ENVIRONMENTAL PRODUCT DECLARATION

IN ACCORDANCE WITH

15804+A2 &

ISO 14025 / ISO 21930

SILENTA PREMIUM, SILENTA EXTREME, SILENTA 3A

GEORG FISCHER

GENERAL INFORMATION

MANUFACTURER INFORMATION

Manufacturer	GEORG FISCHER HAKAN PLASTIK BORU VE PROFIL SAN. TIC, A.S.
Address	ORGANIZE SANAYII BÖLGESI G.O. PASA MAH. ISTIKLAL CAD. Nº 11 ÇERKEZKÖY TEKIRDAĞ/TURKEY
Contact details	iletisim@hakan.com.tr
Website	https://www.gfps.com/com/en.html

PRODUCT IDENTIFICATION

Product name	Silenta Premium, Silenta Extreme, Silenta 3A
Place of production	ORGANIZE SANAYII BÖLGESI G.O. PASA MAH. ISTIKLAL CAD. Nº 11 ÇERKEZKÖY TEKIRDAĞ/TURKEY

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RTS EPD Committee secretary

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Managing Director

EPD INFORMATION

EPDs of construction products may not be comparable if they do not comply with EN 15804 and if they are not compared in a building context.

EPD program operator	The Building Information Foundation RTS sr Malminkatu 16 A, 00100 Helsinki, Finland http://cer.rts.fi
EPD standards	This EPD is in accordance with EN 15804+A2 and ISO 14025 / ISO 21930 standards.
Product category rules (PCR)	The CEN standard EN 15804+A2 serves as the core PCR. In addition, the RTS PCR (English version, 26.8.2020) is used.
EPD author	Ipek Goktas, at One Click LCA Ltd Suvilahdenkatu 10 B 00500 Helsinki, Finland www.oneclicklca.com
EPD verification	Independent verification of this EPD and data, according to ISO 14025: ☐ Internal certification ☑ External verification
EPD verifier	Silvia Vilčeková, Silcert, s.r.o.
Verification date	09.08.2021
EPD number	RTS_145_21
ECO Platform nr.	-
Publishing date	16.08.2021
EPD valid until	16.08.2026

PRODUCT INFORMATION

PRODUCT DESCRIPTION

Silenta Premium is a sound-insulating 3-layered sewer pipe system made of PP material, which is specially formulated and reinforced for non-pressurized drainage systems.

Silenta Extreme is PP-based halogen-free, resistant to fireand noise-insulated soil, waste water and drainage piping system, especially developed and being produced by the highest technology for you to increase building safety and comfort with its features and structure.

Silenta 3A is a cost-effective product that has sound-insulating 3-layered structure and waste water pipe system made of PP material, which is specially formulated and reinforced, for non-pressurized systems.

PRODUCT APPLICATION

All soil and waste water drainage systems inside the buildings
Office buildings, conference halls etc.
Schools, libraries, hospitals, hotels, houses, etc.
All underground drainage systems between the building and the main pipeline
Rainwater systems
Sustainable / green buildings
Industrial areas

PRODUCT RAW MATERIAL COMPOSITION

Raw materials	Weight [kg]	Post-consumer [%]	Renewable [%]	Material origin
Polypropylene	0.66	-	-	Europe, RoW
Barite	0.22	-	-	Europe
Calcite	0.12	-	-	Europe
Additive	< 0.01	-	-	Europe

PRODUCT RAW MATERIAL MAIN COMPOSITION

Raw material category	Amount, mass [%]	Material origin
Metals	-	-
Minerals	34%	Europe
Fossil materials	66%	Europe, RoW
Bio-based materials	-	-

SUBSTANCES, REACH - VERY HIGH CONCERN

The product does not contain any REACH SVHC substances in amounts greater than 0.1 % (1000 ppm).

PRODUCT STANDARDS

TS EN 1451-1: Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure-Polypropylene (PP)- Part 1: Specifications for pipes, fittings and the system
TS EN 1451-2: Plastic piping systems for soil and waste discharge (low and high temperature) within the building structure - Polypropylene (PP) - Part 2: Guidance for the assessment of conformity
TS EN 14366: Laboratory measurement of noise from wastewater installations
DIN 4109: Sound insulation in buildings - Part 1: Minimum requirements
TS EN 13501: Fire classification of construction products and building elements-Part 1: Classification using test data from reaction to fire tests
DIN 4102: Fire behaviour of building materials and elements Section 1: Classification of building materials Requirements and tests

TECHNICAL SPECIFICATIONS

Silenta Premium pipes and fittings have a diameter range d58-d200 mm. The sound performance of the system is 13 dBA at 4 l/s flow rate. The pipes are three layered structures where the inside and outside of the pipes are PP and intermediate layer is PP with inorganic filler.

