ENVIRONMENTAL PRODUCT DECLARATION

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

Owner of the Declaration	Knauf Ceiling Solutions GmbH & Co. KG
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-KNA-20210053-IBC1-EN
Issue date	29/03/2021
Valid to	28/03/2026

AMF THERMATEX & ARMSTRONG Acoustic Range

Knauf Ceiling Solutions GmbH & Co. KG

Institut Bauen und Umwelt e.V.

ECO PLATFORM EPD EN 15804 VERIFIED

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1. General Information

Knauf Ceiling Solutions GmbH & Co. KG	AMF THERMATEX & ARMSTRONG Acoustic Range
Programme holder IBU – Institut Bauen und Umwelt e.V. Panoramastr. 1 10178 Berlin Germany	**Owner of the declaration** Knauf Ceiling Solutions GmbH & Co. KG Elsenthal 15 94481 Grafenau Deutschland
Declaration number EPD-KNA-20210053-IBC1-EN	**Declared product / declared unit** 1 m² THERMATEX/ARMSTRONG Acoustic Range mineral ceiling tiles with an average surface weight of 4,31 kg/m².
This declaration is based on the product category rules: Mineral panels, 12.2018 (PCR checked and approved by the SVR)	**Scope:** This document refers to 1 m² THERMATEX/ARMSTRONG Acoustic Range mineral ceiling tiles with an average recipe and an average surface weight of 4,31 kg/m², manufactured at the production facility in Grafenau, Germany under the brand names THERMATEX and ARMSTRONG.
Issue date 29/03/2021	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*.
Valid to 28/03/2026	**Verification** The standard *EN 15804* serves as the core PCR Independent verification of the declaration and data according to *ISO 14025:2010* ☐ internally ☒ externally
Dipl. Ing. Hans Peters (chairman of Institut Bauen und Umwelt e.V.)	
Dr. Alexander Röder (Managing Director Institut Bauen und Umwelt e.V.))	Prof. Dr. Birgit Grahl (Independent verifier)

2. Product

2.1 Product description/Product definition

The ceiling tiles are manufactured using a wet-felt process and consist of biosoluble mineral wool, perlite, clay and starch. The ceiling tiles meet the requirements of *DIN 18177* and *DIN EN 13964*.

The AMF and Armstrong mineral tiles are available in a wide range of different surface designs and product properties. Depending on the design, the ceiling tiles are available in different formats and edge finishes.

This EPD applies to the following products:

THERMATEX Thermofon, THERMATEX Antaris, THERMATEX Alpha, THERMATEX Alpha ONE, THERMATEX Alpha HD, THERMATEX Acoustic, THERMATEX dB Acoustic, THERMATEX Aquatec, Armstrong Sierra OP, Armstrong Perla, Armstrong Perla dB, Armstrong Perla OP 0,95, Armstrong Perla OP 1,00, Armstrong Ultima, Armstrong Ultima OP, Armstrong Ultima dB, Armstrong Ultima OP dB, Armstrong Bioguard Acoustic OP RH100, Armstrong Ultima+, Armstrong Ultima+ OP, Armstrong Ultima+ dB, Armstrong Ultima+ OP dB, Armstrong Ultima+ HD, Armstrong Ultima+ Acoustic, Armstrong Ultima+ Alpha.

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 13964:2014*, suspended ceiling requirements and test methods and the CE-marking. For the application and use the respective national provisions apply.

2.2 Application

Mineral tiles (wet-felt) are typically used as lay in for suspended ceiling constructions. They are primarily used as optical cladding, but also for sound absorption and sound insulation, for fire resistance and against fire spreading, for cleanrooms and high hygiene requirements.

2.3 Technical Data

Mineral boards (wet-felt) are regulated by *EN 13964* and have corresponding labelling and declaration of performance. The following data provide an overview of results:

Construction data (according to DIN 18177)

Name	Value	Unit
Thermal conductivity	0.04 - 0.075	W/(mK)
Sound absorption coefficient acc. ISO 354 and ISO 11654	0.65 - 1	%
Airborne sound reduction acc. ISO 10848 and EN 717-1	28 - 43	dB
Gross density	160 - 400	kg/m^3

Performance data of the product in accordance with the declaration of performance with respect to its essential characteristics according to *EN 13964:2014*, suspended ceiling requirements and test methods (not part of CE-marking).

