

ENVIRONMENTAL PRODUCT DECLARATION

as per /ISO 14025/ and /EN 15804/



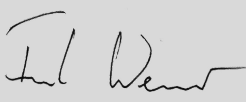
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Metal ceiling systems made of steel
Lindner Group

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1. General Information

<p>Lindner Group</p> <hr/> <p>Programme holder IBU - Institut Bauen und Umwelt e.V. Panoramastr. 1 10178 Berlin Germany</p> <hr/> <p>Declaration number EPD-LIN-20180192-IBC1-EN</p> <hr/> <p>This declaration is based on the product category rules: Metal ceilings, 07.2014 (PCR checked and approved by the SVR)</p> <hr/> <p>Issue date 04.02.2019</p> <hr/> <p>Valid to 03.02.2024</p> <hr/> <div style="text-align: center;">  <hr/> <p>Dipl. Ing. Hans Peters (President of Institut Bauen und Umwelt e.V.)</p> </div> <hr/> <div style="text-align: center;">  <hr/> <p>Dr. Alexander Röder (Managing Director IBU)</p> </div>	<p>Metal ceiling systems made of steel</p> <hr/> <p>Owner of the declaration Lindner Group Bahnhofstr. 29 94424 Arnstorf</p> <hr/> <p>Declared product / declared unit The declared unit is 1 m² metal ceiling system made of steel.</p> <hr/> <p>Scope: The EPD refers to the metal ceiling system made of steel and applies for the following product types:</p> <ul style="list-style-type: none"> · LMD-B (Post cap ceilings) · LMD-E (Hook-on and corridor ceilings) · LMD-K (Cassette ceilings) · LMD-St (Expanded metal ceilings) · LMD-L (Baffle ceilings) · LMD-DS (Canopy ceilings) · LMD-TS (Torsion spring) <p>The production data collected refers to 2017. The metal ceiling systems made of steel are manufactured at the Lindner plant in Arnstorf.</p> <p>The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.</p> <hr/> <p>Verification</p> <table border="1" style="width: 100%;"> <tr> <td colspan="2">The standard /EN 15804/ serves as the core PCR</td> </tr> <tr> <td colspan="2">Independent verification of the declaration and data according to /ISO 14025:2010/</td> </tr> <tr> <td style="text-align: center;"><input type="checkbox"/> internally</td> <td style="text-align: center;"><input checked="" type="checkbox"/> externally</td> </tr> </table> <hr/> <div style="text-align: center;">  <hr/> <p>Dr. Frank Werner (Independent verifier appointed by SVR)</p> </div>	The standard /EN 15804/ serves as the core PCR		Independent verification of the declaration and data according to /ISO 14025:2010/		<input type="checkbox"/> internally	<input checked="" type="checkbox"/> externally
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2. Product

2.1 Product description / Product definition

Lindner metal ceiling systems made of steel are manufactured from folded, roll-formed and partially punched steel as full construction kits or individual components. The construction kit comprises the top layer and the substructure. Both the ceiling panel and the substructure is made of steel, can have various suspension heights and its design is aligned towards the shape, functional requirements and weight of the top layers.

System designations:

- LMD-B (Post cap ceilings)
- LMD-E (Hook-on and corridor ceilings)
- LMD-K (Cassette ceilings)
- LMD-St (Expanded metal ceilings)
- LMD-L (Baffle ceilings)
- LMD-DS (Canopy ceilings)
- LMD-TS (Torsion Spring)

Directive (EU) No. 305/2011 (CPR) applies for placing the product on the market in the EU/EFTA (with the exception of Switzerland). The product requires a Declaration of Performance taking consideration of the /EN 13964: 2014, Suspended ceilings – Requirements and test methods.

Use is governed by the respective national regulations.

2.2 Application

The metal ceilings described here are used in interior design as post-cap, insert, clamped and hook-in systems. As an alternative, they can also be designed as canopy ceilings, baffle ceilings or expanded metal ceilings for ceiling panelling. The product is manufactured in accordance with the respective customer's requirements.

2.3 Technical Data

Structural data

Name	Value	Unit
Weighted sound absorption (/EN ISO 354/, /EN ISO 11654/)	≤ 0,75	-
Grammage	4 - 20	kg/m ²
Approval of formaldehyde (/EN13964/)	Class E1	-

The data in the Declaration of Performance applies

2.4 Delivery status

The metal ceiling construction kits or components are produced in individual sizes. Packaging is usually on pallets and/or in cardboard boxes. Area weight (kg/m²) depends on the specific product. The declared unit (kg/m² ratio) can be converted using a conversion table.

