# ENVIRONMENTAL PRODUCT DECLARATION

in accordance with ISO 14025 and EN 15804

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|---|---|
| Declaration holder | **TAIM e.V. - Verband Industrieller Metalldeckenhersteller (Association of Industrial Metal Ceiling Manufacturers)** |
| Publisher | Institut Bauen und Umwelt e.V. (IBU) |
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| Valid to | 11.11.2018 |

## Metal ceiling systems made of steel as cooling and heating ceilings

## TAIM e.V. - Verband Industrieller Metalldeckenhersteller (Association of Industrial Metal Ceiling Manufacturers)

Institut Bauen und Umwelt e.V.

TAIM

**www.bau-umwelt.com / https://epd-online.com**

# 1. General information

## TAIM e.V. - Verband Industrieller Metalldeckenhersteller (Association of Industrial Metal Ceiling Manufacturers)

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

**Declaration number**
EPD-TAI-20130183-ICG1-EN

**This Declaration is based on the Product Category Rules:**
Metal ceilings, 04-2013
(PCR tested and approved by the independent Expert Committee (SVA))

**Issue date**
11.11.2013

**Valid to**
11.11.2018

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

Dr. Burkhart Lehmann
(Managing Director IBU)

## Metal ceiling systems made of steel as cooling/heating ceilings

**Holder of the Declaration**
TAIM e.V.
Leostrasse 22
40545 Düsseldorf

**Declared product/unit**
The declared unit is 1 kg cooling/heating ceiling. The weight per area kg/m² is calculated for the specific product.

**Area of applicability:**
This Declaration applies to all production facilities of the TAIM e.V. members indicated on page 1. The data on which the LCA is based was recorded for the period January to December 2011.

Armstrong Metalldecken AG, www.armstrong.com
durlum GmbH, www.durlum.com
Geipel AG, www.geipel-genex.de
Lindner Group, www.Lindner-Group.com

The holder of the Declaration is liable for the information and evidence on which it is based; liability on the part of IBU in relation to manufacturer information, LCA data and evidence is excluded.

**Verification**

| |
|---|
| The CEN EN 15804 standard serves as the core PCR. |
| Verification of the EPD by an independent third party in accordance with ISO 14025 |
| ☐ internal ☒ external |

Dr.-Ing. Wolfram Trinius,
Independent auditor appointed by the SVA

# 2. Product

### 2.1 Product description
Cooling and heating ceiling systems are manufactured from folded or roll-formed steel as complete construction kits or as individual components. Metal pipes are integrated in the membrane, surrounded by heat-conducting profiles made of aluminium. Connections and water hoses are not a component of this EPD. The construction kit comprises the membrane component, including heating/cooling coil as well as the entire substructure for securing the metal ceiling system. The substructure made of steel can have various suspension heights and its design is governed by the form, functional requirements and weight of the membrane components.

### 2.2 Application
The metal ceiling systems made of steel outlined here are used in interior design as ceiling panels, square tiles or canopy ceilings, all functioning as cladding of the interior ceiling. In order for the cooling/heating ceiling to work, a connection is required to distributor lines and the water-conducting heat/cold circuit prepared on site. The product is manufactured in accordance with the respective customer's requirements.

### 2.3 Technical data
The following (construction) technical data in delivery status must be indicated with reference to the respective test standard if of relevance for the product declared.
The test standard for the membrane component and substructure is the EN 13964.
The test standard for cooling output is the EN 14240; heating output is established following EN 14037-2 with deviating water temperatures.

| Description | Value | Unit |
|---|---|---|
| Weight per area (min.) | 10 | kg/m² |
| Weight per area (max.) | 20 | kg/m² |

## 2.4 Placing on the market / Application rules

Regulation (EU) No. 305/2011 applies for placing on the European Union market. The products require a Declaration of Performance taking consideration of the harmonised EN 13964 and CE marking.
Use is governed by national guidelines.
Metal ceilings in accordance with the technical rules published by TAIM e.V. (THM) are connected to the above ceiling using hangers or a substructure or ceiling edge trim profile directly secured to supporting structure with space in between. As they are not exposed to any external weathering influences, they are suspended ceilings for interior applications in accordance with EN 13964.

