

Environmental Product Declaration

in accordance with ISO 14025 and EN 15804

Butterfly Valve 565

1. Declaration of general information

1.1 Introduction

GF Piping Systems, founded in 1802, is a division of Georg Fischer AG with its headquarters in Schaffhausen, Switzerland. GF Piping Systems is the leading flow solutions provider worldwide, enabling the safe and sustainable transport of fluids. The company specializes in plastic piping systems and system solutions as well as services in all project phases. The product portfolio includes pipes, fittings, valves and the corresponding automation and jointing technology for industry, building technology as well as water and gas utilities. GF Piping Systems proactively incorporates its environmental responsibility into its everyday business activities. Because we view environmental awareness as one of the corporation's core values, internal structures and processes are geared towards sustainability. Within this context, we increasingly utilize Life Cycle Assessments (LCA) to gain insight into the environmental footprint of our piping systems or products across its different life cycle phases.

This EPD is based on a detailed background report written by Swiss Climate AG. The report is in line with EN 15804:2012+A2:2019 "Sustainability of construction works – environmental product declarations – Core rules for the product category of construction products" and the Product Category Rule (PCR) for Construction Goods (PCR 2019:14 by EPD International). Data regarding the production of the Butterfly Valve 565 is company specific and was provided by GF Piping Systems.

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Declaration

| | |
|--|--|
| Declaration owner | Georg Fischer Piping Systems Ltd. |
| Program operator | The International EPD® System EPD International AB Box 210 60 SE-100 31 Stockholm Sweden www.environdec.com |
| EPD registration number | S-P-05782 |
| Published | 2022-03-20 |
| Valid until | 2027-03-20 |
| Geographical scope | Global |
| EPD-Type | Cradle to gate with options |
| Data calculated by | Swiss Climate AG |
| Third-party verifier | Dr. Nikolay Minkov, greenzero.me GmbH |
| Life Cycle Inventory (LCI) source for generic background processes | Ecoinvent 3.7 |
| Software | SimaPro (Version 9.2.0.2) |

1.2 System and conversion factors

The investigated product is the Butterfly Valve (BuV) 565 in the configuration DN 100 with hand lever, produced in Seewis, Switzerland. The EPD applies to this specific product system. BuV 565 is a wafer-style valve mainly made of plastic materials. It offers a replacement to metal solutions. It is lightweight and resistant to corrosion and it is suitable for water and water treatment applications (e.g. sea water, drinking water and industrial water).

In order to convert the results in section 2, a conversion factor for each dimension of BuV 565 is listed in the table below.



| Dimension | Weight [kg] | Actuation | Factor |
|-----------|-------------|------------|--------|
| DN50 | 1.308 | Lever | 0.50 |
| DN65 | 1.542 | Lever | 0.59 |
| DN80 | 1.712 | Lever | 0.65 |
| DN125 | 3.086 | Lever | 1.17 |
| DN150 | 4.029 | Lever | 1.53 |
| DN200 | 5.732 | Lever | 2.18 |
| DN250 | 8.837 | Bare Shaft | 3.36 |
| DN300 | 12.614 | Bare Shaft | 4.79 |