2.5 Base materials / Ancillary materials

Name	Value	Unit
Steel	> 97	%
Surface coating	< 1,5	%
Acoustic non-woven (cellulose/glass)	< 1	%
Hotmelt adhesive	< 0,5	%

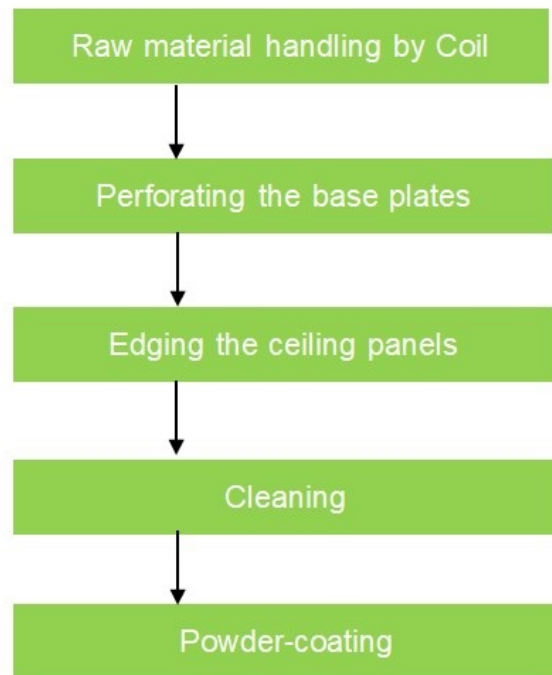
1) The product contains substances on the List of Candidates (/REACH/ 08.01.2019) exceeding 0.1% by mass: No

2) The product contains other CMR substances in categories 1A or 1B which are not on the List of Candidates, exceeding 0.1% by mass: No

3) Biocide products were added to this construction product or it has been treated with biocide products (this then concerns a treated product as defined by the (EU) Ordinance on Biocide Products No. 528/2012): No

2.6 Manufacture

A layer of acoustic non-woven can then be applied to the back in a continuous process. Punching and perforation waste is gathered, collected by local disposal companies, and redirected to the recycling process. Quality is assured taking consideration of the applicable version of the EN 13964 standard: "Suspended ceilings – Requirements and test methods".



2.7 Environment and health during manufacturing

Manufacturing conditions do not demand any particular health protection measures with the exception of those designated by the authorities for special working areas, e.g. high-visibility vests, ear protection, safety shoes. The MWC values (e.g. Germany) are fallen short of at each stage of the production process. Exhaust air generated during production is cleaned in accordance with statutory specifications. Emissions are below the TA Air/Water/Soil (technical instructions on air, water and soil quality): no contamination of water or soil. 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 are insulated 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. Certificates and manufacturer-specific documents on environmental and health protection in accordance with DIN EN ISO 14001 can be requested.

2.8 Product processing/Installation

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

2.9 Packaging

Wooden pallets, cardboard boxes, plastic sheeting and plastic bands are used for packaging 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.

2.10 Condition of use

On the basis of long-term experience, there are no relevant changes concerning material composition for the period of use of metal ceiling systems.

2.11 Environment and health during use

When used normally and in accordance with the designated purpose, no health risks or restrictions are to be anticipated by metal ceiling systems in line with the current state of knowledge.

According to the present state of knowledge, hazards for water, air and soil cannot arise if the products in question are used as designated.

2.12 Reference service life

A reference service life in accordance with ISO 15686 cannot be calculated for the product. Accordingly, the technical service life is derived from the "Service life of components for life cycle analyses in accordance with the BNB assessment system for sustainable building – Code No. 353.211" table of the Federal Office of Building and Regional Planning /BBSR/. BNB assumes that ceiling panelling made of metal is used for more than 50 years. The service life indicated is subject to proper use, maintenance and care.

2.13 Extraordinary effects

Fire

Lindner metal ceiling systems are classified according to EN 13501-1.

Fire protection

Name	Value
Building material class	A2
Burning droplets	d0
Smoke gas development	s1

Water

No environmental influences are known in the case of unforeseen water ingress. The resistance of the ceiling system following the impact of water is dependent on the corrosion protection class in which the ceiling system is classified.

Mechanical destruction

In the event of mechanical destruction, all substances remain in a bound state. It can be assumed that in the case of coated ceiling panels, possible paint splinters arise in such small volumes that they do not result in any negative effects for the environment.

2.14 Re-use phase

Lindner metal ceiling systems can be removed and reused without damaging the product. During the reuse phase, the remaining fleece can be easily removed from the metal ceiling.

Metal top layers and substructure components made of steel can be redirected to material recycling if they are not reused. Non-woven material and varnish can be removed by melting.

2.15 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.

2.16 Further information

Lindner Group, www.lindner-group.com

3. LCA: Calculation rules

3.1 Declared Unit

The declared unit refers to 1 m² Lindner metal ceiling system comprising a cover panel and substructure with an average weight of 10.38 kg.

