ENVIRONMENTAL PRODUCT DECLARATION

as per ISO 14025 and EN 15804

Owner of the Declaration	fischerwerke GmbH & Co. KG
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
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Valid to	19/09/2018

Epoxy Mortar FIS EM 390 S, FIS EM 585 S, FIS EM 1500 S

fischerwerke GmbH & Co. KG

Institut Bauen und Umwelt e.V.

www.bau-umwelt.com / https://epd-online.com

1. General Information

fischerwerke GmbH & Co. KG

Programme holder
IBU - Institut Bauen und Umwelt e.V.
Panoramastr. 1
10178 Berlin
Germany

Declaration number
EPD-FIW-20130107-IBE1-EN

This Declaration is based on the Product Category Rules:
Reaction resin products, 07.2014
(PCR tested and approved by the independent expert committee)

Issue date
20/09/2013

Valid to
19/09/2018

Prof. Dr.-Ing. Horst J. Bossenmayer
(President of Institut Bauen und Umwelt e.V.)

Dr. Burkhart Lehmann
(Managing Director IBU)

Epoxy Mortar FIS EM 390 S, FIS EM 585 S, FIS EM 1500 S

Owner of the Declaration
fischerwerke GmbH & Co. KG
Otto-Hahn-Str. 15
79211 Denzlingen

Declared product / Declared unit
1 kg / 1 kg; density 1,45 g/cm^3

Scope:
This validated declaration entitles the holder to bear the symbol of the Institut Bauen und Umwelt e.V. It exclusively applies for plants in Germany and the product groups referred to for a period of five years from the date of issue. The Declaration holder is liable for the details and documentation upon which the evaluation is based. This involves an EPD for which the product of a group was selected which displays the highest environmental burdens in this group in order to calculate the Life Cycle Assessment. 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.

Verification

The CEN Norm EN 15804 serves as the core PCR
Independent verification of the declaration according to ISO 14025
☐ internally ☒ externally

Matthias Schulz
(Independent tester appointed by SVA)

2. Product

2.1 Product description

FIS EM 390 S, FIS EM 585 S and FIS EM 1500 S are injection systems based on epoxy resins. The reactive resins are manufactured in a two-component process using epoxy resins and polyamine hardening agents.

By using FIS EM 390 S, FIS EM 585 S and FIS EM 1500 S, the fitness for use of structures is decisively improved and their life time significantly extended.

The product with the highest environmental impact was applied as a representative product for calculating the results of the Life Cycle Assessment.

2.2 Application

Reactive resins based on epoxy resins, filled or aqueous, filled with low concentration of fillers

FIS EM 390 S, FIS EM 585 S and FIS EM 1500 S are injection systems based on epoxy resins, which are used for heavy duty anchoring.

The injection mortars can be applied for rebar connections and cracked concrete. Depending on the demand rebar connections between Ø 8 to 40 mm can be conducted with the injection mortar FIS EM.

FIS EM is also approved for diamond-drilled, water-filled drill holes and under water application, thus ensuring more flexibility on the construction site.

FIS EM is also suitable for natural stone with dense structure.

2.3 Technical Data

Open Time:

-5 to +10 °C	240 min
+5 to +10 °C	120 min
+10 to +20 °C	30 min
+20 to +30 °C	14 min
+30 to +40 °C	7 min

(internal determination method)

Curing Time:

-5 to +10 °C	80 h
+5 to +10 °C	40 h
+10 to +20 °C	18 h
+20 to +30 °C	10 h
+30 to +40 °C	5 h

(internal determination method)

Constructional data

Name	Value	Unit
Density according to DIN EN ISO 1183-1	1450	kg/m^3
Tensile bond strength acc. to DIN EN 14293	-	N/mm^2
Temperature resistance (internal method of determination)	100	°C
Shrinkage (internal method of determination)	< 0,1	%
Shore-A (after 45 min) according to DIN EN ISO 868:2003-10	95	
Viscosity (at 20 °C) according to DIN EN ISO 2555:2000-01	approx. 100	Pas
Shelf Life (internal method of determination)	36	Months

2.4 Placing on the market / Application rules

The injection system, comprising the epoxy resin mortar FIS EM combined with the FIS A threaded rod, is suitable for pre-positioned and push-through installation.