Materials

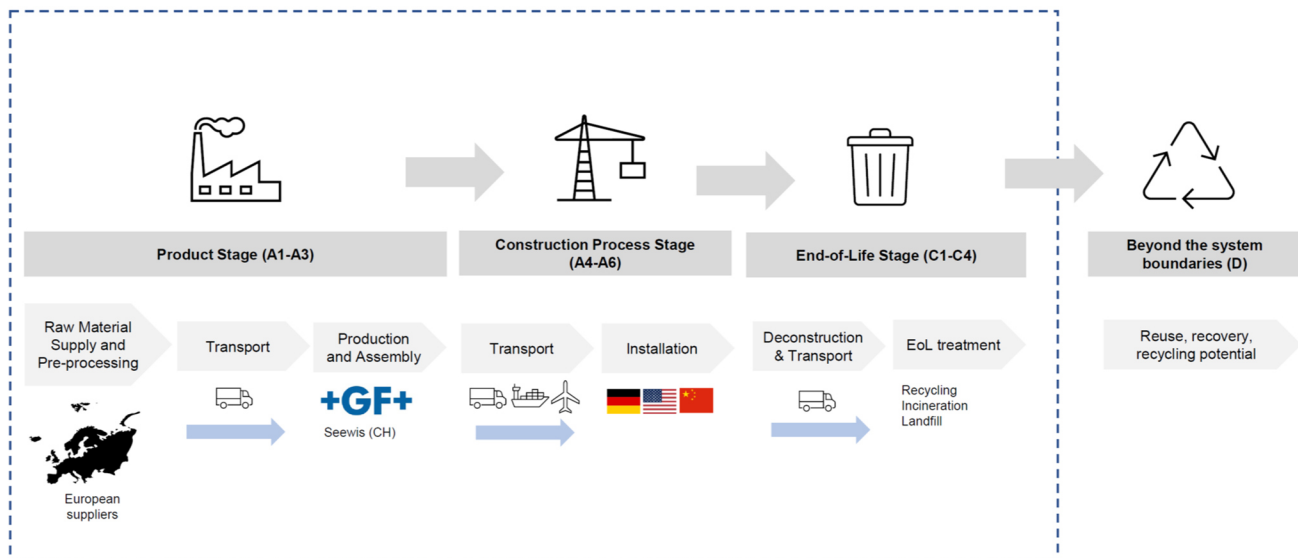
The materials of the different components of the valve are listed below

| Material | Weight (kg) |
|----------------------------|-------------|
| Fiber reinforced polyamide | 1.46 |
| Ferrous metals | 0.72 |
| Other plastics and rubbers | 0.45 |

Declared unit

BuV 565 allows for the safe conveyance of liquids and gases. As stipulated by the PCR 2019:14 the declared unit is 1 kg of BuV 565. In order to express the environmental impacts per kg valve, the conversion factor 2.6320 was used, corresponding to the weight of one BuV 565 DN 100.

System Boundary



1.3 Components of the system

The system mainly consists of Georg Fischer Piping Systems components. However, to complete the system also external components are necessary which are not produced by Georg Fischer Piping Systems. The calculation of the environmental impact of these products is based on publicly available data and assumptions.

| | Product Code | Pieces | Material |
|--------------------------------|--------------|--------|----------------------------|
| System Components | | | |
| Cap | 748436020 | 1 | Other plastics and rubbers |
| Flat Washer | 161481508 | 2 | Ferrous metals |
| Hex head screws fully threaded | 161486850 | 2 | Ferrous metals |
| Hexagon nut | 198800700 | 2 | Ferrous metals |
| Inner Disc | 198204565 | 1 | Fibre reinforced polyamide |
| Lever | 198204493 | 1 | Fibre reinforced polyamide |
| Leverlock | 198204496 | 1 | Fibre reinforced polyamide |
| O-Ring | 748410059 | 2 | Other plastics and rubbers |
| Outer Disc | 122002653 | 1 | Other plastics and rubbers |
| Ratchet | 198204490 | 1 | Fibre reinforced polyamide |
| Seat Liner | 748436025 | 1 | Other plastics and rubbers |
| Shaft | 198811445 | 1 | Ferrous metals |
| Shaft lock | 198204481 | 1 | Fibre reinforced polyamide |
| Spring | 161486745 | 2 | Ferrous metals |
| Wafer Body | 198204445 | 1 | Fibre reinforced polyamide |

