ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A2*

Owner of the Declaration	Kaimann GmbH
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-KAI-20250303-IBC1-EN
Issue date	14.08.2025
Valid to	13.08.2030

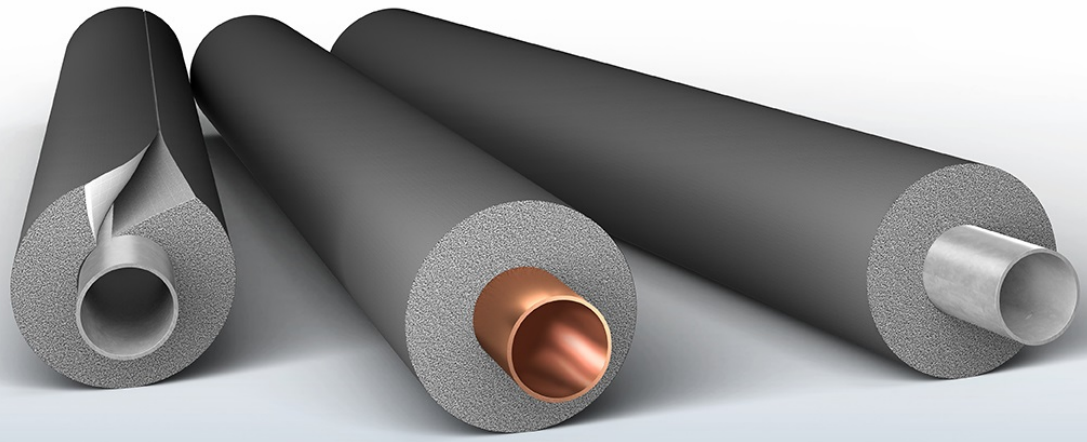
Kaiflex KKplus s2 Tube

Kaimann GmbH

Institut Bauen und Umwelt e.V.

www.ibu-epd.com | https://epd-online.com

ECO PLATFORM EPD VERIFIED



1. General Information

Kaimann GmbH

Programme holder

IBU – Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

Declaration number

EPD-KAI-20250303-IBC1-EN

This declaration is based on the product category rules:

Insulating materials made of foam plastics, 01.08.2021
(PCR checked and approved by the SVR)

Issue date

14.08.2025

Valid to

13.08.2030

Dipl.-Ing. Hans Peters
(Chairman of Institut Bauen und Umwelt e.V.)

Florian Pronold
(Managing Director Institut Bauen und Umwelt e.V.)

Kaiflex KKplus s2 Tube

Owner of the declaration

Kaimann GmbH
Hansastr. 2-5
33161 Hövelhof
Germany

Declared product / declared unit

1 m^3 insulation material made of elastomeric foam based on synthetic rubber (product group Kaiflex KKplus s2 Tube).

Scope:

Product line Kaiflex KKplus s2 Tube
Thermal insulation products for building equipment and industrial installations – Factory-made flexible elastomeric foam (FEF) products.This declaration is an Environmental Product Declaration according to ISO 14025, which has been prepared in accordance with the requirements of PCR Part A with reference to EN 15804+A2 and PCR Part B: Requirements for the EPD for insulation materials made of foamed plastics.
The EPD is based on an average annual production of Kaiflex KKplus s2 Tube in Germany.

The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

The EPD was created according to the specifications of EN 15804+A2. In the following, the standard will be simplified as *EN 15804*.

Verification

The standard EN 15804 serves as the core PCR
Independent verification of the declaration and data according to ISO 14025:2011
☐ internally ☒ externally

Dr. Matthew Fishwick,
(Independent verifier)

2. Product

2.1 Product description/Product definition

Kaiflex KKplus s2 Tube is a flexible closed-cell rubber insulation made of flexible elastomeric foam (FEF) that prevents condensation and reduces energy loss. By incorporating a water vapour barrier into the insulation cell structure, Kaiflex KKplus s2 Tube can effectively eliminate water vapour migration and retain its performance over the entire system life. This EPD covers the Kaiflex KKplus s2 Tube.
For the placing on the market of the product in the European Union/European Free Trade Association (EU/EFTA) (with the exception of Switzerland) *Regulation (EU) No. 305/2011 (CPR)* applies. The product needs a declaration of performance taking into consideration *EN 14304:2009+A1:2013*, Thermal insulation products for building equipment and industrial installations – Factory-made flexible elastomeric foam (FEF) products.
For the application and use the respective national provisions apply.

