USG Danoline™ Borderless Wall and Ceiling Panels are glass fiber reinforced gypsum board with tapered edges and a perforated surface running to the border. The perforations can vary with different types of patterns and can be perforated by up to 19.6% by area to achieve varying levels of sound absorption. The back side is covered by an acoustic backer and the front side has a jobsite applied paint finish. The products can be mounted in interior installations as decorative wall and ceiling panels.

For over a century, sustainable practices have naturally been an inherent part of our business at USG. Today, they help shape the innovative products that become the homes where we live, the buildings where we work and the arenas where we play. From the product formulations we choose, to the processes we employ, USG is committed to designing, manufacturing, and distributing products that minimize overall environmental impacts and contribute toward a healthier living space. We believe that transparency of product information is essential for our stakeholders and EPDs are the next step toward an even more transparent USG. For additional information, visit usg.com, cgcinc.com and usgdesignstudio.com
This declaration is amended for the North American market from an EPD published by Knauf A/S on 2/25/16 for the European market using CEN Standard EN 15804 as the core PCR and the Institut Bauen und Umwelt e.V. (IBU) Plasterboard product system specific PCR. The Knauf Danoline™ Cleanoe Akustik product has been relabeled as USG Danoline™ Borderless Wall and Ceiling Panels for the North American (NA) marketplace.

This environmental product declaration (EPD) is in accordance with ISO 14025 and ISO 21930: 2007. EPDs rely on Life Cycle Assessment (LCA) to provide information on a number of environmental impacts of products over their life cycle. Exclusions: EPDs do not indicate that any environmental or social performance benchmarks are met, and there may be impacts that they do not encompass. LCAs do not typically address the site-specific environmental impacts of raw material extraction, nor are they meant to assess human health toxicity. EPDs can complement but cannot replace tools and certifications that are designed to address these impacts and/or set performance thresholds – e.g. Type 1 certifications, health assessments and declarations, environmental impact assessments, etc.

Accuracy of Results: EPDs regularly rely on estimations of impacts, and the level of accuracy in estimation of effect differs for any particular product line and reported impact. Comparability: EPDs are not comparative assertions and are either not comparable or have limited comparability when they cover different life cycle stages, are based on different product category rules or are missing relevant environmental impacts. EPDs from different programs may not be comparable.

<table>
<thead>
<tr>
<th>DECLARATION NUMBER</th>
<th>EPD 152</th>
</tr>
</thead>
</table>
| PROGRAM OPERATOR   | Original EPD: IBU - Institut Bauen und Umwelt e.V., Germany  
                      Current EPD: ASTM International – 100 Barr Harbor Drive, West Conshohocken, PA USA  www.astm.org |
| DECLARATION HOLDER | USG Corporation - 550 W. Adams St., Chicago, IL USA |
| DECLARED PRODUCT   | USG Danoline™ Borderless Wall and Ceiling Panels |
| REFERENCE PCR      | IBU Part B: Requirements on the EPD for Plasterboard PCR, v1.3, 04.07.2014 |
| DATE OF ISSUE      | 5/15/20 |
| DATE OF EXPIRATION | 8/20/20 |
| CONTENTS OF THE DECLARATION | This EPD is complete and contains the following:  
                      • Product System Documentation  
                      • Life Cycle Calculation Rules  
                      • Life Cycle Impact Assessment Results  
                      • LCA Interpretation  
                      • Additional Data  
                      • References |

This declaration was independently verified in accordance with ISO 14025 and ISO 21930:2007

☐ INTERNAL  ☒ EXTERNAL

Tim Brooke, ASTM International

This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:

Dr.-Ing. Wolfram Trinius  
(Independent verifier appointed by SVR)
1. Product System Documentation

1.1 Product Description and Product Identification

USG Danoline™ Borderless Wall and Ceiling Panels are glass fiber reinforced gypsum board with tapered edges and a perforated surface running to the border. The perforations can vary with different types of patterns and can be perforated by up to 19.6% by area to achieve varying levels of sound absorption. The back side is covered by an acoustic backer and the front side has a jobsite applied paint finish. The products can be mounted in interior installations as decorative wall and ceiling panels.

USG Danoline™ Borderless Wall and Ceiling Panels are mainly used as panels for improvements on room acoustics and sound insulation and/or individual surface design. USG Danoline™ Borderless Wall and Ceiling Panels can be used for panel heating or panel cooling systems.

