ENVIRONMENTAL PRODUCT DECLARATION

According to EN ISO 14025 and EN 15804

This Declaration is based on the Product Category Rules (PCR) for 'Luminaires, lamps and components for luminaires' - 11.2017

Declaration Holder:	Zumtobel Lighting GmbH Schweizerstraße 30, 6850 Dornbirn - Österreich
Program Holder:	Institut Bauen und Umwelt e. V. (IBU), Deutschland (www.ibu-epd.com)
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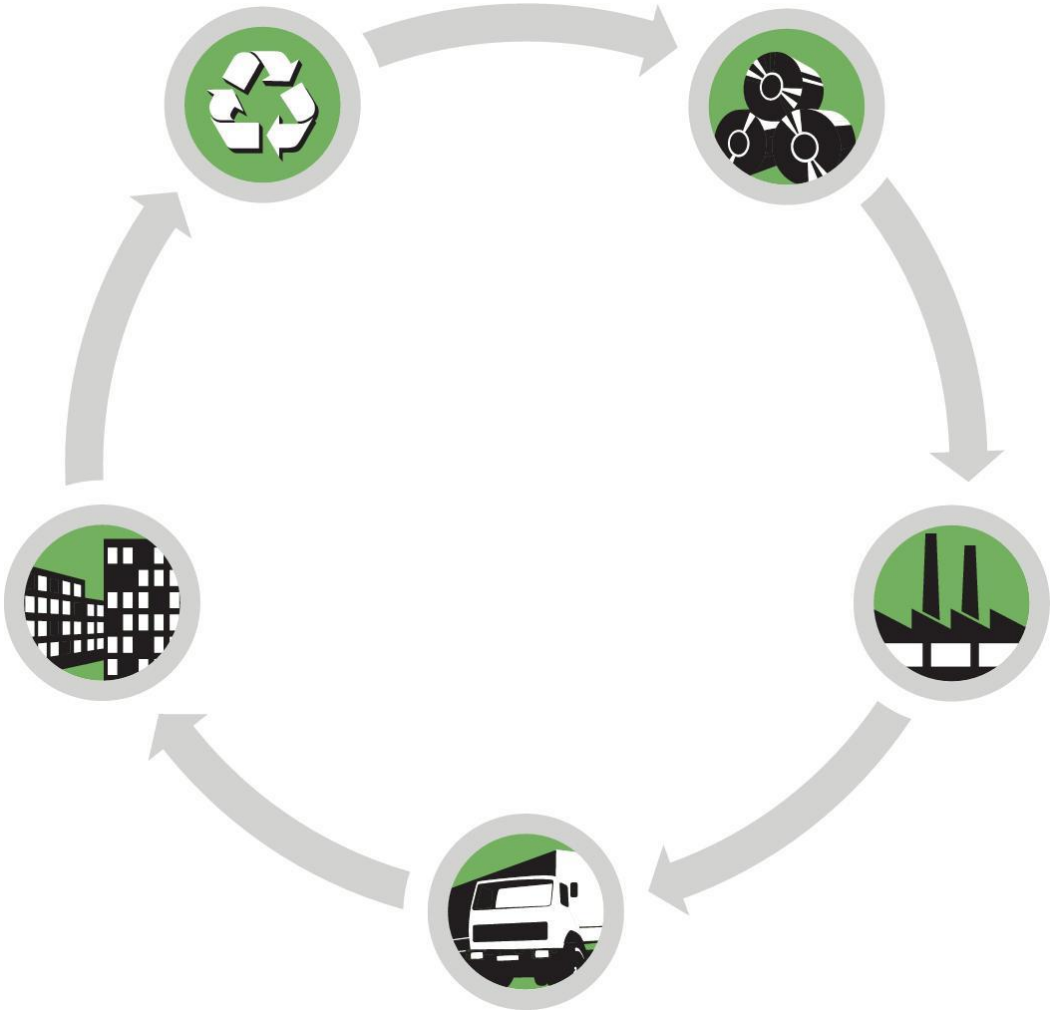
LED pendant luminaire

TECTON MIREL LED4000-840 L1500 LDO WH

42185315



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Summary

Zumtobel is the internationally leading supplier of integral lighting solutions for a wide variety of applications. We want to use light to create worlds of experience, make work easier and improve communications and safety while remaining fully aware of our responsibility for the environment. Based on careful analysis and advanced product development we are improving the environmental performance of our products. The following information details environmental aspects throughout the life cycle of the product.