Resin and hardener are stored in two separate chambers and are not mixed and activated until extrusion through the injection cartridge in the static mixer. The mortar is injected bubble-free from the drill hole base. The mortar bonds the entire surface of the anchor rod with the drill hole wall and seals off the drill hole.

The anchor rod is inserted manually to the ground of the drill hole with slightly rotation. During push-through installation, the annular gap between the anchor rod and attachment is filled with FIS EM.

FIS EM 390 S, FIS EM 585 S and FIS EM 1500 S offer an approval referred to ETA-10/001/2 and are approved for anchoring in cracked and non-cracked concrete C20/25 to C50/60.
FIS EM 390 S, FIS EM 585 S and FIS EM 1500 S are also suitable for natural stone with dense structure.

2.5 Delivery status

Pasty, in plastic cartridges, appropriately packed in the application-friendly mixing ratio
Container sizes: 390 ml, 585 ml and 1500 ml

2.6 Base materials / Ancillary materials

The reactive resins based on epoxy, filled, comprise a resin and a hardening agent component. The resin component (A component) contains epoxy resins based on Bisphenol-A or Bisphenol-F resins (MW < 700).

The components can contain so-called reactive diluting agents (glycidether) and other auxiliaries such as accelerators, catalysts, wetting agents, foam regulators and viscosity regulators for fine adjustment of the product properties

Hardening occurs when installed on site with the hardening agent component. To this aim, polyamines, polyamides, polyamine adducts or mixtures of the same are used.

The mixing ratio is automatically ensured during the squeezing process. Product hardening starts immediately after mixing the components.

On average, the products covered by this EPD contain the following range of base materials and auxiliaries:
Resin component: 30-40 %
Hardener component: 10-15 %
Reactive diluting agent: 10-15 %
Filler: 30-40 %
Others: <5 %

At the time of preparation of this EPD FIS EM does not contain any substances, which are on the candidate list for substances of very high concern for entry into annex XIV of REACH. More detailed information about hazardous substances can be found in the safety data sheet.

2.7 Manufacture

The formulated product components are produced in batch mode and packed in the delivery containers in compliance with DIN ISO 9001 and with conditions of relevant regulations such as the Ordinance on Industrial Safety and Health or the Pollution Control Act.

2.8 Environment and health during manufacturing

As a general rule, no additional environmental protection measures are required beyond those which are specified by law.

2.9 Product processing/Installation

The fixing system is applied by injection via the static mixer.

Health and safety measures (hand and eye protection, ventilation) must be performed and consistently observed in line with the instructions in the safety data sheet and conditions on site.

2.10 Packaging

Empty containers and clean foil can be recycled. Reusable wooden pallets are returned to the building materials trade (reusable pallets against deposits) from where they are returned to the building product manufacturers and redirected into the production process.

2.11 Condition of use

During the use phase FIS EM is fully cured and essentially comprises an inert, three-dimensional network.

They are durable products which protect our buildings and make a significant contribution towards retaining their function and long-term value.

2.12 Environment and health during use

Option 1 – Products for applications outside confined spaces

After curing FIS EM is not reactive anymore and act inertly.

No risks are known for water, air and soil if the products are used as designated.

Option 2 – Products for applications inside confined spaces

The emissions of FIS EM in the indoor air amount after 28 days < 0,2 µg/m³ TVOC („Total Volatile Organic Compounds“, determined after ISO 16000-6).

Other influences on the environment and health caused by escaping materials are not known.

2.13 Reference service life

FIS EM fulfills various, often specific tasks associated with the construction or refurbishment of building structures. Its use decisively improves the usability of building structures and significantly extends their Reference Service Life.
The anticipated Reference Service Life depends on the specific installation situation and associated product exposure. It can be influenced by weather factors as well as by mechanical or chemical exposure.