2.4 Delivery status

The EPD refers to panels with a thickness between 15 - 35 mm which can have variable length and width dimensions.

2.5 Base materials/Ancillary materials

Mineral tile composition:

Name	Value	Unit
Mineral wool	45 - 70	%
Perlite	0 - 20	%
Clay	5 - 30	%
Cellulose fibres	0 - 5	%
Starch	5 - 10	%
others	0 - 15	%

In addition, dispersion paints are used on the surface and water for preparation during production. The recycled content is at least 34 %.

This product/article/at least one partial article contains substances listed in the *ECHA-candidate list* (date: 25.06.2020) exceeding 0.1 percentage by mass: No

This product/article/at least one partial article contains other CMR substances in categories 1A or 1B which are not on the *candidate list*, exceeding 0.1 percentage by mass: No

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

In-can preservatives are used in the production process; however, they are not part of the products and are therefore not within the scope of the *Ordinance on Biocide Products*.

2.6 Manufacture

The mineral tiles are produced in the traditional wet process (wet-felt). The raw materials are mixed with water to form a homogeneous suspension, which is pumped onto a belt conveyor (Fourdrinier). The water is removed mechanically (gravity and vacuum) and by evaporation in the drying oven. As far as possible, the process water is reused. It is treated accordingly and fed back into the process water circuit. Depending on the desired appearance the panels can be sanded, colour-treated, patterned, eroded or embossed. Production waste and dust are reused in the process in the sense of an internal cycle.
The manufacturing plant is certified according to *ISO 9001*, *ISO 14001*, *ISO 45001* and *ISO 50001*.

2.7 Environment and health during manufacturing

The manufacturer complies with the special German and European regulations for the production of mineral slabs:

- The manufacturing plant is certified according to *ISO 9001, ISO 14001, ISO 45001* and *ISO 50001*.
- The production has a closed water cycle, i.e. no waste water is produced.
- Production generates virtually no waste, all resulting blanks, dust and rejects are reused.
- Exclusive use of mineral fibres according to *Regulation (EU) No.1272/2008 Note Q*.
- Prohibition of the production and use of biopersistent fibres (*Ordinance on Hazardous Substances*, Annex II, No. 5).
- Prohibition of placing biopersistent fibres on the market (*Chemicals Prohibition Order*, No.23 of the Annex to §1).
- Not subject to declaration according to *REACH*.

2.8 Product processing/Installation

There are no recognised systemic hazards associated with the installation of ceiling tiles. It is recommended that materials are handled in a manner that minimises dust generation. Workers should wear appropriate personal protective equipment. Equipment such as gloves, goggles and dust masks are recommended to minimise exposure to dust and prevent skin irritation.

2.9 Packaging

The panels are packaged with cardboard boxes and sealed with transparent polyethylene film. These packages lie on chemically untreated wooden pallets. The pallets are wrapped with polyethylene stretch film. Foil, paper and wood can be recycled in the usual ways.

2.10 Condition of use

When handled properly, the mechanical and structural-physical properties of the mineral tile remain intact throughout its entire service life. Direct contact with water should be avoided due to the water-soluble binding agent starch.

2.11 Environment and health during use

When properly installed, no dust/particles are released during the use phase. For the substance groups formaldehyde, volatile organic compounds (VOCs) and total volatile organic compounds (TVOCs), the limits according to *DIN 18177* are complied with.

2.12 Reference service life

The service life of the mineral tiles (wet-felted) is up to 50 years, depending on the area of use, exposure and state of maintenance.

Within the framework of the conditions of use, no ageing effects are to be expected apart from visual discolouration caused by air circulation.

2.13 Extraordinary effects

Fire

The declared products are classified in the fire reaction class A2-s1, d0 according to *EN 13501-1*. This means that they are "non-combustible" according to the German building authority designation (and also many other European countries) with negligible smoke development and no burning drip in the event of fire.

