Environmental Product Declaration

In accordance with ISO 14025:2006 and EN 15804:2012+A2:2019/AC 2021

EPD of multiple products, based on a representative product

LK Heating & DW pipes including PE-Xa/PE-RT/Pipe-in-pipe

LK Pex AB

Programme:	The International EPD® System, www.environdec.com
Programme operator:	EPD International AB
EPD registration number:	S-P-09471
Publication date:	2024-01-09
Valid until:	2029-01-08

An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.environdec.com

Company information

Owner of the EPD:	LK Pex AB Box 21 523 21 Ulricehamn Sweden
Contact:	info@lkpex.se www.lxpex.se
Location of production site:	All pipes are manufactured at LK Pex production site in Ulricehamn, Sweden. LK Pex AB, Rönnåsgatan 4A, 523 38 Ulricehamn, Sweden
Product-related or management system-related certifications:	Certification acc. ISO 9001:2015 (cert. no. 9001-0995) and ISO 14001:2015 (cert. no. 14001-0995), SCAB Sweden

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 characterization factors); have equivalent content declarations; and be valid at the time of comparison. For further information about comparability, see EN 15804 and ISO 14025.

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
CEN standard EN 15804 serves as the Core Product Category Rules (PCR)
Product category rules (PCR): *PCR 2019:14 Construction products (EN 15804+A2) (1.3.1)*
PCR review was conducted by: *Claudia A. Peña, The Technical Committee of the International EPD® System. Contact: info@environdec.com*
LCA practitioner: Marcus Bernhard, Miljögiraff AB
Independent third-party verification of the declaration and data, according to ISO 14025:2006, via: ☒ EPD verification by individual verifier Third-party verifier: Hudai Kara PhD, Metsims Sustainability Consulting Approved by: The International EPD® System
Procedure for follow-up of data during EPD validity involves third party verifier: ☐ Yes ☒ No

About the manufacturer

LK Pex is a part of a family-owned company group and located in the western part of Sweden. We are an innovative manufacturer of high-quality plastic pipes for the heating and plumbing industry. Our core is the efficient, high-technology production process for crosslinked PE-Xa pipes, resulting in products with a unique combination of flexibility and hydrostatic strength. In our pipe production facility, we manufacture high-quality PE-Xa pipes, as well as PE-RT pipes and pipe-in-pipe products, which are suitable for heating and tap water systems. Our pipes are proudly made in Sweden.

For the simpler, smarter everyday

Simpler. Smarter. More sustainable. At LK, we believe there's a better way to do everything. That's why – from water, heating and hydronic solutions to pipe extrusion – we push for innovation over status quo and simplicity over complexity. It's a belief all of us at LK apply to every product and solution we create.

Product information

Product name

LK Pex Heating & DW pipes
Product versions presented in this EPD include pipe of type PE-Xa and PE-RT, as well as Pipe-in-pipe

UN CPC Code

36320 Tubes, pipes and hoses, and fittings therefor, of plastic

Product identification

LK Heating Pipe PE-Xa Class A, SDR 11	Pipes with oxygen barrier manufactured acc. EN ISO 15875, dimension 12–110 mm
LK Heating and DW Pipe PE-Xa Class A, SDR 7,4	Pipes with oxygen barrier manufactured acc. EN ISO 15875, dimension 16–32 mm
LK Heating and DW Pipe PE-Xa Class B1	Pipes with oxygen barrier manufactured acc. EN ISO 15875, dimension 12–28 mm
LK Heating Pipe PE-Xa Class C	Pipes with oxygen barrier manufactured acc. EN ISO 15875, dimension 12–20 mm
LK Heating Pipe PE-RT	Pipes with oxygen barrier manufactured acc. EN ISO 22391, dimension 16–25 mm
LK Universal Pipe PE-Xa	Pipes with oxygen barrier manufactured acc. KIWA type approval TG 0318, dimension 16–25 mm
LK PE-Xa Pipe with Corrugated Conduit (Pipe-in-Pipe)	Pipes with outer corrugated conduit, with conduit acc. Norwegian requirements, NT VVS 129 and Sintef test method 02.

