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Polyethylene fittings (PE-100-RC)



Owner of the EPD:

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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+A2
(Cradle-to-Gate with options)

Product standards: ISO 4427-2:2019/AMD 1:2023, ISO 4437-1:2024, PN-EN 12201-2:2024-04, PN-EN 1555-1:2021-12

The year of preparing the EPD: 2024

Service Life: 50 years for standard product

PCR: ITB-PCR A

Declared unit: 1 kg

Reasons for performing LCA: B2B

Representativeness: Poland, European, 2023

MANUFACTURER

FOX FITTINGS Sp. z o.o. is a manufacturer of PE 100-RC polyethylene fittings: electrofusion, spigot, ball-valves, pe/brass transitions and other welding solutions. With over 35 years of experience and meeting multiple international standards in product development, company is currently one of the leading suppliers of high-quality components, supporting investments in over 70 countries around the world in gas, water and hydrogen distribution systems.



Figure 1 Street view of FOX FITTINGS Sp. z o. o.

FOX FITTINGS Sp. z o.o. ensures the certainty and safety of its solutions thanks to strict and multi-stage quality control. Each stage, from the design to the final product, is carried out with careful attention to detail. Company is constantly aiming to implement technically advanced products and innovative solutions to meet ever-evolving needs of customers.

PRODUCTS DESCRIPTION AND APPLICATION

FOX FITTINGS Sp. z o. o. manufactures PE 100-RC polyethylene fittings dedicated to external networks - pipelines (water, gas and hydrogen). PE 100-RC (RC - resistant to cracks) material provides higher resistance to crack propagation, which in practice translates into greater safety of the installation and extended life span of the fittings and the entire system. Only certified raw materials recommended by the PE100+ Association are used for production. Optimization and constantly controlled parameters of the production process allow to obtain the highest technical properties of the details. Both the raw material and the components are subjected to detailed tests. Multi-stage testing of all new products is carried out for compliance with applicable standards. Table 1 presents the manufactured assortment covered by EPD.

Table 1. List of manufactured polyethylene fittings

Product Name	Dimension	Color	Welding range	Material
Electrofusion coupler SDR 7,4; 11; 17	SDR 7,4 – dn 32-225 SDR 11 – dn 20-630 SDR 17 – dn 90-630	black	SDR 7,4; 11; 17	PE 100-RC
Electrofusion reducer SDR 11 Electrofusion reducer BHZ SDR11	SDR 11- dn 25/20-225/200 SDR11 BHZ – dn 180/160-250/225	black	SDR 11	PE 100-RC
Electrofusion elbow 90° SDR 11 Electrofusion elbow 45° SDR 11 Electrofusion elbow BHZ 90° SDR 11 Electrofusion elbow BHZ 45° SDR 11	90° - dn 20-160 45° - dn 20-160 BHZ 90° - dn 180-500 BHZ 45° - dn 180-500	black	SDR 11	PE 100-RC
Electrofusion end cap SDR 11	dn 20-630	black	SDR 11	PE 100-RC
Repairing clamp SDR 11	dn 63-315	black	SDR 11	PE 100-RC
Electrofusion tee - equal bore SDR 11	SDR 11- dn 20-225	black	SDR 11	PE 100-RC

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Electrofusion tee- reduction bore SDR 11 Electrofusion tee BHZ SDR 11 Electrofusion tee - reduction bore BHZ SDR 11	SDR 11 reduction bore – dn 25/20-225/125 BHZ SDR11 – dn 140-500 BHZ SDR11 reduced – dn 200/90-315/250			
Branch saddle SDR 11 Branch saddle universal SDR 11	SDR 11 – dn 63/20- 315/110 SDR 11uni- dn 355/560/063 – 630/900/110	black	SDR 11	PE 100-RC
Branch saddle VLS	dn 315/225-910/225	black	SDR 11	PE 100-RC
Tapping tee SDR 11 Tapping tee with end cap SDR11	dn 40/20-315/63 Dn 63/20 - 315/63	black	SDR 11	PE 100-RC
Tapping valve SDR 11	Dn 63/32-250/63	black	SDR 11	PE 100-RC
Spigot elbow 90° SDR 11 Spigot elbow 90° SDR 17 Spigot elbow 45° SDR 11 Spigot elbow 45° SDR 17	SDR 11 90°- dn25-315 SDR 17 90° - dn63-315 SDR 11 45°- dn25-315 SDR 17 45°- dn63-315	black	SDR 11;17	PE 100-RC
Spigot tee – equal bore SDR 11 Spigot tee – reduction bore SDR 11 Spigot tee- equal bore SDR 17 Spigot tee – reduction bore SDR 17	SDR 11 -dn 25-500 SDR 11 reduction bore – dn 63/50-315/250 SDR 17 – dn 63-500 SDR 17 reduction bore – dn 75/63-315/250	black	SDR 11	PE 100-RC
Spigot end cap SDR 11 Spigot end cap SDR 17	SDR 11 – dn25-500 SDR 17 – dn63-500	black	SDR 11	PE 100-RC
Spigot flange adaptor SDR 11 Spigot flange adaptor SDR 17	SDR 11 – dn32-630 SDR 17 – dn63-630	black	SDR 11	PE 100-RC
Spigot reducer SDR 11 Spigot reducer SDR 17	SDR 11 – dn 25/20- 315/280 SDR 17 – dn 75/63- 315/280	black	SDR 11	PE 100-RC
PE ball valve – BVR (reduced) PE ball valve – BVS PE ball valve - IBVS	BVR dn 160-315 BVS dn 25-225 IBVS – 1"- 8"	black	SDR 11	PE 100-RC
PE/brass transition male (GZ) PN16 PE/brass transition female (GW) PN16 Electrofusion coupler with brass transition male (GZ) Electrofusion coupler with brass transition female (GW) Electrofusion elbow 90° with brass transition male (GZ) Electrofusion elbow 90° with brass transition female (GW) Electrofusion elbow 45° with brass transition male (GZ) Electrofusion elbow 45° with brass transition female (GW)	dn 20/1/2" – 125/4" dn 20/1/2" – 125/4" dn dn 20/1/2" – 125/4" dn 20/1/2" – 125/4" dn 20/1/2" – 125/4" dn 20/1/2" – 125/4" dn 20/1/2" – 125/4" dn 20/1/2" – 125/4"	black Metal	SDR 11	PE 100-RC brass
PE/Steel transition - injected PE/Steel transition - standard	dn 25/20W-63/50W dn 25/20-355/300	black Metal	SDR 11	PE 100-RC steel

[All additional technical information about the product is available on the manufacturer's website.](#)

LIFE CYCLE ASSESSMENT (LCA) – general rules applied

Unit

The declared unit is 1 kg of product.

If it is necessary to convert the result data expressed per mass to unit (piece of element), the environmental impact values mass based for a given product group must be multiplied by the weight of the reference product unit (Table 2).

Table 2. List of manufactured polyethylene fittings, their composition for types and representative products and weight of selected products

Type of product	Spigot	Electrofusion	Transition		PE Ball valve
Reference products	Elbow 90dg /dn315	Coupler dn630	PE/BRASS dn 110x 4"	PE/STEEL dn 63/50	dn 315
Composition of the product (%)					
PE	100	97.72	23.4	30.15	82.47
copper wire		2.26			
brass insert			76.6		
steel pipe				69.85	
brass pin		0.02			
NBR oring/gasket					0.28
PP (other material)					17.25
Weight of the representative product (kg)					
Product weight	16.81	46.2	2.35	2.005	28.98

System boundary

The life cycle analysis (LCA) of the declared products covers: product stage – modules A1-A5, B1-B6 end of life – modules C1-C4 and benefits and loads beyond the system boundary – module D (cradle to grave) in accordance with EN 15804+A2 and ITB PCR A. Energy and water consumption, emissions as well as information on generated wastes were inventoried and were included in the calculations. It can be assumed that the total sum of omitted processes does not exceed 5% 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 PCR A. Production of the Polyethylene fittings and elements is a line process conducted in factory of FOX FITTINGS Sp. z o. o. located in Wilamowice (Poland). Allocation was done on product mass basis. All impacts associated with the extraction and processing of raw materials used for the production of the declared product are allocated in module A1 of the LCA. Impacts from the global line production of FOX FITTINGS Sp. z o. o. were inventoried and 100% were allocated to Polyethylene fittings production. Water and energy consumption (electrical grid, diesel and LPG), associated emissions and generated wastes are allocated to module A3. Packaging materials were taken into consideration.

System limits

Minimum 99.0% input materials and 100% energy consumption (electricity, diesel, LPG) were inventoried in a processing plant and were included in the calculation. In the assessment, all available data from production have been considered, i.e. all raw materials/elements used as per formulation process, utilized thermal energy for heating, and electric power consumption. Thus, material and energy flows contributing less than 1 % of mass or energy have been considered. It can be assumed that the total sum of neglected processes does not exceed 1 % of energy usage and mass per modules A or D. Machines and facilities required during production are neglected. The packaging products (plastic bags, stretch, pallets, paper and cardboard packaging, etc.) are included.

Modules A1 and A2: *Raw materials supply and transport*

Modules A1 and A2 represent the extraction and processing of raw materials (mainly PE100 RC) and transport to the production site. Wire, brass adaptor, steel pipe and cutter, pin connectors are commonly used semi-finished products for the production of Polyethylene fittings. The PE100 RC used comes from both local and foreign suppliers. Module A2 (transport) includes truck transport and uses Polish and European averages for fuel data.

Module A3: *Production*

The production of the Polyethylene fittings is carried out in factory of FOX FITTINGS Sp. z o. o. in Wilamowice. The production includes the receipt of raw material deliveries for production, which are mainly PE100 RC. Then the PE100 RC is subjected to heat treatment, at this stage it can be connected to cores made of brass and steel. The products obtain specific shapes thanks to a specific processing technology using various dedicated devices. The finished products are subject to quality control, then they are marked, packed, and then transferred to the recipient or sent to him. The diagram of the production process is shown in Figure 2.

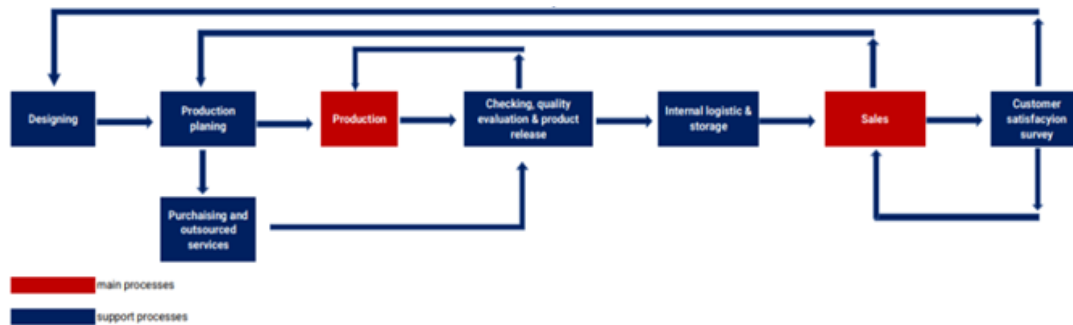


Figure 2. Diagram of the manufacturing process of Polyethylene fittings

Module A4: *Transport to consumer*

Transport of the Polyethylene fittings and elements from plant to the recipient is carried out using trucks. Vehicle transport at distance 100 km is considered (emission standard: Euro 5) with 100% load capacity.

A5: *Installation process*

Impacts from the use of electric tools, welders and consumables were included in the calculations.

Modules C and D: *End-of-life (EoL)*

It is assumed that at the end of life, 100 % of Polyethylene fittings are demounted using electric tools. Materials recovered from dismantled products are recycled (module C3) and landfilled (module C4)

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according to the realistic treatment practice (mass allocation) of industrial waste what is presented in Table 3. 98 % of metals and polymer waste is processed while the remaining part is forwarded to landfill.. A potential credits resulting from the recycling of metals is presented in module D. Utilization of packaging material which constitute less than 1 % of the total system flows was not taken into consideration.

Table 3. End-of-life scenario for a Polyethylene fittings and elements

Material	Material recovery (reuse, recycling)	Landfilling
Polymers	98	2 %
Metals	98	2 %

Data collection period

The data for manufacture of the declared products refer to period between 01.01.2023 – 31.12.2023 (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 FOX FITTINGS Sp. z o. o. and verified during data audit. No data collected is older than five years and no generic datasets used are older than ten years. The representativeness, completeness, reliability, and consistency is judged as good. The background data for the processes come from the following resources database Ecoinvent v.3.10. Specific (LCI) data quality analysis was a part of the input data verification.

Assumptions and estimates

The impacts of the representative products were aggregated using weighted average.

Calculation rules

LCA was performed using ITB-LCA tool developed in accordance with EN15804+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 (Ecoinvent v 3.10 supplemented by actual national KOBiZE data) emission factor used is 0.685 kg CO₂/kWh (National for 2023). As a general rule, no particular environmental or health protection measures other than those specified by law are necessary.

LIFE CYCLE ASSESSMENT (LCA) – Results

Declared unit

The declaration refers to declared unit (DU) – 1 kg of Polyethylene fittings and elements produced in Poland. The following life cycle modules (Table 4) were included in the analysis. The following tables 5-23 show the environmental impacts of the life cycle of selected modules (A1-A5+C1-C4+D).

Table 4 System boundaries for the environmental characteristic of the product.

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	NMD	MND	MD	MD	MD	MD	MD

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Table 4 Life cycle assessment (LCA) results of the electrofusion fittings – environmental impacts (DU: 1 kg)

Indicator	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Global Warming Potential	eq. kg CO ₂	2.43E+00	9.24E-02	1.10E+00	3.63E+00	1.67E-02	6.85E-04	6.85E-03	2.21E-02	3.41E-01	5.18E-03	-4.20E-01
Greenhouse potential - fossil	eq. kg CO ₂	2.51E+00	9.23E-02	1.10E+00	3.70E+00	1.66E-02	6.85E-04	6.85E-03	2.20E-02	2.83E-01	5.16E-03	-3.60E-01
Greenhouse potential - biogenic	eq. kg CO ₂	-8.41E-02	5.58E-05	3.49E-03	-8.06E-02	5.68E-05	1.85E-06	1.85E-05	7.52E-05	5.72E-02	1.32E-05	-5.78E-02
Global warming potential - land use and land use change	eq. kg CO ₂	4.48E-03	3.11E-05	1.44E-04	4.65E-03	6.52E-06	1.07E-07	1.07E-06	8.64E-06	5.24E-04	4.87E-06	-1.33E-03
Stratospheric ozone depletion potential	eq. kg CFC 11	1.11E-07	1.81E-09	6.03E-09	1.19E-07	3.85E-09	3.77E-12	3.77E-11	5.09E-09	5.26E-09	2.09E-09	-7.60E-09
Soil and water acidification potential	eq. mol H ⁺	8.43E-03	4.04E-04	1.12E-02	2.01E-02	6.75E-05	7.25E-06	7.25E-05	8.93E-05	1.45E-03	4.85E-05	-1.65E-03
Eutrophication potential - freshwater	eq. kg P	5.54E-04	6.01E-06	1.80E-03	2.36E-03	1.12E-06	1.18E-06	1.18E-05	1.48E-06	1.62E-04	4.81E-07	-1.80E-04
Eutrophication potential - seawater	eq. kg N	1.69E-03	1.25E-04	1.59E-03	3.40E-03	2.04E-05	1.03E-06	1.03E-05	2.70E-05	3.75E-04	1.69E-05	-4.10E-04
Eutrophication potential - terrestrial	eq. mol N	1.69E-02	1.36E-03	1.40E-02	3.22E-02	2.22E-04	8.95E-06	8.95E-05	2.94E-04	3.33E-03	1.85E-04	-3.64E-03
Potential for photochemical ozone synthesis	eq. kg NMVOC	1.37E-02	5.27E-04	4.01E-03	1.82E-02	6.80E-05	2.57E-06	2.57E-05	9.01E-05	5.26E-09	5.37E-05	-2.10E-04
Potential for depletion of abiotic resources - non-fossil resources	eq. kg Sb	2.91E-05	2.92E-07	4.29E-07	2.98E-05	5.89E-08	2.58E-10	2.58E-09	7.80E-08	2.85E-06	1.18E-08	4.62E-06
Abiotic depletion potential - fossil fuels	MJ	7.70E+01	1.29E+00	1.70E+01	9.52E+01	2.47E-01	1.08E-02	1.08E-01	3.27E-01	5.15E+00	1.41E-01	-6.68E+00
Water deprivation potential	eq. m ³	7.07E-01	6.12E-03	3.17E-01	1.03E+00	1.14E-03	2.07E-04	2.07E-03	1.51E-03	1.15E-01	4.49E-04	-1.82E-02

Table 5 Life cycle assessment (LCA) results of the electrofusion fittings – additional impacts indicators (DU: 1 kg)

Indicator	Unit	A1-A5	C1-C4	D
Particulate matter	disease incidence	INA	INA	INA
Potential human exposure efficiency relative to U235	eg. kBq U235	INA	INA	INA
Potential comparative toxic unit for ecosystems	CTUe	INA	INA	INA
Potential comparative toxic unit for humans (cancer effects)	CTUh	INA	INA	INA
Potential comparative toxic unit for humans (non-cancer effects)	CTUh	INA	INA	INA
Potential soil quality index	dimensionless	INA	INA	INA

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Table 6 Life cycle assessment (LCA) results of the electrofusion fittings - the resource use (DU: 1 kg)

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	2.23E+00	2.13E-02	1.58E+00	3.83E+00	3.54E-03	8.90E-04	8.90E-03	4.69E-03	1.04E+00	1.23E-03	-1.12E+00
Consumption of renewable primary energy resources used as raw materials	MJ	1.67E+00	0.00E+00	0.00E+00	1.67E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-2.51E-02
Total consumption of renewable primary energy resources	MJ	3.90E+00	2.13E-02	1.58E+00	5.51E+00	3.54E-03	8.90E-04	8.90E-03	4.69E-03	1.04E+00	1.23E-03	-1.04E+00
Consumption of non-renewable primary energy - excluding renewable primary energy sources used as raw materials	MJ	3.46E+01	1.29E+00	1.68E+01	5.27E+01	2.47E-01	1.08E-02	1.08E-01	3.27E-01	4.08E+01	1.41E-01	-4.30E+01
Consumption of non-renewable primary energy resources used as raw materials	MJ	4.24E+01	0.00E+00	1.54E-01	4.25E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-3.56E+01	0.00E+00	3.65E+01
Total consumption of non-renewable primary energy resources	MJ	7.70E+01	1.29E+00	1.70E+01	9.53E+01	2.47E-01	1.08E-02	1.08E-01	3.27E-01	5.15E+00	1.41E-01	-6.76E+00
Consumption of secondary materials	kg	8.95E-02	5.91E-04	1.53E-03	9.17E-02	8.27E-05	9.40E-07	9.40E-06	1.10E-04	1.02E+00	2.97E-05	-1.06E+00
Consumption of renew. secondary fuels	MJ	3.14E-02	7.19E-06	7.63E-06	3.14E-02	9.11E-07	4.75E-09	4.75E-08	1.21E-06	0.00E+00	7.77E-07	-4.71E-04
Consumption of non-renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.52E-05	0.00E+00	-3.67E-05
Net consumption of freshwater	m ³	1.84E-02	1.68E-04	1.03E-03	1.96E-02	3.10E-05	3.11E-05	3.11E-04	4.11E-05	3.44E-03	1.55E-04	-2.73E-03

Table 7 Life cycle assessment (LCA) results of the electrofusion fittings – waste categories (DU: 1 kg)

Indicator	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Hazardous waste	kg	9.75E-02	1.85E-03	2.03E-03	1.01E-01	2.77E-04	8.38E-05	8.38E-04	3.67E-04	1.52E-02	1.50E-04	-1.98E-02
Non-hazardous waste	kg	2.20E+01	3.85E-02	1.01E-01	2.21E+01	4.92E-03	5.65E-03	5.65E-02	6.51E-03	1.29E+00	2.12E-03	-1.71E+00
Radioactive waste	kg	5.23E-05	4.00E-07	2.50E-06	5.52E-05	1.84E-08	1.62E-09	1.62E-08	2.44E-08	2.05E-05	9.39E-07	-1.97E-02
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	9.63E-03	1.57E-05	5.11E-02	6.08E-02	7.64E-07	7.26E-08	7.26E-07	1.01E-06	8.03E-04	2.83E-07	-9.81E-04
Materials for energy recovery	kg	4.36E-06	7.94E-08	1.00E-04	1.05E-04	6.18E-09	1.17E-10	1.17E-09	8.18E-09	1.68E-07	3.35E-09	-2.40E-07
Exported Energy	MJ	5.06E-02	5.19E-04	1.28E-02	6.40E-02	0.00E+00	3.46E-05	3.46E-04	0.00E+00	1.63E-02	0.00E+00	-1.77E-02

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Table 8 Life cycle assessment (LCA) results of the spigot fittings – environmental impacts (DU: 1 kg)

Indicator	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Global Warming Potential	eq. kg CO ₂	2.47E+00	9.24E-02	1.10E+00	3.67E+00	1.67E-02	6.85E-04	6.85E-03	2.21E-02	3.48E-01	6.52E-02	-3.92E-01
Greenhouse potential - fossil	eq. kg CO ₂	2.55E+00	9.23E-02	1.10E+00	3.74E+00	1.66E-02	6.85E-04	6.85E-03	2.20E-02	2.89E-01	6.52E-02	-3.33E-01
Greenhouse potential - biogenic	eq. kg CO ₂	-8.45E-02	5.58E-05	3.49E-03	-8.09E-02	5.68E-05	1.85E-06	1.85E-05	7.52E-05	5.83E-02	1.36E-05	-5.82E-02
Global warming potential - land use and land use change	eq. kg CO ₂	4.48E-03	3.11E-05	1.44E-04	4.66E-03	6.52E-06	1.07E-07	1.07E-06	8.64E-06	5.34E-04	1.03E-05	-6.12E-04
Stratospheric ozone depletion potential	eq. kg CFC 11	1.13E-07	1.81E-09	6.03E-09	1.21E-07	3.85E-09	3.77E-12	3.77E-11	5.09E-09	5.37E-09	7.96E-01	-7.18E-09
Soil and water acidification potential	eq. mol H ⁺	7.99E-03	4.04E-04	1.12E-02	1.96E-02	6.75E-05	7.25E-06	7.25E-05	8.93E-05	1.48E-03	5.43E-04	-1.63E-03
Eutrophication potential - freshwater	eq. kg P	5.15E-04	6.01E-06	1.80E-03	2.32E-03	1.12E-06	1.18E-06	1.18E-05	1.48E-06	1.66E-04	4.41E-07	-1.77E-04
Eutrophication potential - seawater	eq. kg N	1.69E-03	1.25E-04	1.59E-03	3.40E-03	2.04E-05	1.03E-06	1.03E-05	2.70E-05	3.83E-04	1.85E-03	-4.16E-04
Eutrophication potential - terrestrial	eq. mol N	1.68E-02	1.36E-03	1.40E-02	3.21E-02	2.22E-04	8.95E-06	8.95E-05	2.94E-04	3.40E-03	3.49E-03	-3.72E-03
Potential for photochemical ozone synthesis	eq. kg NMVOC	1.38E-02	5.27E-04	4.01E-03	1.84E-02	6.80E-05	2.57E-06	2.57E-05	9.01E-05	5.37E-09	7.61E-04	-2.07E-04
Potential for depletion of abiotic resources - non-fossil resources	eq. kg Sb	2.21E-05	2.92E-07	4.29E-07	2.29E-05	5.89E-08	2.58E-10	2.58E-09	7.80E-08	2.91E-06	1.47E-08	-3.30E-06
Abiotic depletion potential - fossil fuels	MJ	7.85E+01	1.29E+00	1.70E+01	9.67E+01	2.47E-01	1.08E-02	1.08E-01	3.27E-01	5.25E+00	6.18E-02	-6.54E+00
Water deprivation potential	eq. m ³	7.09E-01	6.12E-03	3.17E-01	1.03E+00	1.14E-03	2.07E-04	2.07E-03	1.51E-03	1.17E-01	1.45E-03	-1.30E-01

Table 9 Life cycle assessment (LCA) results of the spigot fittings – additional impacts indicators (DU: 1 kg)

Indicator	Unit	A1-A5	C1-C4	D
Particulate matter	disease incidence	INA	INA	INA
Potential human exposure efficiency relative to U235	eg. kBq U235	INA	INA	INA
Potential comparative toxic unit for ecosystems	CTUe	INA	INA	INA
Potential comparative toxic unit for humans (cancer effects)	CTUh	INA	INA	INA
Potential comparative toxic unit for humans (non-cancer effects)	CTUh	INA	INA	INA
Potential soil quality index	dimensionless	INA	INA	INA

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Table 10 Life cycle assessment (LCA) results of the spigot fittings - the resource use (DU: 1 kg)

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	2.22E+00	2.13E-02	1.58E+00	3.82E+00	3.54E-03	8.90E-04	8.90E-03	4.69E-03	1.06E+00	1.13E-03	-1.12E+00
Consumption of renewable primary energy resources used as raw materials	MJ	1.67E+00	0.00E+00	0.00E+00	1.67E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-2.51E-02
Total consumption of renewable primary energy resources	MJ	3.90E+00	2.13E-02	1.58E+00	5.50E+00	3.54E-03	8.90E-04	8.90E-03	4.69E-03	1.06E+00	1.13E-03	-1.14E+00
Consumption of non-renewable primary energy - excluding renewable primary energy sources used as raw materials	MJ	3.51E+01	1.29E+00	1.68E+01	5.33E+01	2.47E-01	1.08E-02	1.08E-01	3.27E-01	4.16E+01	-3.01E+00	-4.30E+01
Consumption of non-renewable primary energy resources used as raw materials	MJ	4.34E+01	0.00E+00	1.54E-01	4.35E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-3.64E+01	3.07E+00	3.65E+01
Total consumption of non-renewable primary energy resources	MJ	7.85E+01	1.29E+00	1.70E+01	9.68E+01	2.47E-01	1.08E-02	1.08E-01	3.27E-01	5.25E+00	6.18E-02	-6.54E+00
Consumption of secondary materials	kg	8.94E-02	5.91E-04	1.53E-03	9.16E-02	8.27E-05	9.40E-07	9.40E-06	1.10E-04	1.04E+00	2.79E-05	-1.06E+00
Consumption of renew. secondary fuels	MJ	3.14E-02	7.19E-06	7.63E-06	3.14E-02	9.11E-07	4.75E-09	4.75E-08	1.21E-06	0.00E+00	3.79E-07	-4.71E-04
Consumption of non-renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.59E-05	0.00E+00	-3.67E-05
Net consumption of freshwater	m ³	1.84E-02	1.68E-04	1.03E-03	1.96E-02	3.10E-05	3.11E-05	3.11E-04	4.11E-05	3.51E-03	5.47E-05	-3.86E-03

Table 11 Life cycle assessment (LCA) results of the spigot fittings – waste categories (DU: 1 kg)

Indicator	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Hazardous waste	kg	9.60E-02	1.85E-03	2.03E-03	9.99E-02	2.77E-04	8.38E-05	8.38E-04	3.67E-04	1.55E-02	4.44E-09	-1.73E-02
Non-hazardous waste	kg	2.23E+01	3.85E-02	1.01E-01	2.24E+01	4.92E-03	5.65E-03	5.65E-02	6.51E-03	1.32E+00	1.16E-02	-1.68E+00
Radioactive waste	kg	5.26E-05	4.00E-07	2.50E-06	5.55E-05	1.84E-08	1.62E-09	1.62E-08	2.44E-08	2.09E-05	3.30E-07	-2.21E-05
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	9.62E-03	1.57E-05	5.11E-02	6.08E-02	7.64E-07	7.26E-08	7.26E-07	1.01E-06	8.20E-04	4.13E-07	-9.81E-04
Materials for energy recovery	kg	4.40E-06	7.94E-08	1.00E-04	1.05E-04	6.18E-09	1.17E-10	1.17E-09	8.18E-09	1.71E-07	5.15E-09	-2.41E-07
Exported Energy	MJ	4.87E-02	5.19E-04	1.28E-02	6.21E-02	0.00E+00	3.46E-05	3.46E-04	0.00E+00	1.66E-02	6.30E-02	-1.77E-02

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Table 12 Life cycle assessment (LCA) results of the transition PE/steel product– environmental impacts (DU: 1 kg)

Indicator	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Global Warming Potential	eq. kg CO ₂	2.58E+00	9.24E-02	1.10E+00	3.78E+00	1.67E-02	6.85E-04	6.85E-03	2.21E-02	1.69E-01	1.59E-03	6.40E-01
Greenhouse potential - fossil	eq. kg CO ₂	2.67E+00	9.23E-02	1.10E+00	3.86E+00	1.66E-02	6.85E-04	6.85E-03	2.20E-02	1.52E-01	1.58E-03	6.34E-01
Greenhouse potential - biogenic	eq. kg CO ₂	-9.01E-02	5.58E-05	3.49E-03	-8.66E-02	5.68E-05	1.85E-06	1.85E-05	7.52E-05	8.27E-02	4.03E-06	-2.77E-02
Global warming potential - land use and land use change	eq. kg CO ₂	4.34E-03	3.11E-05	1.44E-04	4.51E-03	6.52E-06	1.07E-07	1.07E-06	8.64E-06	6.53E-02	1.49E-06	1.95E-02
Stratospheric ozone depletion potential	eq. kg CFC 11	4.75E-08	1.81E-09	6.03E-09	5.54E-08	3.85E-09	3.77E-12	3.77E-11	5.09E-09	6.52E-02	6.39E-10	1.02E-08
Soil and water acidification potential	eq. mol H ⁺	1.01E-02	4.04E-04	1.12E-02	2.17E-02	6.75E-05	7.25E-06	7.25E-05	8.93E-05	6.56E-02	1.49E-05	-2.33E-04
Eutrophication potential - freshwater	eq. kg P	9.83E-04	6.01E-06	1.80E-03	2.79E-03	1.12E-06	1.18E-06	1.18E-05	1.48E-06	6.52E-02	1.47E-07	3.11E-06
Eutrophication potential - seawater	eq. kg N	2.27E-03	1.25E-04	1.59E-03	3.99E-03	2.04E-05	1.03E-06	1.03E-05	2.70E-05	6.53E-02	5.17E-06	-3.17E-04
Eutrophication potential - terrestrial	eq. mol N	2.35E-02	1.36E-03	1.40E-02	3.88E-02	2.22E-04	8.95E-06	8.95E-05	2.94E-04	6.62E-02	5.66E-05	-3.73E-03
Potential for photochemical ozone synthesis	eq. kg NMVOC	1.05E-02	5.27E-04	4.01E-03	1.50E-02	6.80E-05	2.57E-06	2.57E-05	9.01E-05	6.52E-02	1.65E-05	-2.61E-05
Potential for depletion of abiotic resources - non-fossil resources	eq. kg Sb	2.01E-05	2.92E-07	4.29E-07	2.08E-05	5.89E-08	2.58E-10	2.58E-09	7.80E-08	6.52E-02	3.62E-09	-2.23E-04
Abiotic depletion potential - fossil fuels	MJ	4.47E+01	1.29E+00	1.70E+01	6.30E+01	2.47E-01	1.08E-02	1.08E-01	3.27E-01	1.64E+00	4.33E-02	2.43E+00
Water deprivation potential	eq. m ³	8.75E-01	6.12E-03	3.17E-01	1.20E+00	1.14E-03	2.07E-04	2.07E-03	1.51E-03	1.00E-01	1.37E-04	-3.13E+00

Table 13 Life cycle assessment (LCA) results of the transition PE/steel – additional impacts indicators (DU: 1 kg)

Indicator	Unit	A1-A5	C1-C4	D
Particulate matter	disease incidence	INA	INA	INA
Potential human exposure efficiency relative to U235	eg. kBq U235	INA	INA	INA
Potential comparative toxic unit for ecosystems	CTU _e	INA	INA	INA
Potential comparative toxic unit for humans (cancer effects)	CTU _h	INA	INA	INA
Potential comparative toxic unit for humans (non-cancer effects)	CTU _h	INA	INA	INA
Potential soil quality index	dimensionless	INA	INA	INA

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Table 14 Life cycle assessment (LCA) results of the transition PE/steel - the resource use (DU: 1 kg)

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	2.63E+00	2.13E-02	1.58E+00	4.23E+00	3.54E-03	8.90E-04	8.90E-03	4.69E-03	3.83E-01	3.76E-04	-3.58E-01
Consumption of renewable primary energy resources used as raw materials	MJ	1.67E+00	0.00E+00	0.00E+00	1.67E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.52E-02	0.00E+00	-2.51E-02
Total consumption of renewable primary energy resources	MJ	4.31E+00	2.13E-02	1.58E+00	5.91E+00	3.54E-03	8.90E-04	8.90E-03	4.69E-03	3.83E-01	3.76E-04	-3.08E+00
Consumption of non-renewable primary energy - excluding renewable primary energy sources used as raw materials	MJ	3.10E+01	1.29E+00	1.68E+01	4.92E+01	2.47E-01	1.08E-02	1.08E-01	3.27E-01	1.26E+01	4.33E-02	-1.30E+01
Consumption of non-renewable primary energy resources used as raw materials	MJ	1.37E+01	0.00E+00	1.54E-01	1.38E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-1.08E+01	0.00E+00	1.07E+01
Total consumption of non-renewable primary energy resources	MJ	4.47E+01	1.29E+00	1.70E+01	6.30E+01	2.47E-01	1.08E-02	1.08E-01	3.27E-01	1.64E+00	4.33E-02	4.42E+00
Consumption of secondary materials	kg	2.36E-01	5.91E-04	1.53E-03	2.38E-01	8.27E-05	9.40E-07	9.40E-06	1.10E-04	3.77E-01	9.10E-06	-3.24E-01
Consumption of renew. secondary fuels	MJ	3.15E-02	7.19E-06	7.63E-06	3.15E-02	9.11E-07	4.75E-09	4.75E-08	1.21E-06	6.52E-02	2.38E-07	-4.66E-04
Consumption of non-renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.52E-02	0.00E+00	-1.08E-05
Net consumption of freshwater	m ³	2.08E-02	1.68E-04	1.03E-03	2.20E-02	3.10E-05	3.11E-05	3.11E-04	4.11E-05	6.62E-02	4.74E-05	-3.28E-02

Table 15 Life cycle assessment (LCA) results of the transition PE/steel – waste categories (DU: 1 kg)

Indicator	Unit	A1	A2	A3	A1-A3	A5	A6	C1	C2	C3	C4	D
Hazardous waste	kg	7.58E-01	1.85E-03	2.03E-03	7.62E-01	2.77E-04	8.38E-05	8.38E-04	3.67E-04	6.98E-02	4.60E-05	5.23E-02
Non-hazardous waste	kg	1.15E+01	3.85E-02	1.01E-01	1.16E+01	4.92E-03	5.65E-03	5.65E-02	6.51E-03	4.60E-01	6.48E-04	4.51E-01
Radioactive waste	kg	3.58E-05	4.00E-07	2.50E-06	3.87E-05	1.84E-08	1.62E-09	1.62E-08	2.44E-08	6.52E-02	2.88E-07	5.42E-01
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	6.52E-02	0.00E+00	0.00E+00
Materials for recycling	kg	1.08E-02	1.57E-05	5.11E-02	6.20E-02	7.64E-07	7.26E-08	7.26E-07	1.01E-06	6.54E-02	8.67E-08	-4.08E-04
Materials for energy recovery	kg	9.34E-06	7.94E-08	1.00E-04	1.10E-04	6.18E-09	1.17E-10	1.17E-09	8.18E-09	6.52E-02	1.03E-09	-1.91E-07
Exported Energy	MJ	4.11E-02	5.19E-04	1.28E-02	5.45E-02	0.00E+00	3.46E-05	3.46E-04	0.00E+00	7.02E-02	0.00E+00	-5.60E-03

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Table 16 Life cycle assessment (LCA) results of the transition PE/brass product– environmental impacts (DU: 1 kg)

Indicator	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Global Warming Potential	eq. kg CO ₂	1.73E+00	9.24E-02	1.10E+00	2.92E+00	1.67E-02	6.85E-04	6.85E-03	2.21E-02	8.00E-02	1.74E-03	-8.88E-01
Greenhouse potential - fossil	eq. kg CO ₂	1.78E+00	9.23E-02	1.10E+00	2.97E+00	1.66E-02	6.85E-04	6.85E-03	2.20E-02	6.64E-02	1.74E-03	-8.65E-01
Greenhouse potential - biogenic	eq. kg CO ₂	2.74E-03	5.58E-05	3.49E-03	6.28E-03	5.68E-05	1.85E-06	1.85E-05	7.52E-05	1.34E-02	4.43E-06	1.27E-02
Global warming potential - land use and land use change	eq. kg CO ₂	1.94E-02	3.11E-05	1.44E-04	1.96E-02	6.52E-06	1.07E-07	1.07E-06	8.64E-06	1.23E-04	1.64E-06	-2.20E-02
Stratospheric ozone depletion potential	eq. kg CFC 11	1.16E-07	1.81E-09	6.03E-09	1.23E-07	3.85E-09	3.77E-12	3.77E-11	5.09E-09	1.24E-09	7.03E-10	-1.56E-08
Soil and water acidification potential	eq. mol H ⁺	4.95E-02	4.04E-04	1.12E-02	6.11E-02	6.75E-05	7.25E-06	7.25E-05	8.93E-05	3.40E-04	1.63E-05	-1.14E-03
Eutrophication potential - freshwater	eq. kg P	3.72E-03	6.01E-06	1.80E-03	5.53E-03	1.12E-06	1.18E-06	1.18E-05	1.48E-06	3.81E-05	1.62E-07	-1.30E-04
Eutrophication potential - seawater	eq. kg N	6.82E-03	1.25E-04	1.59E-03	8.54E-03	2.04E-05	1.03E-06	1.03E-05	2.70E-05	8.80E-05	5.69E-06	8.25E-05
Eutrophication potential - terrestrial	eq. mol N	6.94E-02	1.36E-03	1.40E-02	8.47E-02	2.22E-04	8.95E-06	8.95E-05	2.94E-04	7.82E-04	6.22E-05	1.55E-03
Potential for photochemical ozone synthesis	eq. kg NMVOC	2.38E-02	5.27E-04	4.01E-03	2.83E-02	6.80E-05	2.57E-06	2.57E-05	9.01E-05	1.24E-09	1.81E-05	-5.01E-04
Potential for depletion of abiotic resources - non-fossil resources	eq. kg Sb	1.44E-03	2.92E-07	4.29E-07	1.44E-03	5.89E-08	2.58E-10	2.58E-09	7.80E-08	6.68E-07	3.99E-09	2.22E-04
Abiotic depletion potential - fossil fuels	MJ	7.94E+01	1.29E+00	1.70E+01	9.77E+01	2.47E-01	1.08E-02	1.08E-01	3.27E-01	1.21E+00	4.76E-02	-6.35E+00
Water deprivation potential	eq. m ³	1.81E+01	6.12E-03	3.17E-01	1.84E+01	1.14E-03	2.07E-04	2.07E-03	1.51E-03	2.69E-02	1.51E-04	3.13E+00

Table 17 Life cycle assessment (LCA) results of the transition PE/brass – additional impacts indicators (DU: 1 kg)

Indicator	Unit	A1-A5	C1-C4	D
Particulate matter	disease incidence	INA	INA	INA
Potential human exposure efficiency relative to U235	eg. kBq U235	INA	INA	INA
Potential comparative toxic unit for ecosystems	CTUe	INA	INA	INA
Potential comparative toxic unit for humans (cancer effects)	CTUh	INA	INA	INA
Potential comparative toxic unit for humans (non-cancer effects)	CTUh	INA	INA	INA
Potential soil quality index	dimensionless	INA	INA	INA

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Table 18 Life cycle assessment (LCA) results of the the transition PE/brass - the resource use (DU: 1 kg)

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	5.14E+01	2.13E-02	1.58E+00	5.30E+01	3.54E-03	8.90E-04	8.90E-03	4.69E-03	2.44E-01	4.14E-04	2.17E+00
Consumption of renewable primary energy resources used as raw materials	MJ	1.67E+00	0.00E+00	0.00E+00	1.67E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-2.51E-02
Total consumption of renewable primary energy resources	MJ	5.31E+01	2.13E-02	1.58E+00	5.47E+01	3.54E-03	8.90E-04	8.90E-03	4.69E-03	2.44E-01	4.14E-04	2.17E+00
Consumption of non-renewable primary energy - excluding renewable primary energy sources used as raw materials	MJ	6.86E+01	1.29E+00	1.68E+01	8.68E+01	2.47E-01	1.08E-02	1.08E-01	3.27E-01	9.57E+00	4.76E-02	-1.03E+00
Consumption of non-renewable primary energy resources used as raw materials	MJ	1.08E+01	0.00E+00	1.54E-01	1.10E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-8.36E+00	0.00E+00	-1.62E-01
Total consumption of non-renewable primary energy resources	MJ	7.93E+01	1.29E+00	1.70E+01	9.76E+01	2.47E-01	1.08E-02	1.08E-01	3.27E-01	1.21E+00	4.76E-02	-8.53E+00
Consumption of secondary materials	kg	6.16E-01	5.91E-04	1.53E-03	6.18E-01	8.27E-05	9.40E-07	9.40E-06	1.10E-04	2.39E-01	1.00E-05	6.78E-04
Consumption of renew. secondary fuels	MJ	3.16E-02	7.19E-06	7.63E-06	3.16E-02	9.11E-07	4.75E-09	4.75E-08	1.21E-06	0.00E+00	2.62E-07	-4.80E-04
Consumption of non-renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.26E-06	0.00E+00	0.00E+00
Net consumption of freshwater	m ³	3.80E-01	1.68E-04	1.03E-03	3.81E-01	3.10E-05	3.11E-05	3.11E-04	4.11E-05	8.08E-04	5.22E-05	-2.89E-02

Table 19 Life cycle assessment (LCA) results of the transition PE/brass – waste categories (DU: 1 kg)

Indicator	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Hazardous waste	kg	3.79E-01	1.85E-03	2.03E-03	3.82E-01	2.77E-04	8.38E-05	8.38E-04	3.67E-04	3.56E-03	5.06E-05	-8.09E-02
Non-hazardous waste	kg	1.69E+01	3.85E-02	1.01E-01	1.71E+01	4.92E-03	5.65E-03	5.65E-02	6.51E-03	3.03E-01	7.13E-04	-1.38E+00
Radioactive waste	kg	2.36E-04	4.00E-07	2.50E-06	2.39E-04	1.84E-08	1.62E-09	1.62E-08	2.44E-08	4.80E-06	3.16E-07	-5.98E-01
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	4.52E-01	1.57E-05	5.11E-02	5.03E-01	7.64E-07	7.26E-08	7.26E-07	1.01E-06	1.89E-04	9.53E-08	-6.78E-03
Materials for energy recovery	kg	7.89E-04	7.94E-08	1.00E-04	8.90E-04	6.18E-09	1.17E-10	1.17E-09	8.18E-09	3.93E-08	1.13E-09	-1.18E-05
Exported Energy	MJ	9.02E-02	5.19E-04	1.28E-02	1.04E-01	0.00E+00	3.46E-05	3.46E-04	0.00E+00	3.82E-03	0.00E+00	-1.35E-03

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Table 20 Life cycle assessment (LCA) results of the ball valves product– environmental impacts (DU: 1 kg)

Indicator	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Global Warming Potential	eq. kg CO ₂	2.45E+00	9.24E-02	1.10E+00	3.65E+00	1.67E-02	6.85E-04	6.85E-03	2.21E-02	3.49E-01	6.52E-02	-3.22E-01
Greenhouse potential - fossil	eq. kg CO ₂	2.53E+00	9.23E-02	1.10E+00	3.73E+00	1.66E-02	6.85E-04	6.85E-03	2.20E-02	3.01E-01	6.52E-02	-2.75E-01
Greenhouse potential - biogenic	eq. kg CO ₂	-8.47E-02	5.58E-05	3.49E-03	-8.11E-02	5.68E-05	1.85E-06	1.85E-05	7.52E-05	1.12E-01	1.36E-05	-4.65E-02
Global warming potential - land use and land use change	eq. kg CO ₂	4.46E-03	3.11E-05	1.44E-04	4.63E-03	6.52E-06	1.07E-07	1.07E-06	8.64E-06	6.43E-02	1.03E-05	-5.05E-04
Stratospheric ozone depletion potential	eq. kg CFC 11	1.13E-07	1.81E-09	6.03E-09	1.21E-07	3.85E-09	3.77E-12	3.77E-11	5.09E-09	6.39E-02	7.96E-01	-6.10E-09
Soil and water acidification potential	eq. mol H ⁺	7.93E-03	4.04E-04	1.12E-02	1.96E-02	6.75E-05	7.25E-06	7.25E-05	8.93E-05	6.51E-02	5.43E-04	-1.33E-03
Eutrophication potential - freshwater	eq. kg P	5.07E-04	6.01E-06	1.80E-03	2.31E-03	1.12E-06	1.18E-06	1.18E-05	1.48E-06	6.40E-02	4.41E-07	-1.44E-04
Eutrophication potential - seawater	eq. kg N	1.68E-03	1.25E-04	1.59E-03	3.39E-03	2.04E-05	1.03E-06	1.03E-05	2.70E-05	6.42E-02	1.85E-03	-3.39E-04
Eutrophication potential - terrestrial	eq. mol N	1.67E-02	1.36E-03	1.40E-02	3.20E-02	2.22E-04	8.95E-06	8.95E-05	2.94E-04	6.67E-02	3.49E-03	-3.04E-03
Potential for photochemical ozone synthesis	eq. kg NMVOC	1.37E-02	5.27E-04	4.01E-03	1.83E-02	6.80E-05	2.57E-06	2.57E-05	9.01E-05	6.39E-02	7.61E-04	-2.06E-04
Potential for depletion of abiotic resources - non-fossil resources	eq. kg Sb	2.21E-05	2.92E-07	4.29E-07	2.28E-05	5.89E-08	2.58E-10	2.58E-09	7.80E-08	6.39E-02	1.47E-08	-2.71E-06
Abiotic depletion potential - fossil fuels	MJ	7.82E+01	1.29E+00	1.70E+01	9.65E+01	2.47E-01	1.08E-02	1.08E-01	3.27E-01	4.37E+00	6.18E-02	-5.48E+00
Water deprivation potential	eq. m ³	6.85E-01	6.12E-03	3.17E-01	1.01E+00	1.14E-03	2.07E-04	2.07E-03	1.51E-03	1.60E-01	1.45E-03	-1.06E-01

Table 21 Life cycle assessment (LCA) results of the ball valves – additional impacts indicators (DU: 1 kg)

Indicator	Unit	A1-A5	C1-C4	D
Particulate matter	disease incidence	INA	INA	INA
Potential human exposure efficiency relative to U235	eg. kBq U235	INA	INA	INA
Potential comparative toxic unit for ecosystems	CTU _e	INA	INA	INA
Potential comparative toxic unit for humans (cancer effects)	CTU _h	INA	INA	INA
Potential comparative toxic unit for humans (non-cancer effects)	CTU _h	INA	INA	INA
Potential soil quality index	dimensionless	INA	INA	INA

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Table 22 Life cycle assessment (LCA) results of the the ball valves - the resource use (DU: 1 kg)

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	2.18E+00	2.13E-02	1.58E+00	3.78E+00	3.54E-03	8.90E-04	8.90E-03	4.69E-03	9.34E-01	1.13E-03	-9.02E-01
Consumption of renewable primary energy resources used as raw materials	MJ	1.67E+00	0.00E+00	0.00E+00	1.67E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.39E-02	0.00E+00	-2.51E-02
Total consumption of renewable primary energy resources	MJ	3.86E+00	2.13E-02	1.58E+00	5.46E+00	3.54E-03	8.90E-04	8.90E-03	4.69E-03	9.34E-01	1.13E-03	-9.28E-01
Consumption of non-renewable primary energy - excluding renewable primary energy sources used as raw materials	MJ	3.67E+01	1.29E+00	1.68E+01	5.48E+01	2.47E-01	1.08E-02	1.08E-01	3.27E-01	3.42E+01	-3.01E+00	-3.47E+01
Consumption of non-renewable primary energy resources used as raw materials	MJ	4.16E+01	0.00E+00	1.54E-01	4.17E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-2.98E+01	3.07E+00	2.92E+01
Total consumption of non-renewable primary energy resources	MJ	7.82E+01	1.29E+00	1.70E+01	9.65E+01	2.47E-01	1.08E-02	1.08E-01	3.27E-01	4.37E+00	6.18E-02	-5.48E+00
Consumption of secondary materials	kg	8.94E-02	5.91E-04	1.53E-03	9.15E-02	8.27E-05	9.40E-07	9.40E-06	1.10E-04	9.16E-01	2.79E-05	-8.53E-01
Consumption of renew. secondary fuels	MJ	3.14E-02	7.19E-06	7.63E-06	3.14E-02	9.11E-07	4.75E-09	4.75E-08	1.21E-06	6.39E-02	3.79E-07	-4.71E-04
Consumption of non-renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.39E-02	0.00E+00	-2.95E-05
Net consumption of freshwater	m ³	1.78E-02	1.68E-04	1.03E-03	1.90E-02	3.10E-05	3.11E-05	3.11E-04	4.11E-05	6.67E-02	5.47E-05	-3.15E-03

Table 23 Life cycle assessment (LCA) results of the ball valves – waste categories (DU: 1 kg)

Indicator	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Hazardous waste	kg	9.56E-02	1.85E-03	2.03E-03	9.95E-02	2.77E-04	8.38E-05	8.38E-04	3.67E-04	7.66E-02	4.44E-09	-1.41E-02
Non-hazardous waste	kg	2.18E+01	3.85E-02	1.01E-01	2.20E+01	4.92E-03	5.65E-03	5.65E-02	6.51E-03	1.14E+00	1.16E-02	-1.41E+00
Radioactive waste	kg	5.14E-05	4.00E-07	2.50E-06	5.43E-05	1.84E-08	1.62E-09	1.62E-08	2.44E-08	6.39E-02	3.30E-07	-1.79E-05
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	6.39E-02	0.00E+00	0.00E+00
Materials for recycling	kg	9.61E-03	1.57E-05	5.11E-02	6.08E-02	7.64E-07	7.26E-08	7.26E-07	1.01E-06	6.45E-02	4.13E-07	-8.16E-04
Materials for energy recovery	kg	4.44E-06	7.94E-08	1.00E-04	1.05E-04	6.18E-09	1.17E-10	1.17E-09	8.18E-09	6.39E-02	5.15E-09	-2.07E-07
Exported Energy	MJ	4.77E-02	5.19E-04	1.28E-02	6.10E-02	0.00E+00	3.46E-05	3.46E-04	0.00E+00	7.75E-02	6.30E-02	-1.43E-02

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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+A2 and ITB PCR A	
Independent verification corresponding to ISO 14025 (subclause 8.1.3.)	
☒ external	☐ internal
External verification of EPD: PhD. Eng. Halina Prejzner	
LCI data, audit and verification: Filip Poznański, M.Sc. Eng.	
LCA, LCI audit and input data verification: Michał Piasecki, PhD., D.Sc., Eng.	

Note 1: The declaration owner has the sole ownership, liability, and responsibility for the information provided and contained in EPD. Declarations of construction products may not be comparable if they do not comply with EN 15804+A2. For further information about comparability, see EN 15804+A2 and ISO 14025.

Note 2: ITB is a public Research Organization and Notified Body (EC Reg. no 1488) to the European Commission and to other Member States of the European Union designated for the tasks concerning the assessment of building products' performance. ITB acts as the independent, third-party verification organization (ISO 17025/17065/17029). ITB-EPD program is recognized and registered member of The European Platform - Association of EPD program operators and ITB-EPD declarations are registered and stored in the international ECO-PORTAL.

Normative references

- ITB PCR A General Product Category Rules for Construction Products (v. 1.6, 2023)
- ISO 4427-2:2019/AMD 1:2023 - Plastics piping systems for water supply, and for drainage and sewerage under pressure - Polyethylene (PE) - Part 2: Pipes - Amendment 1
- ISO 4437-1:2024 - Plastics piping systems for the supply of gaseous fuels - Polyethylene (PE) – Part 1: General
- PN-EN 12201-2:2024-04 - Systemy przewodów rurowych z tworzyw sztucznych do przesyłania wody oraz do kanalizacji ciśnieniowej - Polietylen (PE) - Część 2: Rury
- PN-EN 1555-1:2021-12 - Systemy przewodów rurowych z tworzyw sztucznych do przesyłania paliw gazowych - Polietylen (PE) -- Część 1: Postanowienia ogólne
- 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
- KOBIZE Wskaźniki emisyjności CO₂, SO₂, NO_x, CO i pyłu całkowitego dla energii elektrycznej. December 2023
- <https://ecoinvent.org/>

LCA, LCI, input data verification
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CERTIFICATE No 723/2024 of TYPE III ENVIRONMENTAL DECLARATION

Products:

Polyethylenefittings (PE-100-RC)

Manufacturer:

FOX FITTINGS Sp. z o.o.

ul. Więżniów Oświęcimia 50, 43-330 Wilamowice, Poland

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 20th December 2024 is valid for 5 years
or until amendment of mentioned Environmental Declaration

Head of the Thermal Physic, Acoustics
and Environment Department

Agnieszka Winkler-Skalna
Agnieszka Winkler-Skalna, PhD



Deputy Director
for Research and Innovation

Krzysztof Kuczyński
Krzysztof Kuczyński, PhD

Warsaw, December 2024