Environmental Product Declaration

EPD of multiple products, based on representative product in accordance with ISO 14025:2006 and EN 15804:2012+A2:2019/AC:2021 for:

Electrofusion Couplers, End Caps, Reducers, Elbows, Bends and Tees

from

Fusion Group Limited

Programme:	The International EPD® System, www.environdec.com
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General information

Programme information

Programme:	The International EPD® System
Address:	EPD International AB Box 210 60 SE-100 31 Stockholm Sweden
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Accountabilities for PCR, LCA and independent, third-party verification
Product Category Rules (PCR)
CEN standard EN 15804 serves as the Core Product Category Rules (PCR)
Product Category Rules (PCR): *PCR 2019:14 Construction Products version 1.3.4, UN CPC code: 36320 - Tubes, pipes and hoses, and fittings therefor,of plastics.*
PCR review was conducted by: *The Technical Committee of the International EPD@ System*
Life Cycle Assessment (LCA)
LCA accountability: *Jesper Kokborg Lassen, NRGi Rådgivning A/S*
Third-party verification
Independent third-party verification of the declaration and data, according to ISO 14025:2006, via: ☒ EPD verification by individual verifier Third-party verifier: *Hüdai Kara PhD, Metsims Sustainability Consulting, Oxford, U.K., www.metsims.com* Approved by: The International EPD® System
Procedure for follow-up of data during EPD validity involves third party verifier: ☐ Yes ☒ No

The EPD owner has the sole ownership, liability, and responsibility for the EPD.

EPDs within the same product category but registered in different EPD programmes, or not compliant with EN 15804, may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully-aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterisation factors); have equivalent content declarations; and be valid at the time of comparison. For further information about comparability, see EN 15804 and ISO 14025.

Company information

Owner of the EPD: Fusion Group Limited
Contact: Michael Day, mida@avkuk.co.uk
Description of the organisation: Fusion Group Limited is an international leader in the design, manufacture and distribution of electrofusion fittings, PE ball valves and associated products and services for PE piping infrastructure.
Product-related or management system-related certifications: ISO 9001, ISO 14001, and ISO 29001
Name and location of production site(s): Fusion Plastic Limited, United Kingdom, ACE Plastics, Egypt, GH Fusion Corporation, China, Fusion Syntec, China.

Product information

Product name: Fusamatic Electrofusion Couplers, End Caps, Reducers, Elbows, Bends and Tees
Product identification: Series 1200, 1201, 1202, 1203, 1204, 1205, 1214, and 1231.
Product description: Electrofusion fittings enable utilities, designers and contractors to create fully welded pipe networks and are fully end load resistant. Specifically Fusion Fusamatic electrofusion fittings are suitable for use on polyethylene pipe networks across a range of industries and infrastructure projects both above and below ground. Common applications include gas, water, wastewater, irrigation and mining projects which require a homogeneous welded network, helping to ensure the pipeline remains flexible, corrosion resistant, with excellent long term flow characteristics and no maintenance needs.
Product representativeness: The representative product declared is based on a weighted material average for the products series covered in this EPD.
UN CPC code: 36320 - Tubes, pipes and hoses, and fittings therefor, of plastics.
Geographical scope: Raw materials are sourced from Europe, UAE, Egypt and China, with production being situated at four sites, with one in UK, one in EG, and two in China. Module A4, A5, C1-C4, and D are all based on a global scenario.

LCA information

Functional unit / declared unit: 1 kg of electrofusion couplers, end caps, reducers, elbows, bends and tees
Reference service life: Not applicable
Time representativeness: Covers production data from 2023 for all included production sites
Database(s) and LCA software used: SimaPro 9.6.0.1, Ecoinvent 3.10 – Allocation, cut-off, EN 15804
Description of system boundaries: Cradle to gate with options, modules A4-A5, C1-C4, and D
Calculation method and version: EF3.1

Module A1-A3:
A1: The raw materials are procured from a supply mix in Europe, Egypt, China, and UAE. The PE polymer is 100% virgin.
A2: The supply mix has an applied transport mix, which include truck of EURONORM 4 for transport outside of Europe, and EURONORM 6 for transport of raw materials to UK. Bulk carrier shipping is utilized for transport of polymer between origin and the sites in China and Egypt. Transport to and from port is modelled with EURONORM 4.
A3: The raw materials are received and combined through an injection moulding process which integrates the resistance wire and any other sub-components within the moulding. Where products require additional components after the primary moulding process, these are assembled post moulding. Quality assurance tests are also undertaken on the products before being packed in PE bags and shipped in cardboard boxes on wooden pallets. Energy utilized in A3 is a mix of UK

(Certified green electricity from wind), Egypt grid mix (no certification scheme), and two China grid mixes (no certification scheme)