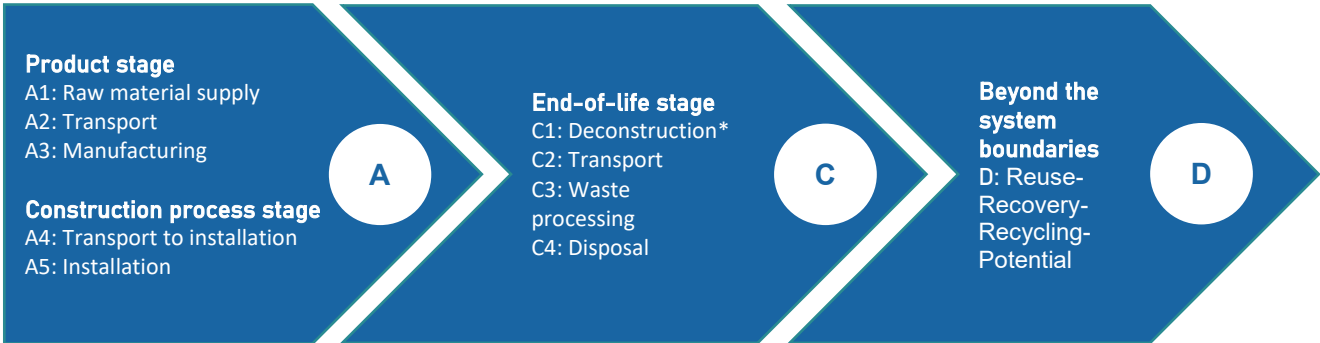
1.3 Comparability

EPDs of construction products may not be comparable if they do not comply with the EN 15804:2012+A2:2019.

2. Declaration of environmental parameters derived from LCA

2.1 Flow diagram of the processes included in the LCA

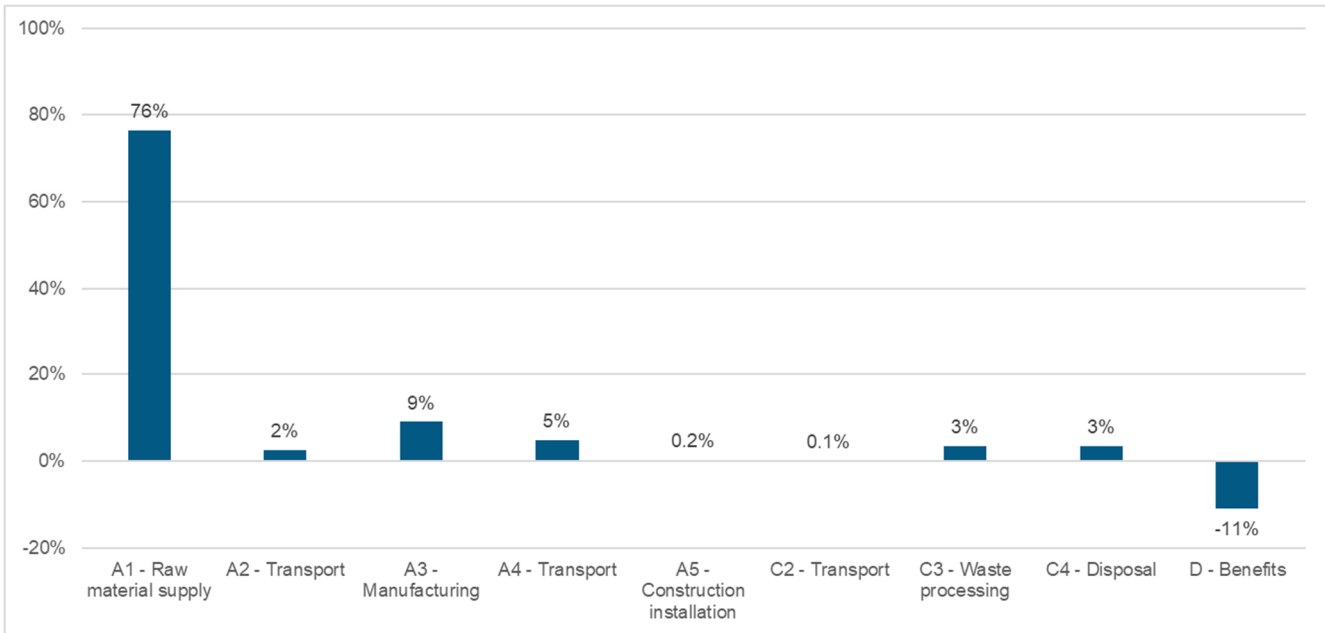
The system boundaries were defined in line with the PCR 2019:14 for Construction Goods. Therefore, the use stage is not included.