Within the product family, the ceiling system varies from 4.94 to 20.05 kg/m².

The panels are perforated prior to delivery. The holes account for 20% of the surface. The overall weight was calculated accordingly.

Declared unit

Name	Value	Unit
Conversion factor to 1 kg	0.0963	-
Declared unit	1	m ²
Declared unit	1	m ²
Declared unit	1	m ²
Grammage	10.38	kg/m ²

3.2 System boundary

The life cycle analysis for the Lindner metal ceiling system comprises the life cycle phases "cradle to gate with options".

Modules A1-A3 are considered as a single module for the manufacturing phase, A4-A5 (construction phase), B1-B5 (use phase), C1-C4 (disposal phase), D (recycling potential).

The following individual processes were included in the Information module A1-A3 of manufacturing the metal ceiling systems:

- Raw material (steel) provision (A1)
 - Transporting the raw, ancillary and operating materials to the plant (A2)
 - Manufacturing processes for the system product in the plant, including expenses associated with energy (electricity, thermal energy and disposal of residual materials incurred (A3))
 - Manufacturing packaging materials (A3)
 - Transport from the plant gate to the construction site (A4)
 - During installation in the building, no other materials are considered; Module A5 comprises the environmental loads for disposal of packaging.
- The modules are declared as 0 for the use phase (B1-B2). During the use phase, the product does not cause any environmental pollution.
- The actual product does not require any maintenance; when used normally, neither repairs nor replacements

can be anticipated during use in the building, nor does it incur any water or energy consumption during use. Modules B3-B5 are declared as not relevant for construction products.

Modules B6 and B7 are not taken into consideration. Deconstruction from the building, panel and substructure is considered in C1 for the disposal stage, plus transport to a recycling depot (C2). The product is recycled in full and achieves end-of-waste status in accordance with C3.

3.3 Estimates and assumptions

Specific or average data inventories for a certain material are not available for all materials. Approximate data sets are applied for the plastic foil and certain chemical additives in the coating plant.

3.4 Cut-off criteria

All data from the operating data survey was offset, i.e. all starting materials used according to the manufacturing guidelines, the thermal energy used as well as electricity. The machinery and plants required during manufacturing were not reviewed. Material flows of 1% by mass are considered. Energy flows accounting for a share of less than 1% are also considered. No known material flows were caused which would make significant contributions to the declared environmental impacts.

3.5 Background data

/GaBi 8/ - the software system for life cycle analysis developed by thinkstep AG – was used for modelling the life cycle of the product under review (service pack 35). The data required for the upstream chain for which no specific details are available, is taken from the /GaBi data base/ <http://www.gabi-software.com/support/gabi/gabi-database-2016-lci-documentation/>.

3.6 Data quality

The background data gives rise to some minor uncertainties owing to the provision of GaBi data bases and which must be taken into consideration when interpreting the results. The background data is no more than 5 years old. The data quality can be regarded as good.

3.7 Period under review

The data for this Life Cycle Assessment is based on a data survey from 2017.

3.8 Allocation

Total production by Lindner AG comprises other products as well as the product reviewed here. While collecting data, the values for thermal and electric energy as well as raw materials refer to the product to be declared.

The manufacturing processes for the steel ceiling system are difficult to break down into various sub-processes. The declared product and other products manufactured in the production line follow the same manufacturing steps.

Apart from steel ceilings, Lindner AG also manufactures heating and cooling ceilings, whereby the ceiling surface is the same as for a normal steel ceiling, plus the heat-conducting profiles and the meander.

Profile manufacturing takes place in a separate manufacturing facility, whereby profiles can also form the substructure for other metal ceilings: aluminium ceilings, stainless steel ceilings, fire protection ceilings, and heated and chilled ceilings.

For this reason, allocation is based on physical properties, in this case mass.

The production data was allocated by mass according to the annual volume of metal ceiling systems. The raw materials and energy were calculated in line with this allocation key.

In the production of profiles, profiles are manufactured for dry construction or wall production along with the substructure for the ceilings under review. The requisite profiles for ceilings were classified by weight. Steel was allocated by size.

A low percentage leaves the product system as scrap but without incurring any loads. Conversion using the available input materials and the weight of the ceiling system was considered.

3.9 Comparability

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

The used background database has to be mentioned. The /GaBi data base/ was used (see section 8 References).

4. LCA: Scenarios and additional technical information

The scenarios on which the LCA is based are outlined in more detail below.

Transport to construction site (A4)

Name	Value	Unit
Litres of fuel	0.0437	l/100km
Transport distance	500	km

Construction installation process (A5)

On the construction site, the ceiling system is installed mechanically by experts; prior to installation, the packaging is removed and the panel with the substructure is installed. No environmental loads arise within the framework of construction.

