ENVIRONMENTAL PRODUCT DECLARATION

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

Owner of the Declaration	ZAPP-ZIMMERMANN GmbH
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-ZZG-20260141-IBC1-EN
Issue date	05.05.2026
Valid to	04.05.2031

Fire Penetration Seals

ZAPP-ZIMMERMANN GmbH

Institut Bauen und Umwelt e.V.

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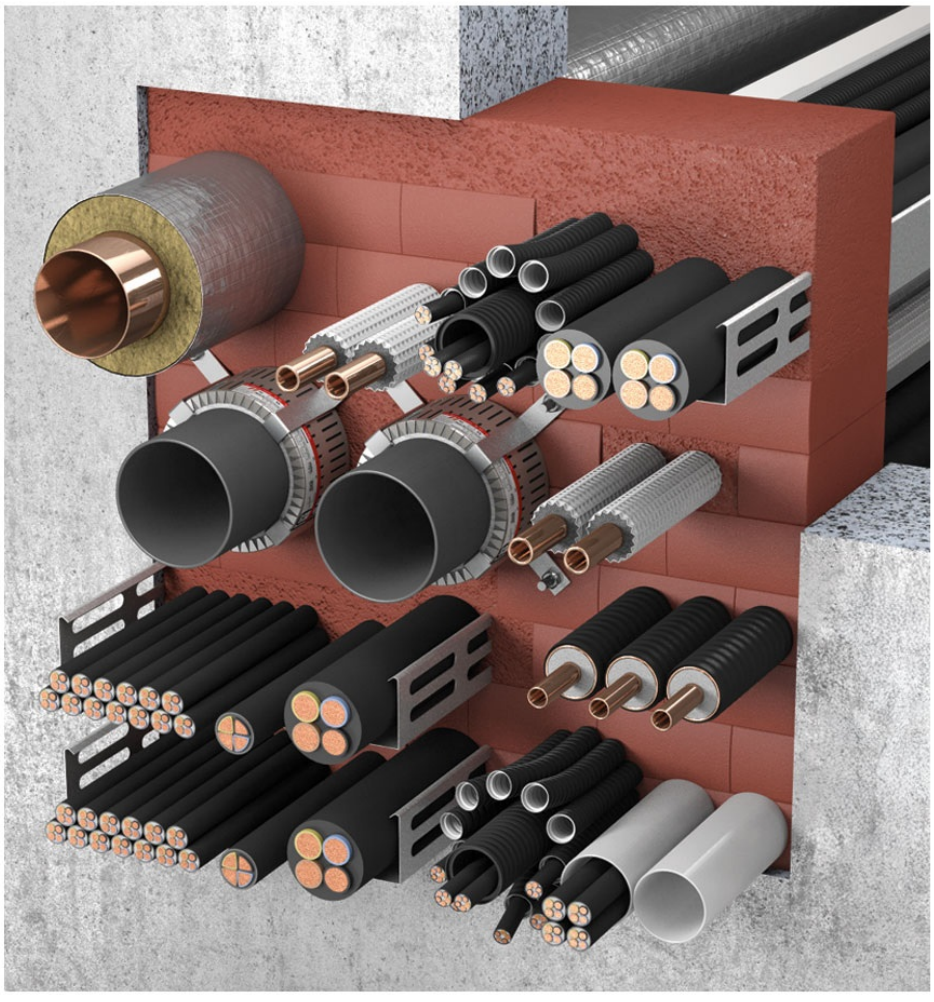


ZAPP-ZIMMERMANN
INNOVATIVE FIRE-PROTECTION SYSTEMS

1. General Information

ZAPP-ZIMMERMANN GmbH

Programme holder

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

Declaration number

EPD-ZZG-20260141-IBC1-EN

This declaration is based on the product category rules:

Pre-formed fire protection systems for cable and duct insulation , 01.08.2021
(PCR checked and approved by the SVR)

Issue date

05.05.2026

Valid to

04.05.2031

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

Dr. Martina Bender
(Managing Director Institut Bauen und Umwelt e.V.)

Fire Penetration Seals

Owner of the declaration

ZAPP-ZIMMERMANN GmbH
Marconistraße 7-9
50769 Kölm
Germany

Declared product / declared unit

1 kg of Fire Penetration Seals (gbP and 2K)

Scope:

This document refers to an average EPD for a declared unit of 1 kilogram of Fire Penetration Seals (gbP: geometrically defined products and 2K: 2-component cartridge) from ZAPP-ZIMMERMANN GmbH, which are manufactured at the production site in Cologne (Germany). Data collection was carried out on a plant-specific basis using current data from 2024 (Jan–Dec). As the PCR requires a declared unit of m³, conversion factors are specified in Section 3.1 depending on the product variant.