Fire Reaction

Name	Value
Building material class	A2
Smoke gas development	s1
Burning droplets	d0

Water

In the case of prolonged contact with water, the starch binder dissolves, which can lead to a loss of structure, and if the soluble components are discharged into the sewage treatment plant, they are biodegradable, increasing the chemical oxygen demand (COD) and the biological oxygen demand (BOD).

Mechanical destruction

The mineral slabs (wet-felt) can be broken by hand and also damaged superficially, which can result in minor dust formation.

2.14 Re-use phase

If the panels are removed properly, they can be reinstalled. In case of minor damage, the slabs can be reused as cut-to-size tiles. Mineral tiles can be returned to the manufacturing process if they are of the correct type and have sufficient material quality; they can be recycled up to 100 %.

2.15 Disposal

The waste code number of production residues for mineral tiles according to the *AVV*, *German List of Wastes Ordinance* is 10 11 03, the waste code number for construction site waste (offcuts) is 17 06 04. If the tiles are not recycled as described in 2.14., they are disposed of in a landfill.

2.16 Further information

Further information at www.knaufceilingsolutions.com
DoPs at knaufamf-dop.com or
www.knaufarmstrong.com/dop.html

3. LCA: Calculation rules

3.1 Declared Unit

This EPD refers to a declared unit of 1 m² THERMATEX/ARMSTRONG Acoustic Range ceiling tiles with an average surface weight of 4,31 kg/m².

Deklarierte Einheit

Name	Value	Unit
Declared unit	1	m^2
Grammage	4.31	kg/m^2
conversion factor [Mass/Declared Unit]	4.31	-

The ceiling tiles are produced at the Knauf Ceiling Solutions production site in Grafenau, Germany under the brand names THERMATEX and ARMSTRONG.

Various types of mineral ceiling tiles are produced at the site. A differentiation between the product groups was made based on the recipe of the products. Acoustic products have common product components and are manufactured in different thicknesses. Acoustic panels are provided with a glass fleece coating. The calculation of the weighted average recipe and surface weight is based on the square meters produced of each product. Ensuring the correct representation of the average composition of the raw boards, the recipe of each of the products included in the average was performed.

3.2 System boundary

The life cycle assessment of average THERMATEX/ARMSTRONG Acoustic Range mineral ceiling tiles includes a cradle-to-gate analysis of the products' environmental impacts with modules (C1-C4 and D). Subsequent life cycle phases are part of the analysis:

Module A1–A3 | Production stage

The production stage includes the upstream burdens of raw material supply, their transports and the manufacturing plant of Knauf Ceiling Solutions located in Grafenau (Germany). Mineral ceiling tiles are produced in the wet-felt process. Main raw material inputs, therefore, refer to mineral wool, perlite, clay and starch. The production site is supplied with electricity from the German power grid and thermal energy from natural gas.

Module C1 | Deconstruction and demolition

Disassembly of the product is done either manually or using smaller tools. Referring energy demand is considered to be negligible.

Modul C2 | Transport to disposal

The transport to the disposal of the material is estimated declaring a 50 km radius to the landfill. In reality, this scenario may vary depending on the actual location of deconstruction and referring waste treatment.

Module C3 | Waste processing

The declared scenario assumes landfilling of the product. Referring environmental impacts are accounted for in module C4.

Module C4 | Disposal

Module C4 refers to the emissions from the disposal of the mineral ceiling tiles. The chosen scenario, therefore, includes the environmental burdens of landfilling of the product.

Module D | Benefits and loads beyond the system boundary
The declared scenario assumes landfilling of the product. Referring environmental impacts are accounted for in module C4.

3.3 Estimates and assumptions
Assumptions and approximations are applied in case of a lack of representative data. All assumptions and approximations are documented precisely and represent a best-guess representation of reality. In case of uncertainty, a conservative approach is chosen.

3.4 Cut-off criteria
The LCA model covers all available input and output flows, which can be represented based on robust data. Data gaps are filled with conservative assumptions from average data (when available) or with generic data and are documented accordingly. Only data with a contribution lower 1 % were cut off. Thus, no data were neglected, of which a substantial impact is to be expected. All relevant data were collected comprehensively. Cut-off material and energy flows were chosen carefully based on their expected quantitative contribution as well as potential environmental impacts. Thus, it can be assumed that the sum of all neglected input flows does not account for more than 5 % of the total material, water and energy flows.

