

# ENVIRONMENTAL SYSTEM DECLARATION

in accordance with ISO 14025 and EN 15804

Declaration holder	Bundesverband der Gipsindustrie e.V.
Publisher	Institut Bauen und Umwelt (IBU)
Programme holder	Institut Bauen und Umwelt (IBU)
Declaration number	ESD-BVG-2013111-EN
Issue date	14.01.2013
Valid until	13.01.2018

**Metal stud partitions with gypsum plasterboards / gypsum fibreboards**  
**Bundesverband der Gipsindustrie e.V.**

[www.bau-umwelt.com](http://www.bau-umwelt.com)



Institut Bauen  
und Umwelt e.V.



## 1 General information

### Bundesverband der Gipsindustrie e.V.

#### Programme holder

IBU – Institut Bauen und Umwelt e.V.  
 Rheinufer 108  
 D-53639 Königswinter

#### Declaration number

ESD-BVG-2013111-EN

#### This Declaration is based on the Product Category Rules:

PCR Part B: Requirements on the EPD for partition systems, 2013-01  
 (PCR tested and approved by the independent Committee of Experts (CoE))

#### Issue date

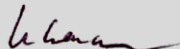
14.01.2013

#### Valid until

13.01.2018



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



Prof. Dr.-Ing. Hans-Wolf Reinhardt  
 (Chairman of the Committee of Experts (CoE))

### Metal stud partitions with gypsum plasterboards / gypsum fibreboards

#### Holder of the Declaration

Bundesverband der Gipsindustrie e.V.  
 Kochstrasse 6-7  
 D-10969 Berlin

#### Declared product/unit

Metal stud partitions 3m x 6m (18 m<sup>2</sup>) with  
 gypsum plasterboards / gypsum fibreboards

#### Area of applicability

This ESD applies for metal stud partitions with gypsum plasterboards and gypsum fibreboards. The consumer data on which the products for the declared metal stud partitions are based involve specific values for the declared partitions. The technical data was taken from up-to-date information supplied by the manufacturers on components for metal stud partitions.

This document is translated from the German Environmental Product Declaration into English. It is based on the German original version ESD-BVG-2013111-DE. The verifier has no influence on the quality of the translation.

#### Verification

The CEN DIN EN 15804 standard serves as the core PCR.

Verification of the EPD by an independent third party as per ISO 14025

internal  external

Dr.-Ing. Wolfram Trinius  
 (Independent auditor appointed by the Committee of Experts (CoE))

## 2 Product

### 2.1 Product description

The declaration covers 4 variants of metal stud partitions featuring single- or double-layer gypsum plasterboards or gypsum fibreboards which are 12.5 mm thick. 60 mm mineral wool is used as insulation material between the metal studs. Connection seal, jointing compound, dry-wall screws and nail plugs are included in the declaration for the partitions.

The set-up is described as follows:

- metal studs CW 75
- channel profiles UW 75
- 60 mm mineral wool insulating material

and

- cladding on each side of the partition:

partition 1) 1 x 12.5 mm gypsum plasterboard  
 partition 2) 2 x 12.5 mm gypsum plasterboards  
 partition 3) 1 x 12.5 mm gypsum fibreboard  
 partition 4) 2 x 12.5 mm gypsum fibreboards

### 2.2 Application

The constructions referred to are used as non-load-bearing interior partitions in buildings for public, private or commercial applications.

### 2.3 Technical data

Technical data on the respective partition structures is available in the information supplied by the manufacturers. Due to continuous updating of technical standards for individual components of the system, such information is not listed within the framework of the Environmental System Declaration.

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

**Danogips** GmbH + Co. KG    www.danogips.de  
**Fermacell** GmbH    www.fermacell.de  
**Knauf Gips** KG    www.knauf.de  
**Siniat** GmbH    www.siniat.de  
**Saint-Gobain Rigips** GmbH    www.rigips.de

### 2.4 Placing on the market / Application rules

*Standard(s) for interior partitions*

DIN 4103-1 "Internal non-loadbearing partitions; requirements, testing"

### 2.5 Delivery status

All of the components required for the partition structure are available individually.

A compilation of all requisite materials in one shipment is possible via the building materials trade or companies in the gypsum industry.

The products supplied can be used for setting up partitions of various formats and surface qualities. A partition with the dimensions W x H = 6 m x 3 m (A = 18 m<sup>2</sup>) is used for the Declaration which is filled in accordance with surface quality level Q2 (compound seams without reinforcing strips).

## 2.6 Base materials / Auxiliaries

Base materials / Auxiliaries do not lead to a hazardous labelling requirement for gypsum plasterboards, gypsum fibreboards, metal studs, connection profiles, screws or jointing compound.

Contents exceeding 0.1% by weight of substances of very high concern are not declared for any of the components used (ECHA 2011).

All manufacturers of gypsum plasterboards, gypsum fibreboards, jointing compound and mineral wool also offer data sheets in the form of safety data sheets even where products or mixtures are involved for which safety data sheets are not legally required due to a lack of hazardous labelling requirement.