2.14 Extraordinary effects

Fire
Even without any special fire safety fittings FIS EM complies with the minimum requirements in accordance with DIN EN 13501-1 for fire class E and Efl. In terms of the quantity used, they only have a subordinate effect on the fire characteristics of a building in which they are installed. As cross-linked epoxy resins involve a duroplastic material, it does not melt or drip with the result that the resins do not contribute to fire spread, whereas the combustibility of cross-linked epoxy resins is greater than that of other duroplastics. Among other substances, formaldehyde and phenol can form in the event of a fire.

Water
The cured Epoxy Mortar FIS EM is chemically inert and insoluble in water.

Mechanical destruction
The mechanical destruction of FIS EM does not lead to any decomposition products which are harmful for the environment or health.

2.15 Re-use phase

According to present knowledge, no environmentally-hazardous effects are reasonably expected during the dismantling and recycling (including landfilling) of building components to which hardened products based on methacrylate resins adhere.
If epoxy systems can be removed from the components at no great effort, thermal recovery is a practical recycling option on account of its energy content.
The low quantities of the products are generally negligible and do not impair disposal or recycling of the remaining components/substances.

2.16 Disposal

Individual components which can no longer be recycled must be combined at a specified ratio and hardened.

Hardened product residue is not special waste.
Non-hardened product residue is special waste.

Empty, dried containers (free of drops and scraped clean) are directed to the recycling process. Residue must be directed to proper waste disposal taking consideration of local guidelines.

The following EWC/AVV waste codes can apply:
Hardened product residue:
080112 Paint and varnish waste with the exception of those covered by 08 01 11
080410 Adhesive and sealant compound waste with the exception of those covered by 08 04 09

2.17 Further information

More information is available in the product or safety data sheets and is available on www.fischer.de or on request.
Valuable technical information is also available on associations' websites.
TKB instructions, for example, are available at www.klebstoffe.com or information on Deutsche Bauchemie is available at www.deutschebauchemie.de.

3. LCA: Calculation rules

3.1 Declared Unit

Reactive resins based on epoxy resins, filled or aqueous, filled with low concentration of fillers

The EPD refers to the declared unit of 1 kg FIS EM in the mixing ratio required for processing both components. Consumption per unit area of the products to be applied extensively can range between only a few hundred grams and more than 1 kg per square meter. In the case of products which are injected, the application volume depends on the component to be injected.

The product with the highest environmental impact in the product groups was declared.

Declared unit

Name	Value	Unit
Declared unit	1	kg
Conversion factor to 1 kg	1	-

3.2 System boundary

Modules A1/A2/A3, A4, A5 and D are taken into consideration in the LCA:
- A1 Manufacture of preliminary products
- A2 Transport to plant
- A3 Production incl. provision of energy, manufacture of packaging, auxiliaries and consumables, waste treatment)
- A4 Transport to site
- A5 Installation (disposal of packaging and emissions during installation)
- D Credits from incineration of packaging materials and recycling the metal container

The Declaration is therefore from the "cradle to plant gate, with options".

3.3 Estimates and assumptions

Where no specific GaBi processes were available, the individual recipe ingredients of formulae were estimated on the basis of information provided by the manufacturer or literary sources.

3.4 Cut-off criteria
No cut-off criteria were applied for calculating the LCA. All raw materials submitted by the associations for the formulae were taken into consideration.
The manufacture of machinery, plants and other infrastructure required for production of the products under review was not taken into consideration in the LCA.

3.5 Background data
Data from the GaBi 5 data base was used as background data. Where no background data was available, it was supplemented by manufacturer information and literary research.

3.6 Data quality
Representative products were applied for this EPD and the product in a group displaying the highest environmental impact was applied for calculating the LCA results. The data sets are no more than 7 years old. The data was taken from the GaBi 5:2010 data bases and is therefore consistent.

