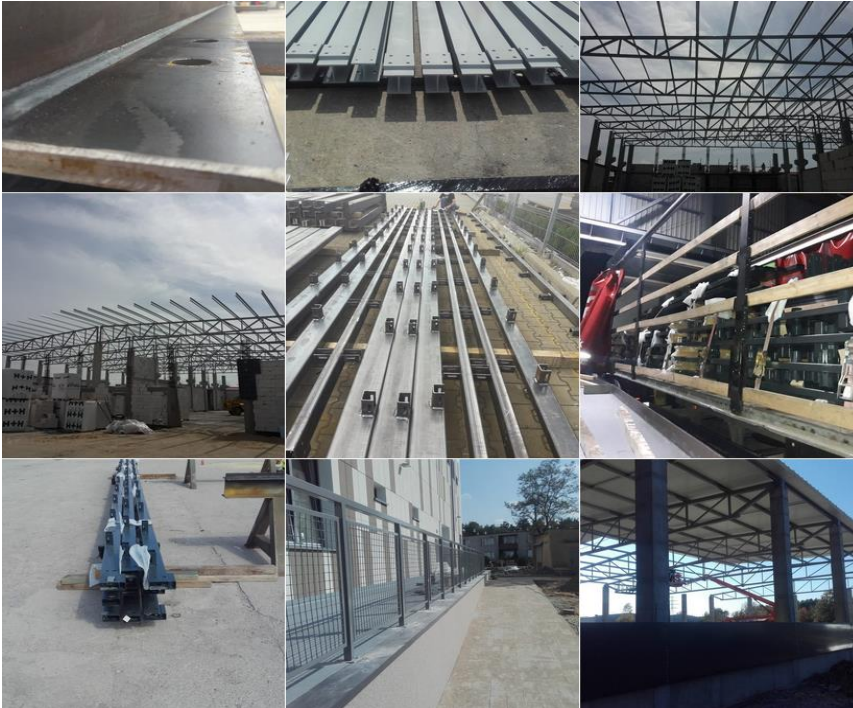




Issuance date: 24.04.2023  
Validity date: 24.04.2028

## Steel tube piles and structural steel pillars



### Owner of the EPD:

Stal&System Sp. z o.o.  
Address: Ul. Kowalewska 20  
87-122 Grębocin, Poland  
Tel.: +48 668 470 643  
Website: <http://stalsystem.pl/>  
Contact: [kontakt@stalsystem.pl](mailto:kontakt@stalsystem.pl)

### EPD Program Operator:

Instytut Techniki Budowlanej (ITB)  
Address: Filtrowa 1,  
00-611 Warsaw, Poland  
Website: [www.itb.pl](http://www.itb.pl)  
Contact: Michał Piasecki  
[m.piasecki@itb.pl](mailto:m.piasecki@itb.pl)  
[energia@itb.pl](mailto:energia@itb.pl)

ITB is the verified member of The European Platform for EPD program operators and LCA practitioner [www.eco-platform.org](http://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 10219, EN 10034

**Service Life:** 50 years

**PCR:** ITB-PCR A

**Declared unit:** 1 ton

**Reasons for performing LCA:** B2B

**Representativeness:** Polish, European, 2022

## **MANUFACTURER**

Stal&System has been welded steel constructions manufacturer since 2007 with a manufacturing plant located at Grębocin, Poland. Since 2017, it has been operating as Stal&System Ltd. The implementation of factory production controlling system allows to provide steel constructions to class EXC3, according to the standard EN 1090-2:2008+A1:2006 and welding quality system in accord. with the EN ISO 3834-2:2005. 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, a full range of solutions is available to meet specific performance specifications. Products are available in various sizes, shape and length dependent on project requirements and design. Dimension of basement tubes varies from D48 mm to D219 mm and thickness of tube wall varies from 2,6 to 20 mm. Top plate of a tube as well as the footplate of pillar has thickness from 10 to 40 mm and cross-section area from 0,01 to 0,25 m<sup>2</sup>. Pillar beams can be manufactured as 8 to 20 mm flat bar or any other standard beam profile, like HEA, HEB, IPE, UPE, UPN 100-360. Length of a tube as well as of a pillar can vary from 500 mm to 12000 mm. Intended use of products is: road infrastructure, installation of acoustic barriers; overhead power lines, building construction, basements for houses and commercial buildings, fences.

