ENVIRONMENTAL PRODUCT DECLARATION

as per /ISO 14025/ and /EN 15804/

Owner of the Declaration	**Xella Baustoffe GmbH**
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-XEL-20140218-CAD2-EN
Issue date	12/01/2015
Valid to	11/01/2020

Multipor Mineraldämmplatte

Xella Baustoffe GmbH

Institut Bauen und Umwelt e.V.

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

multipor®

1. General Information

Xella Baustoffe GmbH

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

Declaration number
EPD-XEL-20140218-CAD2-EN

This declaration is based on the product category rules:
Aereated Concrete, 07.2014
(PCR checked and approved by the SVR)

Issue date
12/01/2015

Valid to
11/01/2020

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

Dr. Burkhart Lehmann
(Managing Director IBU)

Multipor Mineraldämmplatte

Owner of the declaration
Xella Baustoffe GmbH
Düsseldorfer Landstraße 395
D-47259 Duisburg

Declared product / declared unit
1 m^3 Multipor mineral insulating panel with a gross density of 115 kg/m^3.

Scope:
The LCA is based on the German manufacturing plants of Multipor Stulln and Cologne-Porz and the data base for 2013.

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 standard /EN 15804/ serves as the core PCR
Independent verification of the declaration and data according to /ISO 14025:2010/
☐ internally ☒ externally

Patricia Wolf
(Independent verifier appointed by SVR)

2. Product

2.1 Product description / Product definition
The Multipor mineral insulating panels under review are thermal insulating panels made of calcium silicate hydrates with a very high percentage of air-filled pores. Xella Baustoffe GmbH operates 2 facilities in Germany. Averaging was based on the annual production volume for 2013.

2.2 Application
New and old buildings

- Interior and exterior insulation of outer walls
- Underside ceiling insulation of underground car parks, basements and passageways
- On-roof insulation of pitched and flat roofs, parking decks under load
- In the thermal insulation composite system (TICS), as a system component
- Double-layer masonry
- Cavity insulation of walls
- Curtain-type rear-ventilated facades
- Screed insulation

2.3 Technical Data

Structural data

Name	Value	Unit
Compressive strength mean value	0.35	N/mm^2
Gross density	80 - 135	kg/m^3
Tensile strength mean value	0.08	N/mm^2
Thermal conductivity	0.042 - 0.05	W/(mK)
Moisture content at 23 °C, 80%	6	wt.-%

Directive (EU) No. 305/2011 applies for placing the product on the market in the EU/EFTA (with the exception of Switzerland) dated 09/03/2011. The products require a Declaration of Performance on account of the European Technical Approval: ETA-05/0093 Xella Deutschland GmbH – Mineral Insulating Panel “Ytong Multipor Mineral Insulating Panel”, 09.05.2010 and CE-marking.

2.4 Delivery status
600 mm • 390 mm • d
d = 20 / 30 / 40 / 50 / 60 / 80 / 100 / 120 / 140 / 160 / 180 / 200 / 220 / 240 / 260 / 280 / 300 mm

2.5 Base materials / Ancillary materials

Raw materials

Name	Value	Unit
Quartz sand	25-40	% by mass
Cement	25-50	% by mass
Unhydrated lime	5-25	% by mass
Anhydrite/Gypsum	3-7	% by mass
Mineral aggregate	10-20	% by mass
Aluminium as an entrainer	0.7-0.8	% by mass

75-140% water by mass (with reference to the solid materials) is also used.
Mould oil is used as an ancillary material.

Sand: The sand used is a natural raw material which contains quartz (SiO_2) as a primary mineral as well as minor and trace minerals. It is an essential base material for the hydrothermal reaction during steam curing.
Cement: In accordance with /DIN EN 197-1/, cement serves as a binding agent and is largely manufactured from lime marl or a mixture of lime and clay. The natural raw materials are burned before being ground.
Unhydrated lime: In accordance with /DIN EN 459-1/, unhydrated lime serves as a binding agent and is manufactured by burning natural lime.
Anhydrite / Gypsum: The sulphate agent used serves towards influencing the curing time for the raw mixture and originates from natural reserves or is produced technically.
Mineral aggregate: Ground insulating panels from rubble treatment / ground autoclaved aerated concrete from rubble treatment and/or ground limestone as an additional mineral component.
Aluminium: Aluminium paste serves as a pore-forming agent. Metallic aluminium reacts in the alkaline environment, whereby gaseous hydrogen gas is formed which generates the pores and then vents after the expansion process.
Water: The availability of water is a fundamental basis for the hydraulic reaction undergone by the binding agents. Water is also required for manufacturing a homogeneous suspension.
Mould oil: Mould oil is used as a release agent between the mould and the Multipor panel mixture. Mineral oils are used which are free of polycyclic aromatic hydrocarbons and contain long-chain additives to increase viscosity. This prevents it from running down in the mould and permits economical application.
Water-repellent agent (the mixture contains very small volumes): The water-repellent agent reduces water absorption by the mineral insulating panel. Liquid silicones (silicon atoms chain-linked via oxygen atoms) are used.