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

Matthias Klingler,
(Independent verifier)

2. Product

2.1 Product description/Product definition

This EPD describes an average EPD for geometrically defined [gdP] and geometrically undefined products [2C Fire Protection Foam]. The differences are clarified in the course of the descriptions by specifying the deviations.

The different products consist of an intumescent building material that is installed in fire protection systems.

Advantages:

- Quick and easy installation, no power tools required
- Easy closure of larger construction component openings
- Extremely easy to retrofit within the sealed component openings
- No additional coatings required for cables

Product according to CPR with ETA:

Regulation (EU) No. 305/2011 (*CPR*) applies to the marketing of products in the EU/EFTA (with the exception of Switzerland). The products require a declaration of performance [DoP] in accordance with

- ETA-12/0088 dated 7 July 2017 – **ZZ®** C10 (the basis for ETA is a geometrically defined product: **ZZ®** Fire Protection Plugs)
- ETA-11/0206 dated 28 June 2018 – **ZZ®** M30 (basis for ETA is geometrically undefined product: **ZZ®** Fire Protection Foam)
- ETA-10/0431 dated 26 July 2018 – **ZZ®** M20 (Basis for ETA is geometrically defined product: **ZZ®** Fire Protection Block)
- ETA-12/0119 dated 4 May 2021 – **ZZ®** G50 (Basis for ETA is geometrically defined product: **ZZ®** Fire Protection Joint Seal)

and the corresponding CE marking. The respective national regulations apply to use.

The products from the partitioning systems listed above are regulated and marketed in accordance with DIBt approvals (abZ) and have been officially approved by the DIBt, meaning they are also suitable for the German market.

2.2 Application

Temporary and permanent Fire Penetration Seals for all types of electrical cables and wires as well as combustible and non-combustible pipes for the **ZZ®** M30 and **ZZ®** M20 Mixed Penetration Seals. They can be installed in light and solid walls as well as in solid ceilings in accordance with the approval content, e.g.

- cables and cable bundles
- Pipes and pipe bundles
- Plastic and metal pipes
- Cable trays

Medium and large penetration seals with medium and high occupancy (mixed occupancy of cables, combustible and non-combustible pipes) can be installed. Due to the material properties, the products are ideal for flexible fire barrier occupancy and for areas with higher cleanliness requirements (e.g. server rooms).

The **ZZ®** G50 Fire Protection Joint Seal is intended for use as a linear joint and gap seal to maintain fire resistance in linear gaps/joints within solid wall constructions and ceilings in solid construction or where these connect to other wall/ceiling/roof constructions.

2.3 Technical Data

The products are suitable for primary use in interior areas. Direct contact with rain and prolonged exposure to UV radiation should be avoided.

Constructional data

Name	Value	Unit
Application temperature	5 - 40	°C
Storage temperature	5 - 40	°C
Temperature resistance	≤ 80	°C
Reaction to fire	Class E	-
Halogenated flame retardants	No	-
Airborne sound insulation	Rw (C;Ctr) = 49 (-4; -11)	dB
Thermal conductivity	λ = 0.103	W/(mK)
Electrical surface resistance	R0 = 2.39 x 10^9	Ω
Durability and serviceability	Minimum usage category Type Z1	-
Mold growth	No	-

The geometrically undefined products differ in the listed values as follows:

- Application temperature: 15 to 30°C (recommended 20 to 25°C)
- Thermal conductivity: λ = 0.088 W/(mK)
- Electrical surface resistance: R_0 = 1.25 x 10^9 Ω

The product's performance values, as stated in the declaration of performance with regard to its essential characteristics, are documented in Section 2.1.
Further performance characteristics of the products can be found in the general technical approvals of the DIBt.

2.4 Delivery status

The dimensions of the geometrically defined products are described as follows:

- Fire protection plug Ø [mm]: 55 to 250
- Fire protection joint seal Ø [mm]: 16 to 80
- Fire protection block LxWxH [mm]: ≥120 x ≥100 x ≥60

The geometrically undefined products are characterised as follows:

- Fire protection foam: Cartridge (380 ml) with mixer attached

2.5 Base materials/Ancillary materials

The products consist mainly of polyurethane (approximately 40%–65%), to which an intumescent agent (approximately 15%–25%) has been added. This intumescent agent is required in the event of a fire. Non-halogenated flame retardants (approximately 25% to 40%) are also used. Depending on the colour scheme, pigments (up to 3%) may also be added to the product.

The product/article contains substances from the *candidate list* (date 17 January 2023) above 0.1% by mass: yes.
Melamine (CAS No.: 108-78-1)

- Geometrically defined products: Concentration <5%

- Geometrically undefined products
  (Fire Protection Foam) (safety data sheet available at www.z-z.eu)
  Concentration <10%

Hazard statements:

- H351 Suspected of causing cancer.
- H361f May damage fertility.