* The impact of this stage is negligible as described below

2.1 Parameter climate change

The figure below shows the contribution of different life cycle phases to the overall impact in terms of the core environmental impact indicator “Climate Change – Total”.



2.3 Core environmental impact indicators

| Parameters describing core environmental impacts | | Product stage | | | | Construction process stage | | End of life | | | Beyond the system boundaries |
|--|------------------------|---------------------|-----------|---------------|--------------------------|----------------------------|---------------------------|-------------|------------------|----------|------------------------------------|
| | | Raw material supply | Transport | Manufacturing | Total (of product stage) | Transport | Construction installation | Transport | Waste processing | Disposal | Reuse-Recovery-Recycling-Potential |
| | | A1 | A3 | A3 | A1-3 | A4 | A5 | C2 | C3 | C4 | D |
| Climate change - Total | kg CO ₂ eq | 7.31E+00 | 2.39E-01 | 8.61E-01 | 8.41E+00 | 4.61E-01 | 1.55E-02 | 6.62E-03 | 3.33E-01 | 3.35E-01 | -1.05E+00 |
| Climate change - Fossil | kg CO ₂ eq | 7.26E+00 | 2.38E-01 | 7.62E-01 | 8.26E+00 | 4.62E-01 | 1.88E-03 | 6.60E-03 | 1.36E-01 | 2.09E-02 | -1.04E+00 |
| Climate change - Biogenic | kg CO ₂ eq | 5.34E-02 | 5.67E-04 | 9.87E-02 | 1.53E-01 | -1.41E-03 | 1.37E-02 | 1.26E-05 | 1.97E-01 | 3.14E-01 | -1.06E-02 |
| Climate change - Land use and LU change | kg CO ₂ eq | 2.60E-03 | 7.92E-05 | 7.51E-04 | 3.43E-03 | 1.50E-04 | 2.63E-08 | 2.32E-06 | 1.98E-06 | 6.23E-06 | -2.50E-04 |
| Ozone depletion | kg CFC11 eq | 2.47E-07 | 5.46E-08 | 6.27E-08 | 3.64E-07 | 1.02E-07 | 1.25E-11 | 1.45E-09 | 1.06E-09 | 1.23E-09 | -1.85E-08 |
| Acidification | mol H ⁺ eq | 3.27E-02 | 9.63E-04 | 3.70E-03 | 3.73E-02 | 4.12E-03 | 7.38E-06 | 2.71E-05 | 7.86E-05 | 6.16E-05 | -4.66E-03 |
| Eutrophication freshwater | kg P eq | 1.19E-03 | 1.66E-05 | 3.51E-04 | 1.56E-03 | 1.67E-05 | 7.12E-07 | 5.21E-07 | 1.00E-05 | 5.63E-06 | -2.31E-04 |
| Eutrophication aquatic marine | kg N eq | 8.71E-03 | 2.94E-04 | 8.51E-04 | 9.86E-03 | 1.24E-03 | 1.15E-05 | 8.12E-06 | 4.19E-05 | 6.25E-04 | -1.28E-03 |
| Eutrophication terrestrial | mol N eq | 5.48E-02 | 3.20E-03 | 7.21E-03 | 6.52E-02 | 1.35E-02 | 3.65E-05 | 8.86E-05 | 3.57E-04 | 1.70E-04 | -7.73E-03 |
| Photochemical ozone formation | kg NMVOC eq | 1.83E-02 | 1.00E-03 | 2.04E-03 | 2.14E-02 | 3.53E-03 | 1.59E-05 | 2.76E-05 | 8.83E-05 | 1.22E-04 | -2.48E-03 |
| Depletion of abiotic resources - minerals and metals | kg Sb eq | 5.83E-05 | 7.97E-07 | 1.33E-05 | 7.24E-05 | 4.38E-07 | 2.08E-10 | 2.15E-08 | 2.26E-08 | 2.47E-08 | -1.04E-05 |
| Depletion of abiotic resources - fossil fuels | MJ | 1.05E+02 | 3.65E+00 | 1.09E+01 | 1.20E+02 | 6.48E+00 | 9.88E-04 | 9.86E-02 | 8.51E-02 | 1.18E-01 | -1.48E+01 |
| Water use | m ³ depriv. | 5.85E+00 | 1.15E-02 | 3.08E-01 | 6.17E+00 | 1.14E-02 | 3.06E-05 | 3.54E-04 | 2.09E-03 | 4.15E-03 | -8.74E-01 |