Module A5 only comprises the environmental loads associated with disposal of the packaging.

Name	Value	Unit
Auxiliary (not considered)	-	kg
Water consumption (not relevant)	-	m ³
Other resources	-	kg
Electricity consumption (not relevant)	-	kWh
Other energy carriers (not relevant)	-	MJ
Material loss (not relevant)	-	kg
Output substances following waste treatment on site (ceiling packaging)	0.376	kg

Use (B1), please refer to 2.12 Use

The modules are declared as 0 for the use phase (B1-B2). This does not lead to any environmental loads when used as recommended by the manufacturer.

Maintenance (B2)

The actual product does not require any maintenance. During normal use, no repairs or replacements can be anticipated during use of the building. Replacements will only become necessary after 50 years, according to the assessment system for sustainable building (BNB).

Reference Service Life

A reference service life cannot be calculated for the product. According to BNB, a technical service life of approx. 50 years is assumed.

Name	Value	Unit
Life Span (acc. to BBSR)	50	a

Operational energy (B6) and Water consumption (B7)

Name	Value	Unit
Water consumption	-	m ³
Electricity consumption	-	kWh
Other energy carriers	-	MJ
Equipment output	-	kW

End of life (C1-C4)

The product is recycled in the same composition as the declared unit at the end-of-life stage. It is assumed that the ceiling system is transported 100 km by truck from the construction site to the nearest recycling depot.

Name	Value	Unit
Recycling Steel ceiling system recycling	10.38	kg

Re-use, recovery and recycling potential (D), relevant scenario details

Both the top layer and the substructure are recycled in full. The environmental loads avoided by the ensuing secondary steel are indicated in Module D in accordance with their input compilation.

Name	Value	Unit
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5. LCA: Results

Information on the environmental impacts is established using the characterisation factors according to /CML, as published in April 2013/. Long-term emissions are not taken into consideration.

The characterisation factors applied correspond with the requirements of Annex C in /DIN EN 15804/.

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	X	X	MNR	MNR	MNR	MND	MND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 m² steel ceiling system weighing 10.38 kg

Parameter	Unit	A1-A3	A4	A5	B1	B2	C1	C2	C3	C4	D
GWP	[kg CO ₂ -Eq.]	2.67E+1	2.68E-1	3.83E-2	0.00E+0	0.00E+0	0.00E+0	1.55E-1	1.80E+0	0.00E+0	-1.63E+1
ODP	[kg CFC11-Eq.]	4.89E-12	5.60E-15	8.40E-16	0.00E+0	0.00E+0	0.00E+0	3.24E-15	3.78E-14	0.00E+0	2.58E-12
AP	[kg SO ₂ -Eq.]	6.07E-2	5.53E-4	3.96E-6	0.00E+0	0.00E+0	0.00E+0	3.20E-4	5.86E-4	0.00E+0	-3.85E-2
EP	[kg (PO ₄) ³⁻ -Eq.]	6.33E-3	1.33E-4	8.46E-7	0.00E+0	0.00E+0	0.00E+0	7.73E-5	1.46E-4	0.00E+0	-3.23E-3
POCP	[kg ethene-Eq.]	8.16E-3	-1.88E-4	3.40E-7	0.00E+0	0.00E+0	0.00E+0	-1.09E-4	3.76E-5	0.00E+0	-4.93E-3
ADPE	[kg Sb-Eq.]	2.34E-6	2.60E-8	2.36E-10	0.00E+0	0.00E+0	0.00E+0	1.51E-8	6.14E-9	0.00E+0	7.75E-7
ADPF	[MJ]	2.51E+2	3.57E+0	1.01E-2	0.00E+0	0.00E+0	0.00E+0	2.07E+0	4.33E-1	0.00E+0	-1.32E+2

Caption GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources

RESULTS OF THE LCA - RESOURCE USE: 1 m² steel ceiling system weighing 10.38 kg

Parameter	Unit	A1-A3	A4	A5	B1	B2	C1	C2	C3	C4	D
PERE	[MJ]	2.35E+1	2.41E-1	2.30E-3	0.00E+0	0.00E+0	0.00E+0	1.40E-1	6.64E-2	0.00E+0	9.31E+0
PERM	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
PERT	[MJ]	2.35E+1	2.41E-1	2.30E-3	0.00E+0	0.00E+0	0.00E+0	1.40E-1	6.64E-2	0.00E+0	9.31E+0
PENRE	[MJ]	2.57E+2	3.58E+0	1.17E-2	0.00E+0	0.00E+0	0.00E+0	2.07E+0	4.99E-1	0.00E+0	-1.26E+2
PENRM	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
PENRT	[MJ]	2.57E+2	3.58E+0	1.17E-2	0.00E+0	0.00E+0	0.00E+0	2.07E+0	4.99E-1	0.00E+0	-1.26E+2
SM	[kg]	2.19E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	7.75E+0
RSF	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
NRSF	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
FW	[m ³]	5.25E-3	2.80E-4	9.34E-5	0.00E+0	0.00E+0	0.00E+0	1.62E-4	4.10E-3	0.00E+0	4.18E-3