2.2 Application

Kaiflex KKplus s2 Tube is a flexible closed cell rubber insulation made of flexible elastomeric foam (FEF) for technical insulation. As a fully coordinated insulation system consisting of sheet, tube, pipe support and adhesive, Kaiflex KKplus s2 meets stricter building and fire protection requirements as well as thermal requirements for very effective technical insulation. Thanks to our patented KaiCene technology, the sheets can remain uncoated and, like the tube material, help reduce smoke development and improve personal safety in the event of fire. With its very low thermal conductivity and a high water vapour diffusion resistance this closed-cell insulation gives long-term protection from energy loss and corrosion, even at low insulation thicknesses. Kaiflex KKplus s2 Tube is used in refrigeration and air conditioning systems for insulating pipes in highly frequented public and commercial buildings such as airports, large office complexes, hotels, residential buildings, industrial plants, and shipping. Due to its antimicrobial and fiber-free structure, the insulation material can also be used in healthcare facilities such as hospitals.

2.3 Technical Data

Constructional data

Name	Value	Unit
Gross density	52	kg/m^3
Water vapour diffusion resistance factor acc. to EN 13469 and EN 12086	10,000 / 7,000	-
Thermal conductivity acc. to EN ISO 8497 and EN 12667 (at 0°C)	0.033 / 0.036	W/(mK)
Max. service temperature acc. to EN 14706 and EN 14707	+110	°C
Min. service temperature	-50	°C
Reaction to fire acc. to EN 13501-1	BL-s2, d0	

*Please refer to the DoP or the technical data sheet for the product-specific data.

Performance data of the product in accordance with the declaration of performance with respect to its essential characteristics according to *EN 14304:2009+A1:2013*, Thermal insulation products for building equipment and industrial installations – Factory-made flexible elastomeric foam (FEF) products.

2.4 Delivery status

The EPD is declared as an average product of one plant from one manufacturer. The following products are covered by this EPD: Kaiflex ST s2 Tube/ ST Sheet, Kaiflex KKplus s2 Tube, Kaiflex KKplus s3 Sheet, Kaiflex HT s2 Tube and Kaiflex EF (Tube, Sheet)/ Kaiflex Duct plus (Sheet). It looks at the average environmental performance of the product line. This is in accordance with PCR Part A paragraph 6.3. The products are delivered in tubes. Self-adhesive products are available, but are not included in the LCA calculation. The standard thickness of the insulation varies from 6 to 42 mm. The tube diameter ranges from 6 mm to 160 mm. Tubes are produced in 2 m lengths. Kaiflex KKplus s2 Tube is packaged in cardboard boxes and delivered on pallets. The boxes are stretched in PE foil.

2.5 Base materials/Ancillary materials

Kaiflex KKplus s2 Tube is based on synthetic rubber and consists of several components. The following table shows the components clustered into substance groups:

Name	Value	Unit
Rubber and polymers	24.1	%
Pigments	1.1	&
Vulcanisation system, additives, plasticiser	21.2	%
Flame retardant	41.7	%
Blowing agent	11.9	%

Rubber and polymers are the base materials. Pigments are used for the colour. The vulcanisation system, additives and plasticisers ensure flexibility and mechanical properties. The flame retardants ensure the fire behaviour of the end product. The blowing agent causes the expansion process during the manufacture of the product.

1) This product/article/at least one partial article contains substances listed in the *candidate list* (20.12.2024) exceeding 0.1 percentage by mass: **No.**
2) This product/article/at least one partial article contains other carcinogenic, mutagenic, reprotoxic (CMR) substances in categories 1A or 1B which are not on the *candidate list*, exceeding 0.1 percentage by mass: **No.**
3) Biocide products were added to this construction product or it has been treated with biocide products (this then concerns a treated product as defined by the (EU) *Ordinance on Biocide Products No. 528/2012*): **No.**

2.6 Manufacture

Kaiflex products are manufactured in five steps in a continuous or discontinuous production process.
In the first step, all raw materials consisting of rubber, polymers, pigments, vulcanisation system, additives, plasticisers, flame retardants and blowing agents are processed in a mixing and rolling mill to form a homogeneous rubber mass in long sheets. The finished rubber sheets are then pressed into the respective profile in an extrusion process with the highest precision in accordance with the tolerances. The rubber profiles are then given their final shape in an oven at a defined temperature curve. In addition to the blowing process triggered by the blowing agent, the vulcanisation process takes place simultaneously due to the effect of the heat. In a final step, the finished product cools down on long conveyor belts so that it can then be cut to length and packaged.

2.7 Environment and health during manufacturing

The manufacturer of Kaiflex products complies with national manufacturing guidelines and regulations such as the German Energy Saving Regulation (GEG) and the German Renewable Energy Act (EEG). In addition, Kaimann's environmental management is certified in accordance with *ISO 9001/ISO*

14001/ISO 50001.