Applied energy mix	Kg CO2-eq/kWh/DU
Great Britain (Green wind electricity)	1.41
China East grid mix	
China South grid mix	
Egypt grid mix	

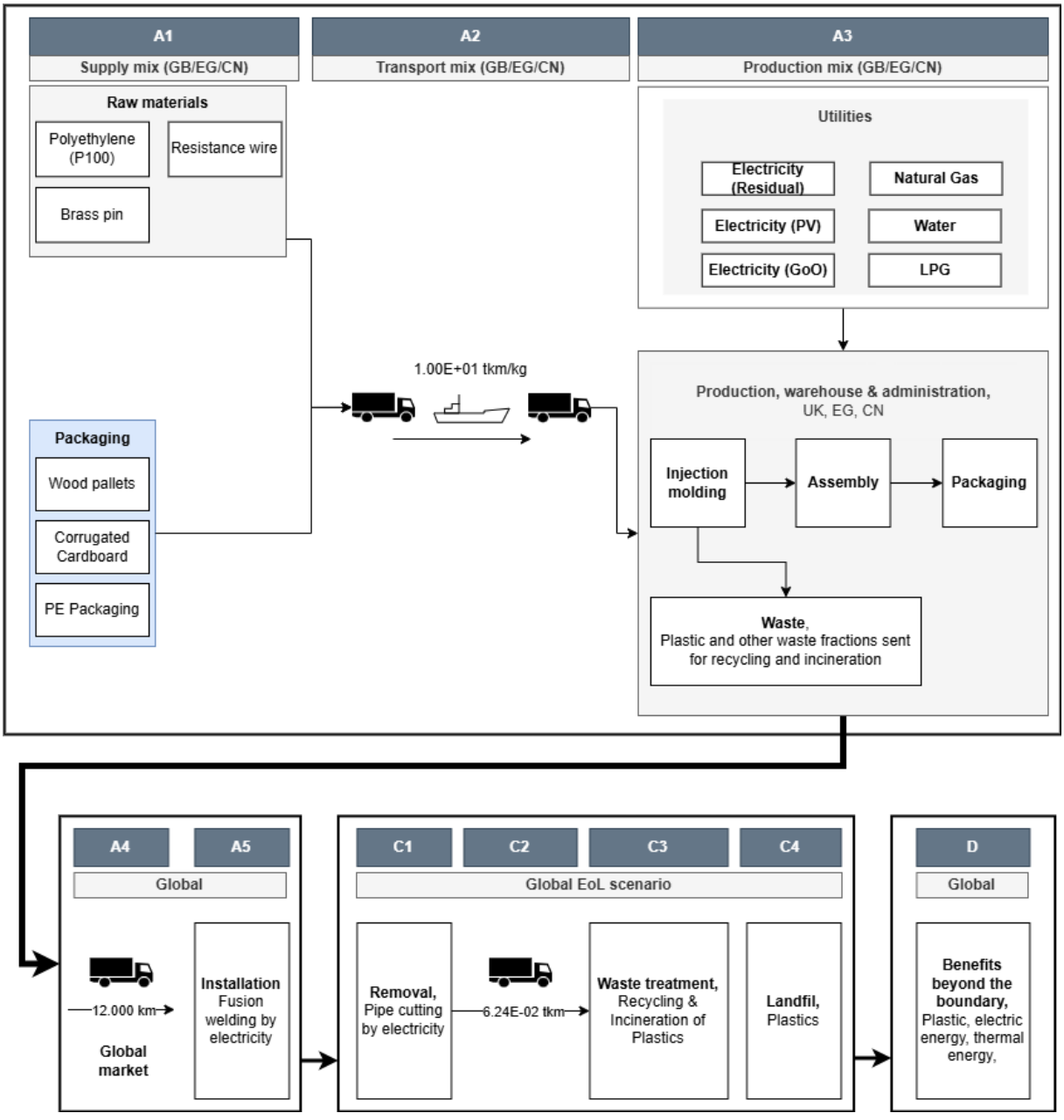
Module A4-A5:
A4: A global scenario has been applied based with a transport to customer of 12.000 km to account for shipping.
A5: The electrofusion products are fused together with a PE pipe, by sending a current through the resistance wire with an Electrofusion Welding Machine, thus creating a homogeneous welded joint.

Module B1-B7:
Assessed as not relevant, and therefore not covered by the EPD

Module C1-C4: C1 is modelled with a minor energy use, as the pipes can be cut (during dismantling) with manual labour, or electric pipe cutters. For C2, transport is considered 50 km for waste sent for recycling or energy recovery, whereas 100 km is considered for landfill. Transport in C2 utilize lorry with EURO4 classification. The waste scenario is comprised of 3 sub scenarios – with product produced at the UK site being modelled cf. Eurostat waste statistics for plastics 2022, and product produced in China cf. “Plastic waste management and burden in China”, IPEN. 100% of product produced at the Egypt site is assumed to be sent for landfill in C4 at EoL.