Caption PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES:

1 m² steel ceiling system weighing 10.38 kg

Parameter	Unit	A1-A3	A4	A5	B1	B2	C1	C2	C3	C4	D
HWD	[kg]	2.43E-7	2.30E-7	4.05E-11	0.00E+0	0.00E+0	0.00E+0	1.33E-7	2.82E-10	0.00E+0	-8.76E-8
NHWD	[kg]	3.74E-1	2.67E-4	1.49E-3	0.00E+0	0.00E+0	0.00E+0	1.55E-4	3.82E-3	0.00E+0	-2.55E-1
RWD	[kg]	2.47E-3	4.32E-6	6.44E-7	0.00E+0	0.00E+0	0.00E+0	2.50E-6	2.65E-5	0.00E+0	2.36E-3
CRU	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
MFR	[kg]	1.37E+0	0.00E+0	9.93E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.02E+1	0.00E+0	0.00E+0
MER	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
EEE	[MJ]	0.00E+0	0.00E+0	6.11E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
EET	[MJ]	0.00E+0	0.00E+0	1.23E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0

Caption HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EEE = Exported thermal energy

6. LCA: Interpretation

Global Warming Potential (GWP)

The global warming potential value for the steel ceiling system is determined during the manufacturing phase (A1-A3) by the production of preliminary products made of steel. The transport processes (A4, C2) only make a very minor contribution to the global warming potential. The environmental loads avoided in Module D are indicated as a negative value for the EoL scenario.

Ozone Depletion Potential (ODP)

The very low values in the ODP impact category are attributable to emissions during steel production (A1-A3).

Eutrophication Potential (EP)

Acidification Potential (AP)

Contributions to these environmental impacts are determined by the manufacture of sheet steel (A1-A3). The negative values in Module D are essentially the result of environmental loads avoided during energy recovery and the secondary steel available again in the next system.

Abiotic Depletion of Resources (fossil) (ADPF) and PENRT

Fossil resources are primarily required for the manufacture of sheet steel. Recycling after end of use also requires energy, albeit less than the recovery of new material, resulting in a negative contribution in Module D.



7. Requisite evidence

LMD metal ceiling panels	CAS no.	Retention time min.	ID cat.	at 28 days $\mu\text{g}/\text{m}^3$	Criteria, e.g. LCI $\mu\text{g}/\text{m}^3$	R 28 days (c / LCI)	Emission rate $\mu\text{g}/(\text{m}^2\cdot\text{h})$	Toluol equivalent $\mu\text{g}/\text{m}^3$
TVOC (AgBB/DIBt) (C6-C16)				10	1,000	-	13	10
VOC individual substances with LCI value:								
n.a.	-	-	-	< 5	-	-	< 7	< 5
Summer R = $\sum \text{Conc}_i/\text{LCI}_i$				-	1	< 0.1	-	-
VOC individual substances without LCI value:								
1.6 Dioxacyclododecan 7.12 dion*	777-95-7	15.53	2	10	-	-	13	10
Total VOC without LCI value				10	100	-	13	10
Total VVOC (< n-C6)				< 5	-	-	< 7	< 5
VVOC individual substances:								
n.a.	-	-	-	< 5	-	-	< 7	< 5
Total SVOC (> n-C16)				< 5	100	-	< 7	< 5
SVOC individual substances:								
n.a.	-	-	-	< 5	-	-	< 7	< 5
Carcinogenic substances				< 1	1	-	< 2	< 1
n.a.	-	-	-	< 1	-	-	< 2	< 1
Volatile aldehydes determined using the DNPH method (see 1.3.4)								
Formaldehyde	50-00-0	-	-	< 2	120	-	< 3	-
Acetaldehyde	75-07-0	-	-	< 2	-	-	< 3	-
C3 – C6 aldehydes	-	-	-	< 2	-	-	< 3	-

< below the quantification limit

* not included in accreditation no. 168; see 1.3.7 Accreditation

n.a. not verified

/Test report no. G1834A2/ is available for the steel ceiling system. The institute responsible for testing was /Eurofins Product Testing/ A/S Smedskovvej 38, DK-8464 Galten, Denmark.

Result: The LMD metal ceiling panel product reviewed is suitable for use in interior areas in accordance with the "Certification principles for health assessment of construction products in interior areas" (DIBt notifications 10/2008), in combination with the LCI values of the AgBB in the version dated March 2008.