1.2 Application

USG Danoline™ Borderless Wall and Ceiling Panels are gypsum board products with further processing. They are intended for use in walls or ceilings and can represent functional, aesthetic or decorative applications when installed individually as freestanding or suspended ceilings.

Square perforated gypsum board are referred to as gypsum board cassettes.

The holes can feature various designs, e.g. circular, perforations, slits, and sizes.

It can be used in buildings for public, private or commercial applications.
# Perforation

<table>
<thead>
<tr>
<th>Perforation Type</th>
<th>Perforation Percentage</th>
<th>Edge UFF Sizes</th>
</tr>
</thead>
<tbody>
<tr>
<td>G 6/18</td>
<td>8.7%</td>
<td>1188 x 1998 mm</td>
</tr>
<tr>
<td>G 8/18</td>
<td>13.5%</td>
<td>1188 x 1998 mm</td>
</tr>
<tr>
<td>G 10/23</td>
<td>14.8%</td>
<td>1196 x 2001 mm</td>
</tr>
<tr>
<td>G 12/25</td>
<td>18.1%</td>
<td>1200 x 2000 mm</td>
</tr>
<tr>
<td>G 15/30</td>
<td>19.6%</td>
<td>1200 x 1980 mm</td>
</tr>
<tr>
<td>G 8/18</td>
<td>19.8%</td>
<td>1188 x 1998 mm</td>
</tr>
<tr>
<td>G 12/25</td>
<td>23%</td>
<td>1200 x 2000 mm</td>
</tr>
<tr>
<td>G 8/12/50</td>
<td>13.1%</td>
<td>1200 x 2000 mm</td>
</tr>
<tr>
<td>G 12/20/66</td>
<td>19.6%</td>
<td>1188 x 1980 mm</td>
</tr>
</tbody>
</table>

*Some perforations can also be supplied with a SK or a MF edge. Exact panel sizes vary from module sizes according to edge type. Contact Knauf Danoline for more information.*
1.2 Product Technical Data

Technical information is available in the specific product data sheets under www.knauf.de.

The following technical data is relevant for the products covered by this EPD.

SURFACE: Untreated

DANISH INDOOR CLIMATE LABELING (DIM)

Indoor value: 10 days

Particle emission: low (< 0.75 mg)

CLEANING

Dust is removed using a dry duster or vacuum cleaner. Removal of marks depends on the paint used on site, although a damp cloth using normal cleaning practices and neutral cleaning solutions is normally suitable for minor marks. In the case of stubborn marks or if in doubt refer to the paint manufacturer’s recommendations.

LIGHT REFLECTION: Depends on the paint used on site.

AMBIENT CONDITIONS

The product is designed to perform under normal conditions of use. Tested at 90% RH and 30°C. The product can withstand ambient temperatures of up to 50°C.

LOAD-BEARING CAPACITY

2 / A / No load

2 / B / 30N

FIRE CLASS

A2-s1,d0

ROBUSTNESS

Made of robust, glass fibre reinforced material with excellent pressure resistance and can therefore be used on walls as well as ceilings. Under normal conditions of use, the product properties are preserved and there is no decomposition of material over time.

WEIGHT

Indicative tile weight: 8.30 – 9.00 kg/m².

All according to type of perforation and thickness.
1.3 Product Composition

The gypsum board used for the Knauf Danoline™ Borderless Wall and Ceiling Panels consist of calcium sulfate dihydrate, surrounded with paper. Gypsum core with graphite, zeolites and small quantities of starch and tenside as well as glass fibers for reinforcing the strength and an inorganic pigment. 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/.

1.4 Product Manufacture

The manufacture of the USG Danoline™ Borderless Wall and Ceiling Panels at the Iphofen, Germany plant is shown in the Figure 1. The process starts with the combining of the dry ingredients in a conveyer, feeding of this dry ingredient mixture into a mixer where these dry ingredients are mixed with water and wet additives. The resulting slurry is fed between two sheets of paper; facing paper (Manila) on the bottom and backing paper (Newsline) on the top. The wet gypsum board is allowed to hydrate after which the hard board is cut and transferred into a kiln for evaporation of excess water. After removal of the evaporative water, the board is cut to its final size, perforated, finished and end tapes are applied. Any gypsum board not meeting quality control specifications is recycled on-site.