3.5 Background data
This study uses generic background data for the evaluation of upstream environmental impacts from *GaBi* databases (*GaBi* 10; 2020.2).

3.6 Data quality
Data collection is based on product-specific questionnaires. It follows an iterative process clarifying questions via e-mail, telephone calls or in personal meetings. Intensive discussions between Knauf Ceiling Solutions and Daxner & Merl results in an accurate mapping of product-related material and energy flows. This leads to a high quality of foreground data collected. Data collection relies on a consistent process according to *ISO 14044*.

The weighted average was calculated based on the product-specific recipes and composition. Its representativity is considered to be good for 90% of the THERMATEX/ARMSTRONG Acoustic products.

The technological, geographical and time-related representativeness of the database was kept in mind when selecting background data. Whenever specific data were missing, either generic datasets or representative average data were used instead. The implemented *GaBi* background datasets refer to the latest versions available (not more than ten years old) and are carefully chosen.

3.7 Period under review
Foreground data were collected in the 2019 production year, and the data are based on the volumes produced on an annual basis.

3.8 Allocation
All information for the allocation of given material and energy flows is based on the site-related evaluations. The calculation of specific input quantities for the raw board production is based on the respective recipe. In addition, product-specific application rates (e.g. basecoat, top coat, glass fleece etc.) were available for the upscaling of referring input quantities. Total annual energy consumption and waste flows are allocated based on the production share of each product.

For in the production used waste paper, the system boundary is set after sorting. It is assumed that the end of waste status has been reached. Waste glass wool does not reach the end of waste status. The system boundary for secondary raw materials defined in *EN 15804* applies.

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 *GaBi* background database was used to calculatethe LCA.

4. LCA: Scenarios and additional technical information

Characteristic product properties
Information on biogenic Carbon
The biogenic carbon content quantifies the amount of biogenic carbon in the declared product.

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

Name	Value	Unit
Biogenic carbon content (in the product)	0,15	kg/m²
Stored carbon dioxide (in the product)	0,54	kg/m²

As the End-of-Life of the product packaging is not declared in module A5, its carbon uptake is not considered in module A1-A3.

Assembly (A5)
The End-of-Life of the product packaging is not declared in module A5.

Name	Value	Unit
Packaging (cardboard)	0,05	kg/m²
Packaging (pallets)	0,13	kg/m²
Packaging (shrink foil)	0,01	kg/m²
Packaging (stretch foil)	0,002	kg/m²

Reference service life

Name	Value	Unit
Declared product properties (at the gate) and finishes	Placing on the market according to EN 13964; see also document centre on the website knaufceilingsolutions.com	-
Design application parameters (if instructed by the manufacturer), including the references to the appropriate practices and application codes	See document centre on the website knaufceilingsolutions.com	-
Indoor environment (for indoor applications), e.g. temperature, moisture, chemical exposure	The load classes of ceiling tiles vary depending on the product, from a fluctuating relative humidity of 90 % at 30 °C up to 100 % at 30 °C, without corrosive impurities.	-
Usage conditions, e.g. frequency of use, mechanical exposure	No mechanical stress during conventional use	-
Maintenance e.g. required frequency, type and quality and replacement of components	As a rule, the ceiling tiles do not need to be cleaned for the duration of their use in normal application. However, the ceiling tiles can be cleaned dry, damp or with pressure according to the cleaning guideline.	-

End-of-Life (C1-C4)

Name	Value	Unit
Collected separately	4.31	kg
Landfilling	4.31	kg

5. LCA: Results

The following table contains the LCA results for a declared unit of 1 m² average THERMATEX/ARMSTRONG Acoustic Range mineral ceiling tiles with an average surface weight of 4,31 kg/m².