2.6 Manufacture

The ground quartz sand is mixed with the other base materials, adding water and aluminium paste, in a mixer to form a raw mixture and is cast in moulds. The water slakes the lime under heat generation.
The aluminium reacts in an alkaline environment, whereby gaseous hydrogen is formed which generates the pores in the raw mixture and vents without residue. The pores usually have a diameter of 0.5 – 1.5 mm and are exclusively filled with air. The initial binding process results in semi-solid ingots from which the insulating panels are automatically cut with high precision.
The final characteristics of the components are formed during the subsequent steam curing process over 5 to 12 hours at approx. 190 °C and pressure of approx. 12 bar in steam pressure chambers, so-called autoclaves, where the substances used form calcium silicate hydrates which correspond to the tobermorit mineral prevailing in nature. The material reaction is concluded on removal from the autoclave. The steam is used for other autoclave cycles once the curing process is finished. The condensate incurred is used as process water. This saves energy and no waste water is incurred.

2.7 Environment and health during manufacturing

The general statutory regulations and the rules of the German Social Accident Insurance Institutions apply. No special measures need to be taken to protect employee health or the environment.

2.8 Product processing/Installation

Multipor mineral insulating panels are processed manually. Insulating panels are cut using band saws or by hand-held carbide saws as they only generate coarse dust and no fine dust. High-speed tools such as angle grinders are not suitable for processing Multipor as they release fine dust.
Multipor mineral insulating panels are secured to the processing subsurface using an adapted mineral lightweight mortar (average 3.5 kg/m²). Raw plugs can also be used. The Multipor mineral insulating panels can be plastered, painted or processed as a room-side finish with structural panels (e.g. with FERMACELL® gypsum fibreboards).

2.9 Packaging

The Multipor mineral insulating panels are packed in recycled shrink film made of polyethylene (PE), stacked on Euro-pallets and shrink-wrapped in recyclable polyethylene (PE).

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2.10 Condition of use

Multipor mineral insulating panels do not alter their properties after leaving the autoclave.

2.11 Environment and health during use

In accordance with the current state of knowledge, Multipor mineral insulating panels do not emit any harmful substances such as VOC, for example.
The naturally ionising radiation of Multipor mineral insulating panels is extremely low permitting unlimited use of this building material from a radiological perspective.

2.12 Reference service life

Multipor mineral insulating panels display unlimited resistance properties when used as designated.

2.13 Extraordinary effects

Fire
In the event of a fire, no toxic gases or vapours can arise. Multipor mineral insulating panels comply with the requirements of building material class A1, "non-combustible", in accordance with /DIN EN 13501-1/.

Fire protection

Name	Value
Building material class	A1

Water
Multipor mineral insulating panels react with a slightly alkaline effect (pH value approx. 10) when exposed to water (e.g. flooding). No substances are washed out which could be hazardous to water.

Mechanical destruction
No destruction occurs when the technical structural rules and building guidelines are adhered to.

2.14 Re-use phase
Multipor mineral insulating panels can exceed the useful life of the buildings in which they are used. Re-use or further use of the insulating panels after de-construction is practically impossible at this stage. No practical experience is available on account of the innovative nature of the product.

2.15 Disposal
Multipor mineral insulating panels can be disposed of in class II landfills in accordance with the /German Landfill Directive (DepV)/. Waste code in accordance with the /European Waste Catalogue/ (EWC): 17 01 01

2.16 Further information
Additional information available online at www.multipor.com.

3. LCA: Calculation rules

3.1 Declared Unit
The Declaration refers to the manufacture of 1 m³ Multipor mineral insulating panels with an average gross density of 115 kg/m³. This is non-reinforced autoclaved aerated concrete.

Deklarierte Einheit

Name	Value	Unit
Declared unit	1	m^3
Gross density	115	kg/m^3
Conversion factor to 1 kg	1/115	-

3.2 System boundary
Type of EPD: cradle to plant gate
The following individual processes were included in the Product stage A1-A3 of manufacturing the aircrete products:

- Processes associated with supplying auxiliaries and energy
- Transporting the resources and preliminary products (cement, lime, sand etc.) to the respective production site
- Manufacturing process in the plant including energy, manufacturing auxiliaries, disposing of any residual materials incurred
- Manufacturing the pro rata packaging

3.3 Estimates and assumptions
No approximations or estimates are necessary within the framework of the LCA.

3.4 Cut-off criteria
All operating data, i.e. all of the starting materials used, thermal energy, internal fuel consumption and electricity consumption, all direct production waste as well as all emission measurements available were taken into consideration in the analysis. Where no primary data was available, assumptions were made as regards the transport expenses associated with all input and output data taken into consideration. Accordingly, material and energy flows with a share of less than 1 per cent were also considered. It can be assumed that the total of all neglected processes does not exceed 5% in the effective categories. Machinery, plants and infrastructure required in the manufacturing process were not considered.

