

Owner: Per Aarsleff A/S
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First issued: 15-06-2023
Issued: 30-06-2023
Valid to: 15-06-2028

3rd PARTY VERIFIED

EPD

VERIFIED ENVIRONMENTAL PRODUCT DECLARATION | ISO 14025 & EN 15804



Owner of declaration

Per Aarsleff A/S
Birkemosevej 9
DK-8361 Hasselager
VAT: 37542784



Issued:

30-06-2023

Valid to:

15-06-2028

Basis of calculation

This EPD is developed in accordance with the European standard EN 15804+A2.

Programme

EPD Danmark
www.epddanmark.dk



- Industry EPD
 Product EPD

Comparability

EPDs of construction products may not be comparable if they do not comply with the requirements in EN 15804. EPD data may not be comparable if the datasets used are not developed in accordance with EN 15804 and if the background systems are not based on the same database.

Declared product(s)

The EPD covers all products below sold under the name PAA-F-Liner.

Validity

This EPD has been verified in accordance with ISO 14025 and is valid for 5 years from the date of issue.

Number of declared datasets: 1

Use

The intended use of an EPD is to communicate scientifically based environmental information for construction products, for the purpose of assessing the environmental performance of buildings.

Production site

Per Aarsleff A/S
Birkemosevej 9
DK-8361 Hasselager

EPD type

- Cradle-to-gate with modules C1-C4 and D
 Cradle-to-gate with options, modules C1-C4 and D
 Cradle-to-grave and module D
 Cradle-to-gate
 Cradle-to-gate with options

Products use

The PAA-F-Liner™ consists of a polyester needle felt impregnated with an epoxy resin. The liner is used to renovate existing vertical downpipes (plumbing stacks).

Declared unit

1 m³ of installed liner material

Year of data

2021

EPD Version

Revision 1: 30-06-2023. Wrong version uploaded. Affects results to a minor extent.

CEN standard EN 15804 serves as the core PCR

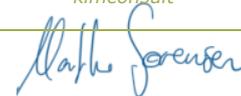
Independent verification of the declaration and data, according to EN ISO 14025

- internal external

Third party verifier:



Kim Christiansen
kimconsult



Martha Katrine Sørensen
EPD Danmark

Life cycle stages and modules (MND = module not declared)

Product			Construction process		Use								End of life				Beyond the system boundary
Raw material supply	Transport	Manufacturing	Transport	Installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Re-use, recovery and recycling potential	
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D	
X	X	X	X	X	MND	MND	MND	MND	MND	MND	MND	X	X	X	X	X	

Product information

Product description

The main product components are shown in the table below. These make up 100% of the product.

Material	Weight-% of declared product
Polyester filit	8%
TPU coating	11%
Epoxy resin	54%
Amine hardener	27%

The packaging material is indicated in the table below.

Packaging	Product
	F 100/3,5
Cardboard	18%
Wooden pallet	79%
PE film	3%

Representativity

The declared unit is 1 m³ of installed liner material incl. material which is cut off to open side branches. Transport, material loss and energy consumption at installation is included.

This declaration, including data collection and the modelled foreground system including results, represents the production of liners on the production site located in Hasselager, Denmark. Product specific data are based on average values collected for the fiscal year oct 21-oct 22.

Background data are based on the GaBi LCA software and are less than 10 years old. Generally, the used background datasets are of high quality, and the majority of the datasets are only a couple of years old.

Hazardous substances

The liners do not contain substances listed in the "Candidate List of Substances of Very High Concern for authorisation"

(<http://echa.europa.eu/candidate-list-table>)

Essential characteristics

Structural design is conducted according to Danish Construction Association, WRC or DWA-A143-2

The PAA-F-Liner is produced and tested according to ISO11296-4:2018.

Further technical information can be obtained by contacting the manufacturer or on the manufacturers website:

<https://www.aarsleffpipe.com/>

Reference Service Life

The expected lifetime of the liner is 100 years. Accelerated stress tests confirms the expected lifetime.

Pictures of products

The photos below shows the product



LCA background

Declared unit

The LCI and LCIA results in this EPD relates to 1 m³ of liner material incl. material which is cut off to open side branches. The product specification below indicates diameter of renovated pipe of 100mm, and a liner thickness of 3,5mm.

Name	F 100/3,5
Declared unit	1 m ³
Density, kg/m ³	1.115
Conversion to kg	0,000896

Functional unit and reference service life (RSL)

The functional unit is not defined as the use stages B1-B7 are not declared

The reference service life (RSL) is approx. 100 years. This is confirmed in accelerated stress tests.