TVOC (C6 - C16)	-	$\mu\text{g}/\text{m}^3$
Sum SVOC (C16 - C22)	-	$\mu\text{g}/\text{m}^3$
R (dimensionless)	-	-
VOC without NIK	-	$\mu\text{g}/\text{m}^3$
Carcinogenic Substances	-	$\mu\text{g}/\text{m}^3$

AgBB overview of results (3 days [$\mu\text{g}/\text{m}^3$])

Name	Value	Unit
TVOC (C6 - C16)	-	$\mu\text{g}/\text{m}^3$
Sum SVOC (C16 - C22)	-	$\mu\text{g}/\text{m}^3$
R (dimensionless)	-	-
VOC without NIK	-	$\mu\text{g}/\text{m}^3$
Carcinogenic Substances	-	$\mu\text{g}/\text{m}^3$

Name	Value	Unit
------	-------	------

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/EN 15804/
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Annex

For LMD steel ceiling systems weighing max. 20 kg/m²

to the

ENVIRONMENTAL PRODUCT DECLARATION

in accordance with /ISO 14025/ and /EN 15804/

Owner of the Declaration	Lindner Group
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-LIN-20180192-IBC1-EN
Issue date	04.02.2019
Valid to	03.02.2024

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



1. General information on the Annex

The EPD is valid for all Lindner steel ceiling systems in the LMD range:

LMD-B (*Post cap ceilings*)

LMD-E (*Hook-on and corridor ceilings*)

LMD-K (*Cassette ceilings*)

LMD-St (*Expanded metal ceilings*)

LMD-L (*Baffle ceilings*)

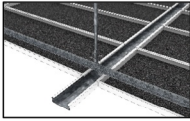
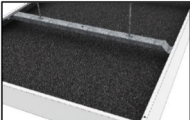
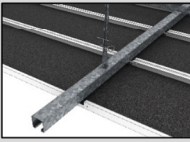
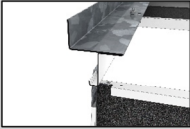
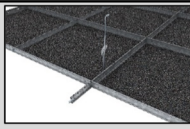
LMD-DS (*Canopy ceilings*)

LMD-TS (*Torsion spring*)

The various ceilings display very different weights, depending on the requisite sizes of the ceiling panels and the associated substructure.

The results of the LCA indicate a linear connection with the overall weight of the ceiling system for all impact categories (WKI) and all modules (A-D).

The overall weights of individual ceiling systems are indicated in Table 1.

Gewicht (kg/m ²)						
		Abmessungen (mm)				
		1000 x 500	1000 x 250	2000 x 500	2000 x 250	-
Produktfamilie	Produkttyp					
Bandrasterdecken						
	LMD-B 100	7,69	8,53	6,81	7,65	
	LMD-B 110	9,17	11,08	7,56	8,94	
Deckensegel						
	LMD-DS 312	9,24	9,07	8,99	8,82	
	LMD-DS 313	10,27	10,90	9,04	9,66	
	LMD-DS 320	7,51	9,15	7,11	8,75	
Einhängedecken						
	LMD-E 200/2	7,16	7,99	6,82	7,66	
	LMD-E 210/1	5,52	5,83	4,94	5,25	
	LMD-E 213/1	8,16	9,01	7,00	7,83	
	LMD-E 213 BWS	10,41	12,45	9,11	11,13	
	LMD-E 213 WL	9,14	10,12	7,95	8,91	
	LMD-E 214/1	8,38	9,20	7,24	8,05	
Flurdecken						
	LMD-E 300/1	5,19	5,76	5,01	5,58	
	LMD-E 312	9,96	10,75	7,73	8,52	
	LMD-E 321/1	12,42	13,26	8,99	9,83	
	LMD-E 340/1	9,37	10,21	7,46	8,30	
		Abmessungen (mm)				
		584 x 584	590 x 590	600 x 600	625 x 625	-
Kassettendecken						
	LMD-K 400	5,01	-	-	-	
	LMD-K 403	-	5,03	-	-	
	LMD-K 420	-	-	5,38	5,29	