The product/article contains other CMR substances of category 1A or 1B that are not on the *candidate list*, above 0.1% by weight in at least one component: no.

Biocidal products have been added to this construction product or it has been treated with biocidal products (it is therefore a treated article within the meaning of the Biocidal Products Regulation (EU) No. 528/2012): no.

2.6 Manufacture

The raw materials required for material preparation and production are all sourced from suppliers in Germany. The substances themselves come mainly from Germany respectively from Central Europe.
The raw materials are prepared and mixed during material preparation. The intermediate products are then transported internally to the production facilities.
For geometrically defined products, the respective components are effervesced into PU foam. The mixtures are then placed into the appropriate moulds. The moulds (with and without lids) vary according to the required dimensions. Once the foam has hardened, the products can be removed from the moulds.
For geometrically undefined products, the mixtures are filled into cartridges. These cartridges are sealed after filling.
After production, all products are packaged in the desired containers and labelled accordingly.

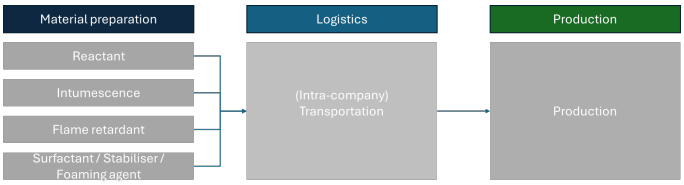


Diagram: Process flow chart of the production

2.7 Environment and health during manufacturing

Environmental and health-related aspects are taken into account during storage and production. The protective measures specified in the safety data sheets are implemented.

The company attaches great importance to waste separation for packaging and containers of raw materials. Among other things, products are processed for further recycling (paper baling press).

2.8 Product processing/Installation

With reference to the European Technical Assessments of the Fire Penetration Seals

- ETA-12/0088 dated 7 July 2017 – **ZZ®** C10
  (basis for ETA is geometrically defined product: **ZZ®** Fire Protection Plug)
- ETA-11/0206 dated 28 June 2018 – **ZZ®** M30
  (Basis for ETA is geometrically undefined product: **ZZ®** Fire Protection Foam)
- ETA-10/0431 dated 26 July 2018 – **ZZ®** M20
  (Basis for ETA is geometrically defined product: **ZZ®** Fire Protection Block)

issued by the OiB, the following measure must be implemented. On-site precautions must be taken to ensure that no person or heavy loads can step on or put weight on a horizontally installed fire-retarding seal or fall or lean against a vertically installed fire penetration seal. This can be secured with a suitable cover (e.g. mesh).

Pipes, cables and cable trays must be installed in such a way that the load is not carried by the penetration seal (e.g. hangers).
The openings to be sealed must be cleaned before sealing. The geometrically defined products can be cut to size as required for the installed media. The geometrically undefined product adapts to the contours of the installed media.
Installation must be carried out in accordance with the relevant ETA respectively in accordance with the general technical approvals of the DIBt.
Possible occurrence of ring gaps and wedge closures must be sealed using the appropriate products specified in the corresponding approval.

2.9 Packaging

The products listed in this average EPD are boxed for transportation purposes. This is done in different package sizes. The 2K products are filled into cartridges and also packed in cardboard boxes.

The packaging cardboard can be recycled. The cardboard itself contains recycled material.
Reusable Euro pallets are used for pallet deliveries.

2.10 Condition of use

There is no material change in the fire protection barriers during the utilisation phase.

2.11 Environment and health during use

The requirements for interior-relevant construction products, as laid down by the Committee for Health Assessment of Construction Products, are met.

2.12 Reference service life

No reference service life was determined for the Fire Penetration Seals.

2.13 Extraordinary effects

Fire

The fire behaviour of the products covered by this average EPD is classified in accordance with EN 13501-1 and corresponds to class E.

Fire protection

Name	Value
Building material class	E
Burning droplets	not applicable
Smoke gas development	not applicable

Water

The products covered by this Ø-EPD should not be exposed to water on a long-term basis (e.g., a burst water pipe).
As a rule, the partitioning systems must then be replaced, as the components surrounding the system may have changed in addition to the product properties. Consequently, functionality cannot be guaranteed.
The systems must be assessed by a trained specialist, and the compartmentalization must be replaced by trained personnel.

Mechanical destruction

If penetration seals show signs of mechanical damage, they must be assessed by a specialist. If necessary, the damaged

areas can be repaired by trained personnel. If repair is not possible, the opening must be resealed in accordance with the underlying ETA respectively in accordance with the general technical approvals of the DIBt.
Generally, the penetration sealing systems depicted in this Ø-EPD can be repaired.

2.14 Re-use phase

The products depicted in this Ø-EPD can be thermally recycled.