Product description

LK PE-Xa products are versatile pipes manufactured by extrusion and IR initiated crosslinking. Depending on type, pipes are suitable for tap water systems and various heating applications, including radiator and floor heating as well as snow melting and secondary district heating. The pipes are manufactured in a wide range of dimension and are delivered as coils. LK PE-RT pipes are intended mainly for floor heating applications. Constituents of the PE-Xa/PE-RT pipes include HD polyethylene, adhesive, oxygen barrier and optionally pigment.

LK PE-Xa pipes up to 32 mm can also be delivered as a pipe-in-pipe solutions, where LK Corrugated Pipe acts as an outer protective/insulating conduit for the PE-Xa pipe and prevents water damage to the building in case of any leakage from the pipe system. The corrugated conduit is made of polypropylene and pigment.

All products are providing excellent performance in both installation and use and sold exclusively as B2B.

LCA information

Functional unit / declared unit	The declared unit is 1 kg of pipe. The declared unit is based on a representative pipe with a dimension of 16x2 mm enclosed in a corrugated pipe.
Time representativeness:	Collected data represent average yearly data for 2022 and are assumed to be representative for the EPDs period of validity of 5 years.
Database(s) and LCA software used:	Ecoinvent 3.9.1 and SimaPro 9.5
LCA practitioner:	Marcus Bernhard, Miljögiraff AB
Geographical scope	Europe
LCA Report	LCA report LK Heating & DW pipes

Description of system boundaries:

The system boundaries of the EPD are cradle-to-gate (A1-A3) with options, including C1-C4 and D. See Table 1 for the modules declared. The system boundaries mean that all processes needed for raw material extraction, transport, manufacturing, and disposal are included in the study. Figure 1 shows a schematic overview of the included processes.

Table 1, 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	ND	ND	ND	ND	ND	ND	ND	ND	ND	X	X	X	X	X
Geography	EU	EU	SE												SE/EU		SE/EU
Specific data used		21%				-	-	-	-	-	-	-	-	-	-	-	-
Variation – products		<10%				-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites		-				-	-	-	-	-	-	-	-	-	-	-	-

X = Modules included in the analysis ND = Module not declared O= Optional modules

Content information

Table 2, shows the weight of the raw material of the declared product.

Product components	**Weight, kg**	**Post-consumer material, weight-%**	**Renewable material, weight-%**
Polyethylene	0,62	0	0
Polypropylene (Conduit)	0,33	0	0
Adhesive	0,02	0	0
Oxygen barrier	0,02	0	0
Pigment	0,01	0	0
TOTAL	1	0	0
Packaging materials	**Weight, kg**	**Weight-% (versus the product)**	
Cardboard box	0,09	9	
EU pallet (reuse system)	0,31	31	
TOTAL	0,40	40	