PCR

This EPD is developed according to the core rules for the product category of construction products in EN 15804 version A2:2019.

Used Guarantee of Origin - certificats

Foreground:

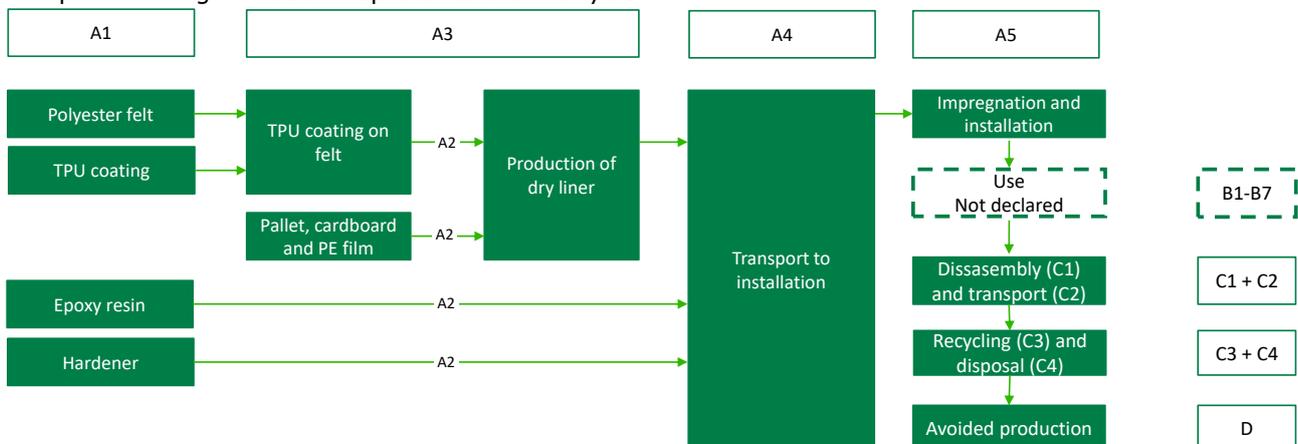
There are no "Guarantee of Origin" certificats used in the production. Consumption of electricity and heat is modelled with residual-mix for elektriciy, and average district heating supply in Kredsløb A/S' supply area.

Background:

Other processes upstream and downstream from the production is modelled with processes from the GaBi background database that is based on average data.

Flowdiagram

The process diagram below represents the life cycle of a liner.



System boundary

This EPD is based on a cradle-to-gate LCA with options, modules C1-C4 and D, in which 100 weight-% has been accounted for. The options are module A4-A5.

The general rules for the exclusion of inputs and outputs follows the requirements in EN 15804, 6.3.5, where the total of neglected input flows per module shall be a maximum of 5 % of energy usage and mass and 1 % of energy usage and mass for unit processes.

Product stage (A1-A3) includes:

- A1 – Extraction and processing of raw materials
- A2 – Transport to the production site
- A3 – Manufacturing processes

The felt material, coating polymers, resins and additives are manufactured by suppliers. The TPU is coated onto the felt before the felt arrives at Aarsleff.

The felt liner is sowed on the sowing product line. The resin and hardener arrives directly from the supplier and is sent out to the installation site.

Installation stage (A4-A5):

The installation stage contains transport to the installation site, impregnation of liner, insertion and hardening of liner, and final cutting of liner. Installation waste is returned to the Aarsleff's production site and disposed from here.

End of Life (C1-C4), and Re-use, recovery and recycling potential (D) includes:

The liner is disposed of together with the original vertical sewer pipe, which is typically in steel. The steel material is shredded and the liner material is sorted away from the metal and sent to landfill.

LCA results

The numbers in the tables below are declared in scientific notation, e.g. 1,95E+02. This number can also be written as: 1,95*10² or 195, while 1,12E-11 is the same as 1,12*10⁻¹¹ or 0,0000000000112.