2.15 Disposal

The foam products shown in this Ø-EPD must be disposed of in accordance with *waste code* 08 04 10 (adhesive and sealant waste, except those covered by 08 04 09). Disposal should be carried out in accordance with local regulations.

2.16 Further information

Further information in respect to our products and the specified ETA respectively the general technical approval from the DIBt can be found at www.z-z.eu / www.z-z.de

3. LCA: Calculation rules

3.1 Declared Unit

The declared unit is 1 kg of fire protection barriers from ZAPP-ZIMMERMANN GmbH. This EPD represents an average; to this end, the net production volumes of the two products—geometrically defined products (gbP) and 2-component cartridges (2K)—for the year 2024 (Jan Dec) were collected and weighted proportionally.The function and the product itself are identical; the difference lies in their application and delivery as a geometric form (block, plug, joint tape) or a cartridge with a mixing nozzle.
At approximately 71%, the share of the average for the gbP product group is significantly higher than that of the 2K solution.
Since the density and functionality of the fire barriers do not differ when installed, no variation ranges were calculated.

Declared unit and mass reference

Name	Value	Unit
Declared unit	1	kg
Density gbP	288	kg/m^3
Density 2K	250	kg/m^3

The differences in density result from the different formulations of the two products for 1 kg of fire-resistant compartmentalisation. Both gbP and the 2C cartridge consist of the same base materials, including polyol, isocyanates, non-halogenated flame retardants and intumescent agents. The cartridge packaging (including piston) and PE mixer are therefore only used with the 2C cartridge. Production takes place at the ZAPP-ZIMMERMANN GmbH plant – Karl Zimmermann GmbH; accordingly, data collected from one site is incorporated into the modelling, and this is therefore representative of the year 2024.

3.2 System boundary

The life cycle assessment considers the system boundaries "cradle to factory gate – with options" and follows the modular structure in accordance with *EN 15804.*

The life cycle assessment takes the following modules into account:

A1: Raw material extraction and processing:
All inputs for the production of fire protection compartments are produced in the relevant upstream supply chains.

A2: Transport to the manufacturer:
Transport of the intermediate products to the ZAPP-ZIMMERMANN GmbH factory.

A3: Manufacturing processes and inputs at the factory:
All raw materials and intermediate products required for the production of fire protection barriers are mixed and manufactured in accordance with the formulations. The CO_2 emissions released during foaming are modelled for the gbP products in A3. No pollutant emissions are generated by the foaming process.

A5: Installation:
The foaming of the cartridge and the disposal of product packaging such as cartridges, mixers and cardboard boxes are part of Module A5. No pollutant emissions are generated by the foaming process.

C1: Dismantling/demolition:
No representative data is available for dismantling; C1 is not declared as a cut-off.

C2: Transport to waste management:
Here, transport to the recycling centre or waste incineration plant (WIP) is assumed with a default distance of 60 km.

C3: Waste management for reuse, recovery and/or recycling:
100% of the fire protection partitions at end-of-life (EoL) are sent to the waste-to-energy plant. Credits for energy recovery (electricity and heat) are awarded in Module D.

C4: Disposal:
There is no landfill; accordingly, Module C4 is set to zero.

D: Reuse, recovery or recycling potential as net flows and credits or debits:
Credits for energy recovery (electricity and heat) are awarded in the same amount as the product enters the end-of-life (EoL) stage.

3.3 Estimates and assumptions

Using data collection tables, ZAPP-ZIMMERMANN GmbH carried out the collection of primary data.
This production data forms the basis of this modelling of the EPD for fire protection partitions.
This made it possible to accurately reflect the energy and resource consumption within the factory itself during production, as well as the quantities of purchased inputs, packaging and transport routes. For the production of precursors such as polyol, isocyanates, flame retardants and intumescent materials, standard data sets from the *ecoinvent 3.11* database were utilised. Additional information from the manufacturer, data sheets and standard market assumptions were also taken into account. Production residues and production waste at the ZAPP-ZIMMERMANN GmbH plant are disposed of in accordance with regulations (Module A3).
For the CO_2 emissions resulting from the exothermic reaction during the manufacture of polyurethane, additional CO_2 emissions are modelled (gbP in Module A3 and the cartridge in A5).

3.4 Cut-off criteria

All relevant data, i.e. all raw materials used in production as well as the energy and resources used in production, were

extracted using a data collection sheet following a prior comprehensive survey of the company's operational data for the life cycle assessment. For the inputs and outputs considered, the actual transport distances were used or estimated using documented rules. Material and energy flows with a share of < 1% were included. This means that the sum of the neglected processes is less than 5% of the impact categories. The costs associated with providing the infrastructure (machinery, buildings, etc.) for the entire system under consideration were not taken into account. Packaging forms part of Module A3 in production. Similarly, the costs associated with decommissioning (Module C1) were excluded. It is assumed that the associated environmental impacts are very low.