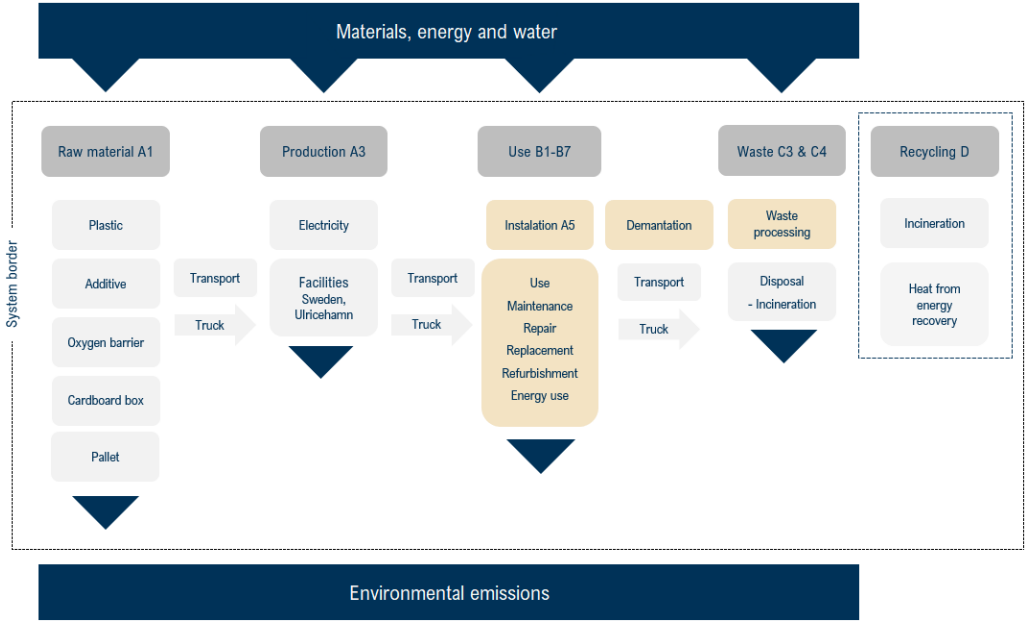
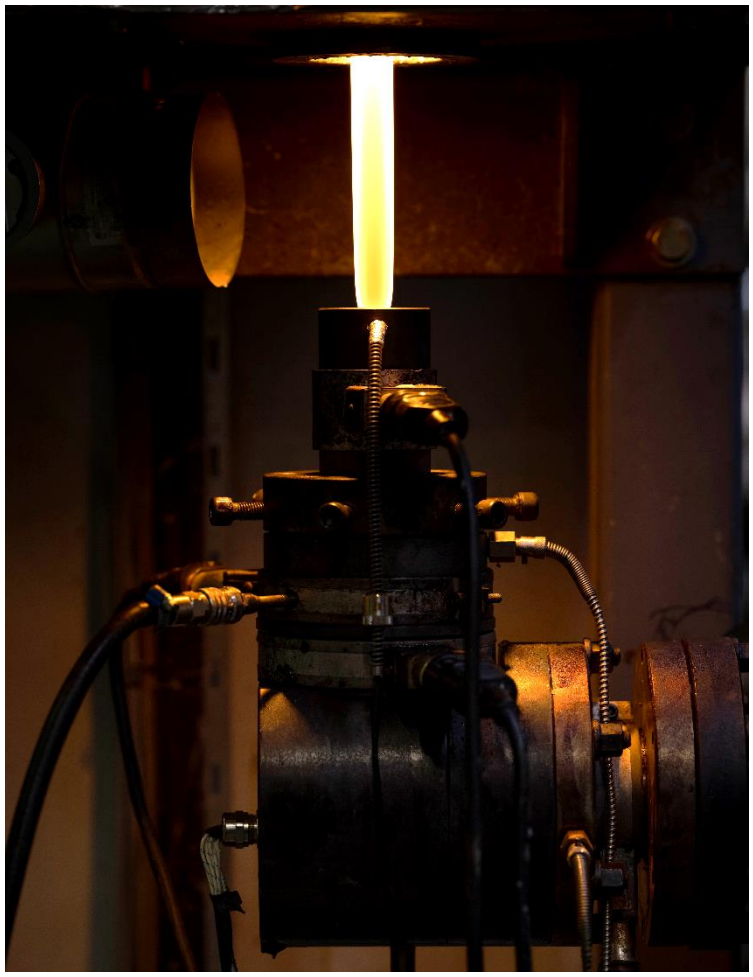


Figure 1, Overview of the included processes. Light gray represents modules included. Yellow represents modules not declared.

Substances REACH

The declared products do not contain any substances from the REACH SVHC candidate list in amounts greater than 0,1 %.



Product life-cycle

Raw material supply, transport & manufacturing (A1-A3)

The pipe products are manufactured in an extrusion process using high-density polyethylene, additives and oxygen barrier materials as inputs. All raw materials in the product are sourced from Europe, and specific transport distances from the suppliers are used in A2. The study also considers the material losses occurring during the pipe manufacturing processes.

The PE-Xa process has a one-step process flow with different machinery in line after each other. The first process steps include mixing and conveying of the polyethylene and additives, feeding into a tube extruder where the mixture is melted, homogenized, formed into pipe, and subsequently crosslinked in an IR-oven. The crosslinked pipe is cooled and calibrated to correct dimension and the oxygen barrier is added before the pipe is cooled, coiled, and packaged. Figure 2 shows a schematic overview of the PE-Xa pipe production processes.

The PE-RT pipe process is a one-step extrusion similar to the PE-Xa process, but it does not contain the crosslinking step, so polyethylene and oxygen barrier layers are co-extruded in the first part of the production line. Pipe-in-pipe has one additional step in the process, where an outer corrugated pipe, made of polypropylene (PP) and pigment, is extruded on the outside of the inner PE-Xa media pipe to form a protective conduit, after which the final pipe-in-pipe product is coiled and packaged. The pipes are delivered in coils that are usually packed in cardboard box and then placed on pallets.