2.8 Product processing/Installation

The installation of Kaiflex KKplus s2 Tube requires basic tools such as a pen, knife, a measuring tape and the system-specific adhesive. No additional specific protection, beyond normal protective clothes, is required. When using our adhesives, please note the safety data sheet and the assembly instructions.
Please refer to the application guideline for general installation instructions and system-related characteristics.
For further information: www.kaimann.com

2.9 Packaging

Kaiflex KKplus s2 Tube is packed in cardboard boxes stretched in polythene film. The cartons are placed on wooden pallets. They are covered by the Interseroh recycling system for recycling (No. 31822).

2.10 Condition of use

Changes in the material composition of Kaiflex products only occur during the use phase in case of extraordinary effects.

2.11 Environment and health during use

Kaiflex KKplus s2 Tube is tested after the requirements of the Eurofins - Indoor Air Quality Test with 'Gold' according to *ISO 16000* standard. The samples were tested with a loading factor of 0.4 m²/m³ in accordance with the test criteria of the *ISO 16000* standard. In addition, the VOC requirements of various countries according to French VOC Regulation/CMR components, Italian CAM Edilizia, AGB/AgBB, Belgian Regulation and the EU Taxonomy are fulfilled.

2.12 Reference service life

Kaiflex products have a service life of more than 40 years when installed correctly and under ideal environmental conditions. The technical performance almost maintains over the entire service life in terms of fire behaviour, thermal conductivity and water diffusion resistance.

2.13 Extraordinary effects

Fire

Kaiflex KKplus s2 Tube is designed to meet European fire regulations and is a self-extinguishing foam that will not drip or support flame spread. It can be safely used with confidence in public, commercial and industrial buildings.

Reaction to fire

Name	Value
Building material class	BL
Smoke gas development	s2
Burning droplets	d0

*Please refer to the DoP or the technical data sheet for the product-specific data.

Water

Kaiflex insulation products have a built-in water vapour barrier with a high water diffusion resistance. No additional vapour diffusion barrier (e.g. aluminium foil) is required. Provided the surface is undamaged, the formation of condensation of water can be ensured and effectively prevent corrosion under the insulation.

Mechanical destruction

Elastomeric foam-based products have a limited mechanical load capacity and a low modulus of elasticity. They should therefore be supported from the outside in the event of greater mechanical loads.

2.14 Re-use phase

Kaiflex products can be used multiple times if disassembled correctly. Production waste is recycled into sound-damping products such as Kaisound. At the end-of-life, Kaiflex products can be used for energy recovery in a waste incineration plant. The cardboard boxes can be recycled through Interseroh recycling process. The wooden pallets can be reused.

2.15 Disposal

Kaiflex KKplus s2 Tube is disposed of in accordance with local regulations governed by the *European Waste Catalogue* (waste code: 07 wastes from organic chemical processes - 07 02 13 waste plastic).

2.16 Further information

For more information on Kaiflex KKplus s2 Tube, please visit www.kaimann.com

3. LCA: Calculation rules

3.1 Declared Unit

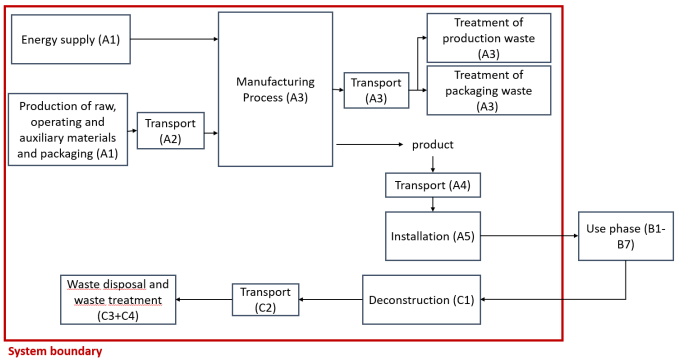
The declared unit is 1 m³ of the thermal insulation material for technical building equipment and industrial installations Kaiflex KKplus s2 Tube. The declared unit refers to the product as it leaves the factory gate. The standard thickness of the insulation varies from 6 to 42 mm. The gross density is the average density of all included products, weighted by production volume.

Declared unit and mass reference

Name	Value	Unit
Gross density	52.72	kg/m^3
conversion factor to 1 kg	0.019	-
Declared unit	1	m^3
Weight per unit area with a product thickness of 32 mm	1.687	kg/m²

3.2 System boundary

The system boundaries of the EPD follow the modular structure of *EN 15804* and consider the cradle to gate analysis with modules C1–C4 and module D (A1–A5 + C + D). This includes the product stage (A1-A3), the construction stage (A4-A5), the disposal stage (C1-C4) and benefits and loads outside the system boundary (Module D). Modules A1 (provision of raw materials), A2 (transportation) and A3 (production) are aggregated in the assessment as modules A1-A3.



The following life cycle stages are considered:

Module A1: The system boundaries comprise raw material extraction and supply from cradle to factory gate and are represented through generic background data sets.

Module A2: The transport of the raw materials from the factory gate to the point of manufacturing is represented through generic background data sets. The transportation distances have been provided by the manufacturer.