Silenta Extreme pipes and fittings have a diameter range of d50 to d200 mm. All three layers have halogen free FR additives therefore the fire resistance performance is B-s1; d0. The noise performance of this system is 18 dBA at 4 l/s.

Silenta 3A pipes and fittings have a diameter range of d50 to d200 mm. Like the Premium, it is 3-layered structure but a thinner solution. The sound performance of the system is 16 dBA at 4 l/s flow rate.

All above systems are push-fit, easy joint installation systems.

PHYSICAL PROPERTIES OF THE PRODUCT

System and Material Properties	Value/Unit	Standard/Test Method
Density	1.8-1.9 g/cm³	ISO 1183
Ring Stiffness	> 4.0 kN/m2	ISO/DIN 9969
Thermal Expansion Coefficient	0.06 mm/m°K *	DIN 53752
Tensile strength	13 MPa	ISO 527
Chemical resistance	2-12 pH	-

* Thermal Expansion Coefficient is 0.15 mm/m°K for conventional pipes.

ADDITIONAL INFORMATION

Further information: https://www.gfps.com/com/en/products-solutions/systems/aquasystem.html

PRODUCT LIFE CYCLE

MANUFACTURING AND PACKAGING (A1-A3)

For Piping:

- Income quality check for raw materials
- Feeding the raw material
- Melting of the raw material
- Forming the outer diameter with co-extrusion
- Calibrating the outer and inner diameter
- Cooling
- Outer diameter control (on-going)
- Cooling
- Cutting and Packaging
- Final Quality Control

For Fitting:

- Income quality check for raw materials
- Feeding the raw material
- Mixing PP-B, and inorganic filler with masterbatch
- Melting of the raw material
- Forming the part with injection moulding
- Cooling
- Taking the part
- Separating the gutters from plastic parts
- Quality Control
- Packaging
- Final Quality Control

TRANSPORT AND INSTALLATION (A4-A5)

Annual delivery rates are taken into consideration for delivery scenario. (A4) Transportation impacts occurred from delivering of the product cover direct exhaust emissions of fuel, environmental impacts of fuel production, as well as related infrastructure emissions.

Environmental impacts from installation into the building include packaging material waste 'carton and plastic film' and weight loss from the product. The impacts of energy consumption and used ancillary materials during installation are negligible. (A5)

PRODUCT USE AND MAINTENANCE (B1-B7)

This EPD does not cover use phase. Air, soil and water impacts during the use phase have not been studied.

PRODUCT END OF LIFE (C1-C4, D)

At the end-of-life, in the demolition phase 100% of the end-of-life product is assumed to be collected separately; however, consumption of energy and natural resources in demolition process assumed to be negligible. (C1) The collected end-of-life product is sent to the closest facilities for incineration, recycling and landfilling by lorry which is the most common transportation method (C2). 50% and 44% of end-of-life product is converted to energy in incineration plant and recycled respectively (C3); accordingly, 6% of end-of-life product is landfilled (C4). Due to the incineration and recycling potential of polypropylene, the end-of-life product is converted into energy and recycled raw materials (D).

LIFE CYCLE ASSESSMENT

LIFE CYCLE ASSESSMENT INFORMATION

Period for data	year 2020

DECLARED AND FUNCTIONAL UNIT

Declared unit	1 kg Silenta Premium, Silenta Extreme, Silenta 3A
Mass per declared unit	1 kg

BIOGENIC CARBON CONTENT

Product's biogenic carbon content at the factory gate

Biogenic carbon content in product	0 kg C
Biogenic carbon content in packaging	0.009 kg C

SYSTEM BOUNDARY

The scope of the EPD is "cradle to gate with modules A4, A5, C1-C4 and D". The modules A1 (Raw material supply), A2 (Transport) and A3 (Manufacturing), A4 (Transport), A5 (Assembly) as well as C1 (Deconstruction/ demolition), C2 (Transport at end-of-life), C3 (Waste processing), C4 (Disposal) and D (benefits and loads beyond the system boundary) are included in the study.