PAA-F-Liner 100/3,5

PAA-F-Liner 100/3,5

ENVIRONMENTAL EFFECTS PER PRODUCT PER M ³									
Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP-total	[kg CO ₂ eq.]	9,99E+03	2,03E+03	1,83E+03	6,79E-01	7,25E+00	1,62E+01	7,69E+01	-3,12E+02
GWP-fossil	[kg CO ₂ eq.]	9,92E+03	2,04E+03	1,81E+03	7,11E-01	7,17E+00	1,61E+01	7,77E+01	-3,70E+02
GWP-bio	[kg CO ₂ eq.]	5,98E+01	-1,99E+01	2,42E+01	-3,66E-02	3,00E-02	7,56E-02	-8,27E-01	5,78E+01
GWP-luluc	[kg CO ₂ eq.]	3,15E+00	1,38E+01	1,96E-01	4,62E-03	4,90E-02	5,75E-03	3,78E-02	-3,09E-02
ODP	[kg CFC 11 eq.]	2,81E-08	2,02E-10	4,88E-09	6,73E-14	7,14E-13	2,82E-10	1,04E-10	-1,40E-09
AP	[mol H ⁺ eq.]	1,32E+01	2,16E+00	7,41E+00	3,45E-03	7,98E-03	2,56E-02	2,30E-01	-2,90E-01
EP-fw	[kg P eq.]	3,83E-02	7,34E-03	3,36E-02	2,45E-06	2,60E-05	9,17E-05	1,45E-02	-4,64E-04
EP-mar	[kg N eq.]	4,46E+00	6,68E-01	3,70E+00	1,61E-03	2,54E-03	8,69E-03	5,10E-02	-1,12E-01
EP-ter	[mol N eq.]	4,57E+01	8,08E+00	3,94E+01	1,79E-02	3,05E-02	8,48E-02	5,59E-01	-1,18E+00
POCP	[kg NMVOC eq.]	1,44E+01	1,84E+00	1,13E+01	4,51E-03	6,84E-03	2,07E-02	1,64E-01	-3,03E-01
ADP-mm ¹	[kg Sb eq.]	1,46E-03	2,07E-04	1,41E-04	6,90E-08	7,33E-07	8,55E-06	5,39E-06	-4,33E-05
ADP-fos ¹	[MJ]	1,92E+05	2,70E+04	1,62E+04	8,99E+00	9,55E+01	1,93E+02	1,10E+03	-5,82E+03
WDP ¹	[m ³]	6,12E+02	2,30E+01	9,26E+01	7,66E-03	8,14E-02	1,36E+00	-7,66E-01	-7,70E+00
Caption	GWP-total = Globale Warming Potential - total; GWP-fossil = Global Warming Potential - fossil fuels; GWP-bio = Global Warming Potential - biogenic; GWP-luluc = Global Warming Potential - land use and land use change; ODP = Ozone Depletion; AP = Acidification; EP-freshwater = Eutrophication – aquatic freshwater; EP-marine = Eutrophication – aquatic marine; EP-terrestrial = Eutrophication – terrestrial; POCP = Photochemical zone formation; ADPm = Abiotic Depletion Potential – minerals and metals; ADPf = Abiotic Depletion Potential – fossil fuels; WDP = water use								
Disclaimer	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.								

PAA-F-Liner 100/3,5

PAA-F-Liner 100/3,5

ADDITIONAL ENVIRONMENTAL EFFECTS PER PRODUCT PER M ³									
Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
PM	[Disease incidence]	1,36E-04	1,54E-05	2,87E-05	3,91E-08	5,55E-08	2,31E-07	2,21E-06	-2,80E-06
IRP2	[kBq U235 eq.]	5,58E+02	7,59E+00	7,53E+01	2,53E-03	2,69E-02	1,79E+00	2,00E+00	-9,01E+00
ETP-fw1	[CTUe]	9,19E+04	1,91E+04	1,26E+04	6,37E+00	6,77E+01	6,58E+01	1,08E+03	-3,83E+02
HTP-c1	[CTUh]	4,13E-06	3,94E-07	5,49E-06	1,31E-10	1,39E-09	6,55E-09	4,85E-08	-6,06E-08
HTP-nc1	[CTUh]	3,34E-04	2,13E-05	6,57E-04	8,22E-09	7,56E-08	1,45E-07	4,06E-06	-8,77E-07
SQP1	-	2,76E+04	1,14E+04	2,62E+03	3,81E+00	4,04E+01	2,82E+02	7,94E+01	-2,93E+03
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 (dimensionless)								
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.								

**PAA-F-Liner
100/3,5**

RESSOURCE CONSUMPTION PER PRODUCT PER M ³									
Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
PERE	[MJ]	1,96E+03	1,87E+03	2,16E+03	6,23E-01	6,62E+00	4,09E+02	9,07E+01	-2,70E+03
PERM	[MJ]	1,90E+04	0,00E+00						
PERT	[MJ]	2,09E+04	1,87E+03	2,16E+03	6,23E-01	6,62E+00	4,09E+02	9,07E+01	-2,70E+03
PENRE	[MJ]	1,54E+05	2,71E+04	1,62E+04	9,03E+00	9,59E+01	1,93E+02	1,10E+03	-5,82E+03
PENRM	[MJ]	3,80E+04	0,00E+00						
PENRT	[MJ]	1,92E+05	2,71E+04	1,62E+04	9,03E+00	9,59E+01	1,93E+02	1,10E+03	-5,82E+03
SM	[kg]	2,68E+01	0,00E+00						
RSF	[MJ]	0,00E+00							
NRSF	[MJ]	0,00E+00							
FW	[m ³]	3,24E+01	2,16E+00	3,86E+00	7,20E-04	7,65E-03	1,42E-01	1,43E-02	-7,19E-01
Caption	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 resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non renewable secondary fuels; FW = Net use of fresh water								

