association 2017 Life Cycle inventory methodology report for steel products



Thermal Physics, Acoustics and Environment Department
02-656 Warsaw, Ksawerów 21

CERTIFICATE № 454/2023 of TYPE III ENVIRONMENTAL DECLARATION

Products:

Steel structures

Manufacturer:

Zekon Sp. z o.o.

ul. Szyb Walenty 103, 41-700 Ruda Śląska, Polska

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+A2

Sustainability of construction works.

Environmental product declarations.

Core rules for the product category of construction products.

This certificate, issued on 19th May 2023 is valid for 5 years
or until amendment of mentioned Environmental Declaration

Head of the Thermal Physics, Acoustics
and Environment Department


Agnieszka Winkler-Skalna, PhD



Deputy Director
for Research and Innovation

Krzysztof Kulczyński, PhD

Warsaw, May 2023