## 2.5 Delivery status

The metal ceiling systems, construction kits and components are produced in individual sizes and can be supplied with or without substructures. Packaging is usually on pallets and/or in cardboard. Weight by area (kg/m²) depends on the specific product and manufacturer. A conversion table is helpful for converting the declared unit (kg/m²) and can be requested from the respective manufacturers. Section 3.1 includes a sample calculation for a possible application. Conversion is possible by means of simple multiplication of the results per kg by the specific weight by area.

## 2.6 Base materials / Auxiliaries

**Base material / Auxiliary**

| Description | Value | Unit |
|---|---|---|
| Steel (for substructure) | > 76 | % |
| Aluminium | < 10 | % |
| Copper | < 10 | % |
| Powder coating (polyester) | < 2 | % |
| Acoustic tissue (cellulose/glass) | < 2 | % |

## 2.7 Production

The system components for metal ceilings are manufactured in a continuous manufacturing process. The sheet steel comes mainly in coils, perforated (optional), punched (aligned as an option) and cut to size. Where the membrane components do not comprise pre-coated material, they are usually powder- or spray-painted after the cleaning process. A layer of acoustic tissue can then be applied permanently to the back to improve sound absorption and as trickle protection. Punching and perforation waste is gathered, collected by local disposal companies and redirected to the recycling centres.
All production steps are carried out in accordance with the requirements and test guidelines outlined in EN 13964 and the technical rules of TAIM e.V. (THM).

## 2.8 Environment and health during manufacturing

Manufacturing conditions do not demand any particular health and safety measures with the exception of those designated by the authorities for special working areas, e.g. high-visibility vests, safety shoes, dust protection masks. The threshold limit values (TLV, e.g. Germany) are not exceeded at any point of the production process. Waste emissions generated during production are cleaned in accordance with statutory requirements. Emissions are below those outlined in the Technical Guidelines governing Air. Water/Ground: No contamination of water or ground occurs. All of the values established inside and outside the production facilities are below the applicable requirements governing noise protection in Germany. Noise-intensive plant components such as perforation lines are isolated accordingly by structural measures. EN ISO 14001 certificates and other manufacturer-specific documents on health, safety and environment protection can be requested from the manufacturer.

## 2.9 Product processing / Installation

The membrane of the metal ceiling system is attached to, suspended from or wedged against a substructure. Installation must be carried out by qualified personnel and in accordance with the instructions provided by the manufacturer. Connections to the heating/cooling circuit must also be made by qualified personnel.

## 2.10 Packaging

Wooden pallets, cardboard, polystyrene, plastic sheeting, steel and plastic bands are used for packing the metal ceiling systems and components. The packaging material is easily separable and can be reused if necessary. Most of the packaging can be collected, sorted by type and directed to regional recycling services. Residual materials must be disposed of in accordance with the respective national guidelines. Disposal of the product packaging (Module A4) was not taken into consideration.

## 2.11 Condition of use

On account of the many product variants, it is impossible to provide any general cleaning and maintenance recommendations. Long service lives are based on regular maintenance, care and repair of the product. As a general rule, the material composition of the product does not alter during the period of use. Documentation can be requested from the respective metal ceiling system manufacturers.

## 2.12 Environment and health during use

There are no known interactions between the product, the environment and health. Volatile organic compounds are below the valuation limit.

## 2.13 Reference Service Life

The Reference Service Life (RSL) is not taken into consideration in this study as the life cycle as a whole is not declared. For information purposes, they are indicated as an option and correspond to ≥ 50 years in accordance with the Federal Office of Building and Regional Planning (BBSR). This reference service life indicated above serves as an instrument for product selection with regard to the building's anticipated types of use. A prerequisite is the correct application, maintenance and care.

## 2.14 Extraordinary effects

**Fire**

This information is provided in accordance with the criteria outlined in EN 13501-1. General details for all manufacturers can not be provided here. The extent to which the respective requirements on fire protection are complied with can be obtained from the respective manufacturer.

**Water**

The product is designed for operation with water as a heat/cold transfer medium. The actual product does not display any residue which is hazardous to water.

No risk to health or the environment is presented by using with water.

**Mechanical destruction**
In the case of mechanical destruction, all of the substances remain bound. It can be assumed that in the case of coated ceilings, possible paint splinters arise in such small volumes that no negative effects are incurred by the environment.

### 2.15 Re-use phase
The metal ceiling systems can be removed and re-used without damaging the product. During the re-use phase, any remaining tissue can be easily removed from the metal ceiling. Metal membrane components and substructure components made of steel or aluminium can be redirected to material recycling. Pipes and heat-conducting profiles can be detached from the membrane.