## 2.7 Manufacture

Partitions are completed on the building site. First of all, the frame profiles (UW profiles) with connection seal are cut to size if necessary and secured to the supporting structure using screws or nails (stud gun). Then the upright profiles (CW profiles) are cut to size as necessary and inserted in the profiles loosely or crimped using a set of profile connecting pliers. The gypsum plasterboards / gypsum fibreboards are cut as required and secured to one side of the profiles in single or double layers using dry-wall screws or nails and taking consideration of the clearances specified by the manufacturer. Once one side is complete, the insulating material is cut on site and fitted between the profiles. After insulation is complete, the other side is clad similar to the first side (single- or double-layer) using gypsum plasterboards or gypsum fibreboards. The surfaces are filled (joints and securing materials) using jointing compound in accordance with quality level Q2.

The surface weight of the gypsum plasterboards / gypsum fibreboards is 10 kg/m<sup>2</sup>. Single-layer partitions weigh approx. 440 kg/partition or 24 kg/m<sup>2</sup> while double-layer partitions weigh approx. 800 kg/partition or 45 kg/m<sup>2</sup>.

With regard to the manufacturing process for gypsum plasterboards, reference is made to the Environmental Product Declaration available from the Bundesverband der Gipsindustrie e.V. (Gypsum EPD 2009) while mineral wool is covered by the EPD for glass wool at IBU (EPD-SDT-2012112-2012).

## 2.8 Environment and health during manufacturing

During the cutting, sawing or grinding processes for gypsum products, the occupational exposure limit value of 6 mg/m<sup>3</sup> 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 should be provided for based on TRGS 559 "Mineral dust" (issued in February 2010) and the exposure categories outlined there.

Materials required by the declared metal stud partitions made of gypsum plasterboard				
Product	Single-layer		Double-layer	
	Plasterboard (12.5 mm)	36.0 m <sup>2</sup>	360 kg	72.0 m <sup>2</sup>
Metal studs CW 75	32.4 m	27.0 kg	32.4 m	27.0 kg
Channel profiles UW 75	14.4 m	10.3 kg	14.4 m	10.3 kg
Nail plugs (6*40 mm)	28.8 pce.	0.12 kg	28.8 pce.	0.12 kg
Connection seal	21.6 m	0.78 kg	21.6 m	0.78 kg
Mineral wool (60 mm)	18.0 m <sup>2</sup>	32.4 kg	18.0 m <sup>2</sup>	32.4 kg
Dry-wall screw TN 25 mm	360 pce.	0.52 kg	144 pce.	0.21 kg
Dry-wall screw TN 35 mm			360 pce.	0.68 kg
Jointing compound	10.8 kg	10.8 kg	17.6 kg	17.6 kg

Materials required by the declared metal stud partitions made of gypsum fibreboard				
Product	Single-layer		Double-layer	
	Gypsum fibreboard (12.5 mm)	36.0 m <sup>2</sup>	360 kg	72.0 m <sup>2</sup>
Metal studs CW 75	32.4 m	27.0 kg	32.4 m	27.0 kg
Channel profiles UW 75	14.4 m	10.3 kg	14.4 m	10.3 kg
Nail plugs (6*40 mm)	28.8 pce.	0.12 kg	28.8 pce.	0.12 kg
Connection seal	21.6 m	0.78 kg	21.6 m	0.78 kg
Mineral wool (60 mm)	18.0 m <sup>2</sup>	32.4 kg	18.0 m <sup>2</sup>	32.4 kg
Dry-wall screw 30 mm	360 pce.	0.76 kg	144 pce.	0.30 kg
Dry-wall screw 40 mm			360 pce.	0.94 kg
Jointing compound	7.2 kg	7.2 kg	9.4 kg	9.4 kg

## 2.9 Product processing / Installation

Products are processed in accordance with the relevant leaflets of the Bundesverband der Gipsindustrie e.V. and the manufacturers as outlined in section 2.7.

## 2.10 Packaging

Plasterboards/Fibreboards are stored on pallets and delivered without packaging. The wooden pallets are available as reusable or disposable pallets. The metal stud profiles are delivered loose and bundled. Mineral wool is delivered in rolls and packaged in plastic foil. Packaging is disposed of via a return system. Jointing compound is provided as bagged goods. Building material sacks are directed to paper recycling via a return system. Screws and other small parts are offered in cardboard boxes or other small packages as well as loose. Delivery to the construction site is by truck.

## 2.11 Condition of use

The useful life of the non-load-bearing interior partitions assessed here complies with the overall useful life of the building. They are not subject to any exterior exposure.

The partitions can be plastered, tiled, wallpapered or painted on completion. These subsequent interior wall coatings are not considered but they do protect the underlying partition structure from most ambient influences.

The partition structures can be pulled down for the purpose of modifying the layout, e.g. for adapting or converting the building within the supporting structures or for subsequent insertion of doors or breakthroughs. These changes exclusively initiated by the user are not considered here.

## 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. As an example, partition 1 was tested by the Fraunhofer Institut für Bauphysik (Scherer 2010), albeit using impregnated gypsum plasterboards with higher contents of organic substances and without metal studs. The test result indicates that the constructions are not associated with any adverse effects on the interior.

## 2.13 Reference service life

The Reference Service Life in accordance with the BBSR "Nutzungsdauern von Bauteilen für Lebenszyklusanalysen nach dem Bewertungssystem Nachhaltiges Bauen (BNB)" (Useful lives of components for LCAs in accordance with the Sustainable Building evaluation system (BNB)) table, last revised 03.11.2011, amounts to  $\geq 50$  years for all walls listed here in accordance with code number 342.411 "Nichttragende Innenwände – Ständersysteme" (Non-load-bearing interior partitions – Stud systems).