3.5 Background data
The software system for comprehensive analysis (GaBi 6) developed by PE INTERNATIONAL AG was used for modelling the insulating panel production process. The consistent data sets contained in the GaBi data base are documented in the online /GaBi documentation/. The basic data in the GaBi data base was applied for energy, transport and consumables. The Life Cycle Assessment was modelled for Germany as a reference area. This means that apart from the production processes under these marginal conditions, the pre-stages also of relevance for Germany such as provision of electricity or energy carriers were used. The power mix for Germany 2010 is applied.

3.6 Data quality
All of the background data records of relevance for manufacturing were taken from the /GaBi 6/ software data base. Primary data was supplied by Xella Baustoffe GmbH.
The background data used was last revised less than 1 year ago. The production data involves up-to-date industrial data on Xella Baustoffe GmbH from 2013.

3.7 Period under review
The data applied for this LCA is based on data recorded for the manufacture of insulating panel products in 2013. The volumes of raw materials, energy, ancillary materials and consumables used were considered as average annual values in the plants.

3.8 Allocation
One of the manufacturing plants is a combination plant which produces Ytong as well as Multipor where the production figures were allocated by Xella Baustoffe GmbH. PE INTERNATIONAL was not obliged to make any allocations as all production data supplied exclusively concerns the manufacture of Multipor insulating panels.
Furthermore, broken insulating panel material is incurred during the production process which is re-

used directly in production in the form of crushed recycled autoclaved aerated concrete material. These flows are modelled in a closed loop. Any energetic expenses associated with crushing are already included in the plant data

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.

The used background database has to be mentioned. As a general rule, 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 and/or the product-specific characteristics of performance are taken into account.

4. LCA: Scenarios and additional technical information

Reference service life

Name	Value	Unit
Reference service life	80 - 150	a

5. LCA: Results

The environmental impacts of 1 m³ Multipor mineral insulating panels manufactured by Xella Baustoffe GmbH are depicted below. The modules marked "x" as per EN 15804 in the overview are addressed; the modules marked "MND" (Module not declared) do not form a component of the analysis.
The following tables depict the results of the indicators concerning impact estimates, use of resources as well as the waste and other output flows with reference to the declared unit.

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 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	MND	MND	MND	MNR	MNR	MNR	MND	MND	MND	MND	MND	MND	MND

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 m³ Multipor

Parameter	Unit	A1-A3
Global warming potential	[kg CO_2-Eq.]	1.01E+2
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	3.21E-9
Acidification potential of land and water	[kg SO_2-Eq.]	1.86E-1
Eutrophication potential	[kg $(PO_4)^{3-}$-Eq.]	2.31E-2
Formation potential of tropospheric ozone photochemical oxidants	[kg ethene-Eq.]	1.60E-2
Abiotic depletion potential for non-fossil resources	[kg Sb-Eq.]	7.27E-5
Abiotic depletion potential for fossil resources	[MJ]	1.21E+3

RESULTS OF THE LCA - RESOURCE USE: 1 m³ Multipor

Parameter	Unit	A1-A3
Renewable primary energy as energy carrier	[MJ]	3.11E+2
Renewable primary energy resources as material utilization	[MJ]	0.00E+0
Total use of renewable primary energy resources	[MJ]	3.11E+2
Non-renewable primary energy as energy carrier	[MJ]	1.35E+3
Non-renewable primary energy as material utilization	[MJ]	0.00E+0
Total use of non-renewable primary energy resources	[MJ]	1.35E+3
Use of secondary material	[kg]	0.00E+0
Use of renewable secondary fuels	[MJ]	1.20E+1
Use of non-renewable secondary fuels	[MJ]	1.26E+2
Use of net fresh water	[m³]	4.60E-1

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1 m³ Multipor

Parameter	Unit	A1-A3
Hazardous waste disposed	[kg]	1.40E-1
Non-hazardous waste disposed	[kg]	2.55E+1
Radioactive waste disposed	[kg]	6.00E-2
Components for re-use	[kg]	IND
Materials for recycling	[kg]	IND
Materials for energy recovery	[kg]	IND
Exported electrical energy	[MJ]	IND
Exported thermal energy	[MJ]	IND

The results of the impact estimates only represent relative statements. They do not make any claims concerning impact category limits, exceeding threshold values, safety limits or risks.

