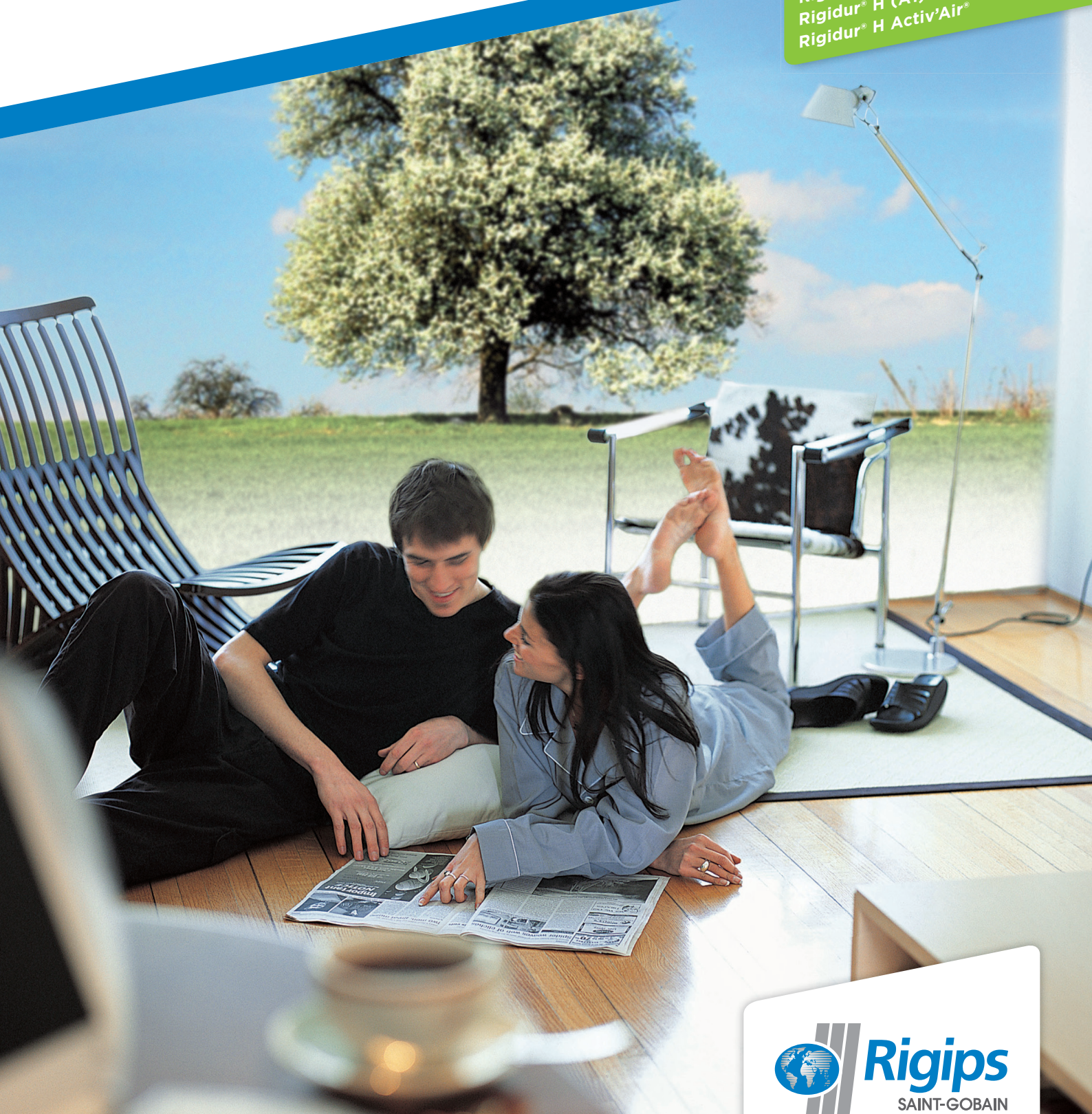


Environmental Product Declaration according to ISO 14025 and EN 15804

Product specific values for the calculation of the environmental impact of a building

Rigidur® H
Rigidur® H (A1)
Rigidur® H Activ'Air®



The Original. For space to live.