3.7 Period under review
The review period concerns annual production for the year 2011.

3.8 Allocation
No allocations were applied for production. A multi-input allocation with a credit for electricity and thermal energy was used for incineration of packaging in accordance with the simple credit method. The credits achieved through packaging disposal are offset in Module D.

3.9 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. In this case, 1 kg FIS EM was selected as the declared unit. Depending on the application, a corresponding conversion factor such as the specific unit area must be taken into consideration.

4. LCA: Scenarios and additional technical information

The following technical information forms the basis for the declared modules or can be used for developing specific scenarios in the context of a building evaluation if modules are not declared (MND).

Transport to site (A4)

Name	Value	Unit
Litres of fuel	0.00248	l/100km
Transport distance	500	km
Capacity utilisation (including empty runs)	85	%
Gross density of products transported	1450	kg/m^3
Capacity utilisation volume factor	100	-

Construction installation process (A5)

Name	Value	Unit
Material loss	0.01	kg
VOC in the air	0.02	kg

5. LCA: Results

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

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARYS
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement[1)]	Refurbishment[1)]	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	MND	MND	MND	MND	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 kg FIS EM

Parameter	Unit	A1-A3	A4	A5	D
Global warming potential	[kg CO_2-Eq.]	6.09E+0	2.51E-2	9.08E-2	-1.57E-1
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	4.42E-8	1.35E-12	3.84E-12	-6.07E-11
Acidification potential of land and water	[kg SO_2-Eq.]	9.06E-3	1.59E-4	1.25E-5	-4.91E-4
Eutrophication potential	[kg $(PO_4)^{3-}$ Eq.]	1.30E-3	3.95E-5	2.51E-6	-4.10E-5
Formation potential of tropospheric ozone photochemical oxidants	[kg Ethen Eq.]	1.91E-3	-6.85E-5	7.22E-3	-7.22E-5
Abiotic depletion potential for non fossil resources	[kg Sb Eq.]	1.19E-5	1.15E-9	1.64E-9	-6.81E-9
Abiotic depletion potential for fossil resources	[MJ]	1.20E+2	3.47E-1	2.55E-2	-1.93E+0

RESULTS OF THE LCA - RESOURCE USE: 1 kg FIS EM

Parameter	Unit	A1-A3	A4	A5	D
Renewable primary energy as energy carrier	[MJ]	3.18E+0	IND	IND	IND
Renewable primary energy resources as material utilization	[MJ]	0.00E+0	IND	IND	IND
Total use of renewable primary energy resources	[MJ]	3.18E+0	1.38E-2	1.87E-3	-3.41E-2
Non renewable primary energy as energy carrier	[MJ]	9.22E+1	IND	IND	IND
Non renewable primary energy as material utilization	[MJ]	2.88E+1	IND	IND	IND
Total use of non renewable primary energy resources	[MJ]	1.21E+2	3.47E-1	2.55E-2	-1.93E+0
Use of secondary material	[kg]	0.00E+0	IND	IND	IND
Use of renewable secondary fuels	[MJ]	1.22E-3	2.94E-6	3.48E-7	1.44E-3
Use of non renewable secondary fuels	[MJ]	1.28E-2	3.08E-5	3.64E-6	1.51E-2
Use of net fresh water	[m^3]	IND	IND	IND	IND

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1 kg FIS EM

Parameter	Unit	A1-A3	A4	A5	D
Hazardous waste disposed	[kg]	IND	IND	IND	IND
Non hazardous waste disposed	[kg]	IND	IND	IND	IND
Radioactive waste disposed	[kg]	IND	IND	IND	IND
Components for re-use	[kg]	IND	IND	IND	IND
Materials for recycling	[kg]	IND	IND	IND	IND
Materials for energy recovery	[kg]	IND	IND	IND	IND
Exported electrical energy	[MJ]	IND	IND	1.11E-1	IND
Exported thermal energy	[MJ]	IND	IND	2.69E-1	IND

Information for the indicators Use of net fresh water, Hazardous Waste disposed, Non hazardous waste disposed and Radioactive waste disposed: Not all background data sets support the methodic approach of these indicators according to DIN 15804. The values of the indicators include therefore a higher uncertainty and are not accounted for according to the decision of the independent expert committee from 07.01.2013.