Module D: For the material sent for energy recovery at a CHP-plant, 75% of the energy recovered is thermal energy, whereas 25% is electrical energy. A 15% loss is factored into the energy recovered at the CHP-plant. The electricity generated substitutes the grid mixes of Europe and China, whereas the thermal energy substitutes natural gas markets in Europe and China.

System diagram:



Modules declared, geographical scope, share of specific data (in GWP-GHG results) and data variation (in GWP-GHG results):

	Product stage			Construction process stage		Use stage							End of life stage				Resource recovery stage
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
Module	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Modules declared	X	X	X	X	X	ND	ND	ND	ND	ND	ND	ND	X	X	X	X	X
Geography	UK, EU, EG, AE, CN	GLO	UK, EG, CN	GLO	GLO	ND	ND	ND	ND	ND	ND	ND	GLO	GLO	GLO	GLO	GLO
Specific data used	>90%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	<1%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	<10%			-	-	-	-	-	-	-	-	-	-	-	-	-	-

Content information

Product components	Weight, %	Post-consumer material, weight-%	Biogenic material, weight-% and kg C/kg
Polyethylene (P100)	0.94	0.00	0.00
Brass	0.03	0.00	0.00
Resistance wire	0.03	0.00	0.00
TOTAL	1.00	0.00	0.00
Packaging materials	**Weight, %**	**Weight-% (versus the product)**	**Weight biogenic carbon, kg C/kg**
Cardboard	0.011	1.07%	0.0053
PE-Plastic	0.015	1.50%	0.00
Pallet	0.001	0.10%	0.0005
TOTAL	0.027	2.67%	0.0058

Results of the environmental performance indicators

Mandatory impact category indicators according to EN 15804 + A2

Results per 1 kg – Electrofusion couplers, End Caps, Reducers, Elbows, Bends and Tees

Indicator	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP-fossil	kg CO_2 eq.	5.14E+00	1.10E-01	6.02E-03	3.11E-03	1.20E-02	7.98E-01	1.84E-01	-1.48E+00
GWP-biogenic	kg CO_2 eq.	-2.12E-02	0.00E+00	2.12E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-7.30E-03
GWP-luluc	kg CO_2 eq.	3.36E-03	5.88E-05	4.31E-06	9.62E-06	4.64E-06	4.80E-05	1.55E-06	-1.76E-03
GWP-total	kg CO_2 eq.	5.12E+00	1.10E-01	2.72E-02	3.12E-03	1.20E-02	7.98E-01	1.84E-01	-1.48E+00
ODP	kg CFC 11 eq.	1.22E-07	1.79E-09	6.13E-11	5.39E-11	1.94E-10	3.08E-10	5.90E-11	-1.91E-08
AP	mol H^+ eq.	5.39E-02	2.02E-03	2.56E-05	1.58E-05	4.41E-05	2.39E-04	6.08E-05	-2.98E-02
EP-freshwater	kg P eq.	3.05E-03	5.25E-06	1.35E-06	2.77E-06	9.14E-07	9.80E-06	3.38E-07	-2.30E-03
EP-marine	kg N eq.	5.72E-03	4.84E-04	5.28E-06	2.75E-06	1.53E-05	1.43E-04	6.53E-05	-2.43E-03
EP-terrestrial	mol N eq.	6.46E-02	5.38E-03	5.47E-05	2.39E-05	1.67E-04	9.21E-04	2.97E-04	-2.93E-02
POCP	kg NMVOC eq.	2.72E-02	1.55E-03	1.78E-05	7.91E-06	6.27E-05	2.54E-04	1.73E-04	-8.77E-03
ADP-minerals& metals*	kg Sb eq.	5.40E-04	2.07E-07	6.36E-09	6.79E-09	3.89E-08	3.77E-07	1.04E-08	-3.35E-04
ADP-fossil*	MJ	1.06E+02	1.42E+00	8.41E-02	7.35E-02	1.70E-01	3.14E-01	5.38E-02	-2.46E+01
WDP*	m^3	1.51E+00	6.01E-03	9.49E-04	2.38E-03	9.50E-04	1.34E-02	8.38E-04	-6.85E-01
Acronyms	GWP-fossil = Global Warming Potential fossil fuels; GWP-biogenic = Global Warming Potential biogenic; GWP-luluc = Global Warming Potential land use and land use change; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential, Accumulated Exceedance; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption								

** Disclaimer: The results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator.*

Note that the LCIA results are relative expressions and do not predict impacts on category end-points, the exceeding of thresholds, safety margins or risks. It is discouraged to use the results of Modules A1-A3 without considering the results of other modules, particularly, Module C.