2.4 Additional environmental impact indicators

| Parameters describing additional environmental impact indicators | | Product stage | | | | Construction process stage | | End of life | | | Beyond the system boundaries |
|--|--------------|---------------------|-----------|---------------|--------------------------|----------------------------|---------------------------|-------------|------------------|----------|------------------------------------|
| | | Raw material supply | Transport | Manufacturing | Total (of product stage) | Transport | Construction installation | Transport | Waste processing | Disposal | Reuse-Recovery-Recycling-Potential |
| | | A1 | A3 | A3 | A1-3 | A4 | A5 | C2 | C3 | C4 | D |
| Particulate Matter emissions | disease inc. | 3.63E-07 | 1.83E-08 | 3.44E-08 | 4.15E-07 | 1.09E-08 | 2.77E-09 | 5.01E-10 | 6.42E-10 | 7.32E-10 | -4.75E-08 |
| Ionizing radiation, human health | kBq U-235 eq | 4.48E-01 | 1.91E-02 | 1.53E-01 | 6.20E-01 | 3.00E-02 | 4.22E-06 | 4.61E-04 | 3.43E-04 | 7.44E-04 | -6.42E-02 |
| Eco-toxicity (freshwater) | CTUe | 6.50E+01 | 2.83E+00 | 1.96E+01 | 8.74E+01 | 3.94E+00 | 7.33E+00 | 8.46E-02 | 6.76E-01 | 1.79E+00 | -8.08E+00 |
| Human toxicity, cancer effects | CTUh | 2.67E-08 | 9.82E-11 | 6.17E-09 | 3.29E-08 | 1.09E-10 | 5.60E-11 | 2.67E-12 | 3.90E-11 | 1.18E-11 | -4.27E-09 |
| Human toxicity, non-cancer effects | CTUh | 4.88E-08 | 2.92E-09 | 1.19E-08 | 6.37E-08 | 5.02E-09 | 2.63E-10 | 8.03E-11 | 1.41E-09 | 5.29E-10 | -7.18E-09 |
| Land use related impacts / Soil quality | Pt | 1.46E+01 | 3.21E+00 | 4.94E+00 | 2.27E+01 | 2.02E+00 | 3.43E-03 | 8.59E-02 | 5.06E-02 | 2.13E-01 | -1.90E+00 |

2.5 Scenarios and additional technical information

The investigated product system is the Butterfly Valve (BuV) 565 in the configuration DN 100, manufactured in Seewis, Switzerland

| Product stage | |
|---------------|---|
| A1 | The production of the raw material was modeled using generic European data (source: ecoinvent) and complemented by specific data from GF Piping Systems to consider the company specific combination of raw materials. |
| A2 | Wherever possible, the specific transport distances were taken into account. Data from ecoinvent with the respective parameters was used to model the transportation. Data of an average lorry (EURO5) and average load factor from ecoinvent was selected. |
| A3 | The use of energy is the most important input for this process step. Fittings and valve parts are injection moulded. For the production of GF Piping Systems components, the electricity mix for the respective location in Seewis was used. The production of components purchased from external suppliers was modeled using generic ecoinvent data for the process in question. |

| Construction process | |
|--|--|
| The manufactured product, BuV 565, is shipped to the distribution center of GF in Schaffhausen, Switzerland and from there distributed to the installation sites. These installation sites are located in Stuttgart, Germany, Shanghai, China and Irvine, United States. Transportation modes and distances to the installation site are as listed below. Average load transportation vehicles and load factors from ecoinvent were used for the analysis. | |