Product stage			Assembly stage		Use stage							End of life stage				Beyond the system boundaries		
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D	D	D
X	X	X	X	X	MND	MND	MND	MND	MND	MND	MND	x	x	x	x	x	x	x
Raw materials	Transport	Manufacturing	Transport	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstr./demol.	Transport	Waste processing	Disposal	Reuse	Recovery	Recycling

Modules not declared = MND

CUT-OFF CRITERIA

The study does not exclude any modules or processes which are stated mandatory in the *EN 15804A1:2012+A2:2019* and *RTS PCR, 26.8.2020*. The study does not exclude any hazardous materials or substances.

The study includes all major raw material and energy consumption. All inputs and outputs of the unit processes which data are available for are included in the calculation. There is no neglected unit process more than 1% of total mass and energy flows. The total neglected input and output flows do also not exceed 5% of energy usage or mass. The life cycle analysis includes all industrial processes from raw material acquisition to production, distribution, and end-of-life stages.

The modules B1-B7 have not been calculated nor included in the LCA calculations.

The production of capital equipment, construction activities, and infrastructure, maintenance and operation of capital equipment, personnel-related activities, energy, and water use related to company management and sales activities are excluded.

ALLOCATION, ESTIMATES AND ASSUMPTIONS

Allocation is based on annual production rate of the reference year and made with high accuracy and precision. The values for 1 kg of the produced product which is used within this study are calculated by considering the total product weight per annual production. The product output is fixed to 1 kg and the corresponding amount of product is used in the calculations.

In the production plant, several kinds of products are produced; however, since there are separate energy meters for each production line, total annual consumed energy in the production line is allocated per 1 kg of product considering the annual production. Packaging material allocation is handled according to the ratio of the annual production of the declared product to the total annual production at the factory since the produced products and used packaging materials for all are similar. Most of the broken or fewer quality products are sent back to the production; accordingly, the energy consumption for preparing the discarded product as raw material is included in the energy consumption per 1 kg of product. The rest of the of discarded product is allocated as by-product due to its energy potential in incineration plant.

This LCA study is conducted in accordance with all methodological considerations, such as performance, system boundaries, data quality, allocation procedures, and decision rules to evaluate inputs and outputs.

All estimations and assumptions are given below.

- Modules A2, A4 & C2: Vehicle capacity utilization volume factor is assumed to be 1 which means full load. It may vary but as the role of transportation emission in total results is small and so the variety in load assumed to be negligible. Empty returns are not considered as it is assumed that return trip is used by transportation companies to serve the needs of other clients.
- Module A4: Transportation doesn't cause losses as products are packaged properly. Also, volume capacity utilisation factor is assumed to be 1 for the nested packaged products. Additionally, transportation distances and vehicle types are assumed according to the delivery in the last year.
- Module A5: Weight loss from cutting process during installation is assumed to be 1%. Weight loss from product and waste from packaging materials are assumed to be incinerated. Consumed energy and other sources for installation is negligible.
- Module C1: Consumed energy and other sources for demolition process of the product is negligible.
- Module C2: Transportation distance to the closest disposal area is estimated as 50 km and the transportation method is assumed as lorry which is the most common.
- Modules C3, C4: 50% and 44% of end-of-life product are assumed to be incinerated and recycled according to *Our World in Data*. Hence, 6% of end-of-life product is landfill waste.
- Module D: The benefits of energy recovering are taken into consideration according to the energy efficiency specified in *Eriksson, O & Finnveden, G., 2017*. Primary contents of the recycled end-of-life polypropylene are assumed to be raw materials for further productions.

AVERAGES AND VARIABILITY

The results represent the average of the Silenta Premium, Silenta Extreme, Silenta 3A pipe and fitting systems.

ENVIRONMENTAL IMPACT DATA

The LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

Note: "ENVIRONMENTAL IMPACTS - EN 15804+A1, CML / ISO 21930" and "ENVIRONMENTAL IMPACTS - TRACI 2.1" are presented in ANNEX-1 and ANNEX-2 respectively.