3.5 Background data

The life cycle assessment is based on plant-specific data collection, including all energy sources and operating resources for one year (the period under consideration is January to December 2024). Background data for the modelling and missing inventories of intermediate products are based on the LCIA database *ecoinvent 3.11*. The modelling and impact assessment are carried out using the SimaPro software (*version 10.2.0.1*). The residual electricity mix from Germany is used as the plant's electricity mix (0.821 kg CO_2e/kWh).

3.6 Data quality

The primary data relates to the financial year from January to December 2024. The recorded data has been checked for representativeness in relation to previous years. Data sets for background data are based on the *ecoinvent 3.11* database. Missing specific data on intermediate products (such as the production of polyol) were modelled on the basis of generic data sets from *ecoinvent 3.11*, taking into account country-specific conditions.
The data quality of all emission factors used in terms of geographical, technological and temporal dimensions can be classified as good for primary data and as moderate for secondary data. Where 100% matching data sets were not available, the greatest possible approximation to the actual process was made; the most recent data sets from the ecoinvent database were used. It should be noted that primary data for the precursor products could not be obtained from suppliers.
The basis of the modelling in A1 is based on secondary data, the evaluation of data sheets, general market-standard processes and assumptions made by the life-cycle assessor regarding production processes and off-cuts. Accordingly, the assessment of the technical data quality for the pre-processes is mostly rated as medium. The extent to which this has a concrete impact on the overall result cannot be quantified; the data sets were compiled with the utmost care and in line with reality. However, primary data quality cannot be achieved due to the limited availability of data.

3.7 Period under review

The quantities of raw materials and energy used, as well as the amounts of waste and all other data collected, relate to the year 2024 (January to December).

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: Germany

3.9 Allocation

All energy consumption and material flows for the product could be allocated on the basis of measured production data or on a mass basis.
In Module D, incineration credits are allocated for the disposal of 1 kg of Fire Penetration Seals.

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 *ecoinvent 3.11* background database was used.

4. LCA: Scenarios and additional technical information

Characteristic product properties of biogenic carbon

The product contains, as a proportion of its total mass, less than 5% biogenic carbon. The use of packaging material has been accounted for in relation to the declared product. Based on the specified packaging quantities, the following amounts of biogenic carbon are bound.
Cardboard packaging (0.094 kg/DU): 0.176 kg CO_2/kg

Information on the measurement of biogenic carbon content at the factory gate

Name	Value	Unit
Biogenic carbon content in accompanying packaging	0.048	kg C

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

Assembly (A5)

Name	Value	Unit
Waste materials resulting from waste management on the construction site (cardboard)	0.094	kg
Waste materials resulting from waste treatment at the construction site (LDPE (cartridge, mixer))	0.068	kg

End of life (C1-C4)

Name	Value	Unit
Separately collected fire protection barriers	1	kg
For disposal (MVA)	1	kg

Wiederverwendungs- Rückgewinnungs- und Recyclingpotential (D), relevante Szenarioangaben

Name	Value	Unit
recycling potential	0	kg
energy recovery (MVA) electric energy	1.96	MJ
energy recovery (MVA) thermal energy	5.4	MJ

100% fire protection barriers are installed in the EoL/MVA.

5. LCA: Results

The following table summarizes the results of the life cycle assessment. The impact assessment results do not provide information on endpoints of the impact categories, threshold exceedances, safety margins, or risks. Long-term emissions (>100 years) are not considered in the impact assessment. The impact assessment is based on *EN 15804*, according to *SimaPro* 10.2.0.1.

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	MND	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 kg fire protection bulkheads

Parameter	Unit	A1-A3	A5	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq	4.7E+00	1.1E-01	0	6.11E-03	1.3E+00	0	-1.75E+00
GWP-fossil	kg CO_2 eq	4.68E+00	1.1E-01	0	6.11E-03	1.3E+00	0	-1.75E+00
GWP-biogenic	kg CO_2 eq	1.84E-02	3.19E-06	0	1.31E-06	1.84E-05	0	-1.96E-04
GWP-luluc	kg CO_2 eq	2.71E-03	2.27E-06	0	2.27E-06	1.18E-05	0	-1.65E-04
ODP	kg CFC11 eq	9.75E-08	1.77E-10	0	1.39E-10	9.53E-10	0	-2.79E-08
AP	mol H^+ eq	1.9E-02	7.47E-05	0	1.48E-05	4.46E-04	0	-4.31E-03
EP-freshwater	kg P eq	1.2E-03	6.69E-06	0	4.47E-07	4.08E-05	0	-8.4E-04
EP-marine	kg N eq	5.29E-03	1.05E-04	0	3.9E-06	6.45E-04	0	-1.14E-03
EP-terrestrial	mol N eq	4.19E-02	3.55E-04	0	4.23E-05	2.15E-03	0	-1.12E-02
POCP	kg NMVOC eq	1.59E-02	9.42E-05	0	2.48E-05	5.57E-04	0	-3.21E-03
ADPE	kg Sb eq	2.26E-05	1.61E-08	0	1.78E-08	8.18E-08	0	-1.37E-06
ADPF	MJ	9.5E+01	9.72E-02	0	9.26E-02	5.08E-01	0	-2.18E+01
WDP	m^3 world eq deprived	3.59E+00	1.63E-03	0	4.21E-04	9.66E-03	0	-2.46E-02