Disclaimer:
EP-freshwater: This indicator has been calculated as “kg P eq” as required in the characterization model (EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe; http://eplca.jrc.ec.europa.eu/LCDN/developerEF.xhtml)

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; ND = 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	ND	ND	ND	ND	MNR	MNR	MNR	ND	ND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1 m² THERMATEX/ARMSTRONG Acoustic Range mineral ceiling tiles (4,31 kg/m²)

Core Indicator	Unit	A1-A3	C1	C2	C3	C4	D
Global warming potential - total	[kg CO_2-Eq.]	5.08E+0	0.00E+0	1.30E-2	0.00E+0	6.03E-1	0.00E+0
Global warming potential - fossil fuels	[kg CO_2-Eq.]	5.64E+0	0.00E+0	1.29E-2	0.00E+0	6.54E-2	0.00E+0
Global warming potential - biogenic	[kg CO_2-Eq.]	-5.64E-1	0.00E+0	-2.15E-5	0.00E+0	5.38E-1	0.00E+0
GWP from land use and land use change	[kg CO_2-Eq.]	4.12E-3	0.00E+0	1.04E-4	0.00E+0	1.88E-4	0.00E+0
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	1.62E-10	0.00E+0	2.35E-18	0.00E+0	2.42E-16	0.00E+0
Acidification potential, accumulated exceedance	[mol H^+-Eq.]	2.10E-2	0.00E+0	4.36E-5	0.00E+0	4.69E-4	0.00E+0
Eutrophication, fraction of nutrients reaching freshwater end compartment	[kg PO_4-Eq.]	9.81E-5	0.00E+0	3.91E-8	0.00E+0	1.12E-7	0.00E+0
Eutrophication, fraction of nutrients reaching marine end compartment	[kg N-Eq.]	4.36E-3	0.00E+0	1.97E-5	0.00E+0	1.21E-4	0.00E+0
Eutrophication, accumulated exceedance	[mol N-Eq.]	6.57E-2	0.00E+0	2.20E-4	0.00E+0	1.33E-3	0.00E+0
Formation potential of tropospheric ozone photochemical oxidants	[kg NMVOC-Eq.]	8.86E-3	0.00E+0	3.87E-5	0.00E+0	3.66E-4	0.00E+0
Abiotic depletion potential for non-fossil resources	[kg Sb-Eq.]	1.40E-6	0.00E+0	1.04E-9	0.00E+0	5.87E-9	0.00E+0
Abiotic depletion potential for fossil resources	[MJ]	8.28E+1	0.00E+0	1.71E-1	0.00E+0	8.58E-1	0.00E+0
Water (user) deprivation potential, deprivation-weighted water consumption (WDP)	[m^3 world-Eq deprived]	1.94E-1	0.00E+0	1.25E-4	0.00E+0	6.85E-3	0.00E+0

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1 m² THERMATEX/ARMSTRONG Acoustic Range mineral ceiling tiles (4,31 kg/m²)

Indicator	Unit	A1-A3	C1	C2	C3	C4	D
Renewable primary energy as energy carrier	[MJ]	6.08E+0	0.00E+0	9.90E-3	0.00E+0	1.12E-1	0.00E+0
Renewable primary energy resources as material utilization	[MJ]	5.79E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Total use of renewable primary energy resources	[MJ]	1.19E+1	0.00E+0	9.90E-3	0.00E+0	1.12E-1	0.00E+0
Non-renewable primary energy as energy carrier	[MJ]	7.67E+1	0.00E+0	1.72E-1	0.00E+0	8.58E-1	0.00E+0
Non-renewable primary energy as material utilization	[MJ]	6.19E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Total use of non-renewable primary energy resources	[MJ]	8.29E+1	0.00E+0	1.72E-1	0.00E+0	8.58E-1	0.00E+0
Use of secondary material	[kg]	1.04E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Use of renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Use of non-renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Use of net fresh water	[m^3]	1.43E-2	0.00E+0	1.15E-5	0.00E+0	2.16E-4	0.00E+0

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1 m² THERMATEX/ARMSTRONG Acoustic Range mineral ceiling tiles (4,31 kg/m²)