ENVIRONMENTAL PRODUCT DECLARATION

as per /ISO 14025/ and /EN 15804/

| | |
|--------------------------|---|
| Owner of the Declaration | Bundesverband der Gipsindustrie e.V. |
| Publisher | Institut Bauen und Umwelt e.V. (IBU) |
| Program holder | Institut Bauen und Umwelt e.V. (IBU) |
| Declaration number | EPD-BVG-SGR-20140069-IAG1-EN |
| Issue date | 15.11.2017 |
| Valid to | 19.08.2019 |

Rigidur Gypsum Fiber Boards Saint-Gobain Rigips GmbH

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



1. General Information

Bundesverband der Gipsindustrie e.V.

Programme holder

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

Declaration number

EPD-BVG-20140069-IAG1-EN

This Declaration is based on the Product Category Rules:

Plasterboard, 07.2014
(PCR tested and approved by the SVR)

Issue date

20.08.2014

Valid to

19.08.2019



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



Dr. Burkhardt Lehmann
(Managing Director IBU)

GYPSUM FIBREBOARDS IN ACCORDANCE WITH DIN EN 15283-2 OR ETA

Owner of the Declaration

Bundesverband der Gipsindustrie e.V.
Kochstraße 6-7
10969 Berlin

Declared product / Declared unit

Gypsum fibreboard in accordance with /DIN EN 15283-2/ or ETA /Construction Products Regulation/
1m² (10 kg)

Scope:

The EPD applies for all member companies of the Bundesverband der Gipsindustrie e.V. in accordance with the current list of members on www.gips.de and for products manufactured in Germany. The LCA considers specific information supplied by the manufacturers and suppliers of components exclusively for the cradle-to-gate production stage. This document is translated from the German Environmental Product Declaration into English. It is based on the German original version EPD-BVG-20140069-IAG1-DE. The verifier has no influence on the quality of the translation. 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



Dr.-Ing. Wolfram Trinius
(Independent verifier appointed by SVR)

2. Product

2.1 Product description

The declaration refers to gypsum fibreboard with a thickness of 12.5 mm and a surface weight of 10 kg/m².

2.2 Application

Gypsum fibreboards are used in dry interior applications, e.g. as metal stud walls (see Environmental System Declaration /IBU ESD-BVG-2013111-D/), studded wall partitions, ceiling panelling, dry floor screed or cavity floors / sheet-panelled access floors. They can be used in buildings for public, private or commercial applications.

2.3 Technical Data

Technical information is available in the information supplied by the manufacturers. Due to continuous updating of technical standards or approvals, such information is not listed within the framework of the Environmental Product Declaration.

Details on essential requirements can be taken from the CE mark and/or Declaration of Performance (Construction Products Regulation).

Up-to-date technical information can be requested from the following manufacturers:

Fermacell GmbH www.fermacell.de
Knauf Gips KG www.knauf.de
Saint-Gobain Rigips GmbH www.rigips.de

2.4 Placing on the market / Application rules

Regulation (EU) No. 305/2011 dated 9 March 2011 applies for placing on the market within the EU/EFTA. The products require a Declaration of Performance considering DIN EN 15283-2: 2009-12, Gypsum boards with fibrous reinforcement – Definitions, requirements and test methods – Part 2: Gypsum fibreboards; German version EN 15283-2:2008+A1:2009 /DIN EN 15283-2/

Use is governed by the respective national regulations.

2.5 Delivery status

Gypsum fibreboards can be supplied in various sizes considering standard dimensions and individual requirements.

Standard dimensions:

Thickness: 10 – 42 mm (depending on the production process)

Width: 1,000 – 1,260 mm

Length: 1,500 – 3,100 mm

Boards can be cut up to sizes of 2,540 x 6,080 mm deviating from standard dimensions.

2.6 Base materials / Ancillary materials

Gypsum fibreboards comprise gypsum and recycled paper fibres. These two raw materials are combined and, after adding water as the only binding agent, are

formed as boards and dried. The water binds the gypsum as well as penetrating and enveloping the fibres. This contributes to the high degree of stability and non-combustibility offered by gypsum fibreboards.

On account of their material composition, the boards can be used universally as construction and fire-protection panels in residential moisture-prone areas.

Gypsum fibreboards do not contain any substances which are hazardous to health. They do not emit any odours as they do not contain any glues.

They do not contain any substances > 0.1% by weight which are included in the "Candidate List of Substances of Very High Concern" (ECHA 2013).