Module A3: The manufacturing includes manufacturer-specific material and energy data which are represented through generic data sets. Machinery, as well as buildings for manufacturing the declared unit is neglected. On average, 45 kWh of electricity and 136 kWh of natural gas are required for the manufacturing of 1 m³ Kaiflex KKplus s2 Tube. These data were provided by Kaimann GmbH. This module also includes packaging with plastics, cardboard and wooden pallets. The biogenic carbon stored is declared in the result section.

Module A4: The transport of Kaiflex KKplus s2 Tube from the factory gate to the site of assembly is represented through generic background data from *ecoinvent*. The transportation distances are based on average transportation from *ecoinvent* background data.

Module A5: The assembly can be done manually without the use of any electrical equipment. Packaging material from module A3 is disposed of here: The packaging is incinerated.

Modules B1-B7: No resource use and impacts occur during the use phase of the products. Modules B1-B7 was not considered in this study.

Modules C1&C3: Dismantling of Kaiflex KKplus s2 Tube is done manually without using any electrical equipment. No processing is required before disposal. Therefore module C1 is declared as 'zero'.

Module C2: The products to be disposed of are transported to the waste treatment facility. The transportation distances are based on average transportation from ecoinvent background data.

Module C4: According to the manufacturer, the industrial insulation materials are incinerated. No landfill therefore takes place. Module C4 is labeled 'zero'.

Module D: Potential benefits and loads from energy recovery are described.

3.3 Estimates and assumptions

Module A1-A3: In the case of multiple-use packaging, the manufacturing and waste treatment processes were not considered. The resulting emissions would have been allocated to all products that were packaged with it during their lifetime, which leads to a low relevance of this aspect.

Module A4: Kaiflex KKplus s2 Tube is distributed Europewide. Distances are assumed to be covered fully by road. The average road transportation distance per declared unit is 434 kilometres. The assumed distance is based on generic background data from ecoinvent 2019. No loss during transportation is assumed.

Module C2: The average distance of disassembled Kaiflex KKplus s2 Tube to the point of disposal is assumed to be 77 kilometres covered by road, according ecoinvent background data from 2019.

Module C3: According to the manufacturer Kaiflex KKplus s2 Tube is incinerated.

3.4 Cut-off criteria

All material flows in module A1 are covered, and almost all material and energy flows in module A3 are covered. Neglected material or energy flows have a mass or energy contribution of less than one percent per process and contribute to less than 5 % of mass and energy flows of a module. Infrastructure such as office buildings and the manufacturing hall have not been considered.

3.5 Background data

The LCA model underlying this EPD was created in *LCA for Experts* developed by *Sphera*. The MLC Database - Professional Core 2024 from Sphera was used and has been complemented by data sets from the MLC Database - Plastics 2024 extension database as well as data sets from the *ecoinvent* database version 3.11 (cut-off).

3.6 Data quality

The life cycle inventory for the assessed product is based on an internal assessment of manufacturing and environmental data, an assessment of LCA-relevant data for the supply chain and energy measurement within the factors. The required product flows for the creation of the product system were handed over to SKZ.
All data were scrutinised and found to be plausible and consistent, and were therefore found to be representative. The data on the production (modules A1-A3) of plastic insulation materials refer to the year under review 2023 (01.01.2023 - 01.01.2024). The data collection is based on annual production data [kg/a]. The quantities and flows calculated in the life cycle inventory were based on 1 m³ of insulation material in accordance with the declared unit. The results of the impact assessment therefore, refer to one m³. The data quality of the relevant background data sets, which together account for at least 80 % of each core indicator of the impact assessment can be rated as good.

3.7 Period under review

The production data refers to the average of the year 2023.

3.8 Geographic Representativeness

Land or region, in which the declared product system is manufactured, used or handled at the end of the product´s lifespan: EU-27 Member States

3.9 Allocation

No co-products are produced during the manufacture of plastic insulation materials (modules A1-A3). Therefore, no co-product allocation was necessary for foreground processes. Co-products are created in the supply chain of PVC, e.g. in the production of vinyl chloride, for which an allocation was available in the background datasets. The raw material, chlorinated paraffin, is allocated by mass, as HCl (43%) is produced as a by-product. 57 % of the expenses in the production process are considered in the life cycle assessment. The electricity demand for production was collected and submitted for the year 2023. Certificates of origin are available for the use of green electricity (from hydropower) in the production plant.

3.10 Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to *EN 15804* and the building context, respectively the product-specific characteristics of performance, are taken into account. The *MLC Database* - Professional Core 2024 from *Sphera* was used and has been complemented by data sets from the MLC Database - Plastics 2024 extension database.