Indicator	Unit	A1-A3	C1	C2	C3	C4	D
Hazardous waste disposed	[kg]	7.32E-6	0.00E+0	7.95E-9	0.00E+0	1.31E-8	0.00E+0
Non-hazardous waste disposed	[kg]	7.94E-1	0.00E+0	2.72E-5	0.00E+0	4.31E+0	0.00E+0
Radioactive waste disposed	[kg]	1.47E-3	0.00E+0	3.17E-7	0.00E+0	9.75E-6	0.00E+0
Components for re-use	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Materials for recycling	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Materials for energy recovery	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Exported electrical energy	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Exported thermal energy	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional:
1 m² THERMATEX/ARMSTRONG Acoustic Range mineral ceiling tiles (4,31 kg/m²)

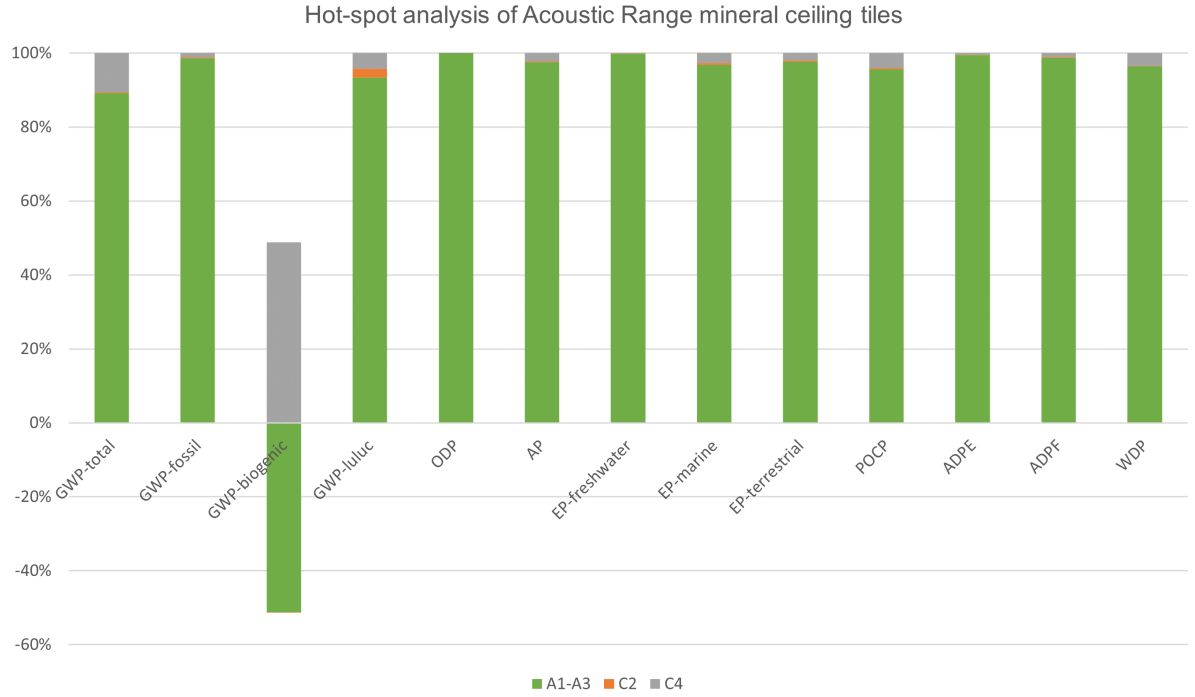
Indicator	Unit	A1-A3	C1	C2	C3	C4	D
Potential incidence of disease due to PM emissions	[Disease Incidence]	1.86E-7	0.00E+0	2.46E-10	0.00E+0	5.81E-9	0.00E+0
Potential Human exposure efficiency relative to U235	[kBq U235-Eq.]	1.90E-1	0.00E+0	4.67E-5	0.00E+0	1.00E-3	0.00E+0
Potential comparative toxic unit for ecosystems	[CTUe]	1.71E+1	0.00E+0	1.28E-1	0.00E+0	4.90E-1	0.00E+0
Potential comparative toxic unit for humans - cancerogenic	[CTUh]	3.09E-9	0.00E+0	2.65E-12	0.00E+0	7.26E-11	0.00E+0
Potential comparative toxic unit for humans - not cancerogenic	[CTUh]	7.35E-8	0.00E+0	1.52E-10	0.00E+0	8.00E-9	0.00E+0
Potential soil quality index	[-]	8.55E+1	0.00E+0	6.01E-2	0.00E+0	1.79E-1	0.00E+0

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 nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – 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 or as there is limited experience with the indicator.