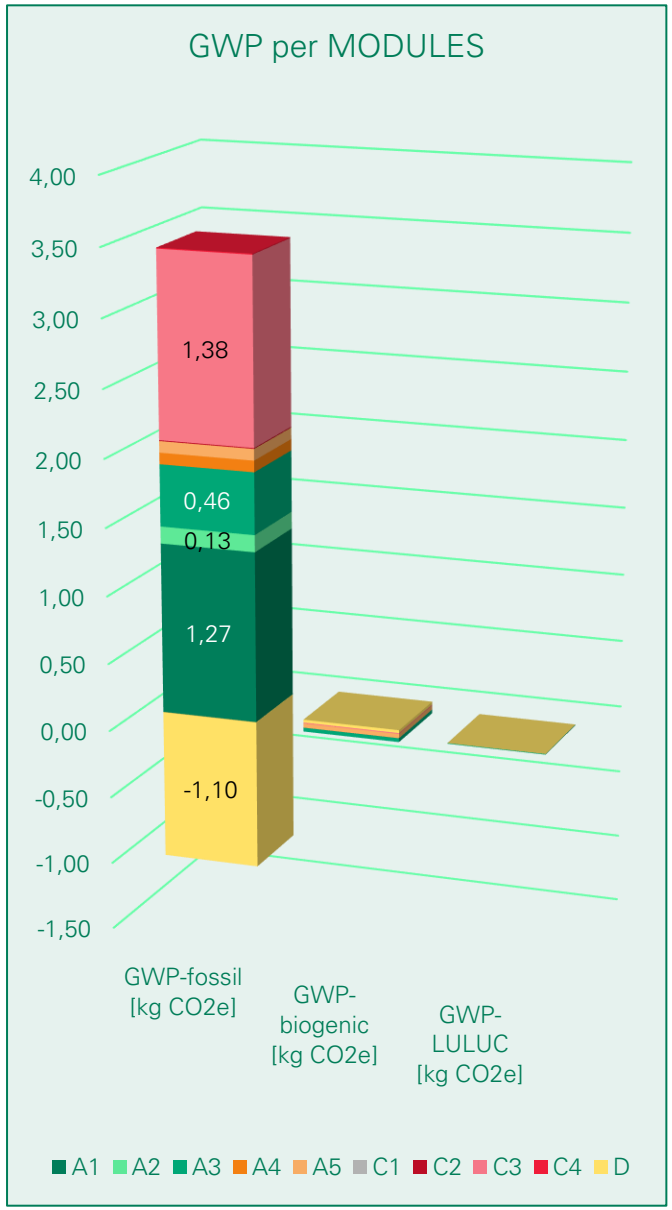
CORE ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, PEF