Distances and transportation modes for the transportation of a BuV 565 to the installation site are as follows:

| | Germany / Stuttgart | China / Shanghai | US / Irvine | Weighted average | |
|----|---------------------|------------------|-------------|------------------|----------|
| A4 | Transport Mode | | | | |
| | By truck | 333 km | 652 km | 676 km | 514 km |
| | By ship | | 13'170 km | 12'402 km | 7'059 km |
| | By aircraft | | 1'637 km | 1'733 km | 923 km |

As there are three installation sites, a weighted average scenario was calculated. According to sales figures, 45 % of the products are shipped to EU, 31 % to Asia and 24 % to the US. Importantly, it is assumed that in the scenario for Shanghai and Irvine for 82 % of the sold units are transported using sea freight while the remaining 18 % are transported using air freight.

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| A5 | At the installation site, the BuV 565 is installed into an overarching piping system. No energy or material inputs are needed for the installation of BuV 565. |
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| End of life stage | |
|-------------------|---|
| C1 | Deconstruction of the system uses mainly manual work. The environmental impact is therefore negligible compared to the impact of the whole system and below the cut-off criteria defined in 15804:2012+A2. |
| C2 | Transportation to the end-of-life treatment facilities is carried out by truck. Distances are estimated at 50 km to the next waste disposal site. |
| C3 | It is assumed that in Germany all metal parts and 20 % of the fiber reinforced polyamide, plastics and rubbers are recycled. The other parts are incinerated with energy recovery. The extracted energy is in the form of electricity and thermal energy. In China and the United States, 80 % of the metal parts are recycled. With regard to fiber reinforced polyamide, plastics and rubbers a share of 20 % is recycled. All remaining waste generated in China and the United States is landfilled (see C4). |
| C4 | In China and the United States, 20 % of the metal parts are landfilled. 80 % of the fiber reinforced polyamide, plastics and rubbers are disposed of in a landfill close to the installation sites in Shanghai and Irvine. |

2.6 Parameters describing resource use

| Parameters describing resource use | | Product stage | | | | Construction process stage | | End of life | | | Beyond the system boundaries |
|---|-------------------------|---------------------|-----------|---------------|--------------------------|----------------------------|---------------------------|-------------|------------------|----------|------------------------------------|
| | | Raw material supply | Transport | Manufacturing | Total (of product stage) | Transport | Construction installation | Transport | Waste processing | Disposal | Reuse-Recovery-Recycling-Potential |
| | | A1 | A3 | A3 | A1-3 | A4 | A5 | C2 | C3 | C4 | D |
| Primary energy resources – Renewable: Use as energy carrier | MJ, net calorific value | 7.48E+00 | 4.96E-02 | 1.06E+01 | 1.81E+01 | 1.27E-01 | 1.84E-05 | 1.15E-03 | 2.70E-03 | 5.24E-03 | -1.42E+00 |
| Primary energy resources – Renewable: Used as raw materials | MJ, net calorific value | 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 |
| Primary energy resources – Renewable: Total | MJ, net calorific value | 7.48E+00 | 4.96E-02 | 1.06E+01 | 1.81E+01 | 1.27E-01 | 1.84E-05 | 1.15E-03 | 2.70E-03 | 5.24E-03 | -1.42E+00 |
| Primary energy resources – Non-renewable: Use as energy carrier | MJ, net calorific value | 6.97E+01 | 3.87E+00 | 4.59E+00 | 7.81E+01 | 6.73E+00 | 1.05E-03 | 1.05E-01 | 9.20E-02 | 1.26E-01 | -1.59E+01 |
| Primary energy resources – Non-renewable: Used as raw materials | MJ, net calorific value | 4.31E+01 | 0.00E+00 | 7.00E+00 | 5.01E+01 | 1.51E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Primary energy resources – Non-renewable: Total | MJ, net calorific value | 1.13E+02 | 3.87E+00 | 1.16E+01 | 1.28E+02 | 6.88E+00 | 1.05E-03 | 1.05E-01 | 9.20E-02 | 1.26E-01 | -1.59E+01 |
| Secondary material | kg | 8.21E-02 | 0.00E+00 | 0.00E+00 | 8.21E-02 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Net use of fresh water | M ³ | 9.17E-02 | 3.82E-04 | 1.41E-02 | 1.06E-01 | 4.97E-04 | 9.35E-07 | 1.36E-05 | 8.33E-05 | 1.35E-04 | -3.15E-02 |