## 2.14 Extraordinary effects

### Fire

In accordance with EN 1350-1, gypsum plasterboards with an impermeable surface and gypsum fibreboards are generally classified as **A2-s1, d0** (**s1** = no smoke, **d0** = no flaming droplets/particles) with regard to their fire performance.

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

### Water

All gypsum products must be protected from permanent moisture penetration unless expressly designated by the manufacturer for this purpose. This also applies for the wall structures outlined here.

A leaflet is available from the Bundesverband der Gipsindustrie e.V. on remedying damage to components made of gypsum following flooding (Flooding leaflet).

### Mechanical destruction

As a general rule, mechanical damage can be compensated for using jointing compound thanks to the ease of repair associated with gypsum plasterboards or gypsum fibreboards without impairing their functional use. In the case of larger damage, gypsum plasterboards or gypsum fibreboards can be replaced by new boards without altering the underlying studs/insulation.

## Re-use phase

### Re-use

The wall structures can not be re-used for the same application without undergoing some change.

Segregation by gypsum plasterboard / gypsum fibreboard, insulation and metal is recommended on site for any other applications involving re-use or disposal.

### Further use

Mineral wool insulating material can be re-used for other insulating applications without necessitating any changes. Mineral wool insulating material can, for example, be re-used as so-called "stuffing wool".

In agreement with the customer, gypsum materials can be used after crushing as recultivation material in mining areas, for use on landfills, as soil conditioner, fertiliser components or acceleration agents for cement, taking consideration of any official specifications.

### Recycling

The galvanised sheet metal used for metal studs and channel profiles can be directed to the metal recycling circuit.

If available according to type, mineral wool insulating material can be redirected to the manufacturing process.

After treatment in special recycling plants for gypsum waste, gypsum products can be added to the manufacturing process for new boards directly after crushing or additional separation from the cardboard. 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. Separated cardboard can be used as a secondary fuel or directed to the paper recycling circuit while separated metal is recycled as scrap.

## 2.15 Disposal

Waste code numbers in category 17 Construction and demolition waste:

For the support system including connection profiles and screws:

17 04 05 Iron and steel

For mineral wool insulating material:

17 06 04 Insulating materials other than those mentioned in 17 06 01 and 17 06 03

For plasterboards/fibreboards including jointing compound:

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

All of the waste referred to here adheres to the disposal conditions from landfill class 1 of the Landfill Ordinance in the event of landfilling.

## 2.16 Further information

[www.gips.de](http://www.gips.de)

### 3 LCA: Calculation rules

#### 3.1 Declared unit

The Declaration refers to metal stud partitions measuring  $W \times H = 6 \text{ m} \times 3 \text{ m}$  ( $A = 18 \text{ m}^2$ ) which are filled in accordance with surface quality level Q2 (compound seams without reinforcing strips).

#### 3.2 System boundary

Type of ESD: cradle to grave

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 metal stud partitions made from plasterboards or fibreboards.

Transport of the components to the building site is included in Module A4 while setting up the partition, including the disposal of packaging is covered by Module A5. Demolition of the partitions as well as recycling and disposal of the materials is included in Module C. Credits attributable to disposal and recycling are allocated to Module D.

#### 3.3 Estimates and assumptions

Assumptions were made as regards transport associated with all materials required and disposal.

#### 3.4 Cut-off criteria

All components for setting up the metal stud partitions as well as the electricity and water required for setting up 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 ignored would have contributed less than 5% to the impact categories under review.

#### 3.5 Background data

“GaBi 5” – the software system for comprehensive analysis (GaBi 5 2012) developed by PE INTERNATIONAL AG – was used for modelling the production of all components.

The Life Cycle Assessment was drawn up for Germany as a reference area. This means that apart from the production processes under these boundary conditions, the pre-stages also of relevance for Germany such as provision of electricity or energy carriers were used. The power mix for Germany 2008 is applied.

#### 3.6 Data quality

All of the background data records of relevance for manufacturing were taken from the GaBi 5 software data base.

#### 3.7 Period under review

The data basis for materials required for the declared partitions is taken from the manufacturer descriptions in 2011/2012.

#### 3.8 Allocation

No allocations arise for the unit process concerning installation of the metal stud partitions in buildings modelled in this ESD. 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-hemi-hydrate.

#### 3.9 Comparability

As a general rule, EPD/ESD data can only be compared or evaluated when all the data to be compared has been recorded in accordance with DIN EN 15804 and the building context or product-specific performance characteristics are considered.

### 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 within the context of a building assessment.

#### Transport to site (A4)

A distance of 200 km was assumed for transporting all components of the metal stud partitions by truck.

#### Construction installation process (A5)

The metal stud partitions are largely installed manually. The gypsum plasterboards / gypsum fibreboards are mounted to the metal studs using cordless screwdrivers requiring approx. 0.1 kWh for the declared partition measuring  $W \times H = 6 \text{ m} \times 3 \text{ m}$  ( $A = 18 \text{ m}^2$ ). Water consumption corresponds with approx. 0.5 l/kg jointing compound.

A generic distance of 50 km plus an empty run of 50 km were assumed for the packaging material to be disposed of.

Disposable pallets made of wood were considered as packaging material for the gypsum plasterboards / gypsum fibreboards and paper sacks for the jointing compound. Incineration in a waste incineration plant was assumed for disposal of the wooden pallets. No further treatment was assumed for the

waste paper; it can be used directly for the production of cardboard for the gypsum plasterboards or directly for the gypsum fibreboards. No other packaging was considered.