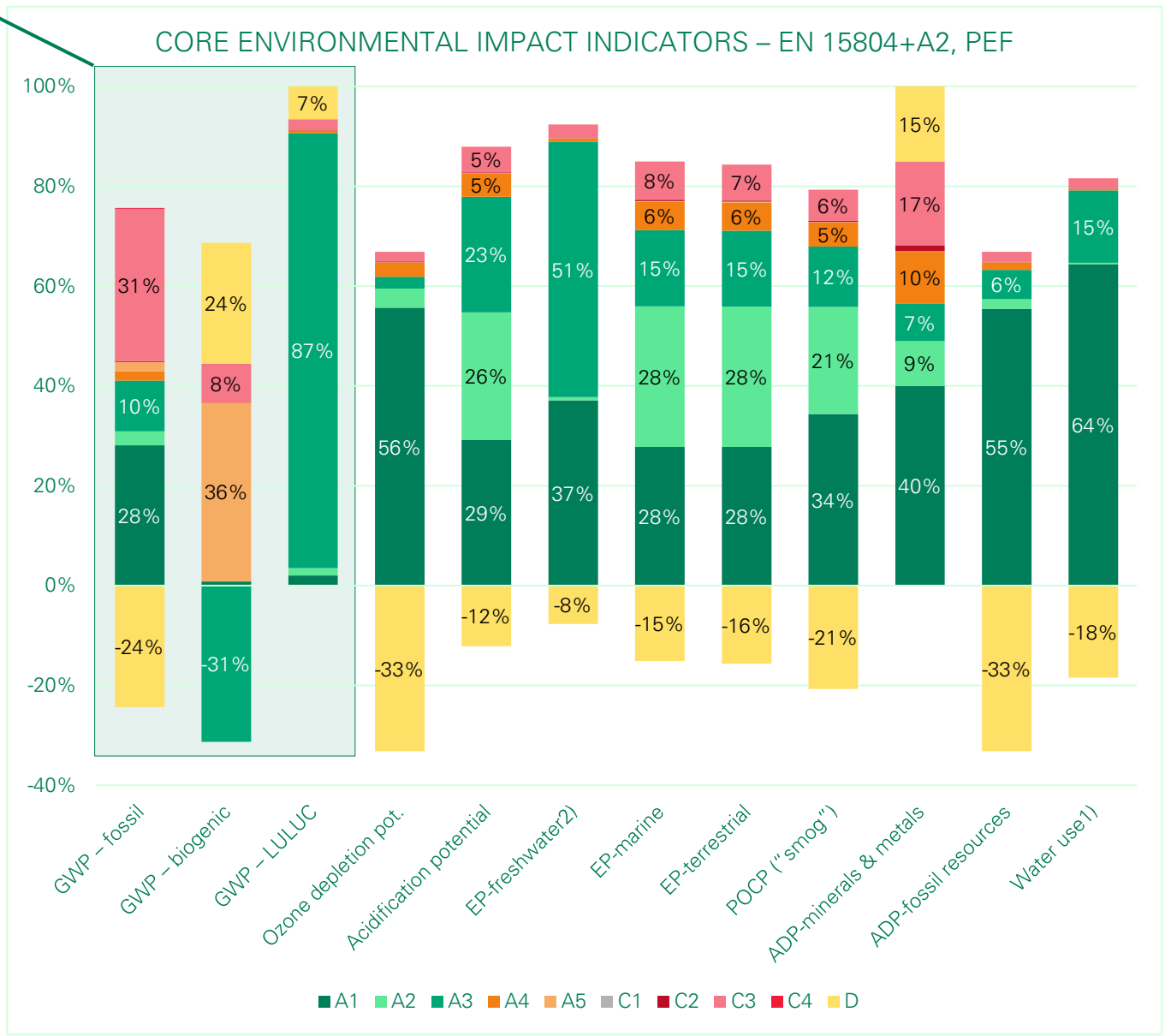
Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Climate change – total	kg CO_2e	1.27E+00	1.26E-01	4.35E-01	1.84E+00	8.47E-02	1.17E-01	MND	0.00E+00	6.31E-03	1.39E+00	7.52E-03	-1.08E+00
Climate change – fossil	kg CO_2e	1.27E+00	1.26E-01	4.59E-01	1.86E+00	8.46E-02	8.52E-02	MND	0.00E+00	6.31E-03	1.38E+00	7.52E-03	-1.10E+00
Climate change – biogenic	kg CO_2e	7.06E-04	-1.34E-05	-2.77E-02	-2.70E-02	5.20E-05	3.17E-02	MND	0.00E+00	3.86E-06	6.80E-03	6.77E-06	2.15E-02
Climate change – LULUC	kg CO_2e	1.04E-04	7.67E-05	4.47E-03	4.66E-03	2.90E-05	1.74E-07	MND	0.00E+00	2.23E-06	1.09E-04	3.32E-07	3.41E-04
Ozone depletion	kg CFC11e	3.76E-07	2.60E-08	1.59E-08	4.18E-07	1.96E-08	7.92E-11	MND	0.00E+00	1.45E-09	1.26E-08	1.95E-10	-2.24E-07
Acidification	mol H^+e	3.89E-03	3.41E-03	3.09E-03	1.04E-02	6.16E-04	1.13E-05	MND	0.00E+00	2.60E-05	6.71E-04	5.47E-06	-1.62E-03
Eutrophication, aquatic freshwater [1]	kg Pe	3.85E-05	6.52E-07	5.31E-05	9.22E-05	6.55E-07	9.04E-09	MND	0.00E+00	5.45E-08	2.77E-06	1.17E-08	-7.99E-06
Eutrophication, aquatic marine	kg Ne	8.31E-04	8.42E-04	4.56E-04	2.13E-03	1.69E-04	5.34E-06	MND	0.00E+00	7.69E-06	2.25E-04	3.11E-06	-4.51E-04
Eutrophication, terrestrial	mol Ne	9.25E-03	9.36E-03	5.07E-03	2.37E-02	1.87E-03	5.78E-05	MND	0.00E+00	8.50E-05	2.37E-03	2.02E-05	-5.22E-03
Photochemical ozone formation	kg NMVOCe	3.93E-03	2.45E-03	1.38E-03	7.75E-03	5.51E-04	1.39E-05	MND	0.00E+00	2.67E-05	7.02E-04	7.42E-06	-2.37E-03
Abiotic depletion, minerals & metals [2]	kg Sbe	5.20E-06	1.17E-06	9.67E-07	7.33E-06	1.36E-06	1.36E-08	MND	0.00E+00	1.57E-07	2.17E-06	6.77E-09	1.96E-06
Abiotic depletion of fossil resources [2]	MJ	4.83E+01	1.67E+00	5.16E+00	5.51E+01	1.29E+00	7.99E-03	MND	0.00E+00	9.62E-02	1.71E+00	1.49E-02	-2.89E+01
Water use [2]	m^3e deprived	1.09E+00	4.11E-03	2.46E-01	1.34E+00	4.61E-03	1.21E-04	MND	0.00E+00	3.42E-04	3.47E-02	6.62E-04	-3.12E-01

[1] The required characterisation method and data are in kg P-eq; to get PO_4e, multiply the result by 3.07.