## **PRODUCTS DESCRIPTION AND APPLICATION**

Product mainly consists of two parts: base tube and pillar, which are fastened together with bolts. Base tube is a long hollow steel structure which meets requirements of standard EN 10219 or, in case product has a top plate, - EN 10210. Pillar is made from steel profile beam in accordance with the standard EN 10034 and flat bars welded with footplate. Pillars and basement tubes consist of steel S355J2 as per EN 10025. Steel is protected against corrosion by hot dip galvanization in accordance with standard EN ISO 1461:2023-02.



### LIFE CYCLE ASSESSMENT (LCA) – general rules applied

#### Unit

The declared unit is 1 ton of steel tube piles and structural steel pillars (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. Production of the covered steel products is a line process (as presented in Figure 1) conducted in the manufacturing plant located in Grębocin (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) 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 (90% 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 painted. In the production process, technical gases and materials for welding elements are used (and included).

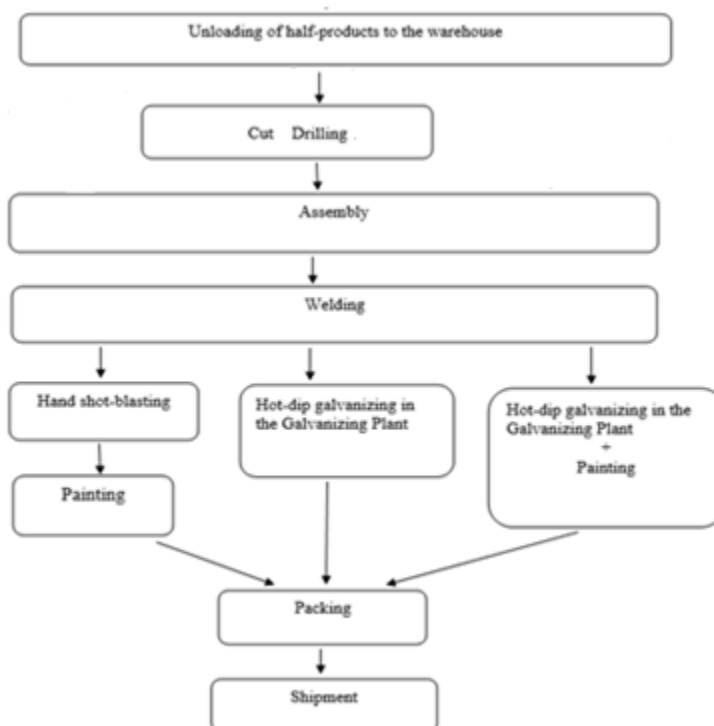


Fig. 1. A basic scheme of the steel product manufacturing process

**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 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%          |

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.

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### Data quality

The data selected for LCA originate from ITB-LCI questionnaires completed by Stal&System 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 90% of input data) and for 10% 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<sub>2</sub>/kWh (KOBiZE). According to the specific information provided, the amount of recycle in the steel used for production from suppliers is 90%.