This Environmental Product Declaration (EPD) is based on EN ISO 14025 and EN 15804 and describes the specific environmental impacts of the mentioned product. The declaration follows also the specified, concretising requirements of the verifying program holder Institut Bauen und Umwelt e.V. (IBU) with respect to the LCA calculation rules and the content of the (core-)EPD according to the underlying PCR-instructions (PCR: Product Category Rules) for 'Luminaires, lamps and components for luminaires' (Ref: IBU PCR Teil A und B).
The described product serves as declared unit. The declaration includes a product description, information on material composition, manufacturing, transport, use-stage, disposal and recycling, as well as results of the life cycle assessment. EPDs of construction products are only comparable if figures are calculated according to the same PCR and suitable, mandatory use-stage scenarios.

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LCA results of selected parameters on basis of the chosen scenario

Assessment parameter	Unit	Production-Stage	Construction Process Stage	Use-stage	End-of-Life Stage	Benefits and loads beyond the system boundary
		A1-A3	A4, A5	B4, B6	C2-C4	D
Acidification Potential (AP)	[kg SO_2 eq]	8,10E-02	4,39E-04	1,36E-01	1,28E-03	-2,45E-02
Eutrophication Potential (EP)	[kg PO_4^{3-} eq]	6,97E-03	9,22E-05	2,55E-02	1,31E-04	-1,63E-03
Global Warming Potential (GWP100)	[kg CO_2 eq]	1,96E+01	3,38E-01	4,02E+01	1,76E+00	-5,08E+00
Primary energy, renewable	[MJ]	3,81E+01	3,72E-01	3,02E+03	2,28E+00	-3,36E+00
Primary energy, non renewable	[MJ]	2,56E+02	2,25E+00	3,86E+03	6,51E+00	-5,24E+01

For a comprehensive description of the results please refer to chapter 4 Life Cycle Assessment Results.

1 Product description* and application

Linear, energy-efficient TECTON MIREL LED continuous row luminaire made of roll-formed sheet steel in polyester lacquer finish, white. Luminaire input power: 27.1 W, Slave luminaire for DALI control (DALI only) with LED converter. LED service life lasts 50000 h before luminous flux is reduced to 90% of the initial value. Chromaticity tolerance (initial MacAdam): 3. Luminaire efficacy: 147 lm/W. Luminaire luminous flux: 3980 lm. Colour rendering Ra > 80, colour temperature 4000 K. LED continuous row luminaire with 4 highly efficient mid-power LEDs per lens segment. Light is guided via the reflector- the lens combination creates a unique continuous row design with photometric benefits such as very low UGR values with minimum light emission surface. Lens reflector enables UGR <19 and luminance of <3000 cd/m². All-in-one solution: Batten luminaire, lamp and reflector are combined in a single product. Base support of LED continuous-row luminaire of sheet steel in polyester lacquer finish, white. 100% flexible, tool-free mechanical and electrical installation using CLIX-technology by means of two side-mounted rotary levers on the TECTON trunking. No ultraviolet or infrared radiation. Impact strength: IK03. ambient temperature: -20°C to +30°C. Luminaire wired with halogen-free leads. Dimensions: 1498 x 60 x 85 mm weight: 2.2 kg

Note: Other technical data are not relevant with respect to the given context.

Additional information is available at http://www.zumtobel.com/42185315.