#### Use (B)

The Reference Service Life for the partition walls is  $\geq 50$  years. Use is not declared in this ESD as no negative environmental impacts are generally incurred by use of the declared partitions.

#### End of Life (C1-C4)

Transport: 50 km (one run at 100% utilisation capacity plus one empty run)

It is assumed that the metal profiles are completely directed to a metal recycling process. The mineral components (gypsum plasterboards, gypsum fibreboards, jointing compound and mineral wool) as well as the screws are deposited in a building debris landfill. Screws are only separated from the gypsum plasterboards during the process of gypsum recycling (please also refer to the gypsum recycling scenario).

The connection seal is incinerated in a waste incineration plant.

Due to standard breakthroughs in partition structures (e.g. frames, doors) or deviating partition sizes, up to 5% of the waste volume is created during installation in the building. As there is no difference in the disposal scenarios for both stages, the ESD which applies for full partition structure of defined measurements does not consider the environmental impacts of any waste incurred during installation until the disposal stage.

### Re-use, recovery and recycling potential (D)

A credit is awarded for the recycled metal profiles. Credits are also considered for electricity and thermal energy as a result of thermal recovery of packaging materials as well as subsequent insulation.

### Gypsum recycling scenario

For the gypsum recycling scenario, it was assumed that 10% of gypsum waste (gypsum plasterboards, gypsum fibreboards and jointing compound) is directed to a gypsum recycling process.

## 5 LCA: Results

The following tables depict the results of the indicators for environmental impact, use of resources and waste, as well as any other output flows relating to the declared partitions measuring W x H = 6 m x 3 m (A = 18 m<sup>2</sup>).

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN THE 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	Manufacture	Transport to site	Construction-installation process	Use / Application	Maintenance	Repairs	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction	Transport	Waste treatment	Landfilling	Re-use, recovery or 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	MND	MND	MND	MND	MND	X	X	X	X	X

Key to the following tables:

GWP	Global warming potential
ODP	Ozone depletion potential
AP	Acidification potential of soil and water
EP	Eutrication potential
POCP	Photochemical ozone creation potential
ADPE	Abiotic depletion potential for non-fossil resources
ADPF	Abiotic depletion potential for fossil fuels
PERE	Renewable primary energy as energy carrier
PERM	Renewable primary energy resources as material utilisation
PERT	Total use of renewable primary energy resources
PENRE	Non-renewable primary energy as energy carrier
PENRM	Non-renewable primary energy as material utilisation
PENRT	Total use of non-renewable primary energy resources
SM	Use of secondary materials
RSF	Renewable secondary fuels
NRSF	Use of non-renewable secondary fuels
FW	Net use of fresh water
HWD	Hazardous waste for disposal
NHWD	Non-hazardous waste for disposal
RWD	Radioactive waste for disposal
CRU	Components for re-use
MFR	Materials for recycling
MER	Materials for energy recovery
EE	Exported energy per type

**LCA RESULTS – ENVIRONMENTAL IMPACT: metal stud partition with gypsum plasterboards, single-layer, 18 m<sup>2</sup>**

Parameter	Unit	A1-3	A4	A5	C1	C2	C3	C4	D
GWP	[kg CO <sub>2</sub> equiv.]	224.0	4.3	7.3	0.0	1.5	1.8	32.1	-62.2
ODP	[kg CFC11 equiv.]	3.36E-07	1.21E-10	5.07E-10	0.00E+00	8.08E-11	3.78E-11	5.31E-09	2.06E-09
AP	[kg SO <sub>2</sub> equiv.]	5.40E-01	1.77E-02	7.56E-04	0.00E+00	6.68E-03	9.64E-05	3.53E-02	-2.20E-01
EP	[kg PO <sub>4</sub> <sup>3</sup> equiv.]	7.39E-02	4.45E-03	1.49E-04	0.00E+00	1.61E-03	2.04E-05	7.19E-03	-1.79E-02
POCP	[kg ethene equiv.]	6.83E-02	-7.12E-03	4.79E-05	0.00E+00	-2.39E-03	1.14E-05	1.08E-02	-3.30E-02
ADPE	[kg Sb equiv.]	1.23E-02	1.03E-07	6.50E-08	0.00E+00	6.88E-08	9.38E-09	2.04E-06	-2.41E-06
ADPF	[MJ]	3326.7	31.0	2.0	0.0	20.7	0.2	76.6	-749.0

**LCA RESULTS – ENVIRONMENTAL IMPACT: metal stud partition with gypsum plasterboards, single-layer, 18 m<sup>2</sup>**

Parameter	Unit	A1-3	A4	A5	C1	C2	C3	C4	D
PERE	[MJ]	205.2	-	-	-	-	-	-	-
PERM	[MJ]	0	-	-	-	-	-	-	-
PERT	[MJ]	205.2	1.2	0.3	0.0	0.8	0.0	5.9	-1.2
PENRE	[MJ]	3487.8	-	-	-	-	-	-	-
PENRM	[MJ]	34.9	-	-	-	-	-	-	-
PENRT	[MJ]	3522.7	31.2	2.4	0.0	20.8	0.2	80.1	-728.9
SM	[kg]	232.2	-	-	-	-	-	-	-
RSF	[MJ]	0	0	0	0	0	0	0	0
NRSF	[MJ]	0	0	0	0	0	0	0	00
FW	[m <sup>3</sup> ]	126.0	0.1	0.3	0.0	0.1	0.0	3.8	5.4