The electricity used in manufacturing has been modelled using a medium voltage residual electricity mix for Sweden with a climate footprint of 0,067 kg CO2-eq per kWh.

Product End-of-Life (C1-C4, D)

The product end of life (C1) is assumed zero since the installation of pipes takes place behind floors and walls and therefore the assumption of de-construction demolition has been excluded. It is assumed that the pipe ends up in combustible waste (C3) when the building, where the pipe is installed, is demolished. The product is assumed to be sent to the nearest waste facility. The benefit in the resource recovery stage (D) is energy recovery. The corrugated pipe that is included in Pipe in pipe is made of polypropylene (PP) and can be recycled, but it has been assumed that the whole product will end up in combustible waste and therefore the benefits will be energy recovery.

Electricity data

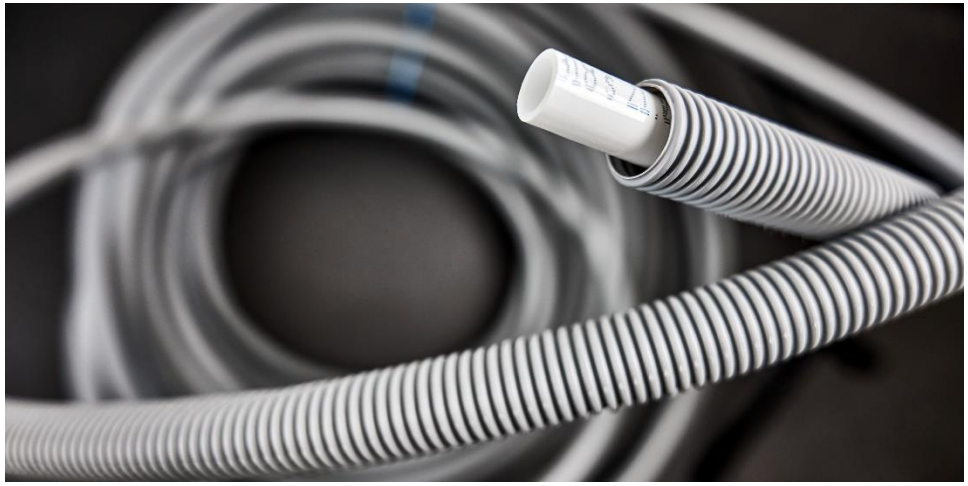
The electricity consumption in the A3 module accounts for less than 30% of the total energy use in module A1-A3. The electricity used is a residual mix for Sweden modelled using the residual mixes available in Ecoinvent.

Figure 2, Production process flow for PE-Xa pipe, excluding the production step of outer corrugated conduit for pipe-in-pipe products.

Background data

The data quality of the background data is considered good. All specific data that includes processes, volume of different materials, energy use, water consumption and transport distance has been collected by questionnaire and personal contact with the LK Pex. Ecoinvent database has been used.

Ecoinvent is the world's biggest LCI data library and contains data for the specific geographical regions relevant for this study, that have been analysed to be the most suitable for the various steps in the process. Collected data represent average yearly data for 2022 and assumed to be representative for the EPDs period of validity of 5 years.



Allocation and assumptions

The declared unit values for 1 kg of product that are used in this study are calculated based on the total product weight produced during the year studied. The declared unit is based on a representative pipe with a dimension of 16x2 enclosed in a corrugated pipe/conduit (pipe-in-pipe). This article is one of the most sold products manufactured by LK Pex. The content of raw material can vary slightly between the different types and dimensions of pipes, and it is examined that the variation of GWP-GHG stays within 10%. The raw material necessary for the manufacturing and the amount of packaging is allocated to the product based on the amount of material used to manufacture the declared unit, including waste.

The used pipe is assumed to be transported 50 km to the nearest waste disposal facility. The product is assumed to end up as combustible waste, even if the corrugated conduit is recyclable. The waste treatment method is selected based on the knowledge that the pipe is installed in the building and that the pipes are generally not separated and recycled when a building is demolished. The pipe is assumed to be incinerated with energy recovery efficiency at 80%.

Environmental information

Potential environmental impact – mandatory indicators according to EN 15804.
Results of declared unit of the study.