2.7 Manufacture

The manufacturing process comprises the steps depicted in Figure 1.

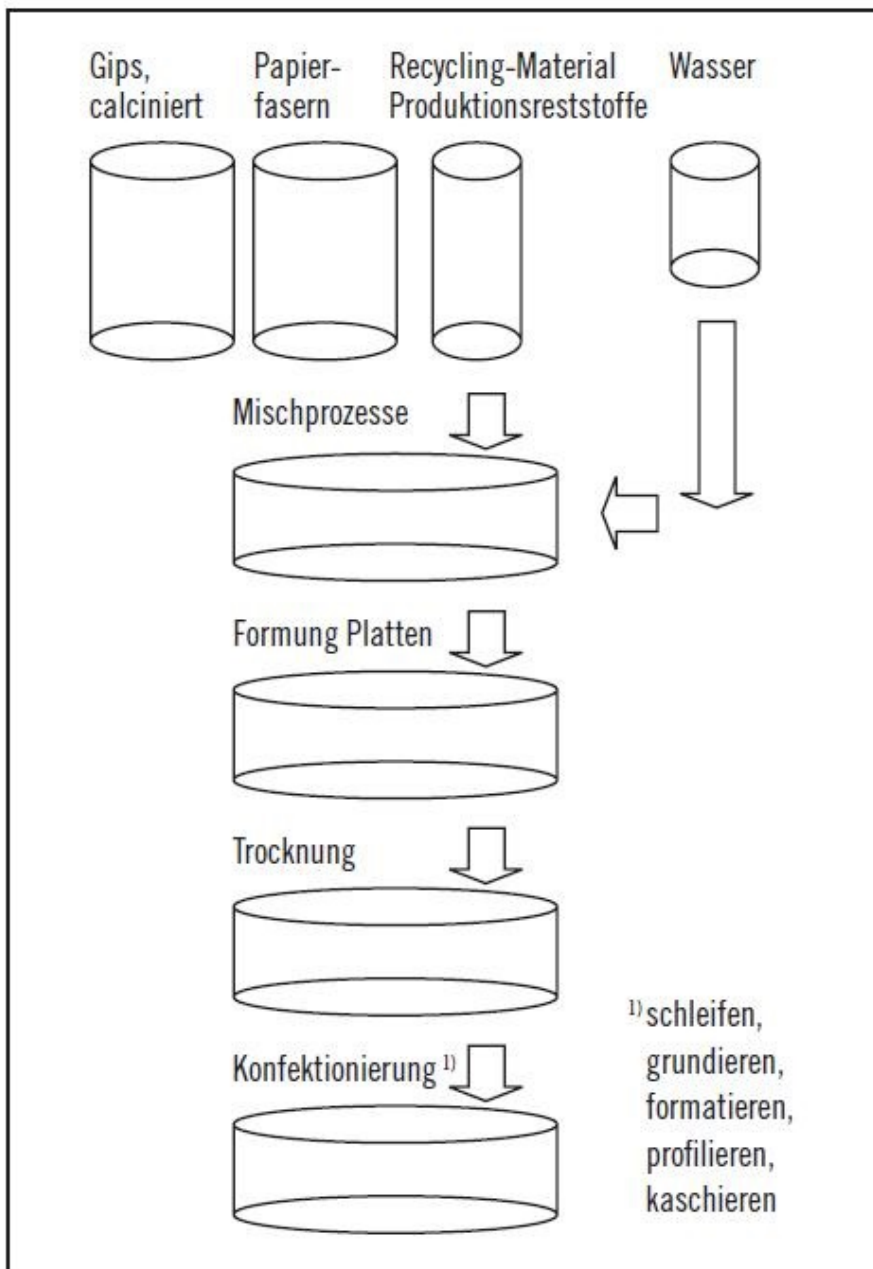


Fig. 1: Gypsum fibreboard manufacturing process in accordance with the /Gypsum Data Book/

[Legend]: [German] [English]
 Gips, calciniert Gypsum, calcined
 Papierfasern Paper fibres

Recycling-Material Produktionsreststoffe
 Production residue recycling material

Wasser Water
 Mischprozesse Mixing processes
 Formung Platten Forming boards
 Trocknung Drying
 Konfektionierung¹⁾ Packing ¹⁾

¹⁾schleifen, grundieren, formatieren, profilieren,
 kaschieren
¹⁾ grinding, priming, formatting, profiling, coating

The manufacturing companies implemented a Quality Management System and are certified according to DIN EN ISO 9001.