The study considers the scenarios C4 (Disposal stage) and D (Recycling potential).

### 2.16 Disposal
In accordance with the Waste Index Act (AVV) and the European Waste Catalogue (EWC), the waste key for steel as a component of metal ceiling systems made of steel as heating and cooling ceilings is:
17-04-05 – Iron and steel
For aluminium: 17-04-02 – Aluminium
For copper: 17-04-01 – Copper, bronze, brass
17-02-03 – Plastic

### 2.17 Further information
Armstrong Metalldecken AG, www.gema.biz
durlum GmbH, www.durlum.de
Geipel AG, www.geipel-genex.de
Lindner Group, *www.lindner-group.com*

## 3. LCA: Calculation rules

### 3.1 Declared unit
The declared unit is 1 kg metal ceiling. The area weight (kg/m²) is established for specific products by the members of the trade association. The declared unit has been defined in accordance with the PCR, Part B. The construction kit for heating ceilings comprises the membrane component, including cooling and heating coils, as well as the entire substructure for securing the metal ceiling system. The substructure is made of steel. A sample calculation for a possible application is outlined below. Owing to the varying sheet thicknesses or areas when using several membrane elements, the basis weight can vary between 10 kg/m² and 20 kg/m².

**Sample indication of declared unit**

| Description | Value | Unit |
|---|---|---|
| Thickness of sheet steel | 0.7 | mm |
| Length of panel | 1200 | mm |
| Width of panel | 600 | mm |
| Area of panel | 0.72 | m² |
| Panel weight | 6.07 | kg/m² |
| Substructure weight | 4.75 | kg/m² |
| Basis weight | 10.82 | kg/m² |

### 3.2 System boundary
Type of EPD: cradle to gate, with options
A1-A3 Product stage: Provision of raw materials, transport to the manufacturer, production (incl. provision of energy and water, provision of auxiliaries, disposal of waste)
C4 End-of-life stage: Waste treatment and disposal:
D Credits: Recycling potential.

### 3.3 Estimates and assumptions
Disposal during the end-of-life stage involves thermal recycling or landfilling of residual materials (Module C4) based on existing technology and current practices. Credits are offset against the equivalent data sets for electricity (DE: Power mix 2011, PE) and thermal energy from natural gas (DE: thermal energy from natural gas 2011, PE). Credits are also awarded for steel in the form of "Value of scrap". For aluminium and copper, it is assumed that they are directed to recycling with the result that credits are allocated to the sum of the expenses associated with primary material.

### 3.4 Cut-off criteria
All of the data from the operating data surveys, thermal energy used, power and diesel consumption were taken into consideration in the analysis. Transport (300 km) was assumed for all inputs and outputs considered or the actual transport expenses applied.
All flows accounting for more than 1% of the total mass, energy used or environmental impacts by the system were taken into consideration in the study. Processes to be ignored account for less than 5% of the impact categories of relevance.
Manufacturing of the machinery, plants and other infrastructure required for production of the items in question were not taken into consideration in the LCA.

### 3.5 Background data
The consistent data records (GaBi) included in the GaBi Data base were used for modelling the background data, preliminary products and auxiliaries for manufacturing the declared product.

### 3.6 Data quality
In order to guarantee comparability of the results, exclusively the consistent background data from the GaBi data base was used in the LCA (e.g. data sets on energy, transport, auxiliaries and consumables). The data used was last revised max. 8 years ago. The corresponding data sets were available in the GaBi data base for the respective preliminary products and auxiliaries used. The production data represents primary data from 2011.

### 3.7 Period under review
The Life Cycle Assessment was drawn up for heating ceiling systems based on average production data from 2011, whereby the data was analysed for various plants owned by the manufacturers referred to above. The Life Cycle Assessment is therefore representative for the average metal ceiling systems produced.

### 3.8 Allocation
No co-product allocations were applied. Commercial waste incurred is incinerated. The energy generated in waste incineration plants is calculated taking consideration of the elementary composition and calorific value. The requisite volume of secondary materials included in production waste and end-of-life waste incurred by the system is initially returned to

production or upstream chains ("closed loop"). The net volume of scrap comprises the volume of scrap collected during the end-of-life stage plus the scrap output from production and/or the upstream chains as more scrap is generated during production than required in the upstream chains. A credit is allocated for the net volume of scrap in Module D (substitution of primary materials).

### 3.9 Comparability

As a general rule, a comparison or evaluation of EPD data is only possible when all of the data to be compared has been drawn up in accordance with EN 15804 and the building context or product-specific characteristics are taken into consideration.

## 4. LCA: Scenarios and other technical information

**End of Life (C4)**

| Description | Value | Unit |
|---|---|---|
| For re-use | 0 | kg |
| For recycling | 0.77 | kg |
| For energy recovery | 0.03 | kg |
| Collection rate | 80 | % |

## 5. LCA: Results

The values depicted in the tables of results were calculated for 1 kg average product. For specific applications, basis weights must be calculated on the basis of information supplied by the manufacturer. Conversion is then possible by means of simple multiplication of the results per kg by the specific basis weight.

**SYSTEM BOUNDARIES (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 | Production | Transport from the manufacturer to the location of application | Assembly | Use / Application | Maintenance | Repairs | Replacement | Renewal | 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 | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | X | X |

**LCA RESULTS - ENVIRONMENTAL IMPACT: 1 kg**

| Parameter | Unit | A1 - A3 | C4 | D |
|---|---|---|---|---|
| Global Warming Potential | [kg $CO_2$ equiv.] | 4.1E+0 | 2.1E-2 | -1.7E+0 |
| Ozone Depletion Potential | [kg CFC11 equiv.] | 1.7E-7 | 2.7E-13 | -6.3E-8 |
| Acidification Potential of soil and water | [kg $SO_2$ equiv.] | 1.6E-2 | 1.2E-5 | -6.1E-3 |
| Eutrification Potential | [kg $(PO_4)^{-3}$ equiv.] | 1.2E-3 | 2.7E-6 | -2.2E-4 |
| Photochemical Ozone Creation Potential | [kg ethene equiv.] | 1.5E-3 | 7.6E-7 | -7.1E-4 |
| Abiotic Depletion Potential non-Fossil Resources | [kg Sb equiv.] | 7.1E-5 | 4.3E-10 | -1.3E-5 |
| Abiotic Depletion Potential Fossil Fuels | [MJ] | 4.6E+1 | 7.7E-3 | -1.7E+1 |

**LCA RESULTS - USE OF RESOURCES: 1 kg**

| Parameter | Unit | A1 - A3 | C4 | D |
|---|---|---|---|---|
| Renewable primary energy as energy carrier | [MJ] | 6.8E+0 | 5.2E-4 | -2.9E+0 |
| Renewable primary energy as material utilisation | [MJ] | 3.1E-1 | 0.0E+0 | 0.0E+0 |
| Total use of renewable primary energy sources | [MJ] | 7.2E+0 | 5.2E-4 | -2.9E+0 |
| Non-renewable primary energy as energy carrier | [MJ] | 5.4E+1 | 8.4E-3 | -1.9E+1 |
| Non-renewable primary energy as material utilisation | [MJ] | 0.0E+0 | 0.0E+0 | 0.0E+0 |
| Total use of non-renewable primary energy sources | [MJ] | 5.4E+1 | 8.4E-3 | -1.9E+1 |
| Use of secondary materials | [kg] | 0.0E+0 | - | - |
| Renewable secondary fuels | [MJ] | 1.7E-4 | 1.1E-7 | 1.1E-5 |
| Non-renewable secondary fuels | [MJ] | 1.7E-3 | 1.2E-6 | 8.0E-5 |
| Net use of fresh water | [$m^3$] | - | - | - |

**LCA RESULTS - OUTPUT FLOWS AND WASTE CATEGORIES: 1 kg**

| Parameter | Unit | A1 - A3 | C4 | D |
|---|---|---|---|---|
| Hazardous waste for disposal | [kg] | - | - | - |
| Disposed of, non-hazardous waste | [kg] | - | - | - |
| Disposed of, radioactive waste | [kg] | 2.8E-3 | 3.2E-7 | -7.7E-4 |
| Components for re-use | [kg] | - | - | 0.0E+0 |
| Materials for recycling | [kg] | - | - | 7.7E-1 |
| Materials for energy recovery | [kg] | - | - | 1.2E-2 |
| Exported electrical energy | [MJ] | - | - | 3.2E-2 |
| Exported thermal energy | [MJ] | - | - | 7.8E-2 |

* Some of the data inventories used do not support the methodical approach for declaring water and waste indicators. The indicators can not therefore be accounted for (decision by the Expert Committee (SVA) on 07.01.2013).
** Although sheet steel and sheet aluminium are manufactured to a certain extent from secondary materials, no secondary materials are used in the primary system (ceiling system manufacture) which is why this value is 0.

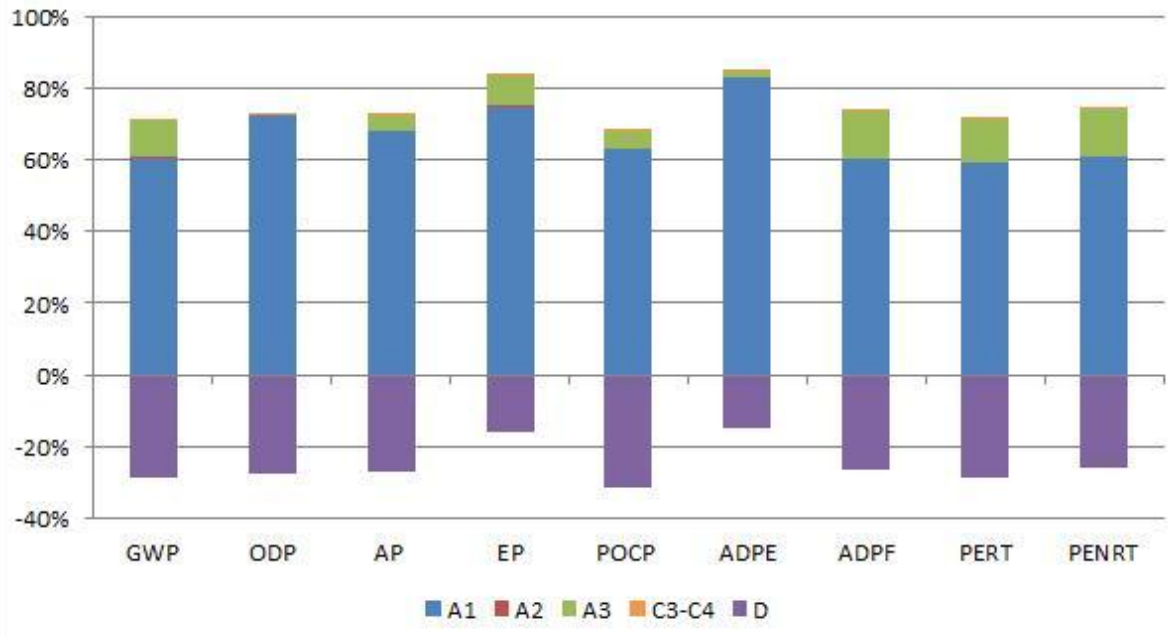
## 6. LCA: Interpretation

Approx. 85% of the **Global Warming Potential (GWP, 100 years)** is caused by the provision of raw materials. The provision of raw materials includes both iron ore, bauxite and copper ore mining as well as manufacturing of the semi-finished products used (steel coils, aluminium coils and copper piping). The remaining approx. 14% is accounted for by actual production of the heating metal ceiling system. In terms of the raw materials used, particularly aluminium, steel and copper are of relevance, i.e. emissions as a result of using thermal and electrical energy in the upstream chains. A total of approx. 40% of GWP emissions are credited by recycling aluminium, steel, copper and plastic piping at the end of life.

Practically 100% of the **Ozone Depletion Potential (ODP)** is attributable to the manufacture of raw

materials (primarily sheet aluminium and sheet steel). Credits account for 38%.
Approx. 93% of the **Acidification Potential (AP)** during the Production stage is triggered by the provision of raw materials (mainly sheet aluminium and sheet steel as well as the production of copper piping). Approx. 6% of the entire AP is caused by production of the actual metal ceiling system. Credits accounting for approx. 37% of all AP emissions are primarily offset against recycling aluminium, steel and copper piping.
Approx. 89% of the entire **Eutrification Potential (EP)** is caused by the provision of raw materials, especially the high energy requirements in the form of natural gas and electricity. 10% of the entire EP is accounted for by the manufacture of heating ceilings and approx. 1% is caused by transporting raw materials and auxiliaries. A total of approx. 18% of all emissions are credited by recycling aluminium, steel and copper piping.
93% of the **Photochemical Ozone Creation Potential (POCP)** is triggered during the production stage by the provision of raw materials in the form of sheet aluminium and sheet steel as well as production of copper piping. Credits account for approx. 46%.
The **Abiotic Depletion Potential of non-fossil resources (ADPE)** is largely caused by the production stage in Module A1 where the upstream chain for sheet steel and sheet aluminium at 98% is the main contributor to overall ADP. Credits account for 18%.
The **Abiotic Depletion Potential of Fossil Fuels (ADPF)** is primarily the result of the upstream chains in Module A1 (approx. 82%). Approx. 18% is attributable to production of the metal ceiling system. Credits of approx. 36% are largely generated for recycling steel, aluminium and copper piping.
The **Total primary energy requirements** are divided among non-renewable energy carriers (approx. 89%) and renewable energy (approx. 11%).
The **Total use of renewable primary energy sources (PERT)** is largely the result of the upstream chains associated with manufacturing preliminary products (Module A1) – approx. 83%. Total credits (Module D) account for approx. 40% attributable to aluminium and steel recycling as well as copper piping recycling.
When considering the **Total use of non-renewable primary energy sources (PENRT)**, the upstream chains associated with manufacturing preliminary products account for the greatest percentage (approx. 82%). Production of the metal ceiling system accounts for approx. 18% of non-renewable primary energy sources. Total credits of approx. 35% are allocated which are incurred by recycling the metallic preliminary products.

**Relative contributions by the declared life cycle modules to environmental impact and the use of primary energy for heating metal ceiling systems**




## 7. Requisite evidence

Not of relevance; as an average EPD is involved, no details can be provided.

## 8. References


**Institut Bauen und Umwelt e.V.**, Berlin (pub.):

**General principles** for the EPD range of Institut Bauen und Umwelt e.V. (IBU), 2013-04

**Product Category Rules for Building Products, Part A:** Calculation rules for the Life Cycle Assessment and requirements on the background report, 2013-04

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

**EN 15804**:2012-04, Sustainability of construction works — Environmental product declarations — Core rules for the product category of construction products

**GaBi 6:2013:** Software system and data base for comprehensive analysis Copyright, TM Stuttgart, Echterdingen, 1992-2013

**GaBi 6:2013D:** Documentation of the GaBi 6: data sets from the data base for comprehensive analysis Copyright, TM Stuttgart, Echterdingen, 1992-2013. http://documentation.gabi-software.com/

**IBU PCR, Part B:** PCR – Part B: Metal ceilings, Institut Bauen und Umwelt e.V., www.bauumwelt.com, 2012

**EN 13964**:2007-02: Suspended ceilings – Requirements and test methods

**EN 14240:**2004-04
Ventilation for buildings – Chilled ceilings - Testing and rating

**EN 14037-2**:2011
Ceiling-mounted radiant panels supplied with water at temperatures below 120 °C - Test method for thermal output

**EN ISO 14001**:2009-11: Environmental management systems – Requirements with guidance for use; German version DIN EN ISO 14001:2009-11

**EN 13501-1**:2010-01: Part 1: Classification with the results of tests on fire performance by building products; German version DIN EN 13501-1:2007

**BBSR**:2006-12: Federal Office of Building and Regional Planning, Info sheet no. 4.2 - Life cycle of components and component layers, 2006-12

**European Waste Catalogue (EWC):** in accordance with AVV 2012-02

**THM:** 2003-11: TAIM e.V., Technisches Handbuch Metalldecken (THM) (Technical Manual for Metal Ceilings), http://www.taim.info/de/downloads-und-merkblaetter.php#.Ukp7u5yK4ct, German version 2003-11

Institut Bauen
und Umwelt e.V.

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

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

Institut Bauen
und Umwelt e.V.

**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
E-mail info@bau-umwelt.com
Web **www.bau-umwelt.com**

PE INTERNATIONAL
SUSTAINABILITY PERFORMANCE

**Author of the Life Cycle Assessment**
PE International
Hauptstrasse 111
70771 Leinfelden-Echterdingen
Germany

Tel. +49 (0)711 341817-0
Fax +49 (0)711 341817-25
E-mail info@pe-international.com
Web **www.pe-international.com**

TAIM

**Holder of the Declaration**
TAIM e.V.
Leostrasse 22
40545 Düsseldorf
Germany

Tel. +49 (0)211 955 93 27
Fax +49 (0)211 556 466
E-Mail mail@taim.info
Web **http://www.taim.info**