Indicator	Unit	Tot.A1-A3	C1	C2	C3	C4	D
GWP-fossil	kg CO2 eq.	2,70E+00	0	7,43E-03	2,35E+00	0	-4,30E-01
GWP-biogenic	kg CO2 eq.	-1,74E-02	0	6,23E-06	2,89E-02	0	-1,35E-02
GWP-luluc	kg CO2 eq.	2,27E-03	0	3,63E-06	4,82E-05	0	-7,53E-03
GWP-total	kg CO2 eq.	2,69E+00	0	7,44E-03	2,37E+00	0	-4,51E-01
ODP	kg CFC 11 eq.	2,49E-08	0	1,63E-10	1,38E-08	0	-1,00E-08
AP	mol H+ eq.	8,95E-03	0	3,47E-05	5,91E-04	0	-2,78E-03
EP-freshwater	kg PO43- eq	3,50E-04	0	5,36E-07	1,32E-05	0	-3,39E-04
EP-freshwater	kg P eq.	1,93E-03	0	1,38E-05	3,04E-04	0	-6,68E-04
EP-marine	kg N eq.	1,82E-02	0	1,47E-04	2,72E-03	0	-7,56E-03
EP-terrestrial	mol N eq.	8,65E-03	0	5,15E-05	7,10E-04	0	-1,89E-03
POCP	kg NMVOC eq.	1,12E-05	0	2,31E-08	2,44E-07	0	-8,45E-07
ADP-minerals&metals[2]	kg Sb eq.	1,04E+02	0	1,07E-01	4,49E-01	0	-1,94E+01
ADP-fossil[2]	MJ	2,00E+00	0	4,67E-04	2,52E-02	0	-2,24E-01
WDP[2]	m3	1,02E-07	0	7,32E-10	4,16E-09	0	-3,27E-08
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						

Potential environmental impact – additional mandatory indicators according to EN 15804.

Indicator	Unit	Tot.A1-A3	C1	C2	C3	C4	D
Particulate matter	disease inc.	1,78E+00	0	1,48E-04	3,44E-03	0	-1,05E+00
Ionnising radiation[1]	kBq U-235 eq	5,52E+00	0	5,28E-02	5,88E+00	0	-1,49E+00
Ecotoxicity, freshwater[2]	CTUe	6,90E-10	0	4,00E-12	4,51E-10	0	-2,87E-10
Human toxicity, cancer[2]	CTUh	1,46E-08	0	8,32E-11	3,18E-09	0	-6,14E-09
Human toxicity, non-cancer[2]	CTUh	7,25E+00	0	8,06E-02	1,28E-01	0	-2,05E+01
Land use[2]	Pt	2,71E+00	0	7,44E-03	2,35E+00	0	-4,41E-01

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.

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.

Climate impact IPCC GWP 100

Indicator	Unit	Tot.A1-A3	C1	C2	C3	C4	D
GWP-GHG	kg CO2 eq.	2,71E+00	0	7,44E-03	2,35E+00	0	-4,41E-01

The indicator includes all greenhouse gases included in GWP-total but excludes biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. This indicator is thus almost equal to the GWP indicator originally defined in EN 15804:2012+A1:2013.

Use of resources

Indicator	Unit	Tot.A1-A3	C1	C2	C3	C4	D
PERE	MJ	2,27	0,00	0,00	0,04	0,00	-11,17
PERM	MJ	7,30	0,00	0,00	0,00	0,00	0,00
PERT	MJ	9,57	0,00	0,00	0,04	0,00	-11,17
PENRE	MJ	68,35	0,00	0,11	0,48	0,00	-19,85
PENRM	MJ	41,46	0,00	0,00	-41,46	0,00	0,00
PENRT	MJ	109,80	0,00	0,11	-40,98	0,00	-19,85
SM	kg	0,00	0,00	0,00	0,00	0,00	0,00
RSF	MJ	0,00	0,00	0,00	0,00	0,00	0,00
NRSF	MJ	0,00	0,00	0,00	0,00	0,00	0,00
FW	m3	0,01	0,00	0,00	0,001	0,00	-0,005
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 resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = use of net fresh water						

Waste production and output flows

Waste production

Indicator	Unit	Tot.A1-A3	C1	C2	C3	C4	D
Hazardous waste disposed	kg	0	0	0	0	0	0
Non-hazardous waste disposed	kg	0	0	0	0	0	0
Radioactive waste disposed	kg	0	0	0	0	0	0

Note: Ecoinvent database include all waste treatment processes within the system boundaries, i.e. there are no waste flows exiting the system boundaries and the waste indicators to be declared are therefore zero.

