Environmental Product Declaration

in accordance with ISO 14025 and EN 15804

Butterfly Valve 565

1. Declaration of general information

Georg Fischer Piping Systems Ltd
Ebnatstrasse 111
8201 Schaffhausen/Switzerland
+41 (0) 52 631 11 11
sustainability.ps@georgfischer.com
www.gfps.com

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.

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

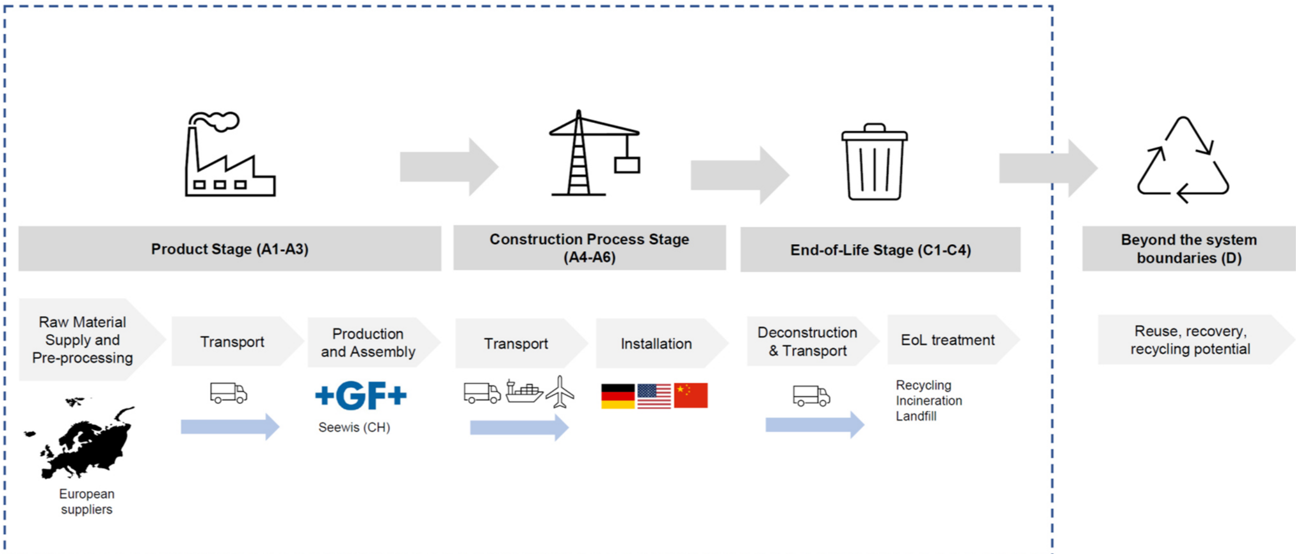
The materials of the different components of the valve are listed below

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



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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