6. LCA: Interpretation

The following interpretation contains a summary of the LCA results referenced to a functional unit of 1 m² average THERMATEX/ARMSTRONG Acoustic Range mineral ceiling tiles.



The comparison of the product's life cycle phases shows a clear dominance of the production phase (modules A1-A3) in all environmental impact categories. The potential environmental impacts from transport to disposal (module C2) and the End-of-Life of the products due to landfilling (module C4) have a minor contribution.

The direct emissions from the combustion of natural gas for the production process represent the main driver when it comes to potential climate change (GWP) as well as depletion of fossil resources (ADPF).

Also, the photo oxidant creation potential (POCP) is determined by direct emissions at site to a great extent. Potential acidification (AP), as well as terrestrial eutrophication (EP-terrestrial) are dominated by direct emissions from natural gas combustion, the upstream supply chain of stone wool as well as starch in equal parts. Potential eutrophication of marine ecosystems (EP-marine) is mainly affected by upstream emission from starch production and direct emissions at the site as well. When it comes to the eutrophication potential of freshwater (EP-freshwater) the share of the upstream supply chain of starch is even more

dominant than in the other impact categories. Potential water scarcity (WDP) is determined by the upstream supply chain of stone wool, starch and the electricity used.

The declared environmental impacts represent a weighted average of the THERMATEX/ARMSTRONG Acoustic product group. The analysis of the variance of the specific composition of the products within the group shows a good representativity of the results for 90 % of the production quantity. The environmental impacts of THERMATEX Acoustic/ARMSTRONG Perla products are potentially overrated. In contrast, THERMATEX Thermofon/Alpha/Alpha ONE, are potentially underrated.

7. Requisite evidence

7.1 Radioactivity

Measurements of radioactivity did not reveal any evidence of artificial radioactivity outside the natural background radiation.
Measuring point: *TÜV Süd Industrie Service*
Test Number: G 7078 001
Testing Date: 04.05.2015

7.2 Biopersistence

The mineral wool used for the production of the panels is biosoluble and, according to *EU Regulation 1272/2008/EC*, is to be assessed as free of suspected cancer. The "*RAL Mineral Wool Quality Seal*" monitors and guarantees the quality of the wool used.
The production and use of non-exempt fibres is prohibited by the *Ordinance on Hazardous Substances* and the *Chemicals Prohibition Ordinance*.

AgBB Overview (28 Days)

Name	Value	Unit
TVOC (C6 - C16)	< 5	µg/m³
Sum SVOC (C16 - C22)	< 5	µg/m³
R (dimensionless)	0	-
VOC without NIK	< 5	µg/m³
Carcinogenic Substances	< 1	µg/m³

7.3 VOC emissions

Measuring point: *Eurofins Product Testing A/S*
Test report: VOC emission test report Indoor Air Comfort GOLD (10.08.2018)
Number: 392-2018-00244703_EN
Testing periode: 06.07.2018-03.08.2018
Test basis: *ISO 16000-6*

AgBB Overview (28 days)

Name	Value	Unit
TVOC (C6 - C16)	< 5	µg/m^3
Sum SVOC (C16 - C22)	< 5	µg/m^3
R (dimensionless)	0	
VOC without NIK	< 5	µg/m^3
Carcinogenic substances	< 1	µg/m^3

8. References

Standards

DIN 18177
DIN 18177:2012, Mineral tiles manufactured in the factory by the wet felt process - Characteristic values and test methods.

EN 13501-1
DIN EN 13501-1:2019, Classification of construction products and building elements according to their reaction to fire, Part 1: Classification with the results of tests on the reaction to fire of construction products.

EN 13964
DIN EN 13964:2014, Suspended ceilings - Requirements and test methods.