Output flows

Indicator	Unit	Tot.A1-A3	C1	C2	C3	C4	D
Components for re-use	kg	0	0	0	0	0	0
Material for recycling	kg	0	0	0	0	0	0
Materials for energy recovery	kg	0	0	0	0	0	0
Exported energy, electricity	MJ	9,82E-01	0	0	1,02E+01	0	0
Exported energy, thermal	MJ	1,99E+00	0	0	2,07E+01	0	0

Information on biogenic carbon content

Results per functional or declared unit

Biogenic carbon content	Unit	Quantity
Biogenic carbon content in product	kg C	0,00
Biogenic carbon content in packaging	kg C	0,18

Note: 1 kg biogenic carbon is equivalent to 44/12 kg CO2.

Additional information

Application areas

Table 3 shows an overview of application areas for the declared products.

Storage and handling

The pipes must be protected against UV light exposure, *i.e.* must not be stored or installed in such a way that they are exposed to direct sunlight (maximum exposure 3 months during installation). This requirement also applies to pipe-in-pipe products. The packaging provides adequate protection against UV radiation. After completion of the building construction, it is assumed that the pipes are not exposed to direct sunlight other than temporarily. Window glass provides sufficient protection against UV radiation and therefore, does not affect the good long-term properties of the pipes.

Technical product questions

For any technical questions regarding LK products, please contact our Customer & Sales Coordinators at info@lkpex.se.

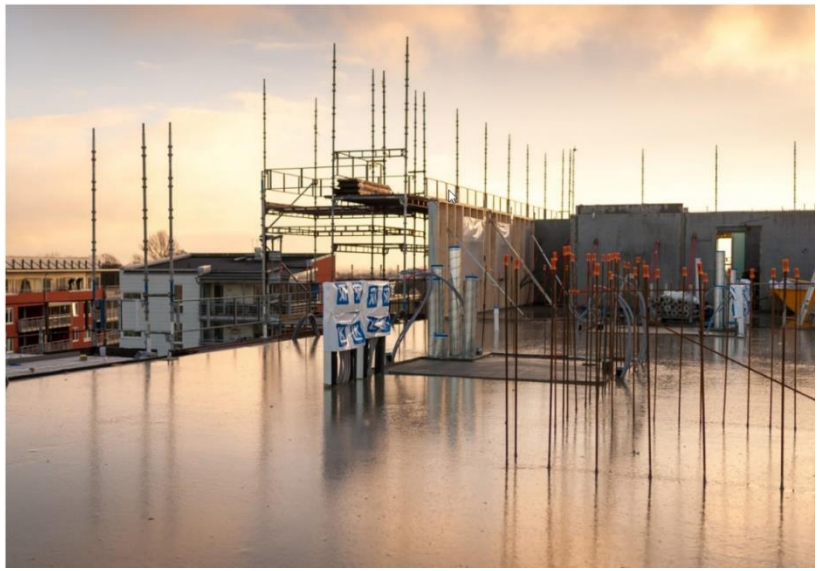


Table 3, Application area overview per product category

Product	Application		Pressure class
	Tap water	Heat/cooling	
LK Heating Pipe PE-Xa Class A, SDR 11		x	PN6
LK Heating and DW Pipe PE-Xa Class A, SDR 7,4	x	x	PN10
LK Heating and DW Pipe PE-Xa Class B1	x	x	PN10
LK Heating Pipe PE-Xa Class C		x	PN6
LK Heating Pipe PE-RT		x	PN6
LK Universal Pipe PE-Xa	x	x	PN10
LK PE-Xa Pipe with Corrugated Conduit (Pipe-in-Pipe)	x	x	PN10

References

General Programme Instructions of the International EPD® System. Version 4.0.

PCR 2019:14. Construction products (EN 15804+A2) (1.3.1)

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PRé Consultants, “SimaPro 9.5” (PRé Consultants, 2023), http://www.pre-sustainability.com/simapro

Ecoinvent, ‘Ecoinvent’ <https://www.ecoinvent.org/database/database.html

Residual mix, Sweden: https://www.ei.se/bransch/ursprungsmarkning-av-el/residualmix