**LCA RESULTS – ENVIRONMENTAL IMPACT: metal stud partition with gypsum plasterboards, single-layer, 18 m<sup>2</sup>**

Parameter	Unit	A1-3	A4	A5	C1	C2	C3	C4	D
HWD*	[kg]	- (*)	- (*)	- (*)	- (*)	- (*)	- (*)	- (*)	- (*)
NHWD	[kg]	826.0	0.2	0.6	0.0	0.1	0.0	409.0	-428.0
RWD	[kg]	7.53E-02	4.40E-05	1.69E-04	0.00E+00	2.94E-05	1.26E-05	1.42E-03	8.73E-03
CRU	[kg]	-	-	-	-	-	0	-	-
MFR	[kg]	-	-	-	-	-	34.7	-	-
MER	[kg]	-	-	-	-	-	0.581	-	-
EE [electricity]	[MJ]	-	-	10.37	-	-	3.48-	2.39	-
EE [steam]	[MJ]	-	-	25.04	-	-	8.39	0	-

\* In accordance with the transition solution of 4.10.2012 approved by the CoE

**LCA RESULTS – ENVIRONMENTAL IMPACT: metal stud partition with gypsum plasterboards, double-layer, 18 m<sup>2</sup>**

Parameter	Unit	A1-3	A4	A5	C1	C2	C3	C4	D
GWP	[kg CO <sub>2</sub> equiv.]	305.1	7.4	9.1	0.0	2.8	1.8	54.3	-63.0
ODP	[kg CFC11 equiv.]	4.09E-07	2.06E-10	6.66E-10	0.00E+00	1.48E-10	3.78E-11	9.82E-09	1.23E-10
AP	[kg SO <sub>2</sub> equiv.]	6.57E-01	3.03E-02	9.82E-04	0.00E+00	1.22E-02	9.64E-05	6.66E-02	-2.21E-01
EP	[kg PO <sub>4</sub> <sup>3-</sup> equiv.]	1.03E-01	7.58E-03	1.93E-04	0.00E+00	2.95E-03	2.04E-05	1.20E-02	-1.80E-02
POCP	[kg ethene equiv.]	8.02E-02	-1.21E-02	6.15E-05	0.00E+00	-4.37E-03	1.14E-05	1.90E-02	-3.31E-02
ADPE	[kg Sb equiv.]	1.84E-02	1.76E-07	8.45E-08	0.00E+00	1.26E-07	9.38E-09	3.88E-06	-2.47E-06
ADPF	[MJ]	4548.6	52.9	2.6	0.0	37.9	0.2	145.1	-759.7

**LCA RESULTS – ENVIRONMENTAL IMPACT: metal stud partition with gypsum plasterboards, double-layer, 18 m<sup>2</sup>**

Parameter	Unit	A1-3	A4	A5	C1	C2	C3	C4	D
PERE	[MJ]	282.7	-	-	-	-	-	-	-
PERM	[MJ]	0	-	-	-	-	-	-	-
PERT	[MJ]	282.7	2.1	0.3	0.0	1.5	0.0	11.2	-2.1
PENRE	[MJ]	4765.1	-	-	-	-	-	-	-
PENRM	[MJ]	34.9	-	-	-	-	-	-	-
PENRT	[MJ]	4800.0	53.1	3.2	0.0	38.1	0.2	151.8	-741.2
SM	[kg]	438.5	-	-	-	-	-	-	-
RSF	[MJ]	0	0	0	0	0	0	0	0
NRSF	[MJ]	0	0	0	0	0	0	0	0
FW	[m <sup>3</sup> ]	160.0	0.2	0.4	0.0	0.1	0.0	7.3	4.5

**LCA RESULTS – ENVIRONMENTAL IMPACT: metal stud partition with gypsum plasterboards, double-layer, 18 m<sup>2</sup>**

Parameter	Unit	A1-3	A4	A5	C1	C2	C3	C4	D
HWD*	[kg]	- (*)	- (*)	- (*)	- (*)	- (*)	- (*)	- (*)	- (*)
NHWD	[kg]	941.0	0.3	0.8	0.0	0.2	0.0	783.0	-430.0
RWD	[kg]	9.78E-02	7.50E-05	2.22E-04	0.00E+00	5.38E-05	1.26E-05	2.70E-03	8.08E-03
CRU	[kg]	-	-	-	-	-	0	-	-
MFR	[kg]	-	-	-	-	-	34.7	-	-
MER	[kg]	-	-	-	-	-	0.581	-	-
EE [electricity]	[MJ]	-	-	12.62	-	-	3.48	2.39	-
EE [steam]	[MJ]	-	-	30.49	-	-	8.39	0	-