6. LCA: Interpretation

The environmental impacts during the manufacture of Multipor are dominated by energy consumption (electricity, natural gas) in the plant and the environmental loads from manufacturing the binding agents (lime, cement).
The manufacture of 1 m³ Multipor requires almost 1350 MJ non-renewable primary energy (PENRT). 60% of the use of non-renewable primary energy is determined by the use of energy sources in the plant (electricity and thermal energy). Essential influences continue to be reflected by the use of lime and cement as binding agents accounting for a total of 14% and the packaging materials used which also account for 14%. Additionally, approx. 300 MJ/m³ renewable primary energy (PERT) are also used.
When considering other impact categories, it transpires that the results are determined by the use of both energy sources and binding agents. The contributions to ADPe are practically entirely attributable to the upstream chains associated with cement production as

low volumes of natural gypsum are used when burning the cement clinker.
While the GWP and ADPe are primarily dominated by the use of binding agents, the use of energy in the plant has a greater influence on the results of other impact categories. The influence of aluminium paste as a pore-forming agent is primarily apparent in the ODP and AP. The contributions to the impact categories account for >20%, hereby it must be noted that at < 1%, the mass percentage in the product is very low. During the direct product manufacturing process, no secondary materials or secondary fuels are used. The declared secondary fuels are entirely attributable to the upstream chains associated with cement production.

All in all, the quality of data can be regarded as good for modelling the Xella Baustoffe GmbH Multipor mineral insulating panel products. Corresponding consistent data records were available in the GaBi data base for the preliminary products and auxiliaries used. The data used was last revised less than 1 year ago.
The production data involves up-to-date primary data on all Xella Baustoffe GmbH plants in 2013. The volumes of raw materials, energy, auxiliaries and consumables used are considered as average annual values.

7. Requisite evidence

7.1 Radioactivity

Measuring agency: Verein für Kernverfahrenstechnik und Analytik Rossendorf e.V., Dresden
Method: Measurement of the nuclide content in Bq/kg, determining the Activity Index I
Test report: Measurement report 1813.10, dated 29.10.2014
Result: The samples were evaluated in accordance with the /European Commission Guideline "Radiation Protection 112"/ (Radiological Protection Principles concerning the Natural Radioactivity of Building Materials, 1999). The Index values I established are in all cases lower than the exclusion level which dispenses with a requirement for any additional controls. From a radiological perspective, the natural radioactivity of the building material permits unlimited use thereof.

7.2 VOC emissions

Measuring agency: eco-INSTITUT GmbH, Cologne
Process: Testing in the 0.125 m³ chamber in accordance with DIN ISO 16000-9
Test report: Multipor mineral insulating panel and Multipor lightweight mortar, thermal insulation for use as interior, ceiling, roof and exterior insulation, No.: 40173-001 dated 25.07.2013
Result: The conditions outlined in emissions class A+ are maintained when evaluating in accordance with the “Décret n°2011-321(23.03.2011)” VOC Directive.

8. References

/IBU 2016/
IBU (2016): General Programme Instructions for the Preparation of EPDs at the Institut Bauen und Umwelt e.V., Version 1.1 Institut Bauen und Umwelt e.V., Berlin.
www.ibu-epd.de

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

/EN 15804/
/EN 15804:2012-04+A1 2013/, Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

PCR 2013, Teil B
Institut Bauen und Umwelt e.V., Berlin (pub.): Produktkategorienregeln für Bauprodukte aus dem Programm für Umwelt-Produktdeklarationen des Instituts Bauen und Umwelt (IBU) Teil B: Anforderungen an die EPD Porenbeton. v1.5 2013-10, www.bau-umwelt.de

DIN EN 197-1: 2011-11; Cement - Part 1: Composition, specifications and conformity criteria for common cements; German version EN 197-1:2011

DIN EN 459-1: 2010-12; Building lime - Part 1: Definitions, specifications and conformity criteria; German version EN 459-1:2010

ETA-05/0093 Xella Deutschland GmbH – Mineralische Wärmedämmplatte „Ytong Multipor Mineraldämmplatte, 09.05.2010

DIN EN 13501-1:2010-01 +A12009: Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests; German version EN 13501-1:2007+A1:2009

DepV (2009): Verordnung über Deponien und Langzeitlager - Deponieverordnung vom 27.04.2009 (BGBl I S. 900) zuletzt geändert durch Art. 7 V vom 26.11.2010

European Waste Cataloge EWC in the version of the Comission Decision 2001/118/EG dated 16 January 2001 Amending Decision 2000/532/EG on a waste directory

EU Recommendation "Radiation Protection 112": European Commission: Radiological Protection Principles concerning the Natural Radioactivity of Building Materials, 1999

GaBi 6: Software and data base for comprehensive analysis. LBP, University of Stuttgart and PE International, 2013

GaBi 6: Dokumentation der GaBi 6-Datensätze der Datenbank zur Ganzheitlichen Bilanzierung. LBP, Universität Stuttgart und PE International, 2013. http://documentation.gabi-software.com/

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