6. LCA: Interpretation

The main share **of non-renewable primary energy requirements** is necessitated by manufacturing of the preliminary products as it almost exclusively involves preliminary products from fossil resources which are usually energy-intensive in terms of manufacturing. The primary energy carriers used are therefore natural gas and crude oil, whereby more than 95% of non-renewable primary energy is required for manufacturing the preliminary products (A1). Amine components in particular are associated with a very energy-intensive manufacturing process, while the resin components have fewer effects on primary energy requirements. On account of the complexity associated with manufacturing the preliminary products applied, the other components have a minor influence on the final result. The share of renewable primary energy is relatively low at < 4% (of total primary energy). The renewable share of the power mix is primarily apparent in A1, whereby the use of wooden pallets in packaging has the greatest impact in A3. Timber growth requires solar energy for photosynthesis which therefore appears as a renewable source of primary energy here.
The **Global Warming Potential (GWP)** is dominated by the manufacture of preliminary products (A1). The amine components also have a significant influence on

the overall GWP result. Production of the actual epoxy resin product also has a tangible influence which is attributable to the energy required. During the installation process, packaging is incinerated with the result that the emissions incurred are also listed here. The credits are primarily necessitated by the credit for the sheet steel container which is redirected to the recycling process and are less attributable to electricity and thermal energy from the packaging incineration process. The GWP is dominated by carbon dioxide emissions.

The **Ozone Depletion Potential (ODP)** indicates that the impact is almost exclusively necessitated by A1 and A3 which is primarily attributable to halogenated organic emissions from the power mix used.

The **Acidification Potential (AP)** is primarily attributable to nitric oxides and sulphur dioxide which are in turn incurred during manufacturing of the preliminary products in particular. In A3, they are necessitated by electricity and manufacturing the container. Transport to the building site is also apparent here where nitric oxide emissions in particular have an influence on acidification.

In terms of the **Eutrophication Potential (EP),** nitric oxides are once again obvious in emissions into air (80%) although the emissions into water also make a significant contribution accounting for approx. 10 -15% by ammonium and nitrates. This is primarily accounted for by the provision of energy.

Only the **Summer Smog Potential (POCP)** is not dominated by manufacturing of preliminary products. A1 only accounts for < 20% of the POCP. The main share (>80%) is incurred during installation of the epoxy resin product in the form of emissions of benzyl alcohol.
Highly-filled systems are associated with lower environmental impact as filler material in general is less complex to manufacture and therefore reduces the loads on the system as a whole. It must however be noted that evaluations here refer to 1 kg of product. Reference must be made to the correct functional unit for certain applications (e.g. an area with a certain basis weight) in order to comply with the requisite function.

7. Requisite evidence

7.1 VOC

The VOC emissions in the indoor air of FIS EM were determined according to ISO 16000. They amount after 28 days < 0,2 µg/m³ TVOC („Total Volatile Organic Compounds“).

Measuring process: GEV test method for determining the emission of volatile organic compounds from building products in accordance with DIN EN ISO 16000, Part 3, Part 6, Part 9, Part 11 in a test chamber. Testing for CMR substances as well as TVOC/TSVOC after 3 and 28 days.

The corresponding test certificate applies as **evidence** (Test report n° SB-12-072, CSTB Centre Scientifique et Technique du Bâtiment).

8. References

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REACH
Directive (EG) No. 1907/2006 of the European Parliament and of the Council dated 18 December 2006 n the registration, evaluation, approval and restriction of chemical substances (REACH), for establishing a European Agency for chemical substances, for amending Directive 1999/45/EC and for annulment of Directive (EEC) No. 793/93 of the Council, Directive (EC) No. 1488/94 of the Commission, Guideline 76/769/EEC of the Council and Guidelines 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC of the Commission.

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