## LIFE CYCLE ASSESSMENT (LCA) – Results

### Declared unit

The declaration refers to declared unit (DU) – 1 ton of the specific steel structures manufactured by Stal&System 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 |
| 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 Stal&System 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 <sub>2</sub> | 1.19E+03 | 1.00E+01 | 1.31E+02 | 1.34E+03 | 4.25E+01 | 6.98E+01 | 6.98E+00 | 1.67E+01 | 1.64E+01 | 1.06E-01 | -5.82E+02 |
| Greenhouse gas potential - fossil                                   | eq. kg CO <sub>2</sub> | 1.19E+03 | 9.97E+00 | 1.25E+02 | 1.32E+03 | 4.25E+01 | 6.85E+01 | 0.00E+00 | 1.66E+01 | 1.63E+01 | 1.05E-01 | -5.73E+02 |
| Greenhouse gas potential - biogenic                                 | eq. kg CO <sub>2</sub> | 6.06E+00 | 3.41E-02 | 5.27E+00 | 1.14E+01 | 3.98E-01 | 2.00E+00 | 0.00E+00 | 5.68E-02 | 5.57E-02 | 2.68E-04 | -1.25E+01 |
| Global warming potential - land use and land use change             | eq. kg CO <sub>2</sub> | 3.23E-01 | 3.91E-03 | 2.70E-01 | 5.97E-01 | 4.57E-02 | 2.40E-02 | 0.00E+00 | 6.52E-03 | 6.39E-03 | 9.94E-05 | -4.19E-01 |
| Stratospheric ozone depletion potential                             | eq. kg CFC 11          | 2.71E-05 | 2.31E-06 | 1.53E-05 | 4.48E-05 | 2.69E-05 | 1.40E-06 | 0.00E+00 | 3.85E-06 | 3.77E-06 | 4.26E-08 | 2.13E-05  |
| Soil and water acidification potential                              | eq. mol H <sup>+</sup> | 9.24E+00 | 4.05E-02 | 1.16E+01 | 2.09E+01 | 4.72E-01 | 7.60E-01 | 5.30E-02 | 6.75E-02 | 6.61E-02 | 9.90E-04 | -4.85E+00 |
| Eutrophication potential - freshwater                               | eq. kg P               | 1.36E+00 | 6.70E-04 | 1.29E-01 | 1.49E+00 | 7.82E-03 | 1.30E-01 | 0.00E+00 | 1.12E-03 | 1.10E-03 | 9.81E-06 | -6.17E-01 |
| Eutrophication potential - seawater                                 | eq. kg N               | 1.37E+00 | 1.22E-02 | 5.77E-01 | 1.96E+00 | 1.43E-01 | 1.10E-01 | 0.00E+00 | 2.04E-02 | 2.00E-02 | 3.45E-04 | -5.71E-01 |
| Eutrophication potential - terrestrial                              | eq. mol N              | 1.26E+01 | 1.33E-01 | 4.90E+01 | 6.17E+01 | 1.56E+00 | 9.30E-01 | 0.00E+00 | 2.22E-01 | 2.18E-01 | 3.77E-03 | -3.85E+00 |
| Potential for photochemical ozone synthesis                         | eq. kg NMVOC           | 4.75E+00 | 4.08E-02 | 5.83E-01 | 5.37E+00 | 4.76E-01 | 2.60E-01 | 0.00E+00 | 6.80E-02 | 6.67E-02 | 1.10E-03 | -1.21E-01 |
| Potential for depletion of abiotic resources - non-fossil resources | eq. kg Sb              | 2.15E-03 | 3.54E-05 | 3.84E-02 | 4.05E-02 | 4.12E-04 | 3.34E-04 | 1.77E-07 | 5.89E-05 | 5.77E-05 | 2.42E-07 | 1.38E-02  |
| Abiotic depletion - fossil fuels                                    | MJ                     | 1.43E+04 | 1.48E+02 | 2.08E+03 | 1.65E+04 | 1.73E+03 | 1.16E+03 | 0.00E+00 | 2.47E+02 | 2.42E+02 | 2.89E+00 | -7.40E+03 |
| Water deprivation potential   | eq. m <sup>3</sup>     | 2.79E+02 | 6.84E-01 | 1.26E+02 | 4.05E+02 | 7.99E+00 | 2.40E+01 | 0.00E+00 | 1.14E+00 | 1.12E+00 | 9.16E-03 | -4.61E+01 |

Table 4. Life cycle assessment (LCA) results of the steel products manufactured by Stal&System 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 |