4. LCA: Scenarios and additional technical information

Characteristic product properties of biogenic carbon

The biogenic carbon content quantifies the amount of biogenic carbon in a construction product and its product packaging when it leaves the factory gate. According to the *Sphera* background data set, the wooden product packaging has approx. 47.7 % biogenic carbon per kg of wood, and the cardboard packaging about 43 %. The mass of biogenic carbon bound in the product packaging of the product accounts for approx. 45 % of the packaging weight per declared unit. The amount of biogenic carbon in the product is less than 1 %.

Information on describing the biogenic carbon content at factory gate

Name	Value	Unit
Biogenic carbon content in product	-	kg C
Biogenic carbon content in accompanying packaging	8.94	kg C

Note: 1 kg of biogenic carbon is equivalent to 44/12 kg of CO_2.

The following information serves as a basis for the declared modules. All values refer to the declared unit of 1 m³.

Transport to the building site (A4)

Transportation to construction sites takes place over a distance of 434 km, based on statistical background data for the average truck transport of plastic products [ecoinvent, 2019].

Name	Value	Unit
Transport distance	434	km
Diesel for transportation	0.714	kg/ d. E.

Installation into the building (A5)

Name	Value	Unit
Cardboard and paper packaging waste (thermally treated)	13.1	kg
PE film (PE bags, panel bags, stretch films, half-tube films) packaging waste (thermally treated)	0.267	kg
Wood (pallets, support boards, frames) packaging waste (thermally treated)	6.26	kg

End of life (C1-C4)

The product is removed manually. Module C1 is therefore declared as 'zero'. It is assumed that the extracted product is completely sent for thermal utilisation.

Name	Value	Unit
Insulation material for incineration (C3)	52.7	kg
Diesel for transportation module (C2)	0.092	kg

Reuse, recovery and/or recycling potentials (D), relevant scenario information

Module D includes the benefits and loads of the incineration processes from module A5 (packaging waste) and C3 at a waste incineration plant with an efficiency of R1<0.6.

Name	Value	Unit
Exported electrical energy based on the declared unit	112	MJ
Exported thermal energy based on the declared unit	154	MJ

5. LCA: Results

The results of the impact assessment refer to 1 m^3 Kaiflex KKplus s2 Tube insulation material. Characterization factors according to EK-JRC were used. Long-term emissions over a period of more than 100 years were not considered in the impact assessment. The list of characterization factors for EN 15804 released in February 2023 based on the EF Reference Package 3.1 (EN 15804 XLS file) was used at the time the LCA was created.

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

Product stage			Construction process stage		Use stage							End of life stage				Benefits and loads beyond the system boundaries
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction 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**
X	X	X	X	X	MND	MND	MNR	MNR	MNR	MND	MND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1 m³ Insulation material made of plastics

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq	2E+02	2.64E+00	2.97E+01	0	3.42E-01	7.9E+01	0	-3.33E+01
GWP-fossil	kg CO_2 eq	2.3E+02	2.59E+00	1.57E+00	0	3.35E-01	7.62E+01	0	-3.32E+01
GWP-biogenic	kg CO_2 eq	-3.09E+01	6.19E-03	2.81E+01	0	8.01E-04	2.81E+00	0	-1.43E-01
GWP-luluc	kg CO_2 eq	4.01E-01	4.36E-02	2.49E-03	0	5.64E-03	1.15E-02	0	-3E-03
ODP	kg CFC11 eq	7.49E-09	3.82E-13	3.72E-12	0	4.94E-14	4.2E-11	0	-2.93E-10
AP	mol H^+ eq	5.33E-01	4.79E-03	7.17E-03	0	6.19E-04	1.7E-02	0	-3.46E-02
EP-freshwater	kg P eq	9.62E-04	1.11E-05	1.56E-06	0	1.43E-06	1.42E-05	0	-5.48E-05
EP-marine	kg N eq	6E-01	1.98E-03	2.51E-03	0	2.55E-04	5.69E-03	0	-1.06E-02
EP-terrestrial	mol N eq	1.45E+00	2.25E-02	3.22E-02	0	2.91E-03	7.59E-02	0	-1.14E-01
POCP	kg NMVOC eq	5.33E-01	4.75E-03	6.69E-03	0	6.14E-04	1.63E-02	0	-3E-02
ADPE	kg Sb eq	8.39E-01	2.26E-07	5.01E-08	0	2.92E-08	5.28E-07	0	-2.85E-06
ADPF	MJ	4.19E+03	3.42E+01	9.94E+00	0	4.42E+00	1.4E+02	0	-5.91E+02
WDP	m^3 world eq deprived	8.97E+01	4.02E-02	3.5E+00	0	5.19E-03	8.58E+00	0	-3.53E+00

GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential)

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1 m³ Insulation material made of plastics