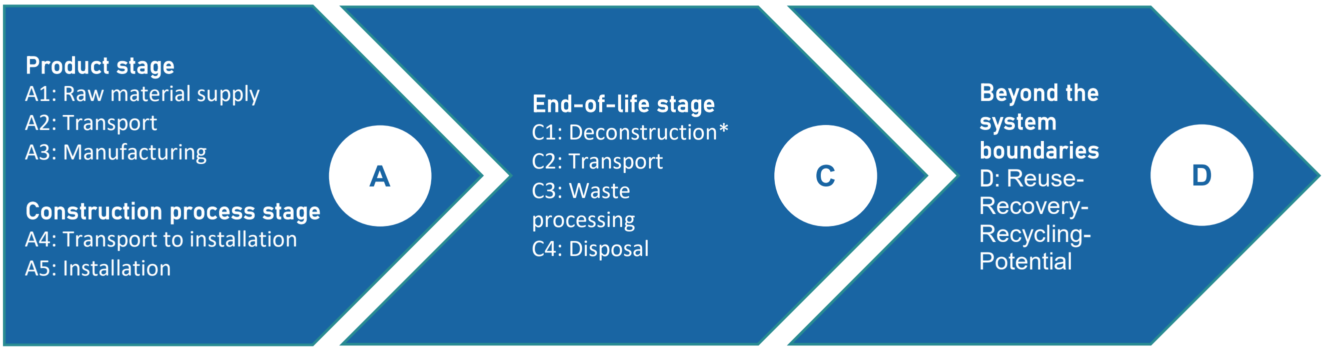
1.3 Comparability

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

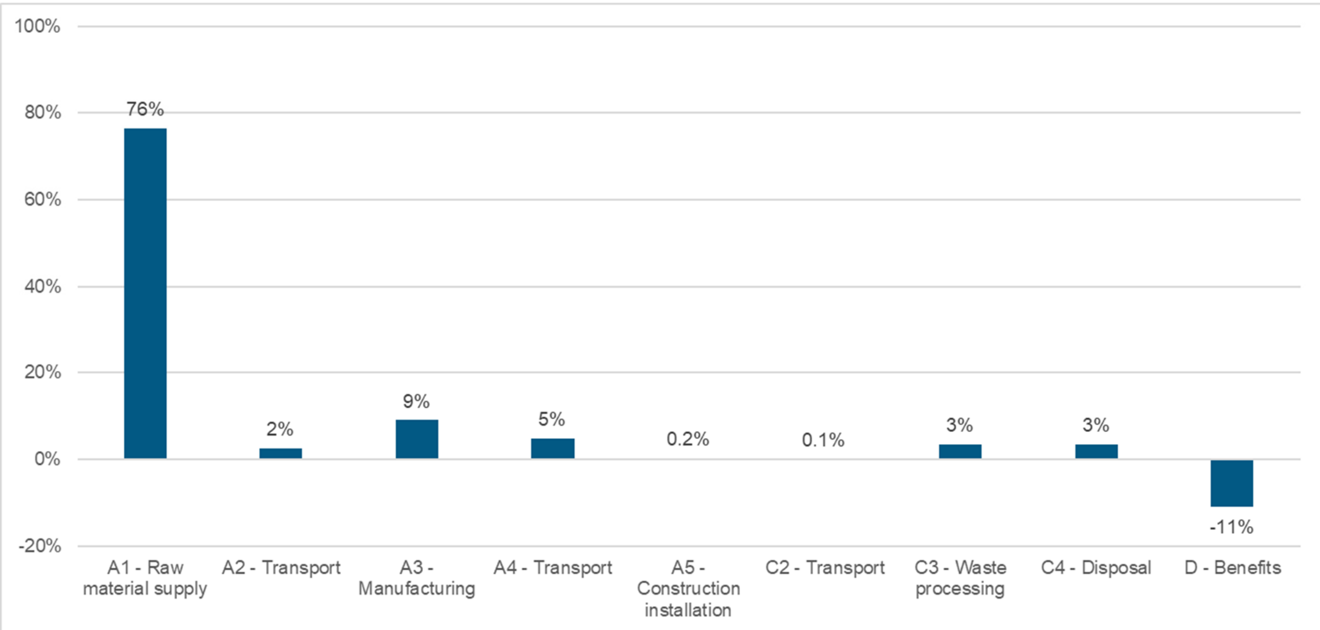
The system boundaries were defined in line with the PCR 2019:14 for Construction Goods. Therefore, the use stage is not included.



* 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	
A4	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:

Transport Mode	Germany / Stuttgart	China / Shanghai	US / Irvine	Weighted average
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.

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.

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

- CEN. (2019). DIN EN 15804:2020-03, Nachhaltigkeit von Bauwerken- Umweltproduktdeklarationen- Grundregeln für die Produktkategorie Bauprodukte; Deutsche Fassung EN_15804:2012+A2:2019. Beuth Verlag GmbH.
- EPD International. (2019). Product Category Rules (PCR) - Construction Products.
- Achyut K. Panda, R.K. Singh, D.K. Mishra,Thermolysis of waste plastics to liquid fuel: A suitable method for plastic waste management and manufacture of value added products—A world prospective, Renewable and Sustainable Energy Reviews,Volume 14, Issue 1, 2010, Pages 233-248, ISSN 1364-0321, https://doi.org/10.1016/j.rser.2009.07.005.
- Umweltbundesamt. “THE ROLE OF WASTE INCINERATION IN GERMANY”. 2008, https://www.umweltbundesamt.de/sites/default/files/medien/publikation/long/3872.pdf.

GF Piping Systems

Georg Fischer Piping Systems Ltd
Ebnatstrasse 111
8201 Schaffhausen / Switzerland
Phone +41 52 631 11 11
sustainability.ps@georgfischer.com
www.gfps.com