2.8 Environment and health during manufacturing

Gypsum fibreboards are manufactured in plants permitted by emission laws in accordance with the specifications of the Federal Immission Control Act. The plants implemented an Energy Management System in accordance with /DIN EN ISO 50001/. As of an aggregated rated thermal input of > 20 MW, gypsum plants are subordinated/subject to emissions trading.

2.9 Product processing/Installation

The products are processed in accordance with the relevant information leaflets issued by the Bundesverband der Gipsindustrie e.V. and the manufacturers.

During the cutting, sawing or grinding processes for gypsum products, the occupational exposure limit value of 6 mg/m³ alveolar dust (A-dust) must be observed for calcium sulphate as a time-weighted average; in accordance with TRGS 900 "Occupational Exposure Limit Values" (issued in January 2006, last amended and supplemented by GMBI 2012, p. 11 [No. 1]).

If necessary, dust-reducing measures or organisational measures must be taken which are oriented towards the /TRGS 559/ "Mineral Dust" (issued in February 2010) and the exposure categories outlined therein.

2.10 Packaging

Gypsum fibreboards are stored on pallets and delivered without packaging. The wooden pallets used are available as reusable or disposable pallets.

2.11 Condition of use

The useful life of the gypsum fibreboards for interior applications reviewed here generally complies with the overall useful life of the building. They are not subject to any exterior exposure.

2.12 Environment and health during use

During the use phase, no hazardous substances are emitted which exceed the limit values of the AgBB test scheme. Gypsum fibreboards have been tested by the Institut für Bauphysik /Scherer 2010/. The test result indicates that the gypsum fibreboards are not associated with any adverse effects on the interior.

2.13 Reference service life

Reference Service Lives depend on the respective applications. In accordance with the BBSR "Useful lives of components for LCAs in accordance with the Sustainable Building assessment system" of the BBSR, last revised 03.11.2011, this is > 50 years for walls as per code number 342.411 "Non-supporting interior partitions – Stud systems" (BBSR RSL).

There are no influences on ageing when the recognised rules of technology are applied.

Einflüsse auf die Alterung bei Anwendung nach den Regeln der Technik bestehen nicht.

2.14 Extraordinary effects

Fire

In accordance with EN 13501-1, gypsum fibreboards are generally classified as

A2-s1, d0

(s1 = no smoke, d0 = no flaming droplets/particles) in terms of their fire performance.

In accordance with DIN 4102-4, they are classified as construction product class A2, "non-combustible".

Water

Unless expressly designated by the manufacturer, all gypsum products must be protected from permanent humidity.

A leaflet is available from the Bundesverband der Gipsindustrie e.V. on restoration of components made of gypsum after flood damage /Flooding leaflet/.

Mechanical destruction

As a general rule, mechanical damage can be offset using jointing compound due to the ease of repair associated with the gypsum fibreboards and without any adverse effects on function.

Gypsum fibreboards can easily be replaced with new boards in the event of more extensive damage.

2.15 Re-use phase

Re-use

The gypsum fibreboards can not be re-used for the same application without undergoing some change. For the remaining re-uses/disposals, segregation of building materials on the building site is recommended.

Further use

After crushing, gypsum fibreboards can be re-used in agreement with the customer as recultivation material in mining areas, for recovery on landfills, as soil conditioner, fertiliser components or acceleration agent for cement taking consideration of any official specifications.

Recycling

After treatment in special recycling plants for gypsum waste, gypsum fibreboards can be added to the manufacturing process for new boards following crushing and separation from the paper fibres. Alternatively, the recycled gypsum can be used in the areas outlined for further use.

These recycling plants for gypsum waste also ensure that any screws or nails are removed by a magnetic separator.

Paper fibres removed in these plants can be used as a secondary fuel or directed to paper recycling; separated metals are recycled as scrap.

2.16 Disposal

Disposal in accordance with the waste code:

17 08 02 Gypsum-based construction materials other than those mentioned in 17 08 01.

Gypsum-based construction materials adhere to the disposal conditions from landfill class 1 of the Landfill Ordinance in the case of landfilling.