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
PERE	MJ	1.5E+03	2.94E+00	3.18E+02	0	3.8E-01	3.04E+01	0	-1.96E+02
PERM	MJ	3.22E+02	0	-3.16E+02	0	0	-6.5E+00	0	0
PERT	MJ	1.83E+03	2.94E+00	2.43E+00	0	3.8E-01	2.39E+01	0	-1.96E+02
PENRE	MJ	4.44E+03	3.42E+01	2.15E+01	0	4.42E+00	9.9E+02	0	-5.91E+02
PENRM	MJ	8.61E+02	0	-1.16E+01	0	0	-8.5E+02	0	0
PENRT	MJ	5.31E+03	3.42E+01	9.94E+00	0	4.42E+00	1.4E+02	0	-5.91E+02
SM	kg	0	0	0	0	0	0	0	0
RSF	MJ	0	0	0	0	0	0	0	0
NRSF	MJ	0	0	0	0	0	0	0	0
FW	m^3	2.47E+00	3.28E-03	8.25E-02	0	4.24E-04	2.1E-01	0	-1.5E-01

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

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1 m³ Insulation material made of plastics

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
HWD	kg	1.41E-05	1.31E-09	4.84E-09	0	1.69E-10	5.13E-08	0	-3.95E-07
NHWD	kg	3.26E+00	5.58E-03	7.87E-01	0	7.21E-04	2.2E+01	0	-3.06E-01
RWD	kg	5.87E-02	6.22E-05	4.3E-04	0	8.05E-06	3.37E-03	0	-4.31E-02
CRU	kg	0	0	0	0	0	0	0	0
MFR	kg	0	0	0	0	0	0	0	0

MER	kg	0	0	0	0	0	0	0	0
EEE	MJ	3.24E+01	0	4.41E+01	0	0	1.13E+02	0	0
EET	MJ	6.83E+01	0	7.97E+01	0	0	1.54E+02	0	0

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

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: 1 m³ Insulation material made of plastics

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
PM	Disease incidence	5.91E-06	4.26E-08	4.23E-08	0	5.51E-09	2.86E-07	0	-2.83E-07
IR	kBq U235 eq	1.02E+01	9.03E-03	6.78E-02	0	1.17E-03	4.85E-01	0	-7.09E+00
ETP-fw	CTUe	4.5E+03	2.54E+01	4.83E+00	0	3.28E+00	5.3E+01	0	-8.27E+01
HTP-c	CTUh	2.46E-07	5.12E-10	2.86E-10	0	6.62E-11	2.37E-09	0	-6.74E-09
HTP-nc	CTUh	5.31E-06	2.3E-08	9.75E-09	0	2.97E-09	1.45E-07	0	-1.59E-07
SQP	SQP	4.32E+03	1.68E+01	3.37E+00	0	2.17E+00	2.21E+01	0	-1.15E+02

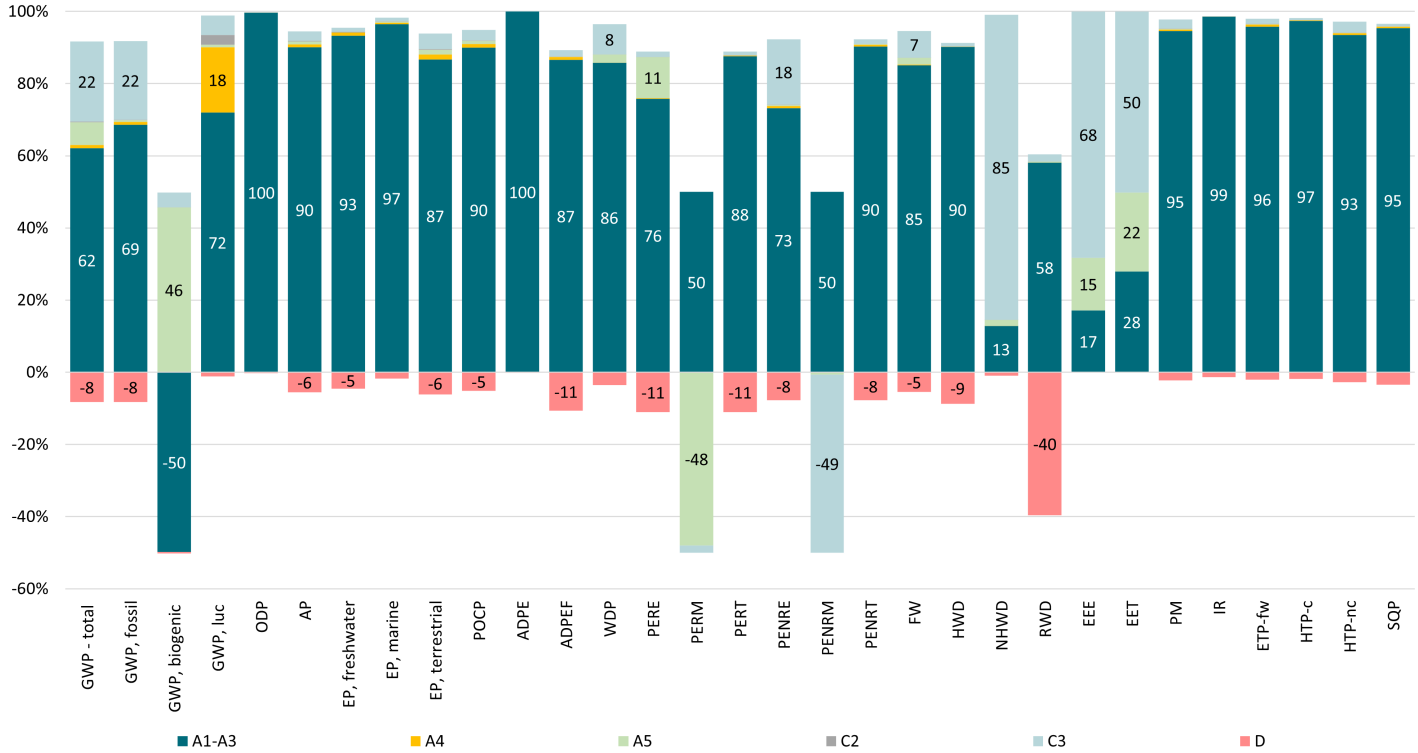
PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); SQP = Potential soil quality index