EN 15804
DIN EN 15804:2012+A2:2019, Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products.

EN 16487
DIN EN 16487:2015-02, Acoustics - Test specifications for suspended ceilings - Sound absorption.

ISO 354
DIN EN ISO 354:2003-12, Acoustics - Measurement of sound absorption in reverberant rooms.

ISO 717-1
DIN EN ISO 717-1:2013-06, Acoustics - Assessment of sound insulation in buildings and of building elements - Part 1: Airborne sound insulation.

ISO 9001
DIN EN ISO 9001:2015-11,Quality management systems - Requirements.

ISO 10848-2
DIN EN ISO 10848-2:2006-08, Acoustics - Measurement of airborne and impact sound transmission between adjacent rooms in test stands - Part 2: Application to lightweight components where the connection has a minor influence.

ISO 11654
DIN EN ISO 11654:1997-07, Acoustics - Sound absorbers for use in buildings - Evaluation of sound absorption.

ISO 14001
DIN EN ISO 14001:2015-11, Environmental management systems - Requirements with guidance for use.

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

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

ISO 16000-6
ISO 16000-6:2011-12, Indoor air contaminants - Part 6: Determination of VOCs in indoor air and test chambers, sampling on Tenax TA®, thermal desorption and gas chromatography with MS/FID.

ISO 45001
DIN ISO 45001:2018-06, Occupational health and safety management systems - Requirements with guidance for use.

ISO 50001
DIN EN ISO 50001:2011-12, Energy management systems - Requirements with guidance for use.

Further References

AgBB
Ausschuss zur gesundheitlichen Bewertung von Bauprodukte (AgBB) (Committee for health-related evaluation of building products): Vorgehensweise bei der gesundheitlichen Bewertung der Emissionen von flüchtigen organischen Verbindungen (VOC und SVOC) aus Bauprodukten.

AVV, German List of Wastes Ordinance
Regulation on the European Waste List.

Chemicals Prohibition Ordinance
Chemicals Prohibition Ordinance (German designation: Chemikalien-Verbotsverordnung – ChemVerbotsV) of 20 January 2017 (Federal Law Gazette I p. 94; 2018 I p. 1389), last amended by Article 300 of the Ordinance of 19 June 2020 (Federal Law Gazette I p. 1328).

ECHA-candidate list
List of substances of very high concern (SVHC) for authorisation (ECHA Candidate List), 25.06.2020, published under Article 59(10) of REACH. Helsinki: European Chemicals Agency.

Eurofins Product Testing A/S
Test report: VOC emission test report Indoor Air Comfort GOLD (10.08.2018), Number: 392-2018-00244703_EN.

GaBi
GaBi 10, Software-System and Database for Life Cycle Engineering. DB v8.7 2020.2. Stuttgart, Echterdingen: thinkstep AG, 1992-2020. Available at: http://documentation.gabi-software.com.

Ordinance on Biocide Products
Regulation (EU) No 528/2012 of the European Parliament and of the Council of 22 May 2012 concerning the making available on the market and use of biocidal products.

Ordinance on Hazardous Substances
Ordinance on Hazardous Substances, of 26 November 2010 (Federal Law Gazette I p. 1643, 1644), last amended by Article 148 of the Law of 29 March 2017 (Federal Law Gazette I p. 626).

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

PCR Part A
Institut Bauen und Umwelt e.V. (IBU), 2019. Product Category Rules for Building-Related Products and Services. Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report. Version 1.8.

PCR: Mineral panels
Institut Bauen und Umwelt e.V. (IBU), 2019. Product Category Rules for Building-Related Products and Services. Part B: Requirements on the EPD for Mineral panels. Version 1.1. 10.12.2018.

RAL Mineral Wool Quality Seal
GGM members with the right to use the RAL quality mark including plants and fibre types, as of January 2021.

REACH
Regulation (EC) No 1907/2006 of the European Parliament and Council from 18 December 2006, Regulation concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH).

Regulation (EU) Nr. 305/2011(CPR)
Regulation (EU) No 305/2011 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 Text with EEA relevance.

Regulation (EU) Nr.1272/2008
Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006.

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