[2] EN 15804+A2 Disclaimer 2: "The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator."

Reading Example: 1.00E-03 = 1.00×10^{-3} = 0.001
1.00E+03 = $1.00 \times 10^{+3}$ = 1000


GWP per MODULES
4,00
3,50
3,00
2,50
2,00
1,50
1,00
0,50
0,00
-0,50
-1,00
-1,50
1,38
0,46
0,13
1,27
-1,10
GWP-fossil [kg CO2e]
GWP-biogenic [kg CO2e]
GWP-LULUC [kg CO2e]
A1 A2 A3 A4 A5 C1 C2 C3 C4 D


CORE ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, PEF
100%
80%
60%
40%
20%
0%
-20%
-40%
31%
10%
28%
-24%
24%
8%
36%
-31%
7%
87%
56%
-33%
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23%
26%
29%
-12%
51%
37%
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7%
9%
40%
6%
55%
-33%
15%
64%
-18%
GWP – fossil
GWP – biogenic
GWP – LULUC
Ozone depletion pot.
Acidification potential
EP-freshwater2)
EP-marine
EP-terrestrial
POCP (“smog”)
ADP-minerals & metals
ADP-fossil resources
Water use1)
A1 A2 A3 A4 A5 C1 C2 C3 C4 D

ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, PEF

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Particulate matter	Incidence	5.18E-08	5.29E-09	1.52E-08	7.23E-08	7.11E-09	5.40E-11	MND	0.00E+00	4.87E-10	1.48E-08	1.04E-10	-8.62E-09
Ionizing radiation, human health [3]	kBq U235e	4.11E-02	7.20E-03	3.68E-03	5.19E-02	5.63E-03	1.22E-05	MND	0.00E+00	4.21E-04	4.12E-03	5.82E-05	-1.07E-02
Eco-toxicity (freshwater) [2]	CTUe	1.04E+01	1.10E+00	6.21E+00	1.78E+01	9.70E-01	2.08E-02	MND	0.00E+00	7.51E-02	2.49E+00	1.49E-02	-2.67E+00
Human toxicity, cancer effects [2]	CTUh	1.23E-10	6.46E-11	8.44E-11	2.72E-10	2.81E-11	3.01E-12	MND	0.00E+00	2.13E-12	3.02E-10	4.11E-13	1.39E-10
Human toxicity, non-cancer effects [2]	CTUh	5.54E-09	1.01E-09	4.05E-09	1.06E-08	1.12E-09	1.21E-10	MND	0.00E+00	8.62E-11	4.38E-09	9.97E-12	-9.20E-10
Land use related impacts/soil quality [2]	-	1.23E-01	5.96E-01	3.14E-01	1.03E+00	1.77E+00	2.32E-03	MND	0.00E+00	1.07E-01	1.02E+00	5.26E-02	7.58E-01

[2] EN 15804+A2 Disclaimer 2: "The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator."

[3] EN 15804+A2 Disclaimer 1: "This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator."

USE OF NATURAL RESOURCES

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Renewable PER used as energy	MJ	7.06E-01	1.35E-02	1.68E+00	2.40E+00	1.56E-02	1.72E-04	MND	0.00E+00	1.37E-03	7.26E-02	2.60E-04	-2.04E-02
Renewable PER used as materials	MJ	0.00E+00	0.00E+00	3.65E-01	3.65E-01	0.00E+00	-3.65E-01	MND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use of renewable PER	MJ	7.06E-01	1.35E-02	2.04E+00	2.76E+00	1.56E-02	-3.65E-01	MND	0.00E+00	1.37E-03	7.26E-02	2.60E-04	-2.04E-02
Non-renewable PER used as energy	MJ	1.70E+01	1.67E+00	5.13E+00	2.38E+01	1.29E+00	7.99E-03	MND	0.00E+00	9.62E-02	1.71E+00	1.49E-02	-1.52E+01
Non-renewable PER used as materials	MJ	3.13E+01	0.00E+00	3.35E-02	3.13E+01	0.00E+00	-3.46E-01	MND	0.00E+00	0.00E+00	-2.91E+01	0.00E+00	-1.36E+01
Total use of non-renewable PER	MJ	4.83E+01	1.67E+00	5.16E+00	5.51E+01	1.29E+00	-3.38E-01	MND	0.00E+00	9.62E-02	-2.74E+01	1.49E-02	-2.89E+01
Use of secondary materials	kg	7.43E-04	0.00E+00	2.00E-04	9.43E-04	0.00E+00	0.00E+00	MND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.87E-01
Use of renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of non-renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of net fresh water	m^3	1.82E+01	2.00E-04	2.49E-03	1.82E+01	2.55E-04	2.15E-05	MND	0.00E+00	1.82E-05	6.94E-04	1.67E-05	-7.93E+00