\* In accordance with the transition solution of 4.10.2012 approved by the CoE



**LCA RESULTS – ENVIRONMENTAL IMPACT: metal stud partition with gypsum fibreboards, single-layer, 18 m<sup>2</sup>**

Parameter	Unit	A1-3	A4	A5	C1	C2	C3	C4	D
GWP	[kg CO <sub>2</sub> equiv.]	263.1	4.0	7.3	0.0	1.5	1.8	31.9	-62.2
ODP	[kg CFC11 equiv.]	3.88E-07	1.12E-10	5.06E-10	0.00E+00	8.02E-11	3.78E-11	5.27E-09	2.06E-09
AP	[kg SO <sub>2</sub> equiv.]	5.69E-01	1.65E-02	7.55E-04	0.00E+00	6.62E-03	9.64E-05	3.51E-02	-2.20E-01
EP	[kg PO <sub>4</sub> <sup>3-</sup> equiv.]	7.06E-02	4.13E-03	1.49E-04	0.00E+00	1.60E-03	2.04E-05	7.14E-03	-1.79E-02
POCP	[kg ethene equiv.]	7.21E-02	-6.61E-03	4.78E-05	0.00E+00	-2.37E-03	1.14E-05	1.08E-02	-3.30E-02
ADPE	[kg Sb equiv.]	1.15E-02	9.57E-08	6.48E-08	0.00E+00	6.83E-08	9.38E-09	2.02E-06	-2.41E-06
ADPF	[MJ]	3872.7	28.8	2.0	0.0	20.6	0.2	75.9	-749.0

**LCA RESULTS – ENVIRONMENTAL IMPACT: metal stud partition with gypsum fibreboards, single-layer, 18 m<sup>2</sup>**

Parameter	Unit	A1-3	A4	A5	C1	C2	C3	C4	D
PERE	[MJ]	204.7	-	-	-	-	-	-	-
PERM	[MJ]	0	-	-	-	-	-	-	-
PERT	[MJ]	204.7	1.1	0.3	0.0	0.8	0.0	5.8	-1.2
PENRE	[MJ]	3985.1	-	-	-	-	-	-	-
PENRM	[MJ]	34.9	-	-	-	-	-	-	-
PENRT	[MJ]	4078.1	28.9	2.4	0.0	20.6	0.2	79.4	-728.9
SM	[kg]	232.2	-	-	-	-	-	-	-
RSF	[MJ]	0	0	0	0	0	0	0	0
NRSF	[MJ]	0	0	0	0	0	0	0	0
FW	[m <sup>3</sup> ]	152.0	0.1	0.3	0.0	0.1	0.0	3.8	5.4

**LCA RESULTS – ENVIRONMENTAL IMPACT: metal stud partition with gypsum fibreboards, single-layer, 18 m<sup>2</sup>**

Parameter	Unit	A1-3	A4	A5	C1	C2	C3	C4	D
HWD*	[kg]	- (*)	- (*)	- (*)	- (*)	- (*)	- (*)	- (*)	- (*)
NHWD	[kg]	876.0	0.2	0.6	0.0	0.1	0.0	406.0	-428.0
RWD	[kg]	9.34E-02	4.08E-05	1.69E-04	0.00E+00	2.91E-05	1.26E-05	1.41E-03	8.73E-03
CRU	[kg]	-	-	-	-	-	0	-	-
MFR	[kg]	-	-	-	-	-	34.7	-	-
MER	[kg]	-	-	-	-	-	0.581	-	-
EE [electricity]	[MJ]	-	-	10.37	-	-	3.48	2.39	-
EE [steam]	[MJ]	-	-	25.04	-	-	8.39	0	-

\* In accordance with the transition solution of 4.10.2012 approved by the CoE

**LCA RESULTS – ENVIRONMENTAL IMPACT: metal stud partition with gypsum fibreboards, double-layer, 18 m<sup>2</sup>**

Parameter	Unit	A1-3	A4	A5	C1	C2	C3	C4	D
GWP	[kg CO <sub>2</sub> equiv.]	382.7	7.3	9.1	0.0	2.7	1.8	53.9	-63.0
ODP	[kg CFC11 equiv.]	5.11E-07	2.04E-10	6.65E-10	0.00E+00	1.47E-10	3.78E-11	9.72E-09	1.23E-10
AP	[kg SO <sub>2</sub> equiv.]	7.15E-01	3.00E-02	9.80E-04	0.00E+00	1.21E-02	9.64E-05	6.60E-02	-2.21E-01
EP	[kg PO <sub>4</sub> <sup>3-</sup> equiv.]	9.66E-02	7.51E-03	1.92E-04	0.00E+00	2.92E-03	2.04E-05	1.19E-02	-1.80E-02
POCP	[kg ethene equiv.]	8.76E-02	-1.20E-02	6.13E-05	0.00E+00	-4.33E-03	1.14E-05	1.88E-02	-3.31E-02
ADPE	[kg Sb equiv.]	1.69E-02	1.74E-07	8.40E-08	0.00E+00	1.25E-07	9.38E-09	3.84E-06	-2.47E-06
ADPF	[MJ]	5633.8	52.4	2.6	0.0	37.6	0.2	143.6	-759.7

**LCA RESULTS – ENVIRONMENTAL IMPACT: metal stud partition with gypsum fibreboards, double-layer, 18 m<sup>2</sup>**

Parameter	Unit	A1-3	A4	A5	C1	C2	C3	C4	D
PERE	[MJ]	281.4	-	-	-	-	-	-	-
PERM	[MJ]	0	-	-	-	-	-	-	-
PERT	[MJ]	281.4	2.1	0.3	0.0	1.5	0.0	11.1	-2.1
PENRE	[MJ]	5938.3	-	-	-	-	-	-	-
PENRM	[MJ]	34.9	-	-	-	-	-	-	-
PENRT	[MJ]	5973.2	52.6	3.2	0.0	37.7	0.2	150.3	-741.2
SM	[kg]	438.2	-	-	-	-	-	-	-
RSF	[MJ]	0	0	0	0	0	0	0	0
NRSF	[MJ]	0	0	0	0	0	0	0	0
FW	[m <sup>3</sup> ]	212.0	0.2	0.4	0.0	0.1	0.0	7.2	4.5

**LCA RESULTS – ENVIRONMENTAL IMPACT: metal stud partition with gypsum fibreboards, double-layer, 18 m<sup>2</sup>**

Parameter	Unit	A1-3	A4	A5	C1	C2	C3	C4	D
HWD*	[kg]	- (*)	- (*)	- (*)	- (*)	- (*)	- (*)	- (*)	- (*)
NHWD	[kg]	1040.0	0.3	0.8	0.0	0.2	0.0	775.0	-430.0
RWD	[kg]	1.34E-01	7.43E-05	2.22E-04	0.00E+00	5.32E-05	1.26E-05	2.67E-03	8.08E-03
CRU	[kg]	-	-	-	-	-	0	-	-
MFR	[kg]	-	-	-	-	-	34.7	-	-
MER	[kg]	-	-	-	-	-	0.581	-	-
EE [electricity]	[MJ]	-	-	12.62	-	-	3.48	2.39	-
EE [steam]	[MJ]	-	-	30.49	-	-	8.39	0	-

\* In accordance with the transition solution of 4.10.2012 approved by the CoE

## 6 LCA: Interpretation

The use of non-renewable primary energy (PENRT) is dominated by the manufacturing phase for individual products required for setting up the metal stud partitions (Modules A1-A3). Without consideration of the credit, the manufacture of gypsum plasterboards, gypsum fibreboards, metal profiles and mineral wool for the respective partitions accounts for approx. 90-95% of the use of non-renewable primary energy and the respective impact categories (GWP, ODP, AP etc.). The only exception is formed by the Eutrophication Potential impact category which is determined by approx. 80% by the manufacture of the components referred to above. The remaining 20% is essentially attributable to landfilling of the mineral components (gypsum plasterboards, gypsum fibreboards, jointing compound and mineral wool) as well as transport of the components to the building site. The production of other components for the metal partitions (screws, plugs, jointing compound, connection insulation) accounts for approx. 2-2.5% of overall PENRT. The share accounted for

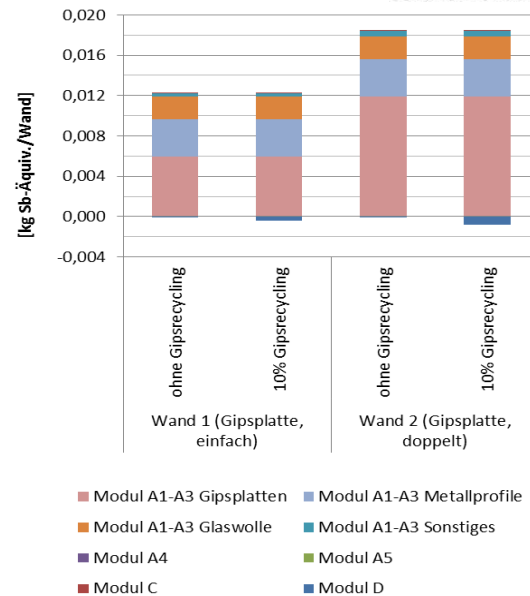
by all other impact categories is between 1 and 3%. At a distance of 200 km, transporting the components to the building site accounts for less than 1% of PENRT. Transport to the building site accounts for approx. 2% of the Global Warming Potential and 4% of the Eutrophication Potential. Installation of the metal stud partitions accounts for approx. 0.8% of total GWP and < 0.2% of all other impact categories and the use of primary energy. Waste treatment, primarily landfilling of mineral components, accounts for 16% of the total Eutrophication Potential of single-layer metal stud partitions. The share of GWP accounted for is 8% (6% of AP and 5% of POCP). The credits awarded primarily for recycled metal profiles reduce the PENRT by 19%. The credit reduces POCP by 46% (AP by 32%, GWP by 24%, ADPF by 21%, EP by 16%).

In the case of double-layer partitions, the share accounted for by gypsum plasterboard production in total PENRT and the impact categories increases significantly. Overall, the use of non-renewable primary energy by double-layer partitions is approx.

38% higher than for single-layer partitions. The values are similar for most of the impact categories. The POCP only increases by 14% as it is more significantly determined by the manufacture of metal profiles.

### Gypsum recycling scenario

The results for the gypsum recycling scenario indicate that for all impact categories, with the exception of ADPE, there are only very minor differences ( $\pm 0.5\%$ ) compared to modelling with 100% landfilling of gypsum waste. In the case of ADPE, taking consideration of the credit for gypsum gives rise to a 3.4% lower ADPE for single-layer partitions and a 4.5% lower ADPE for double-layer partitions.



[Legend:]

[kg Sb-Äquiv./Wand]	[kg Sb equiv./partition]
0,020	0.020
0,016	0.016
0,012	0.012
0,008	0.008
0,004	0.004
0,000	0.000
-0,004	-0.004
Wand 1 (Gipsplatte, einfach)	Partition 1 (gypsum plasterboard, single-layer)
ohne Gipsrecycling	without gypsum recycling
10% Gipsrecycling	10% gypsum recycling
Wand 2 (Gipsplatte, doppelt)	Partition 2 (gypsum plasterboard, double-layer)
ohne Gipsrecycling	without gypsum recycling
10% Gipsrecycling	10% gypsum recycling
Modul A1-A3 Gipsplatten	Modules A1-A3 gypsum plasterboards
Modul A1-A3 Glaswolle	Modules A1-A3 glass wool
Modul A4	Module A4
Modul C	Module C
Modul A1-A3 Metallprofile	Modules A1-A3 metal profiles
Modul A1-A3 Sonstiges	Modules A1-A3 other
Modul A5	Module A5
Modul D	Module D

## 7 Requisite evidence

The requirements of the AgBB test scheme, version 2008, are complied with in terms of all existing test items (Scherer 2010):

<b>TVOC<sub>3</sub></b>	$\leq 10 \text{ mg/m}^3$
<b>Carcinogens<sub>3</sub> EU cat. 1 and 2</b>	$\leq 0.01 \text{ mg/m}^3$
<b>TVOC<sub>28</sub></b>	$< 1.0 \text{ mg/m}^3$

<b>SVOC<sub>28</sub></b>	$\leq 0.1 \text{ mg/m}^3$
<b>Carcinogens<sub>28</sub> EU cat. 1 and 2</b>	$\leq 0.001 \text{ mg/m}^3$
<b>Total VOC<sub>28</sub> excl. LCI</b>	$\leq 0.1 \text{ mg/m}^3$
<b>Total VOC incl. LCI <math>R = \sum C_i/LCI_i</math></b>	$< 1$

## 8 References

### General principles:

Institut Bauen und Umwelt e.V., Königswinter (pub.): Drawing up Environmental Product Declarations (EPD); General principles for the EPD range of Institut Bauen und Umwelt e.V. (IBU), 2011-06, www.bau-umwelt.de

### Product Category Rules for Building Products:

**PCR guidelines for building products and building-related services**

Institut Bauen und Umwelt e.V., Königswinter (pub.): **PCR Part A:** Calculation rules for the LCA and requirements on the background report, 2011-07

**PCR Part B:** Requirements on the EPD for partition systems, 2013-01, www.bau-umwelt.de

### Standards:

**DIN 4103-1:**1984-07, Internal non-load-bearing partitions; requirements, testing

**DIN EN ISO 14025:**2011-10, Environmental labels and declarations – Type III environmental declara-

tions – Principles and procedures (ISO 14025:2006); German and English versions EN ISO 14025:2011

**DIN EN 15804:**2012-04, Sustainability of buildings – Environmental declarations for products – Basic rules for the construction products product category; German version EN 15804:2012

**ECHA (European Chemicals Agency):** List of Substances of Very High Concern (SVHC), <http://echa.europa.eu/web/guest/identification-of-svhc>, December 2012

#### **EPD Gypsum**

Bundesverband der Gipsindustrie e.V., Forschungsvereinigung der Gipsindustrie e.V.: Environmental Product Declarations for gypsum products, Darmstadt, 2009; <http://www.gips.de/service/download/umwelt/umwelt-produktdeklarationen/>

#### **EPD-SDT-2012112-D**

Schwenk Dämmtechnik GmbH & Co. KG: climowool und Schwenk Glaswolle, ESD-SDT-2012112-D, Institut Bauen und Umwelt e.V., 2012

#### **GaBi software & documentation**

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

**Bundesverband der Gipsindustrie e.V.** Removing damage caused by flooding to components made of gypsum or gypsum plaster, Darmstadt

**C. Scherer, S. Mair:** Cross-sectional study on the emission potential of volatile organic compounds from gypsum components and gypsum products for interior applications, Fraunhofer Institut für Bauphysik IBP, Valley 2010

 <p>Institut Bauen und Umwelt e.V.</p>	<p><b>Publisher</b> Institut Bauen und Umwelt e.V. Rheinufer 108 53639 Königswinter Germany</p> <p>Tel. +49 (0)2223 296 679-0 Fax +49 (0)2223 296 679-1 E-mail <a href="mailto:info@bau-umwelt.com">info@bau-umwelt.com</a> Web <a href="http://www.bau-umwelt.com">www.bau-umwelt.com</a></p>
 <p>Institut Bauen und Umwelt e.V.</p>	<p><b>Programme owner</b> Institut Bauen und Umwelt e.V. Rheinufer 108 53639 Königswinter Germany</p> <p>Tel. +49 (0)2223 296 679-0 Fax +49 (0)2223 296 679-1 E-mail <a href="mailto:info@bau-umwelt.com">info@bau-umwelt.com</a> Web <a href="http://www.bau-umwelt.com">www.bau-umwelt.com</a></p>
	<p><b>Declaration holder</b> Bundesverband der Gipsindustrie e.V. Kochstrasse 6-7 10969 Berlin Germany</p> <p>Tel. +49 (0)30 3116 9822-0 Fax +49 (0)30 3116 9822-9 E-mail <a href="mailto:info@gips.de">info@gips.de</a> Web <a href="http://www.gips.de">www.gips.de</a></p>
 <p><b>PE INTERNATIONAL</b></p>	<p><b>LCA auditor</b> PE INTERNATIONAL AG Hauptstrasse 111-113 70771 Leinfelden-Echterdingen Germany</p> <p>Tel. +49 (0)711 341 817-0 Fax +49 (0)711 341 817-25 E-mail <a href="mailto:info@pe-international.com">info@pe-international.com</a> Web <a href="http://www.pe-international.com">www.pe-international.com</a></p>