**PAA-F-Liner
100/3,5**

WASTE CATEGORIES AND OUTPUT FLOWS PER PRODUCT PER M ³									
Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
HWD	[kg]	8,32E-05	1,43E-07	4,75E-07	4,78E-11	5,07E-10	4,69E-08	1,70E-07	-3,22E-07
NHWD	[kg]	1,45E+02	4,41E+00	3,03E+02	1,47E-03	1,56E-02	6,55E-01	1,09E+03	-3,93E+00
RWD	[kg]	3,93E+00	5,02E-02	6,61E-01	1,68E-05	1,78E-04	1,61E-02	1,36E-02	-8,13E-02
CRU	[kg]	0,00E+00							
MFR	[kg]	5,60E-02	0,00E+00	4,45E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MER	[kg]	0,00E+00							
EEE	[MJ]	0,00E+00	0,00E+00	1,10E+03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EET	[MJ]	0,00E+00	0,00E+00	4,67E+03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Caption	HWD = Hazardous waste disposed; NHWD = Non hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy								

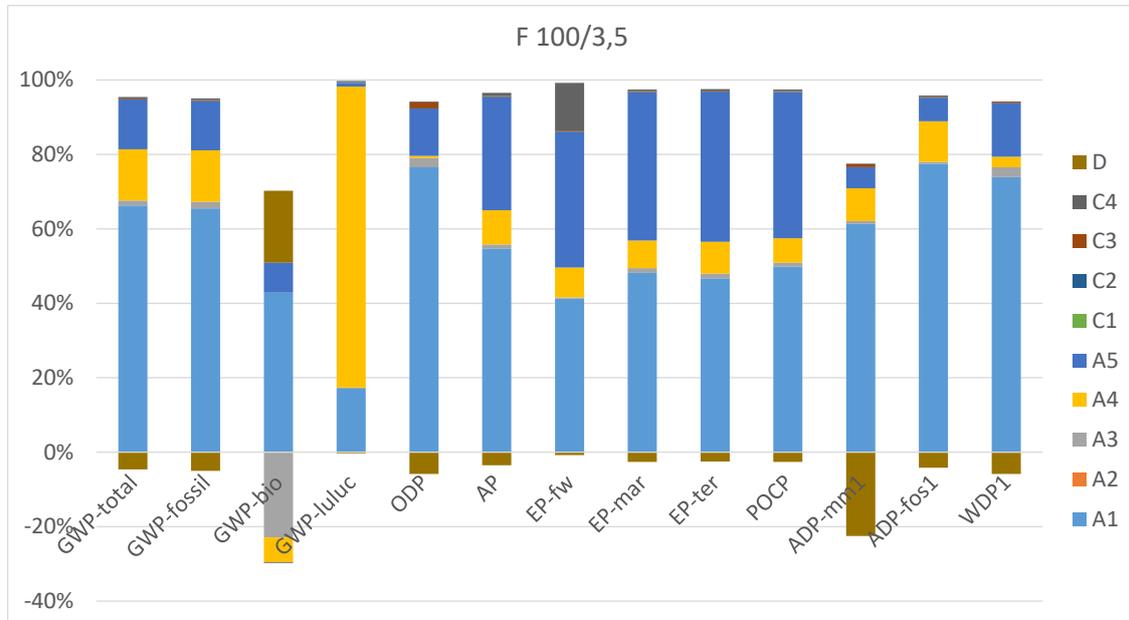
**PAA-F-Liner
100/3,5**

BIOGENIC CARBON CONTENT PER PRODUCT PER M ³	
Parameter	At the factory gate
Biogenic carbon content in product	0,00E+00
Biogenic carbon content in accompanying packaging	4,63E+02

Additional information

LCA interpretation

Broadly speaking, the largest part of the environmental impacts are related to the production of raw materials (A1) in the figure below. However, both transport for installation (A4) and the installation itself (A5) are essential.



A large part of the climate impact (GWP) comes from the production of raw materials in module A1, from the Epoxy resin and amine-based hardener. CO₂-eq uptake and CO₂-eq from land-use are two orders of magnitude under the fossil impact, and originate from wood production for the packaging pallet, and land-use related to diesel production, respectively.