2.17 Further information

www.gips.de

3. LCA: Calculation rules

3.1 Declared Unit

Declared Unit

| Name | Value | Unit |
|---------------------------|-------|----------------|
| Declared unit | 1 | m ² |
| Conversion factor to 1 kg | 0.1 | - |

3.2 System boundary

The EPD refers to the production phase in accordance with DIN EN 15804, i.e. it comprises the manufacturing steps from the cradle to the factory gate.

Modules A1-A3 include the production of raw materials and transport thereof, the provision of energy and the manufacturing processes required for the production of all components for the gypsum fibreboard product.

3.3 Estimates and assumptions

Assumptions regarding transport were made for all materials required and for disposal.

3.4 Cut-off criteria

All components for manufacturing the gypsum fibreboards as well as all electricity and water required were 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 processes neglected would have contributed less than 5% to the impact categories under review.

3.5 Background data

The "GaBi 5" software system for comprehensive analysis developed by PE INTERNATIONAL AG

was used for modelling the production of all components (GaBi 5 2012).

The Life Cycle Assessment was modelled for Germany as a reference area. Consequently, apart from the production processes under these framework conditions, the upstream stages of relevance for Germany such as the provision of electricity or energy were also used. The electricity mix for Germany 2008 is used.

3.6 Data quality

All background data sets of relevance were taken from the GaBi 5 software data base.

3.7 Period under review

The data used by PE INTERNATIONAL AG complies with the current level of knowledge at the time of modelling the LCA in early 2013.

3.8 Allocation

Allocations were used in the background data for modelling the requisite components, e.g. for the provision of electricity. An allocation was avoided for the provision of FGD gypsum which is sometimes used for the production of calcium sulphate beta hemihydrate.

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.

4. LCA: Scenarios and additional technical information

Technical information on the application forms the basis for developing specific scenarios within the context of a building evaluation.

Such scenarios for gypsum fibreboards are already available, e.g. for single- or double-layer metal stud frames with gypsum fibreboards (IBU ESD-BVG-2013111-D).

On account of the great number of possible applications, no scenarios are developed within the framework of this cradle-to-gate declaration; instead, reference is made to the Environmental System Declarations available on gypsum fibreboards.

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 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 m² = 10 kg gypsum fibreboard

| Parameter | Unit | A1-A3 |
|--|---|----------|
| Global warming potential | [kg CO ₂ -Eq.] | 3.08 |
| Depletion potential of the stratospheric ozone layer | [kg CFC11-Eq.] | 3.90E-10 |
| Acidification potential of land and water | [kg SO ₂ -Eq.] | 4.07E-3 |
| Eutrophication potential | [kg (PO ₄) ³ -Eq.] | 6.98E-4 |
| Formation potential of tropospheric ozone photochemical oxidants | [kg ethene-Eq.] | 3.88E-4 |
| Abiotic depletion potential for non-fossil resources | [kg Sb-Eq.] | 1.45E-4 |
| Abiotic depletion potential for fossil resources | [MJ] | 47.33 |

RESULTS OF THE LCA - RESOURCE USE: 1 m² = 10 kg gypsum fibreboard

| Parameter | Unit | A1-A3 |
|--|-------------------|-------|
| Renewable primary energy as energy carrier | [MJ] | 1.84 |
| Renewable primary energy resources as material utilization | [MJ] | 0.00 |
| Total use of renewable primary energy resources | [MJ] | 1.84 |
| Non-renewable primary energy as energy carrier | [MJ] | 47.33 |
| Non-renewable primary energy as material utilization | [MJ] | 0.00 |
| Total use of non-renewable primary energy resources | [MJ] | 47.33 |
| Use of secondary material | [kg] | 5.68 |
| Use of renewable secondary fuels | [MJ] | 0.00 |
| Use of non-renewable secondary fuels | [MJ] | 0.00 |
| Use of net fresh water | [m ³] | 0.01 |

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES:

1 m² = 10 kg gypsum fibreboard

| Parameter | Unit | A1-A3 |
|-------------------------------|------|-------|
| Hazardous waste disposed | [kg] | 0.00 |
| Non-hazardous waste disposed | [kg] | 0.32 |
| Radioactive waste disposed | [kg] | 0.00 |
| 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 |