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 kg fire protection bulkheads

Parameter	Unit	A1-A3	A5	C1	C2	C3	C4	D
PERE	MJ	5.65E-01	1.83E+00	0	1.15E-03	9.92E-03	0	-9.27E-02
PERM	MJ	1.83E+00	-1.83E+00	0	0	0	0	0
PERT	MJ	2.4E+00	1.79E-03	0	1.15E-03	9.92E-03	0	-9.27E-02
PENRE	MJ	7.05E+01	2.9E+00	0	9.29E-02	2.47E+01	0	-2.18E+01
PENRM	MJ	2.7E+01	-2.8E+00	0	0	-2.42E+01	0	0
PENRT	MJ	9.75E+01	9.77E-02	0	9.29E-02	5.1E-01	0	-2.18E+01
SM	kg	1.9E-02	0	0	0	0	0	0
RSF	MJ	0	0	0	0	0	0	0
NRSF	MJ	0	0	0	0	0	0	0
FW	m^3	8.59E-02	1.43E-04	0	1.29E-05	8.7E-04	0	-3.26E-03

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 kg fire protection bulkheads

Parameter	Unit	A1-A3	A5	C1	C2	C3	C4	D
HWD	kg	9.86E-04	8.37E-07	0	6.17E-07	4.55E-06	0	-1.12E-04
NHWD	kg	2.96E-01	8.1E-02	0	7.98E-03	4.92E-01	0	-3.57E-02
RWD	kg	6.42E-05	4.29E-08	0	2.55E-08	2.4E-07	0	-1.4E-05
CRU	kg	0	0	0	0	0	0	0
MFR	kg	0	0	0	0	0	0	0
MER	kg	0	0	0	0	0	0	0

EEE	MJ	0	0	0	0	1.96E+00	0	0
EET	MJ	0	0	0	0	5.4E+00	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 kg fire protection bulkheads

Parameter	Unit	A1-A3	A5	C1	C2	C3	C4	D
PM	Disease incidence	3.76E-07	6.59E-10	0	6.06E-10	3.46E-09	0	-1.5E-08
IR	kBq U235 eq	2.48E-01	1.69E-04	0	1.04E-04	9.37E-04	0	-4.78E-02
ETP-fw	CTUe	5.16E+02	7.78E-01	0	2.13E-02	4.78E+00	0	-4.64E+00
HTP-c	CTUh	3.32E-09	2.91E-11	0	1.01E-12	1.79E-10	0	-1.39E-10
HTP-nc	CTUh	4.4E-08	7.35E-10	0	5.93E-11	4.48E-09	0	-8.2E-09
SQP	SQP	1.22E+01	6.23E-02	0	9.31E-02	2.92E-01	0	-1.9E+00