Disclaimer 1 – for the indicator “Potential Human exposure efficiency relative to U235”. 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 or radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – for the indicators “abiotic depletion potential for non-fossil resources”, “abiotic depletion potential for fossil resources”, “water (user) deprivation potential, deprivation-weighted water consumption”, “potential comparative toxic unit for ecosystems”, “potential comparative toxic unit for humans – cancerogenic”, “Potential comparative toxic unit for humans - not cancerogenic”, “potential soil quality index”. The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high as there is limited experience with the indicator.

6. LCA: Interpretation

Many of the indicators on environmental impact and resource consumption are dominated by the production phase A1-A3. In addition, waste treatment (Module C3) has a significant share in the indicators. Furthermore, recovery and recycling potentials result in benefits outside the system boundaries (Module D). The following graph shows the relative shares of the modules in the indicator results for Kaiflex KKplus s2 Tube (based on 1 m³ of insulation material). The values are scaled in such a way that all bars are the same height. Impact categories with a value of zero show no bar. Values below 10 % are not shown in the graph. Indicators with a value of '0' are not considered.



GWP – Global warming potential

Greenhouse gas emissions are primarily caused by production and thermal waste treatment at the end of the product's service life. The most relevant greenhouse gases are carbon dioxide (fossil 78.1 %, biogenic 14.4 %) and methane (fossil 6.9 %, biogenic 0.4 %). The impact of land use change is very low.

ODP – Ozone depletion
Effects on ozone depletion result primarily from the production process. Emissions of chloromethanes, chlorotetrafluoroethanes, dichloro-1-fluoroethanes and chlorodifluoroethanes are primarily responsible therefore.

AP – Acidification potential
The acidification potentials result primarily from emissions of nitrogen oxides and sulphur dioxide, and in a lower rate from emissions of ammonia that occur during the production phase.

EP – Eutrophication potential
The effects on the eutrophication of water and soil originate primarily from the production phase. Relevant emissions are phosphates and phosphorus (for water) and nitrogen oxides (for soil).

POCP – Ground-level ozone formation
Ground-level ozone formation is mainly caused during the production process. Relevant emissions are nitrogen oxides and various NMVOCs.

ADPE – Potential for the depletion of abiotic, non-fossil resources
The consumption of non-fossil resources results primarily from the manufacturing process. The element that contributes the most is bromine.

ADPF – Potential for fossil fuel depletion
Fossil resources are primarily consumed using energy during production (A1-A3) and incineration in module C3. This primarily concerns the energy sources crude oil, natural gas and, to a smaller extent, hard coal, lignite, and uranium.

WDP – Water use
Water use results primarily from water consumption for the provision of electricity (the manufacturer generates electricity from hydropower). To a smaller extent, water is required for the provision of raw materials. This mainly relates to the raw materials blowing agent, plasticiser and flame retardant.

7. Requisite evidence

7.1 VOC emissions
The Volatile Organic Compound (VOC) emissions have been tested by Eurofins Product Testing A/S by using the Committee for health-related evaluation of building products/Deutsches Institut für Bautechnik (AgBB/DIBt), June 2021.

AgBB overview of results (3 days [mg/m³]

Name	Value	Unit
TVOC	0.047	mg/m³
TSVOC	< 0.005	mg/m³
R-value (dimensionles)	1.0	
Sum of VOC without NIK/LCI	0.005	mg/m³
Formaldehyde	-	
Total carcinogens	< 0.001	mg/m³

AgBB overview of results (28 days [mg/m³]

Name	Value	Unit
TVOC	< 0.005	mg/m³
TSVOC	< 0.005	mg/m³
R-value (dimensonless)	0	
Sum of VOC without NIC/LCI	< 0.005	mg/m³
Formaldehyde	< 0.003	mg/m³
Total carcinogens	< 0.001	mg/m³

7.2 Content of chlorides
The concentration of water-soluble chloride ions is < 500 ppm according to *DIN EN ISO 12624:2023-03*.

7.3 Resistance to mold and bacteria
Kaiflex KKplus s2 Tube is mould and bacteria resistant in accordance with *DIN EN ISO 846:2020-11* and therefore complies with VDI guideline 6022.

8. References

DIN EN ISO 846:2020-11, Plastics - Evaluation of the action of microorganism, 2020

DIN EN ISO 8497:1996-09, Thermal insulation - Determination of steady-state thermal transmission properties of thermal insulation for circular pipes, 1996

DIN EN 12086:2013-06, Thermal insulating products for building applications - Determination of water vapour transmission properties, 2013

DIN EN ISO 12624:2023-03, Thermal insulating products for building equipment and industrial installations - Determination of trace quantities of water soluble chloride, fluoride, silicate, sodium ions and pH, 2023

DIN EN 12667:2001-05, Thermal performance of building materials and products - Determination of thermal resistance by means of guarded hot plate and heat flow meter methods - Products of high and medium thermal resistance, 2001

DIN EN 13469:2013-01, Thermal insulating products for building equipment and industrial installations - Determination of water vapour transmission properties of preformed pipe insulation, 2013

DIN EN 13501-1:2019-05, Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests, 2019

DIN EN ISO 14001:2015-11, Environmental management systems - requirements with instructions for use, 2015

DIN EN ISO 14025:2011-10, Environmental labels and declarations - Type III Environmental declarations - Principles and procedures, 2011

DIN EN ISO 14040:2006-10, Environmental management - Life cycle assessment - Principles and framework, 2006

DIN EN ISO 14044:2006-10, Environmental management - Life cycle assessment - Requirements and guidance, 2006

DIN EN 14706:2013-01, Thermal insulating products for building equipment and industrial installations - Determination of maximum service temperature, 2013

DIN EN 14707:2013-01, Thermal insulating products for building equipment and industrial installations - Determination of maximum service temperature for preformed pipe insulation, 2013

DIN ISO 16000, Indoor air pollution, 2021-2024

Ecoinvent Centre, 'Background data for transport', 2019

EN 14304:2009+A1:2013, Thermal insulation products for building equipment and industrial installations - Factory made flexible elastomeric foam (FEF) products - Specification, 2013

EN 15804+A2:2022-11, Sustainability of construction works - Basic rules Environmental product declarations - Basic rules for the product category construction products, 2022

European Waste Catalogue (EWC) No. 2000/532/EC2, European Waste Catalogue and hazardous waste list, 2000

Institut Bauen und Umwelt e.V., General EPD program guide of the Institut Bauen und Umwelt e.V. (IBU). Version 2.0, 2021

Institut Bauen und Umwelt e.V., Product category rules for construction products Part A: Calculation rules for the life cycle assessment and requirements for the project report according to EN 15804+A2:2022-11, Version 1.4, 2024

ISO 9001, Quality management systems - requirements, 2015

ISO 45001, Management systems for safety and health at work - Requirements with instructions for use, 2018

ISO 50001, Energy management systems - requirements with instructions for use, 2018

LCA for Experts, Version 2024.1 Leinfelden-Echterdingen: Sphera Solutions Inc., 2024

Product data sheet Kaiflex KKplus s2 Tube, Kaimann Saint-Gobain, access: https://www.kaimann.com/service/download-center, 2024

REACH Regulation (EC) No. 1907/2006, SVHC candidate list (20.12.2024), 2024

Regulation EU No. 305/2011, EU Construction Products Regulation (EU-BauPVO), 2011

Regulation (EU) No. 528/2012, Ordinance on Biocide Products No. 528/2012, 2012

Publisher

Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

+49 (0)30 3087748- 0
info@ibu-epd.com
www.ibu-epd.com

Programme holder

Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

+49 (0)30 3087748- 0
info@ibu-epd.com
www.ibu-epd.com

Author of the Life Cycle Assessment

SKZ - Das Kunststoff-Zentrum
Friedrich-Bergius-Ring 22
97076 Würzburg
Germany

+49 931 4104-433
kfe@skz.de
www.skz.de

Owner of the Declaration

Kaimann GmbH
Hansastr. 2-5
33161 Hövelhof
Germany

+49 5257 9850-0
info.kaimann@saint-gobain.com
www.kaimann.com