PER abbreviation stands for primary energy resources.

END OF LIFE – WASTE

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Hazardous waste	kg	6.65E-03	1.88E-03	2.74E-02	3.60E-02	1.28E-03	5.87E-04	MND	0.00E+00	1.00E-04	0.00E+00	2.70E-05	1.50E-02
Non-hazardous waste	kg	2.52E-01	5.92E-02	2.22E+00	2.53E+00	1.28E-01	3.16E-02	MND	0.00E+00	8.32E-03	0.00E+00	5.94E-02	3.42E-01
Radioactive waste	kg	8.13E-06	1.17E-05	3.75E-06	2.36E-05	8.88E-06	1.61E-08	MND	0.00E+00	6.58E-07	0.00E+00	8.88E-08	3.63E-06

END OF LIFE – OUTPUT FLOWS

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	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	MND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND	0.00E+00	0.00E+00	4.36E-01	0.00E+00	0.00E+00
Materials for energy recovery	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.22E-02	MND	0.00E+00	0.00E+00	4.95E-01	0.00E+00	0.00E+00
Exported energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

KEY INFORMATION TABLE (RTS) – KEY INFORMATION PER KG OF PRODUCT

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Climate change – total	kg CO_2e	1.27E+00	1.26E-01	4.35E-01	1.84E+00	8.47E-02	1.17E-01	MND	0.00E+00	6.31E-03	1.39E+00	7.52E-03	-1.08E+00
Abiotic depletion. minerals & metals [2]	kg Sbe	5.20E-06	1.17E-06	9.67E-07	7.33E-06	1.36E-06	1.36E-08	MND	0.00E+00	1.57E-07	2.17E-06	6.77E-09	1.96E-06
Abiotic depletion of fossil resources [2]	MJ	4.83E+01	1.67E+00	5.16E+00	5.51E+01	1.29E+00	7.99E-03	MND	0.00E+00	9.62E-02	1.71E+00	1.49E-02	-2.89E+01
Water use [2]	m^3e deprived	1.09E+00	4.11E-03	2.46E-01	1.34E+00	4.61E-03	1.21E-04	MND	0.00E+00	3.42E-04	3.47E-02	6.62E-04	-3.12E-01
Use of secondary materials	kg	7.43E-04	0.00E+00	2.00E-04	9.43E-04	0.00E+00	0.00E+00	MND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.87E-01
Biogenic carbon content in product	kg C	N/A	N/A	0.00E+00	0.00E+00	N/A	N/A	MND	N/A	N/A	N/A	N/A	N/A
Biogenic carbon content in packaging	kg C	N/A	N/A	8.64E-03	8.64E-03	N/A	N/A	MND	N/A	N/A	N/A	N/A	N/A

[2] EN 15804+A2 Disclaimer 2: "The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator."

SCENARIO DOCUMENTATION

Manufacturing energy scenario documentation

Scenario parameter	Value
Electricity data source and quality	Electricity, high voltage, production mix, Ecoinvent v3.6, Turkey, 2019
Electricity CO_2e/kWh	0.54 kg CO2e / kWh

Transport scenario documentation

Scenario parameter	Value
A4 specific transport CO2e emissions, kg CO_2e / tkm	0.0465
A4 average transport distance, km	1767

End of life scenario documentation

Scenario parameter	Value
Collection process – kg collected separately	0.9900
Collection process – kg collected with mixed waste	-
Recovery process – kg for re-use	-
Recovery process – kg for recycling	0.4356
Recovery process – kg for energy recovery	0.4950
Disposal (total) – kg for final deposition	0.0594
Scenario assumptions for transportation	End-of-life product is transported 50 km with an average lorry

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ANNEX-1: ENVIRONMENTAL IMPACTS - EN 15804+A1, CML / ISO 21930