Ozone layer influence (ODP) and the two consumptions of metallic (ADP-mm) and fossil resources (ADP-fos) are also primarily from the production of Epoxy resin and associated hardener.

Water for cleaning before installation has the greatest impact in Water Depletion, and the subsequent treatment of wastewater the greatest impact of nutrients to fresh water. nutrient load of fresh water.

Running the gasoline compressor for hardening of the downpipe has the greatest contribution to acidification (AP), marine and terrestrial nutrient load (EP-mar and -ter), and formation of smog (POCP).

Impact Category	Unit	Total	Dominant	% of category	Process
GWP-total	[kg CO2 eq.]	13.639	4.465	33%	Epoxy resin
GWP-fossil	[kg CO2 eq.]	13.501	4.354	32%	
GWP-bio emission	[kg CO2 eq.]	121	110	91%	
GWP-bio uptake	[kg CO2 eq.]	121	-56	-46%	Pallet
GWP-luluc	[kg CO2 eq.]	17	14	80%	Diesel production
ODP	[kg CFC ₁₁ eq.]	3,22E-08	2,13E-08	66%	Epoxy resin
AP	[mol H+ eq.]	23	6,6	29%	Hardening of liner
EP-fw	[kg P eq.]	0,093	0,030	32%	Treatment of pre-installation cleaning water
EP-mar	[kg N eq.]	8,8	3,3	37%	Hardening of liner
EP-ter	[mol N eq.]	93	36	39%	
POCP	[kg NMVOC eq.]	27	11	38%	
ADP-mm	[kg Sb eq.]	0,0018	0,0007	39%	Epoxy resin
ADP-fos	[MJ]	230.774	89.296	39%	
WDP	[m3]	720	2.086	290%	Pre-installation cleaning water

Technical information on scenarios

Transport to the construction site (A4)

Name	Value	Unit
Fuel quantity and type (alternatively: type of transport)	Diesel, 3 liter / km	-
Transport types	<i>Diesel truck with installation equipment</i>	
Transport distance	45	km
Capacity utilisation (including empty return journey)	100	%
Bulk density of transported product	1,15E03	kg/m ³
Capacity utilisation, volume factor	1	-

Reference service life

RSL information	Unit
Reference service Life	100 years
Declared product properties	Technical specifications and guidance can be obtained from direct contact to Aarsleff Pipe A/S at +45 8744 2222 or https://aarsleffpipe.dk/kontakt-os/
Design application parameters	
Assumed quality of work	
Outdoor environment	
Indoor environment	
Usage conditions	
Maintenance	

End of life (C1-C4), and Re-use, recovery and recycling potential (D)

End of life/Disposal (C1-C4)

Materiale	Produkt	Enhed
	F 100/3,5	
Sorted construction waste	0	kg
Mixed construction waste	1,15E03	kg
For reuse	0	kg
For recycling	0	kg
For energy recovery	0	kg
For landfill	1,15E03	kg
Prerequisites for end-of-life scenarios	Original vertical liner is shredded and the liner material sent to landfill	-

Re-use, recovery and recycling potential (D)

Materiale	Produkt	Enhed
	F 100/3,5	
Avoided production of material	0	kg

Indoor air

The product has no direct contact to indoor air.

Soil and water

The EPD does not give information on release of dangerous substances to soil and water because the horizontal standards on measurement of release of regulated dangerous substances from construction products using harmonised test methods according to the provisions of the respective technical committees for European product standards are not available.

References

Publisher	 www.epddanmark.dk
Programme operator	Danish Technological Institute Buildings & Environment Gregersensvej DK-2630 Taastrup www.teknologisk.dk
LCA-practitioner	Danish Technological Institute Buildings & Environment Gregersensvej DK-2630 Taastrup www.teknologisk.dk
LCA software / background data	Thinkstep GaBi 10.6 Database version 2022.2 www.gabi-software.com
3rd party verifier	Kim Christiansen Kimconsult www.kimconsult.dk

General programme instructions

Version 2.0

www.epddanmark.dk

EN 15804

DS/EN 15804 + A2:2019 - "Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products"

EN 15942

DS/EN 15942:2011 – " Sustainability of construction works – Environmental product declarations – Communication format business-to-business"

ISO 14025

DS/EN ISO 14025:2010 – " Environmental labels and declarations – Type III environmental declarations – Principles and procedures"

ISO 14040

DS/EN ISO 14040:2008 – " Environmental management – Life cycle assessment – Principles and framework"

ISO 14044

DS/EN ISO 14044:2008 – " Environmental management – Life cycle assessment – Requirements and guidelines"