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Table 5. Life cycle assessment (LCA) results of the steel products manufactured by Stal&System 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             | 1.27E+03 | 2.12E+00 | 2.07E+02 | 1.48E+03 | 2.48E+01 | 8.60E+01 | 1.52E-07 | 3.54E+00 | 3.47E+00 | 2.51E-02 | -7.07E+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             | 1.54E+04 | 1.48E+02 | 2.22E+03 | 1.78E+04 | 1.73E+03 | 1.16E+03 | 0.00E+00 | 2.47E+02 | 2.42E+02 | 2.89E+00 | -8.56E+03 |
| Consumption of secondary materials   | kg             | 8.99E+02 | 4.96E-02 | 7.59E-02 | 1.00E+03 | 5.79E-01 | 1.06E-01 | 0.00E+00 | 8.27E-02 | 8.11E-02 | 6.07E-04 | -6.32E+02 |
| Consumption of renewable secondary fuels   | MJ             | 3.10E+03 | 5.47E-04 | 2.35E-04 | 3.10E+03 | 6.38E-03 | 5.91E-04 | 9.00E-13 | 9.11E-04 | 8.93E-04 | 1.59E-05 | -1.29E+03 |
| Consumption of non-renewable secondary fuels   | MJ             | 5.63E-01 | 0.00E+00 | 1.67E-01 | 7.31E-01 | 0.00E+00 | 9.39E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | -2.35E-01 |
| Net consumption of freshwater resources  | m <sup>3</sup> | 8.58E+00 | 1.86E-02 | 4.44E+00 | 1.30E+01 | 2.17E-01 | 3.15E-01 | 0.00E+00 | 3.10E-02 | 3.04E-02 | 3.16E-03 | -2.99E-01 |

## Type III Environmental Product Declaration No. 448/2023

Table 6. Life cycle assessment (LCA) results of the steel products manufactured by Stal&System 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   | 2.49E+00 | 1.66E-01 | 5.72E-01 | 3.23E+00 | 1.94E+00 | 1.20E-02 | 0.00E+00 | 2.77E-01 | 2.71E-01 | 3.07E-03 | -1.03E+01 |
| Non-hazardous waste           | kg   | 5.44E+01 | 2.95E+00 | 1.68E+01 | 7.41E+01 | 3.44E+01 | 6.24E-01 | 0.00E+00 | 4.92E+00 | 4.82E+00 | 4.32E-02 | -3.84E+02 |
| Radioactive waste             | kg   | 1.42E-01 | 1.11E-05 | 7.86E-03 | 1.50E-01 | 1.29E-04 | 8.70E-04 | 7.83E-18 | 1.84E-05 | 1.81E-05 | 1.92E-05 | -6.49E+00 |
| 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   | 9.72E-03 | 4.58E-04 | 1.51E-01 | 1.61E-01 | 5.35E-03 | 1.20E-03 | 0.00E+00 | 7.64E-04 | 7.49E-04 | 5.78E-06 | 0.00E+00  |
| Materials for energy recovery | kg   | 2.18E+01 | 3.71E-06 | 3.97E-06 | 2.18E+01 | 4.32E-05 | 1.05E-05 | 0.00E+00 | 6.18E-06 | 6.05E-06 | 6.85E-08 | 0.00E+00  |



## Type III Environmental Product Declaration No. 448/2023

### 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.)<br><input checked="" type="checkbox"/> external <input type="checkbox"/> internal |
| External verification of EPD: Halina Prejzner, PhD. Eng.<br>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 General Product Category Rules for Construction Products
- EN 10219-1 Straight Seam Steel Pipe Technical delivery conditions
- 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<sub>2</sub>, SO<sub>2</sub>, NO<sub>x</sub>, CO i pyłu całkowitego dla energii elektrycznej. December 2021
- World Steel Association 2017 Life Cycle inventory methodology report for steel products



Instytut Techniki Budowlanej

00-611 Warsaw, Filtrów 1

Thermal Physics, Acoustics and Environment Department

02-656 Warsaw, Ksawerów 21

# CERTIFICATE No 448/2023 of TYPE III ENVIRONMENTAL DECLARATION

Product:

**Steel tube piles and structural steel pillars**

Manufacturer:

**Stal&System Sp. z o.o.**

ul. Kowalewska 20, 87-122 Grębocin, Poland

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

**PN-EN 15804+A2**

**Sustainability of construction works.**

**Environmental product declarations.**

**Core rules for the product category of construction products.**

This certificate, issued for the first time on 17<sup>th</sup> April 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



Deputy Director  
for Research and Innovation

  
Krzysztof Kuczyński, PhD

Warsaw, April 2023