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Global warming potential	kg CO_2e	1.24E+00	1.25E-01	4.55E-01	1.82E+00	8.39E-02	8.51E-02	MND	0.00E+00	6.25E-03	1.38E+00	5.33E-03	-1.03E+00
Depletion of stratospheric ozone	kg CFC11e	3.93E-08	2.06E-08	1.31E-08	7.31E-08	1.56E-08	7.15E-11	MND	0.00E+00	1.15E-09	1.04E-08	1.55E-10	-6.17E-08
Acidification	kg SO_2e	3.18E-03	2.69E-03	2.66E-03	8.53E-03	3.93E-04	7.87E-06	MND	0.00E+00	1.29E-05	5.29E-04	5.36E-06	-1.14E-03
Eutrophication	kg $(PO_4)^{3-}e$	9.56E-04	3.04E-04	1.61E-03	2.87E-03	5.76E-05	6.76E-06	MND	0.00E+00	2.67E-06	8.39E-04	2.63E-04	2.77E-04
Photochemical ozone formation	kg C_2H_4e	2.70E-04	7.19E-05	9.74E-05	4.39E-04	1.59E-05	1.37E-07	MND	0.00E+00	8.31E-07	3.82E-05	1.12E-06	-1.76E-04
Abiotic depletion of non-fossil resources	kg Sbe	5.20E-06	1.17E-06	9.67E-07	7.33E-06	1.36E-06	1.36E-08	MND	0.00E+00	1.57E-07	2.17E-06	6.77E-09	1.96E-06
Abiotic depletion of fossil resources	MJ	4.83E+01	1.67E+00	5.16E+00	5.51E+01	1.29E+00	7.99E-03	MND	0.00E+00	9.62E-02	1.71E+00	1.49E-02	-2.89E+01

ANNEX-2: ENVIRONMENTAL IMPACTS - TRACI 2.1

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Global warming potential	kg CO_2e	1.24E+00	1.25E-01	4.56E-01	1.82E+00	8.38E-02	8.51E-02	MND	0.00E+00	6.24E-03	1.38E+00	5.65E-03	-1.04E+00
Ozone depletion	kg CFC11e	4.46E-08	2.75E-08	1.83E-08	9.04E-08	2.07E-08	8.37E-11	MND	0.00E+00	1.53E-09	1.37E-08	2.07E-10	-8.02E-08
Acidification	kg SO_2e	3.27E-03	2.89E-03	2.56E-03	8.72E-03	5.30E-04	1.05E-05	MND	0.00E+00	2.26E-05	6.29E-04	4.87E-06	-1.37E-03
Eutrophication	kg Ne	2.27E-03	1.37E-04	4.42E-04	2.85E-03	5.01E-05	3.56E-06	MND	0.00E+00	3.19E-06	1.15E-04	2.36E-06	-8.98E-04
Photochemical smog formation	kg O_3e	5.85E-02	5.36E-02	2.83E-02	1.40E-01	1.07E-02	3.32E-04	MND	0.00E+00	4.87E-04	1.35E-02	1.16E-04	-3.10E-02
Depletion of non-renewable energy	MJ	7.08E+00	2.45E-01	3.83E-01	7.71E+00	1.85E-01	1.11E-03	MND	0.00E+00	1.37E-02	2.13E-01	2.04E-03	-4.62E+00

ABOUT THE MANUFACTURER

Founded in Switzerland in 1802, Georg Fischer Corporation operates in three main business lines: GF Piping Systems, GF Casting Solutions and GF Machining Solutions. Georg Fischer is present in 34 countries with 57 production plants and 136 companies.
GF Piping Systems, the largest business line of Georg Fischer Corporation, is one of the leading companies in plastic and metal piping systems in the world. GFPS produces system solutions and high-quality components for the secure transmission of water and gas in industries, utilities and building technology. Reaching out to over 100 countries with its more than 30 production plants, GF Piping Systems acquired Hakan Plastik in 2013.
Founded in 1965, Hakan Plastik has achieved so many breakthroughs as the first company that produced the silent pipe in Turkey and has reflected the importance that it attaches to development and change to its products and services as well.

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EPD verifier	Silvia Vilčeková, Silcert, s.r.o.
EPD program operator	The Building Information Foundation RTS sr
Background data	Ecoinvent 3.6 (cut-off) and Plastics Europe 2012
LCA software	One Click LCA Pre-Verified EPD Generator for Plumbing Products, Components, Equipment and Systems