Base materials / Ancillary materials*

Materials	weight [kg]	weight [%]	Materials	weight [kg]	weight [%]
Steel	1,37E+00	61,47	Ferrites	2,20E-02	0,99
Epoxy resin	2,25E-02	1,01	PVC	2,73E-04	0,01
Silicon dioxide (SiO_2)	1,85E-02	0,83	Electrolyte	1,15E-03	0,05
Silicon	7,71E-05	0,00	EPDM	1,01E-03	0,05
Tin	4,30E-02	1,93	PBT	3,78E-03	0,17
Aluminum and alloys	5,61E-03	0,25	Silver in alloy	2,81E-05	0,00
Aluminum Oxide (Al_2O_3)	5,70E-04	0,03	Polyurethane	3,55E-05	0,00
Glass	1,19E-05	0,00	Unsaturated polyester	5,00E-07	0,00
Copper alloys	8,42E-04	0,04	PC	2,25E-01	10,11
Zinc	1,28E-01	5,75	Colophony	1,52E-05	0,00
Lead	4,94E-06	0,00	Nylon	4,34E-02	1,95
Tetrabromobisphenol A (TBBA)	2,88E-04	0,01	Silicone	1,45E-03	0,06
Tin in alloy	1,15E-03	0,05	Brass	3,85E-03	0,17
Antimony oxide (Sb_2O_3)	1,50E-05	0,00	EVA	1,92E-02	0,86
Silver	9,23E-05	0,00	PE	1,48E-02	0,66
Inorganic flame retardants	3,70E-08	0,00	Silicone	4,62E-03	0,21
Nickel in alloy	2,65E-06	0,00	PMMA	2,05E-01	9,21
Gold	1,49E-05	0,00	Paper	4,73E-04	0,02
Nickel	2,22E-05	0,00	Unsaturated polyester (UP)	5,00E-07	0,00
Palladium in alloy	2,67E-06	0,00	Zinc in alloy	4,65E-06	0,00
Copper	8,79E-02	3,94	Not Considered	0,00E+00	0,00
PET	3,49E-03	0,16	Total Weight	2,23E+00	100,00

* The calculation of the LCA results are solely based on the actual weight of all single material components in the table. The product weight in the product description may differ from the declared total weight in the EPD.

Regulation (EC) No 1907/2006 (REACH), Annex XIV

Zumtobel Group fulfils the requirements of the EU-Regulation REACH.
For lighting components from Tridonic the conformity of products is declared overall in a letter that can be downloaded from internet (status 12-2018): http://www.tridonic.com/com/en/environmental-declarations.asp
For the luminaire brands Thorn and Zumtobel a defined process was set up to secure the REACH conformity of purchased components for luminaire production. On that basis separate requests are answered individually.

Packaging	weight [kg]	weight [%]
Paper	2,83E-01	100,00
Not Considered	0,00E+00	0,00
Total Weight	2,83E-01	100,00

Life Cycle Stages - Overview

Manufacturing

The product is made in Austria, Dornbirn. The originating plant is certified according to ISO 9001, ISO 14001 and ISO 50001.

Delivery

Products are mostly delivered by truck in Europe.

Use-stage

During the use-stage, consumption of electricity and potential replacement of components is taken into account.

Abnormal effects: Fire

The thermal load of the product is approximately 14,141 MJ. The calculation is based on the material composition and the gross calorific values of plastics.

End of life

The product is obliged to be professionally collected and recycled in accordance with the EU Directive 2012/19/EU on waste of electric and electronic equipment (WEEE). Zumtobel fulfils its responsibility inside EU via participation in the national WEEE-Schemes. Outside EU the same is valid respectively, according to actual national regulations.

2 LCA: Framework / Calculation rules

The declared unit is the product described in chapter 1 with a total weight of 2,229 kg.

System boundaries

The life cycle assessment covers the whole life cycle; the EPD type is cradle-to-grave. The declared product does not contribute to any potential environmental effects in the modules marked with MND.
The following table provides an overview of the declared modules:

Product assessment information (x = included in LCA, MND = module not declared)																
Product life cycle information																Supplementary information beyond the product life cycle
Production-Stage			Construction Process Stage		Use-stage							End-of-Life Stage				Benefits and loads beyond the system boundary
Raw material supply	Transport	Manufacturing	Transport to building site	Construction installation process	Use	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	MND	MND	MND	X	MND	X	MND	MND	X	X	X	X