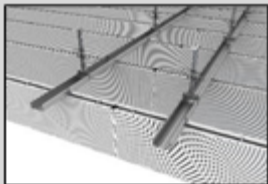
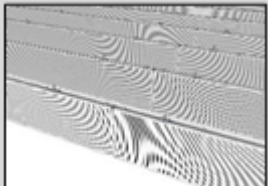
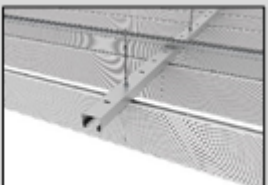
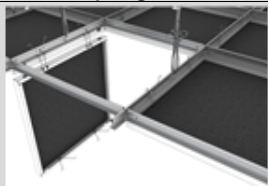
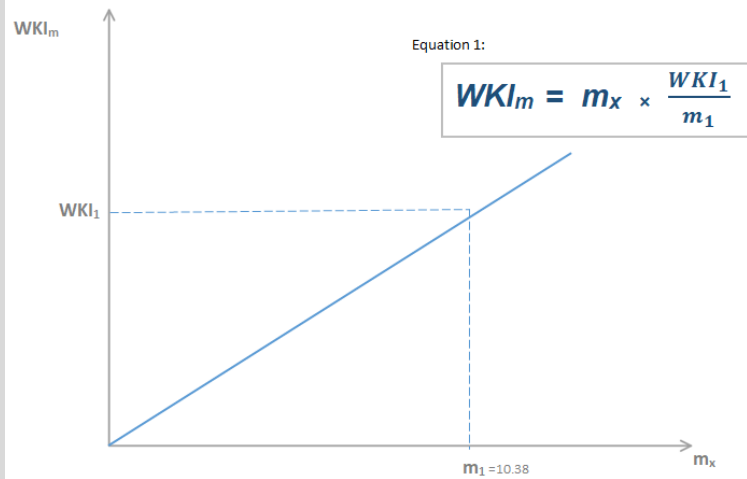
		Dimensions (mm)					
		1000 x 500	1000 x 250	2000 x 500	2000 x 250	Mesh	
Expanded metal data							
	LMD-St 213	13.42	18.31	10.24	13.10	16 x 8.0 x 2.0 x 1.5	
		11.56	16.23	9.39	12.07	28 x 12 x 2.5 x 1.5	
		13.23	18.11	11.01	13.89	42 x 15 x 3.0 x 2.0	
	LMD-St 213 BWS	12.91	17.79	10.69	13.57	42 x 15 x 3.0 x 2.0	
		LMD-St 214	13.64	18.50	10.48	13.32	16 x 8.0 x 2.0 x 1.5
			11.56	16.23	9.39	12.07	28 x 12 x 2.5 x 1.5
	LMD-St 312	13.23	18.11	11.01	13.89	42 x 15 x 3.0 x 2.0	
		15.22	20.05	10.97	13.79	16 x 8.0 x 2.0 x 1.5	
		11.56	16.23	9.39	12.07	28 x 12 x 2.5 x 1.5	
		LMD-St 700 BWS	13.23	18.11	11.01	13.89	42 x 15 x 3.0 x 2.0
	LMD-St 700 BWS	5.93		9.51		42 x 15 x 3.0 x 2.0	
Baffle ceilings							
		Dimensions (mm)				Baffle width	
		100	200	300	400		
	LMD-L 601	10.92	9.73	9.34	9.14	35	
		11.33	9.98	9.52	9.30	40	
		11.59	10.14	9.66	9.42	45	
		11.86	10.32	9.80	9.54	50	
	LMD-L 607	12.12	10.48	9.94	9.54	55	
		12.44	10.25	9.52	9.16	35	
		12.85	10.50	9.71	9.32	40	
		13.11	10.66	9.85	9.44	45	
		13.38	10.84	9.99	9.56	50	
	LMD-L 608	13.64	11.00	10.13	9.68	55	
		12.12	10.93	10.54	10.34	35	
		12.53	11.18	10.72	10.50	40	
		12.79	11.34	10.86	10.62	45	
		13.06	11.52	11.00	10.74	50	
Torsion spring							
	LMD-TS 100	Dimensions (mm)					
		1000 x 500	1000 x 250	1250 x 625	-		
		6.42	7.19	6.19	-		

Table 1: General overview of ceiling systems and weights

It is possible to calculate specific LCA results (WKlm) for each product (x) in all possible size variations, scaled according to the overall weight of the system.

The calculation formula in Fig. 1 shows how to calculate the LCA results for all types of ceilings.



WKI_m = Impact category value subject to weight
 WKI_1 = Impact category value for the declared unit
 m_x = weight in [kg]

Fig. 1: Formula for calculating the impact categories

1. Information on steel ceiling systems with a total weight of 1kg/m²

Components

Designation	Value	Unit
Steel	> 99.5	%
Acoustic non-woven	< 0.5	%

Declared unit

Designation	Value	Unit
Declared unit	1	m ²
Basis weight	1	kg

2. LCA: Results for a steel ceiling system with a weight of 1kg/m²

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)

Product stage			Construction process stage		Use stage							End-of-life stage				Benefits and loads beyond the system boundaries
Raw material supply	Transport	Manufacturing	Transport from manufacturer to site	Assembly	Use / Application	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction / Demolition	Transport	Waste processing	Disposal	Reuse, 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	X	X	MNR	MNR	MNR	MND	MND	X	X	X	X	X