Additional mandatory and voluntary impact category indicators

Results per 1 kg – Electrofusion couplers, End Caps, Reducers, Elbows, Bends and Tees									
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-GHG[1]	kg CO_2 eq.	5.17E+00	1.10E-01	6.04E-03	3.13E-03	1.21E-02	8.02E-01	1.85E-01	-1.48E+00

Resource use indicators

Results per 1 kg – Electrofusion couplers, End Caps, Reducers, Elbows, Bends and Tees									
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	MJ	1.43E+01	1.69E-02	9.90E-03	1.72E-02	2.40E-03	3.16E-02	7.48E-04	-3.40E+00
PERM	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
PERT	MJ	1.43E+01	1.69E-02	9.90E-03	1.72E-02	2.40E-03	3.16E-02	7.48E-04	-3.40E+00
PENRE	MJ	1.06E+02	1.42E+00	8.41E-02	7.35E-02	1.70E-01	3.14E-01	5.38E-02	-2.46E+01
PENRM	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
PENRT	MJ	1.06E+02	1.42E+00	8.41E-02	7.35E-02	1.70E-01	3.14E-01	5.38E-02	-2.46E+01
SM	kg	4.22E-02	7.45E-04	8.92E-06	7.89E-06	7.68E-05	1.61E-03	3.19E-05	-1.76E-02
RSF	MJ	2.31E-02	4.19E-06	3.81E-08	3.24E-08	9.78E-07	1.37E-05	2.83E-07	-9.72E-05
NRSF	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
FW	m^3	3.96E-02	1.48E-04	2.92E-05	6.11E-05	2.32E-05	3.26E-04	1.99E-05	-1.76E-02
Acronyms	PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy re-sources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water								

[1] This indicator accounts for all greenhouse gases except biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. As such, the indicator is identical to GWP-total except that the CF for biogenic CO_2 is set to zero.

Waste indicators

Results per 1 kg – Electrofusion couplers, End Caps, Reducers, Elbows, Bends and Tees									
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	kg	5.06E-01	2.15E-03	4.79E-04	1.68E-04	2.84E-04	9.89E-03	7.03E-04	-2.25E-01
Non-hazardous waste disposed	kg	3.16E+01	3.51E-02	6.65E-03	1.36E-02	5.48E-03	3.86E-01	2.33E-01	-9.15E+00
Radioactive waste disposed	kg	8.30E-05	2.88E-07	2.31E-07	5.28E-07	3.92E-08	3.89E-07	1.12E-08	-6.38E-05

Output flow indicators

Results per 1 kg – Electrofusion couplers, End Caps, Reducers, Elbows, Bends and Tees									
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
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
Material for recycling	kg	1.02E-02	0.00E+00	1.50E-02	0.00E+00	0.00E+00	5.21E-01	0.00E+00	0.00E+00
Materials for energy recovery	kg	2.17E-03	0.00E+00	1.17E-02	0.00E+00	0.00E+00	2.45E-01	0.00E+00	0.00E+00
Exported energy, electricity	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
Exported energy, thermal	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

Other environmental performance indicators

ADDITIONAL ENVIRONMENTAL IMPACTS PER 1 kg – Electrofusion couplers, End Caps, Reducers, Elbows, Bends and Tees									
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
PM	[Disease incidence]	2.99E-07	5.22E-09	2.86E-10	5.53E-11	9.59E-10	4.11E-09	8.66E-08	-1.20E-07
IRP2	[kBq U235 eq.]	3.39E-01	1.17E-03	9.22E-04	2.05E-03	1.59E-04	1.53E-03	4.54E-05	-2.50E-01
ETP-fw1	[CTUe]	6.47E+01	3.17E-01	1.48E-02	9.46E-03	4.54E-02	6.98E-01	7.48E-01	-3.84E+01
HTP-c1	[CTUh]	2.16E-08	6.25E-10	7.07E-12	6.33E-12	6.84E-11	1.03E-09	6.30E-11	-6.07E-09
HTP-nc1	[CTUh]	4.76E-07	5.88E-10	2.96E-11	2.80E-11	1.09E-10	1.63E-09	1.35E-09	-2.62E-07
SQP1	-	3.53E+01	3.94E-01	1.02E-02	1.25E-02	1.02E-01	4.95E-01	1.55E-01	-1.06E+01
Caption		PM = Particulate Matter emissions; IRP = Ionizing radiation – human health; ETP-fw = Eco toxicity – freshwater; HTP-c = Human toxicity – cancer effects; HTP-nc = Human toxicity – non cancer effects; SQP = Soil Quality							
Disclaimers		1 The results of this environmental indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator. 2 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.							

References

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