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

1 Cardboard is fed in facing downwards forming the visible side of the panel and incised to form the edges
2-3 Addition of gypsum slurry which is spread in the forming station as the cardboard is fed in from above.
4-5 Setting section with shears for cutting
6-8 Turning table with input in a multi-level drier
9-11 Panel discharge with trimming of transverse edges and bundling
1.5 Environment and Health During Manufacturing
All appropriate equipment required by governmental regulations are in place at all Knauf manufacturing facilities.

1.6 Packaging
USG Danoline™ Borderless Wall and Ceiling Panels are stored on pallets and delivered without packaging. The wooden pallets used are available as reusable pallets.

1.7 Reference Service Life
The Reference Service Life is considered not to be relevant for this cradle-to-gate study.

1.8 Extraordinary effects

Fire
Gypsum boards offer outstanding fire protection with regard to their low density. This is due to the fact that the gypsum core contains approx. 20% water of crystallisation which evaporates when exposed to fire thereby consuming energy by means of conversion. The temperature on the side facing away from the fire remains constant at approx. 110 °C over a longer period of time depending on the board thickness. The resulting dehydrated gypsum layer offers increased thermal insulation.
Perforated gypsum board is generally classified as Class A when tested per ASTM E84.

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 /Floodling 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 board and without any adverse effects on function. Gypsum board can easily be replaced with new boards in the event of more extensive damage. No environmental consequences are to be anticipated in the event of unforeseen mechanical destruction.

2. LCA Calculation Rules 2.1 Declared Unit
The declared unit for this LCA study is 1m² of USG Danoline™ Borderless Wall and Ceiling Panels, from raw material extraction (A1) to the factory gate (A3).

<table>
<thead>
<tr>
<th>Declared Unit</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Declared Unit</td>
<td>1</td>
<td>m²</td>
</tr>
<tr>
<td>Conversion factor to 1 kg</td>
<td>0.1176</td>
<td>-</td>
</tr>
</tbody>
</table>
2.2 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 board product.

Table 1: Description of the system boundary modules

<table>
<thead>
<tr>
<th>PRODUCT STAGE</th>
<th>CONSTRUCTION PROCESS STAGE</th>
<th>USE STAGE</th>
<th>END OF LIFE STAGE</th>
<th>BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>A2</td>
<td>A3</td>
<td>A4</td>
<td>A5</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>MND</td>
<td>MND</td>
</tr>
</tbody>
</table>

2.3 Estimates and Assumptions

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

2.4 Cut-off Criteria

All components for manufacturing gypsum board 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.

2.5 Background Data

The "GaBi 5" software system for comprehensive analysis developed by PE INERNATIONAL 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.

2.6 Data Quality

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

2.7 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.

2.8 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.
2.9 Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to /EN 15804/ and the building context, respectively the product-specific characteristics of performance, are taken into account. The used background database has to be mentioned.

3. LCA Results

Technical information on the application forms the basis for developing specific scenarios within the context of a building evaluation. Such scenarios for gypsum board are already available, e.g. for single- or double-layer metal stud frames with gypsum board (IBU ESD-BVG-2013111-D).

3.1 Life Cycle Impact Assessment Results

Table 2: LCA Results for 1 Square Meter of USG Danoline™ Borderless Wall and Ceiling Panels

<table>
<thead>
<tr>
<th>Environmental Impact</th>
<th>Unit</th>
<th>A1-A3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global warming potential</td>
<td>kg CO₂ eq.</td>
<td>1.89</td>
</tr>
<tr>
<td>Depletion potential of the stratospheric ozone layer</td>
<td>kg CFC-11 eq.</td>
<td>2.15E-10</td>
</tr>
<tr>
<td>Acidification potential of land and water</td>
<td>kg SO₂ eq.</td>
<td>3.26E-03</td>
</tr>
<tr>
<td>Eutrophication potential</td>
<td>kg PO₄³⁻ eq.</td>
<td>7.50E-04</td>
</tr>
<tr>
<td>Formation potential of tropospheric ozone photochemical oxidants</td>
<td>kg C₂H₄ eq.</td>
<td>3.48E-04</td>
</tr>
<tr>
<td>Abiotic depletion potential for non-fossil resources</td>
<td>kg Sb eq.</td>
<td>1.36E-04</td>
</tr>
<tr>
<td>Abiotic depletion potential for fossil resources</td>
<td>MJ</td>
<td>30.1</td>
</tr>
</tbody>
</table>