6. LCA: Interpretation

In calculating the LCA, a generic national raw material mix for gypsum is applied for the upstream chain in order to comply with the various levels of availability in the individual plants and the interchangeability and/or combination possibilities offered by raw gypsum. Gypsum can be procured as a raw material from nature or as a by-product from desulphurisation of coal-fired power stations (FGD gypsum). While all material and energy flows are considered for natural gypsum, the cut-off limit for FGD gypsum is represented by the expenses associated with the manufacture of FGD gypsum following desulphurisation (e.g. electricity consumption by the belt filter but not the use of limestone in the flue gas scrubber or the disposal of FGD waste water). Delivery to the gypsum plant is initially followed by the manufacture of calcium sulphate beta hemi-hydrate

(stucco) through combustion of the raw gypsum (calcination) below 180 °C. This stucco is then combined with waste paper and formed as boards. This process is followed by thermal removal of the excess moisture in a drier. Production significantly dominates the LCA impact categories due to the calcination of the raw gypsum associated with the consumption of fossil energy sources and drying the boards; these two sub-processes are responsible for approximately 70% of the GWP.

There is no scarcity of resources of the raw materials used, i.e. gypsum and waste paper. More than 90% of the ADPE is dominated by the use of natural gypsum for which the sulphur content of the earth's crust is applied as a criterion for calculating the Sb equivalent. As the LCA has been modelled from the cradle to the

factory gate, no credits are considered for possible

recycling of gypsum at the end of life.

7. Requisite evidence

7.1 Leaching (sulphate + heavy metals)

On analysis according to the Landfilling Ordinance, the product displays the sulphate concentration in the saturation range which is typical for gypsum (approx. 1500 mg/l), resulting in disposal options only from landfill class I upwards.

Gypsum is classified as a listed substance in Water Hazard Class 1 (slightly hazardous for water). Heavy metal content is significantly below the corresponding criteria for landfill class I.

Proper disposal in accordance with the parameters which can depend on use, sorting depth during deconstruction, collection (separately or together with other construction waste) and treatment, and must be determined by the waste producer responsible.

7.2 Radioactivity

The product can be used without restriction with overall dose contributions of significantly lower than 0.3 mSv/a, determined on the basis of the index calculation to RP 112 and the radon concentration (BFS report).

7.3 VOC emissions

The requirements in accordance with the AgBB test scheme, version 2008, are satisfied with regard to all existing test items (Scherer 2010):

TVOC 3 ≤ 10 mg/m³

Carcinogens 3 EU cat. 1 and 2 ≤ 0.01 mg/m³

TVOC 28 < 1.0 mg/m³

SVOC28 ≤ 0.1 mg/m³

Carcinogens 28 EU cat. 1 and 2 ≤ 0.001 mg/m³

Total VOC 28 excl. LCI ≤ 0.1 mg/m³

Total VOC incl. LCI R = Σ Ci/LC*i* < 1

8. References

Institut Bauen und Umwelt

Institut Bauen und Umwelt e.V., Berlin(pub.):
Generation of Environmental Product Declarations (EPDs);

General principles

for the EPD range of Institut Bauen und Umwelt e.V. (IBU), 2013/04
www.bau-umwelt.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

/Construction Products regulation/
Directive (EU) No. 305/2011 of the European Parliament and Council dated 9 March 2011 establishing harmonised conditions for marketing building products and replacing Council Guideline 89/106/EEC; ABI. EU L88/5 dated 4.4.2011

/BBSR Reference Service Life/

BBSR table "Service lives of components for LCA in accordance with BNB"
"Sustainable Building Information Portal" by the Federal Ministry of Transport, Building and Urban Affairs: <http://www.nachhaltigesbauen.de/baustoff-und-gebaeuedaten/nutzungsdauern-von-bauteilen.html>, last revised: 03.11.2011

/BfS report/

Natural radioactivity in construction materials and the ensuing radiation exposure
Field of radiation protection and environment

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Federal Office for Radiation Protection, Salzgitter, November 2012
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DIN 4102-4/A1:2004-11
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/DIN 4103-1/
DIN 4103-1:2014-03
Title (German): Internal non-loadbearing partitions – Part 1: Requirements and Requisite Evidence

/DIN 4103-4/
DIN 4103-4:1988-11
Title (German): Internal non-loadbearing partitions; Partitions with timber framing