2.7 Parameters describing waste production

| Parameters describing waste production | | Product stage | | | | Construction process stage | | End of life | | | Beyond the system boundaries |
|--|----|---------------------|-----------|---------------|--------------------------|----------------------------|---------------------------|-------------|------------------|----------|------------------------------------|
| | | Raw material supply | Transport | Manufacturing | Total (of product stage) | Transport | Construction installation | Transport | Waste processing | Disposal | Reuse-Recovery-Recycling-Potential |
| | | A1 | A3 | A3 | A1-3 | A4 | A5 | C2 | C3 | C4 | D |
| Hazardous waste disposed | kg | 5.30E-05 | 9.22E-06 | 1.77E-05 | 7.99E-05 | 1.55E-05 | 2.38E-09 | 2.51E-07 | 2.69E-07 | 3.92E-07 | -5.77E-06 |
| Non-hazardous waste disposed | kg | 1.93E+00 | 2.34E-01 | 4.70E-01 | 2.64E+00 | 7.11E-02 | 2.36E-04 | 6.26E-03 | 7.19E-02 | 3.51E-01 | -3.61E-01 |
| Radioactive waste disposed | kg | 1.71E-04 | 2.49E-05 | 5.29E-05 | 2.48E-04 | 4.51E-05 | 5.24E-09 | 6.49E-07 | 2.80E-07 | 6.13E-07 | -1.99E-05 |

2.8 Parameters describing output flows

| Parameters describing output flows | | Product stage | | | | Construction process stage | | End of life | | | Beyond the system boundaries |
|------------------------------------|----|---------------------|-----------|---------------|--------------------------|----------------------------|---------------------------|-------------|------------------|----------|------------------------------------|
| | | Raw material supply | Transport | Manufacturing | Total (of product stage) | Transport | Construction installation | Transport | Waste processing | Disposal | Reuse-Recovery-Recycling-Potential |
| | | A1 | A3 | A3 | A1-3 | A4 | A5 | C2 | C3 | C4 | D |
| Components for reuse | 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 |
| Material recycling | kg | 0.00E+00 | 0.00E+00 | 1.11E-01 | 1.11E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 3.88E-01 | 0.00E+00 | 0.00E+00 |
| Materials for energy recovery | kg | 0.00E+00 | 0.00E+00 | 6.23E-02 | 6.23E-02 | 0.00E+00 | 1.12E-02 | 0.00E+00 | 2.62E-01 | 0.00E+00 | 0.00E+00 |
| Exported energy, electricity | MJ | 0.00E+00 | 0.00E+00 | 2.43E-01 | 2.43E-01 | 0.00E+00 | 1.96E-02 | 0.00E+00 | 1.02E+00 | 0.00E+00 | 0.00E+00 |
| Exported energy, thermal | MJ | 0.00E+00 | 0.00E+00 | 6.36E-01 | 6.36E-01 | 0.00E+00 | 5.12E-02 | 0.00E+00 | 2.67E+00 | 0.00E+00 | 0.00E+00 |

References

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