Note: Life cycle impact assessment results are presented using the Leiden University Institute of Environmental Sciences (CML) methods, the default methods for the European market. The CML methods are identical to the global international market characterization methods with the exception of acidification potential (AP) and formation potential of tropospheric ozone photochemical oxidants (photochemical oxidant creation potential (POCP)) under Section 7.3 of ISO 21930:2017.
Table 3: Resource Use for 1 Square Meter of USG Danoline™ Borderless Wall and Ceiling Panels

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>A1-A3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renewable primary energy as energy carrier</td>
<td>MJ</td>
<td>2.40</td>
</tr>
<tr>
<td>Renewable primary energy resources as material utilization</td>
<td>MJ</td>
<td>0.00</td>
</tr>
<tr>
<td>Total use of renewable primary energy resources</td>
<td>MJ</td>
<td>2.40</td>
</tr>
<tr>
<td>Non-renewable primary energy as energy carrier</td>
<td>MJ</td>
<td>30.10</td>
</tr>
<tr>
<td>Non-renewable primary energy as material utilization</td>
<td>MJ</td>
<td>0.00</td>
</tr>
<tr>
<td>Total use of non-renewable primary energy resources</td>
<td>MJ</td>
<td>30.10</td>
</tr>
<tr>
<td>Use of secondary material</td>
<td>kg</td>
<td>4.52</td>
</tr>
<tr>
<td>Use of renewable secondary fuels</td>
<td>MJ</td>
<td>0.00</td>
</tr>
<tr>
<td>Use of non-renewable secondary fuels</td>
<td>MJ</td>
<td>0.00</td>
</tr>
<tr>
<td>Use of net fresh water</td>
<td>m³</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Table 4: Resource Use for 1 Square Meter of USG Danoline™ Borderless Wall and Ceiling Panels

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>A1-A3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hazardous waste disposed</td>
<td>kg</td>
<td>0.00</td>
</tr>
<tr>
<td>Non-hazardous waste disposed</td>
<td>kg</td>
<td>0.44</td>
</tr>
<tr>
<td>Radioactive waste disposed</td>
<td>kg</td>
<td>0.00</td>
</tr>
<tr>
<td>Components for re-use</td>
<td>kg</td>
<td>IND</td>
</tr>
<tr>
<td>Materials for recycling</td>
<td>kg</td>
<td>IND</td>
</tr>
<tr>
<td>Materials for energy recovery</td>
<td>kg</td>
<td>IND</td>
</tr>
<tr>
<td>Exported electrical energy</td>
<td>MJ</td>
<td>IND</td>
</tr>
<tr>
<td>Exported thermal energy</td>
<td>MJ</td>
<td>IND</td>
</tr>
</tbody>
</table>
4. **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 water and additives and applied between the cardboard sheets. 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 subprocesses are responsible for approximately 60% of the GWP.

There is no scarcity of the resources used, i.e. gypsum, cardboard made from waste paper and the additives used depending on the board type. Almost 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.

5. **Additional Data**

5.1 **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 responsible waste producer.

5.2 **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).

5.3 **VOC emissions**

USG certifies that the gypsum board products covered by this EPD when used in ceiling applications are Low-Emitting, defined as below the emissions of the concentrations for each individual volatile organic compound as specified in the Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions for Indoor Sources using Environmental Chambers Version 1.1 [CDPH/EHLB/Standard Method V1.1 (February 2010); chamber testing portion of CA Section 01350] and ASTM Guide D5116-06. Additional information can be obtained at USG.com, cgcinc.com and USGDesignStudio.com.
6. References

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

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

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


ISO 21930:2017 Sustainability in buildings and civil engineering works - Core rules for environmental product declarations of construction products and services.


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-undgebaeudedaten/ nutzungsduerenvon-bauteilen.html, last revised: 03.11.2011

Natural radioactivity in construction materials and the ensuing radiation exposure Field of radiation protection and environment K. Gehrcke, B. Hoffmann, U. Schkade, V. Schmidt, K. Wichterey; urn:nbn:de:0221-201210099810


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 14190:2005-11 Title (German): Gypsum board products from reprocessing - Definitions, requirements and test methods; German version EN 14190:2005

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


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

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

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)

TRGS 900 "Occupational limit values" (issued January 2006, last amended and supplemented GMBI 2012, p. 11 [No. 1])

TRGS 559 "Mineral dust" (issued February 2010)