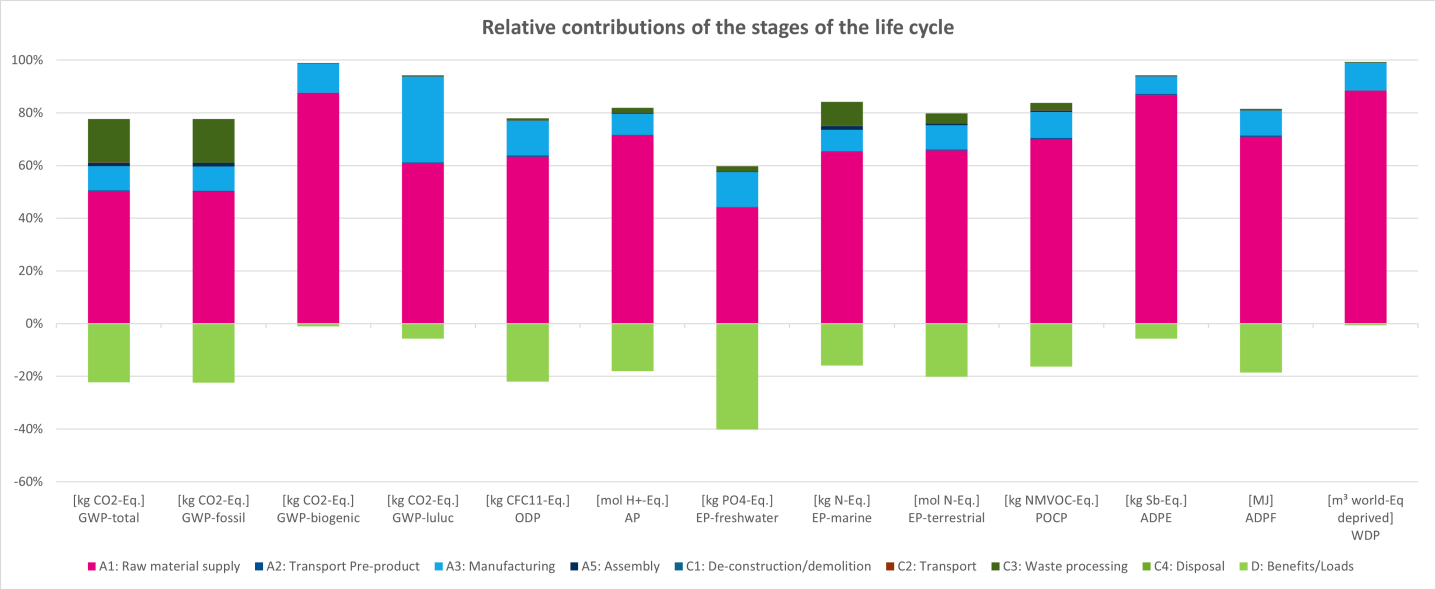
PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); 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 these environmental impact indicators must be interpreted with caution, as there is a high degree of uncertainty associated with them or because there is limited experience with these indicators.

6. LCA: Interpretation

The following figure illustrates the relative contributions of different life cycle phases in the form of a dominance analysis for each impact category.



A large proportion of the emissions within the individual impact categories arise during the manufacturing phase (A1–A3). The main drivers of this are, in particular, the production of raw materials. Manufacturing emissions are very low, as the ZAPP-ZIMMERMANN production plant is solely involved in the blending and production of the end product. In terms of total GWP, emissions from the manufacturing phase of the precursors account for just under 84% of the total emissions across the entire value chain. Within the production of raw materials in A1, emissions from the polyol, isocyanates, polyurethane and flame retardant contribute significantly to the total emissions. Thus, it is not only energy-intensive manufacturing processes but also the main components in the model that generate the majority of emissions here. Compared to raw material supply (A1), the contributions to environmental impacts in terms of GWP from the transport of precursors (A2: 1%) within the manufacturing phase are very low, and their significance in terms of GWP impact GWP, as well as the production phase itself, is negligible.
Manufacturing emissions (Module A3) account for 15% of the total GWP. Across all environmental impact categories, the manufacture of pre-products contributes at least 84% to the total emissions of the respective impact category. Within the cradle-to-gate system boundary (A1-A3), the primary energy demand from non-renewable energy sources is 96% and that

from renewable energy sources is accordingly 4%. Within the manufacturing phase (A1-A3), the largest contribution to non-renewable primary energy demand (PENRT) comes from raw materials (A1) (87%); manufacturing accounts for just under 12%. When considering the total renewable primary energy requirement (PERT), a similar picture emerges as with the PENRT. Just under 90% of the PERT is attributable to raw material procurement (A1), with manufacturing accounting for 12% of the total PERT. Transport contributes negligibly to the overall result, at <1%. Variation ranges were not calculated in this EPD by product variant, as the FU, being a mass-based unit, does not refer to density and packaging type, but to 1 kg and thus applies equally across all product variants. To enable ZAPP-ZIMMERMANN GmbH to share results not only via the average EPD, which takes into account approximately 71% gbP and 29% 2C cartridges, but also individually per product, both internally and with customers, the model for each individual product was evaluated here and compared with the average value. The following figure shows the results:

Impact category	Unit	Model values of the life cycle assessment	gbP	2K
Climate change	kg CO2 eq	4.70E+00	4.49E+00	5.61E+00
Ozone depletion	kg CFC11 eq	9.75E-08	8.83E-08	1.21E-07
Ionising radiation	kBq U-235 eq	2.48E-01	2.26E-01	3.05E-01
Photochemical ozone formation	kg NMVOC eq	1.59E-02	1.49E-02	1.86E-02
Particulate matter	disease inc.	3.76E-07	3.68E-07	3.99E-07
Human toxicity, non-cancer	CTUh	4.40E-08	4.22E-08	5.11E-08
Human toxicity, cancer	CTUh	3.32E-09	3.26E-09	3.57E-09
Acidification	mol H+ eq	1.90E-02	1.82E-02	2.13E-02
Eutrophication, freshwater	kg P eq	1.20E-03	1.13E-03	1.41E-03
Eutrophication, marine	kg N eq	5.29E-03	5.09E-03	6.15E-03
Eutrophication, terrestrial	mol N eq	4.19E-02	4.02E-02	4.76E-02
Water use	m3 depriv.	3.59E+00	3.26E+00	4.41E+00
Resource use, fossils	MJ	9.50E+01	8.87E+01	1.11E+02
Resource use, minerals and metals	kg Sb eq	2.26E-05	2.15E-05	2.54E-05

It is clear that the composition of the two products does not differ significantly, and consequently nor do the results in the individual environmental impact categories.