LCA RESULTS – ENVIRONMENTAL IMPACT: 1 m² steel ceiling system weighing 1 kg

Parameter	Unit	A1-A3	A4	A5	B1	B2	C1	C2	C3	C4	D
GWP	[kg CO ₂ equiv.]	2.57E+00	2.58E-02	3.69E-03	0.00E+00	0.00E+00	0.00E+00	1.49E-02	1.73E-01	0.00E+00	-1.57E+00
ODP	[kg CFC11 equiv.]	4.71E-13	5.39E-16	8.09E-17	0.00E+00	0.00E+00	0.00E+00	3.12E-16	3.64E-15	0.00E+00	2.49E-13
AP	[kg SO ₂ equiv.]	5.85E-03	5.33E-05	3.82E-07	0.00E+00	0.00E+00	0.00E+00	3.08E-05	5.65E-05	0.00E+00	-3.71E-03
EP	[kg (PO ₄) ³ equiv.]	6.10E-04	1.28E-05	8.15E-08	0.00E+00	0.00E+00	0.00E+00	7.45E-06	1.41E-05	0.00E+00	-3.11E-04
POCP	[kg ethene equiv.]	7.86E-04	-1.81E-05	3.28E-08	0.00E+00	0.00E+00	0.00E+00	-1.05E-05	3.62E-06	0.00E+00	-4.75E-04
ADPE	[kg Sb equiv.]	2.25E-07	2.50E-09	2.27E-11	0.00E+00	0.00E+00	0.00E+00	1.45E-09	5.92E-10	0.00E+00	7.47E-08
ADPF	[MJ]	2.42E+01	3.44E-01	9.73E-04	0.00E+00	0.00E+00	0.00E+00	1.99E-01	4.17E-02	0.00E+00	-1.27E+01

Legend: GWP = Global warming potential; ODP = Ozone depletion potential; AP = Acidification potential; EP = Eutrophication potential; POCP = Photochemical ozone creation potential; ADPE = Abiotic depletion potential non-fossil resources; ADPF = Abiotic depletion potential fossil fuels

LCA RESULTS – RESOURCE USE: 1 m² steel ceiling system weighing 1 kg

Parameter	Unit	A1-A3	A4	A5	B1	B2	C1	C2	C3	C4	D
(PERE)	[MJ]	2.26E+00	2.32E-02	2.22E-04	0.00E+00	0.00E+00	0.00E+00	1.35E-02	6.40E-03	0.00E+00	8.97E-01
PERM	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	[MJ]	2.26E+00	2.26E+00	2.22E-04	0.00E+00	0.00E+00	0.00E+00	1.35E-02	6.40E-03	0.00E+00	8.97E-01
PENRE	[MJ]	2.48E+01	3.45E-01	1.13E-03	0.00E+00	0.00E+00	0.00E+00	1.99E-01	4.81E-02	0.00E+00	-1.19E+01
PENRM	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	[MJ]	2.48E+01	3.45E-01	1.13E-03	0.00E+00	0.00E+00	0.00E+00	1.99E-01	4.81E-02	0.00E+00	-1.19E+01
SM	[kg]	2.11E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.47E-01
RSF	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	[m ³]	5.06E-04	2.70E-05	9.00E-06	0.00E+00	0.00E+00	0.00E+00	1.56E-05	3.95E-04	0.00E+00	4.03E-04

Legend: PERE = Renewable primary energy as primary 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 = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

LCA RESULTS – OUTPUT FLOWS AND WASTE CATEGORIES: 1 m² steel ceiling system weighing 1 kg

Parameter	Unit	A1-A3	A4	A5	B1	B2	C1	C2	C3	C4	D
HWD	[kg]	2.34E-08	2.22E-08	3.90E-12	0.00E+00	0.00E+00	0.00E+00	1.28E-08	2.72E-11	0.00E+00	-8.44E-09
NHWD	[kg]	3.60E-02	2.57E-05	1.44E-04	0.00E+00	0.00E+00	0.00E+00	1.49E-05	3.68E-04	0.00E+00	-2.46E-02
RWD	[kg]	2.38E-04	4.16E-07	6.20E-08	0.00E+00	0.00E+00	0.00E+00	2.41E-07	2.55E-06	0.00E+00	2.27E-04
CRU	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	[kg]	1.32E-01	0.00E+00	9.57E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.86E-01	0.00E+00	0.00E+00
MER	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEE	[MJ]	0.00E+00	0.00E+00	5.89E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EET	[MJ]	0.00E+00	0.00E+00	1.18E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Legend: HWD = Hazardous waste for disposal; NHWD = Non-hazardous waste for disposal; RWD = Radioactive waste for disposal; CRU = Components for reuse; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy