ENVIRONMENTAL PRODUCT DECLARATION

in accordance with ISO 14025 and EN 15804

Declaration holder	**TAIM e.V. - Verband Industrieller Metalldeckenhersteller (Association of Industrial Metal Ceiling Manufacturers)**
Publisher	Institute Construction and Environment e.V. (IBU)
Programme holder	Institute Construction and Environment e.V. (IBU)
Declaration number	EPD-TAI-20130184-ICG1-EN
Issue date	11.11.2013
Valid to	11.11.2018

Metal ceiling systems made of steel

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

Institut Bauen und Umwelt e.V.

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

Presented by the**TAIM** member **Lindner Group**, www.lindner-group.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-20130184-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 system made of steel

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

Declared product/unit
The declared unit is 1 kg steel 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
Burgess Architectural Products, www.burgessceilings.co.uk
Chicago Metallic Continental BVBA, www.chicagometallic.com
Dipling Werk GmbH, www.dipling.de
Durlum GmbH, www.durlum.com
Geipel AG, www.geipel-genex.de
Hunter Douglas Europe BV, www.hunterdouglascontract.com
König GmbH & Co.KG, www.koenig-produkte.de
Lindner Group, www.Lindner-Group.com
Metalit Metallbauelemente AG, www.metalit.ch
N&E GmbH & Co.KG, www.ne-paneeldecken.de
Richter System GmbH & Co.KG, www.richtersystem.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

Steel ceiling systems are manufactured from folded, roll-formed and partially punched steel as complete construction kits or as individual components. The construction kit comprises the membrane component, e.g. linear panels or strip panel ceilings, as well as the substructure for suspending the metal ceiling. The substructure is usually made of steel. 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 and exterior design as rectangular panels, strip panel ceiling, square tiles, expanded metal ceilings, ceiling grids or canopy ceilings, all functioning as cladding of the interior ceiling. The product is manufactured in accordance with the

respective customer's requirements.

2.3 Technical data

EN 13964 is the test standard.

Description	Value	Unit
Weight by area (min.)	3	kg/m^2
Weight by area(max.)	15	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. Area weight (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 basis weight.

2.6 Base materials / Auxiliaries

Base material / Auxiliary

Description	Value	Unit
Steel	> 97	%
Surface coating	< 2	%
Acoustic tissue (cellulose/glass)	< 1	%

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 to the back using a heating process. Adding heat activates a hot-melt adhesive embedded in the tissue which causes it to adhere to the back of the panel. 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 soil 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. The statutory guidelines governing industrial protection for metal and drywall construction apply as well as the respective provisions of the construction industry. EN ISO 14001 certificates and other manufacturer-specific documents on environment protection can be requested from the manufacturer.

2.9 Product processing / Installation

The membrane of the metal ceiling system is secured to a substructure. Installation must be carried out by trained personnel, usually from the area of drywall construction.

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
There are no known effects on the environment in the event of unforeseen ingress by 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 can be redirected to material recycling. Adhesive residue can be removed by melting. 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 is:
17-04-05 – Iron and steel

2.17 Further information
Armstrong Metalldecken AG, www.gema.biz
Burgess Architectural Products
www.burgesscellings.co.uk
Chicago Metallic BVBA, www.chicagometallic.com
Dipling Werk GmbH, www.dipling.de/
Durlum GmbH, www.durlum.de
Geipel AG, www.geipel-genex.de
Hunter Douglas Europe BV,
www.hunterdouglascontract.com
König GmbH & Co.KG, *www.koenig-produkte.de*
Lindner Group, *www.lindner-group.com*
Metalit Metallbauelemente AG, *www.metalit.ch*
N&E GmbH & Co.KG, *www.ne-paneeldecken.de*
Richter System GmbH & Co.KG, *www.richtersystem.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 metal ceilings made of steel comprises the membrane component, e.g. plank system or panels, as well as the substructure for securing the metal ceiling. 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 3 kg/m² and 15 kg/m².

Sample indication of declared unit

Description	Value	Unit
Thickness of sheet steel	1.5	mm
Length of membrane element	1200	mm
Width of membrane element	600	mm
Area of membrane element	0.72	m²
Panel weight	4.85	kg/m²
Substructure weight	1.98	kg/m²
Basis weight	6.83	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".

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 steel 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	Manufacture	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.]	3.2E+0	8.4E-3	-1.3E+0
Ozone Depletion Potential	[kg CFC11 equiv.]	2.7E-9	1.1E-13	4.0E-8
Acidification Potential of soil and water	[kg SO_2 equiv.]	1.2E-2	4.8E-6	-3.0E-3
Eutrification Potential	[kg $(PO_4)^{-3}$ equiv.]	9.6E-4	1.1E-6	-8.3E-5
Photochemical Ozone Creation Potential	[kg ethene equiv.]	1.4E-3	3.0E-7	-6.7E-4
Abiotic Depletion Potential non-Fossil Resources	[kg Sb equiv.]	5.9E-5	1.7E-10	-1.3E-5
Abiotic Depletion Potential Fossil Fuels	[MJ]	3.8E+1	3.1E-3	-1.3E+1

LCA RESULTS - USE OF RESOURCES: 1 kg

Parameter	Unit	A1 - A3	C4	D
Renewable primary energy as energy carrier	[MJ]	2.7E+0	2.1E-4	6.8E-1
Renewable primary energy as material utilisation	[MJ]	1.1E-1	0.0E+0	0.0E+0
Total use of renewable primary energy sources	[MJ]	2.8E+0	2.1E-4	6.8E-1
Non-renewable primary energy as energy carrier	[MJ]	4.1E+1	3.4E-3	-1.2E+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]	4.1E+1	3.4E-3	-1.2E+1
Use of secondary materials	[kg]	0.0E+0	-	-
Renewable secondary fuels	[MJ]	1.9E-4	4.4E-8	-9.4E-7
Non-renewable secondary fuels	[MJ]	2.0E-3	4.6E-7	-9.8E-6
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]	1.1E-3	1.3E-7	4.2E-4
Components for re-use	[kg]	-	-	0.0E+0
Materials for recycling	[kg]	-	-	8.3E-1
Materials for energy recovery	[kg]	-	-	4.8E-3
Exported electrical energy	[MJ]	-	-	1.3E-2
Exported thermal energy	[MJ]	-	-	3.1E-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

The greatest contribution to the **Global Warming Potential (GWP, 100 years)** is made by the provision of raw materials (approx. 82%). The provision of raw materials includes both iron ore mining as well as manufacturing of the semi-finished products used (steel coils). The remaining approx. 18% is accounted for by actual production of the metal ceiling system. Of the raw materials used, steel is of particular relevance, i.e. emissions incurred by thermal conversion of brown coal, as well as the upstream chains associated with the electrical energy used. Transporting preliminary products accounts for approx. 0.3% of emissions. A total of 40% of all GWP emissions are credited by recycling steel at the end-of-life stage.
The **Ozone Depletion Potential (ODP)** is dominated by steel recycling (approx. 94%). 6% is attributable to production of the metal ceiling system.

Primarily R11 and R114 emissions from the upstream chain associated with the provision of electricity contribute to the ODP (especially electricity from nuclear energy). The "value of scrap" data set of the international steel association "worldsteel" represents a theoretical environmental profile for steel scrap. It represents the difference between manufacturing primary steel (theoretical value based on the blast furnace route, no scrap input) and manufacturing secondary steel using electric arc furnaces (EAF) (100% scrap input in the EAF route). Both routes represent global production mixes. The ODP value is primarily dependent on electricity consumption, whereby it is based on the nuclear proportion of the electricity mix. In the EAF route, primarily electrical energy is used as an energy carrier while the blast furnace route is based on fossil energy carriers (e.g. coal). What's more, the EAF electricity mix includes higher percentages of nuclear electricity than the blast furnace electricity mix (depending on the production country mix). This results in a negative ODP value for the "value of scrap" data set which leads to an additional environmental burden in terms of scrap credits.

Approx. 88% of the **Acidification Potential (AP)** is triggered during the production stage by the provision of raw materials (primarily sheet steel). The remaining approx. 11% is accounted for by actual production of the metal ceiling system. Credits accounting for approx. 25% of all AP emissions are primarily offset by recycling steel.

The provision of raw materials makes the largest contribution to the **Eutrification Potential (EP)** (approx. 83%), especially necessitated by the high energy requirements in the form of natural gas and electricity. 16% is attributable to the metal ceiling manufacturing process and 1% is accounted for by transporting preliminary products and auxiliaries. Credits are allocated for approx. 9% of all emissions.

Approx. 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 steel. Another 8% is attributable to the metal ceiling manufacturing process. Credits account for approx. 47%.

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 at 100% is the main contributor to the overall ADP. Total credits account for approx. 22%.

The **Abiotic Depletion Potential of Fossil Fuels (ADPF)** is primarily the result of the upstream chains in Module A1 (approx. 77%). Almost 23% is attributable to production of the metal ceiling system. Credits of approx. 35% are largely generated for recycling steel.

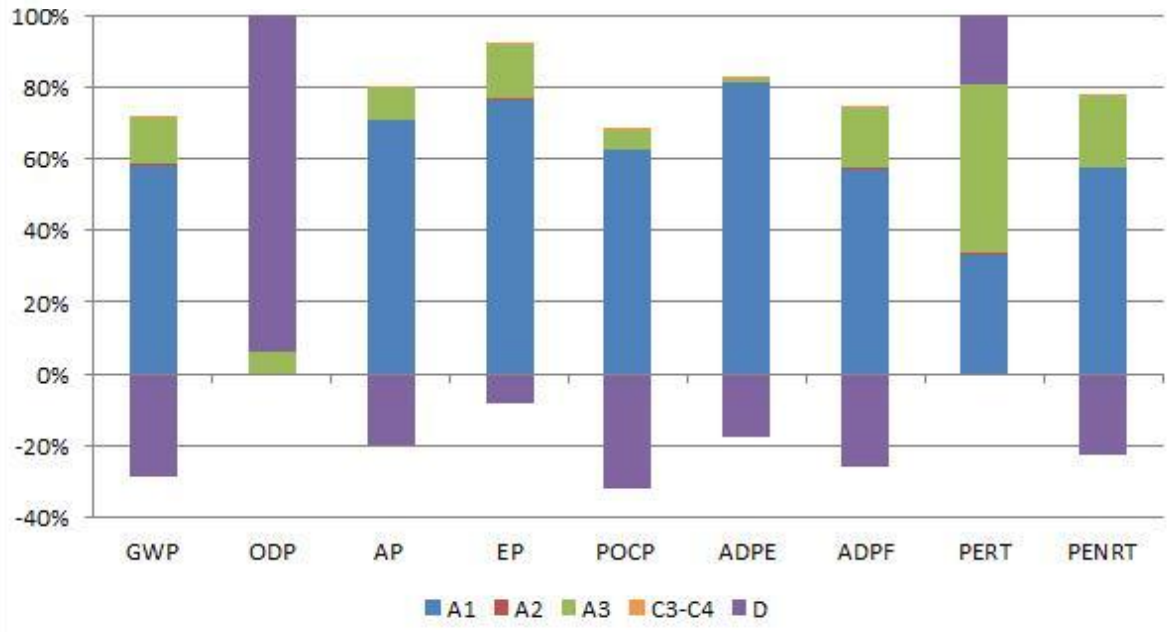
The **Total primary energy requirements** are divided among non-renewable (approx. 89%) and renewable energy (approx. 11%).

The **Total use of renewable primary energy sources (PERT)** is the result of the upstream chains associated with manufacturing of the preliminary products (Module A1) – approx. 33% - and the actual metal ceiling manufacturing process (approx. 47%). Another 19% can be attributed to the credits (Module D) from steel recycling.

The **PERT** indicates a positive contribution by the credits, i.e. an additional load based on the "value of scrap" similar to the ODP. This is accounted for by the various upstream chains associated with the provision of energy in the primary and secondary routes. The electrical energy used during secondary steel production (EAF) includes a certain percentage of renewable energy depending on the power mix. The difference between 100% primary steel production and 100% secondary steel production results in a negative value for the renewable primary energy used. All in all, the PERT percentage of overall primary energy requirements for the product is low. In primary steel products, a very high percentage of fossil energy carriers is deployed compared to a low percentage of electricity. The secondary route uses electricity only. On the provision that the same power mix is used, a higher absolute percentage of renewable primary energy is obtained than in the secondary route. As the credit is also negative, this results in a positive value for PERT.

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. 74% is caused by the manufacture of sheet steel. Production of the metal ceiling system accounts for approx. 26% of non-renewable primary energy sources. Total credits of approx. 29% 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 steel 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 ISO 14001:2009-11: Environmental management systems – Requirements with guidance for use; German version DIN EN ISO 14001:2009-11

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

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

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**

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**

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**