7. Requisite evidence

7.1 VOC
According to the test reports (Cologne, 2017) from Eco-Institut Germany GmbH, whose assessment is based on the test criteria of the scheme 'Health-related assessment of emissions of volatile organic compounds (VVOC, VOC and SVOC) from construction products' of the Working Group for the Health-related Assessment of Construction Products (*AgBB 2015*), it has been confirmed that the fire protection partitions from ZAPP-ZIMMERMANN comply with the emission requirements of the *AgBB* scheme. The following table summarises the results:

VOC emissions

Name	Value	Unit
TVOC (C6 - C16) gbP	14	µg/m³
TVOC (C6 - C16) 2K	64	µg/m³
Sum SVOC (C16 - C22) gbP	< 5	µg/m³
Sum SVOC (C16 - C22) 2K	11	µg/m³
R gbP	0.02	-
R 2K	0.18	-
VOC without NIK gbP	< 5	µg/m³
VOC without NIK 2K	12	µg/m³
Carcinogenic gbP and 2K	< 1	µg/m³

8. References

Standards

ISO 9001
DIN EN ISO 9001:2015: Quality management systems – Requirements.

ISO 14001
DIN EN ISO 14001:2015: Environmental management systems – Requirements with guidance for use.

ISO 14025
DIN EN ISO 14025:2011-10: Environmental labelling and declarations – Type III environmental declarations – Principles and procedures.

ISO 14040
DIN EN ISO 14040:2021-02: Environmental management – Life cycle assessment – Principles and framework (ISO 14040:2006 + Amd1:2020).

ISO 14044
DIN EN ISO 14044:2021-02: Environmental management – Life cycle assessment – Requirements and guidance (ISO 14044:2006 + Amd1:2017 + Amd 2:2020).

EN 15804
DIN EN 15804:2022-03: Sustainability of construction works – Environmental product declarations – Basic rules for the product category of construction products.

ISO 50001
DIN EN ISO 50001:2011: Energy management systems – Requirements with guidance for use.

Further reading

AVV
Regulation on the European Waste Catalogue (Waste Catalogue Regulation - AVV), Construction and demolition waste (including excavated material from contaminated sites).

BBSR 2017
Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR): Service lives of building components. Service lives of building components for life cycle analyses according to the Sustainable Building Assessment System (BNB), in: Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (ed.), 2017.

CPR
Regulation (EU) No. 305/2011: Regulation of the European Parliament and of the Council of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC (EU Construction Products Regulation), in: Official Journal of the European Union L 88/5, April 2011.

ECHA List
European Chemicals Agency (ECHA): CMR substances from Annex VI of the CLP Regulation that have been registered under REACH and/or notified under CLP.

Ecoinvent 3.11

ecoinvent V 3.11 (2025): Eco-inventory database version 3.10 of the Swiss Centre for Eco-Inventories, Dübendorf. www.ecoinvent.ch

IBU 2022
Institute for Building and Environment (IBU) (ed.): The creation of Environmental Product Declarations (EPDs). General EPD program guidelines of the Institute for Building and Environment (IBU), version 2.1, 2022.

Candidate List
European Chemicals Agency (ECHA): Candidate List of substances of very high concern for authorization, in: https://echa.europa.eu/candidate-list-table, 2020.

PCR Part A
Institute for Building and Environment (IBU) (ed.): Product category rules for building-related products and services. Part A: Calculation rules for life cycle assessment and requirements for the project report, Version 1.4, 2022.

PCR Part B
Institute for Building and Environment (ed.): PCR Guidelines for building-related products and services. Part B: Requirements for the EPD for pre-formed fire protection systems for cable and pipe penetrations, Version v11, August 1, 2024.

SimaPro
Prè Sustainability: SimaPro Version 10.2.0.1, 2025.

ZAPP-ZIMMERMANN
z-z.de | ZAPP-ZIMMERMANN GmbH.

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

myclimate Deutschland gGmbH
Kurrerstr. 40/3
72762 Reutlingen
Germany

+49 7121 9223 50
kontakt@myclimate.de
www.myclimate.de

Owner of the Declaration

ZAPP-ZIMMERMANN GmbH
Marconistraße 7-9
50769 Kölm
Germany

+49 221 97061-700
info@z-z.de
https://www.z-z.de/