/DIN EN ISO 9001/
DIN EN ISO 9001:2008-12 (D/E/F)
Quality management systems – Requirements (ISO 9001:2008); trilingual version EN ISO 9001:2008

/DIN EN 13501-1/
DIN EN 13501-1:2010-01
Title (German): Classification of building products and types by fire performance – Part 1: Classification with the results of tests on Reaction to Fire by construction products; German version EN 13501-1:2007 + A1:2009

/DIN EN 15804/
DIN EN 15804/A1:2013-05
Title (German): Sustainability of construction works – Environmental product declarations – Core rules for

the construction products product category; German
version EN 15804:2012/FprA1:2013

/DIN EN ISO 50001/
DIN EN ISO 50001:2011-12
Environmental management systems – Requirements
with guidance for use (ISO 50001:2011)

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European Chemicals Agency (ECHA)
Candidate List of Substances of Very High Concern for
Authorisation (published in accordance with Article
59(10) of the REACH Regulation)
<http://echa.europa.eu/de/candidate-list-table>, last
revised: 20 June 2013

/GaBi 5 2012/
GaBi 5: Software and data base for comprehensive
analysis, LBP, University of Stuttgart and PE
International
GaBi 5 documentation
<http://documentation.gabi-software.com/> (2012)

/Gypsum Data Book/
Gypsum Data Book
Pub.: Bundesverband der Gipsindustrie e. V.
Kochstrasse 6–7, 10969 Berlin
Published on: www.gips.de (section: Publications /
Books), last revised: May 2013

/Flooding Leaflet/

Removing damage caused by flooding to components
made of gypsum or gypsum plaster
BVG Information Service No. 01
Published on: www.gips.de (section: Download,
Publications, Information services), last revised: June
2013

/Scherer 2010/
Fraunhofer-Institut für Bauphysik IBP, Holzkirchen
Test report
Cross-sectional study on the emission potential of
volatile organic compounds from gypsum components
and gypsum products for interior applications (July
2010)
Published on: www.gips.de (section: Research
association, Projects, 2010)

/IBU ESD-BVG-2013111-D/
Environmental System Declaration in accordance with
ISO 14025 and EN 15804
Metal stud walls with gypsum plasterboards / gypsum
fibreboards
Declaration number ESD-BVG-2013111-D
Bundesverband der Gipsindustrie e.V.
Pub.: Institut Bauen und Umwelt (IBU), 14.01.2013

TRGS 900 "Occupational limit values" (issued January
2006, last amended and supplemented GMBI 2012, p.
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TRGS 559 "Mineral dust" (issued February 2010)

**Publisher**

Institut Bauen und Umwelt e.V.
Panoramastr. 1
10178 Berlin
Germany

Tel +49 (0)30 3087748- 0
Fax +49 (0)30 3087748- 29
Mail info@bau-umwelt.com
Web www.bau-umwelt.com

**Programme holder**

Institut Bauen und Umwelt e.V.
Panoramastr 1
10178 Berlin
Germany

Tel +49 (0)30 - 3087748- 0
Fax +49 (0)30 – 3087748 - 29
Mail info@bau-umwelt.com
Web www.bau-umwelt.com

**PE INTERNATIONAL****Author of the Life Cycle Assessment**

PE INTERNATIONAL AG
Hauptstraße 111
70771 Leinfelden-Echterdingen
Germany

Tel +49 (0)711 34817-0
Fax +49 (0)711 341817-25
Mail info@pe-international.com
Web www.pe-international.com

**Owner of the Declaration**

Bundesverband der Gipsindustrie e.V.
Kochstraße 6-7
10969 Berlin
Germany

Tel +49 (0)30 31169822-0
Fax +49 (0)30 31169822-9
Mail info@gips.de
Web www.gips.de

Saint-Gobain Rigips GmbH

Headquarters
Schanzenstrasse 84
40549 Duesseldorf
Germany

Phone +49 (0) 211 5503-0
Fax +49 (0) 211 5503-208

info@rigips.de
rigips.de



Export Team

Saint-Gobain Rigips GmbH
Schanzenstrasse 84
40549 Duesseldorf
Germany

exportde@saint-gobain.com
rigips.de
rigitone.com

Further Information:



rigips.de