- A1-A3: Production: Power generation, production of base materials, pre-products, ancillary materials, processing of secondary materials, packaging materials, installation of products; transport of base materials and purchased components as well as in-house transport is taken into account.
- A4: delivery of products from plant to customer
- A5: effort (energy and material) and emissions of packaging incineration / landfilling
- B4: replacement of components, disposal of failed light sources and production of new light sources
- B6: operational energy use (electricity consumption)
- C2: transport scenario for material recovery resp. Incineration or waste disposal
- C3: Incineration of non-recyclable and combustible materials (assumption: incineration plant with R1 > 0,6), pre-treatment of scrap for the subsequent recycling process (shredder)
- C4: disposal of non-combustible residual materials
- D: Returns for succeeding systems by energy recovery from incineration plants (from A5 and C3) and material recovery incl. recycling efforts

Cut-off rules

In the assessment of the production stage (A1-A3), all available data from production are considered, i.e. all raw materials used as per formulation, utilised thermal energy, and electric power consumption. Thus material and energy flows contributing less than 1 % of mass or energy may have also been considered to some extent. Machines and facilities required during production are neglected. The production of etiquettes, tape and glue is also neglected.
It can be assumed that the total sum of neglected processes does not exceed 5 % of energy usage and mass per module A, B, C or D.

Data quality

The data for the manufacturing of the product are average values, due to the analysis of the factory for 12 months. The used data are not older than 5 years. The basic data used in the calculation are consistent, reproducible, comparable and up to date. Necessary background data result from the GaBi database 12-2018. The geographical representativeness of generic or average data reflects the region where the production is located.

Description of data

The demand of energy for the manufacturing processes is modelled, depending on the product type (luminaires resp. components for lighting systems, e. g. control gears etc.), by using the average consumption of process energy per piece which is reported yearly at Zumtobel Group. By doing that, electrical as well as thermal energy is considered. The average consumption of process energy in the manufacturing sites includes the energy of additional appliances that is not measured separately, e. g. air condition and lighting (incl. outdoor).
For luminaires the energy consumption is modelled with an European grid mix. For system components, a mix of 50% European and 50% Asian grid mix is applied. The energy mix considered for the electric energy consumption during the use-stage is described in the use-stage scenario.
Generic data is used for the upstream processes beyond manufacturer's influence. Information on secondary materials for upstream processes is available and considered.

Allocation

Recycling of metals and glass is considered. Material reused in succeeding systems is included in module D.
During manufacture of the products no side products arise. In background datasets appropriate allocations are used according to documentation.

Comparability

Basically a comparison or an evaluation of EPD data is only reasonable if all respective datasets are made according to EN 15804 and the context of the building respectively the use-stage scenario and the specific characteristic of the product are considered.

3 LCA: Scenarios and additional technical information

Delivery scenario

Standard scenario is the delivery in Europe by truck with a transport distance of 700 km (maximum). The weight of the transported unit includes product with packaging.

Transport to building site

Name	
fuel [l/100 km]	2,31E-03
Transport distance [km]	700
Transport route	Europe
Capacity utilisation (including empty runs) [%]	55

Use-stage scenario

During the use-stage, consumption of electricity is calculated, based on a chosen standardardised scenario which is characteristical for this luminaire type. Not only operating time and average product lifetime is considered but also additional influences like stand-by circuits, dimming function and more.

Use-stage model	
Scenario	Education
Reference Service Lifetime [years]	20
Total active time [hours]	40 000
Total passive time [hours]	135 200
Correction factors $F_{CP}/F_D/F_O$ for dimming/presence detection	1/0,8/1
Energy Mix	SE

The Constant Illuminance Factor F_{CP}, the Daylight Dependency Factor F_D and the Occupancy Dependency Factor F_O are considered according to EN 15193.

Energy consumption in the use-stage according to the use-stage model	
Nominal Power [W]	27,1
Passive Power [W]	0,2
Constant Illuminance Control	False
Dimmable	True
Presence Detector	False
Total Energy Consumption [kWh] (B6)	910,2
Primary energy demand due to Total Energy Consumption [MJ]	6 885,8

Some functionality may require further controls not considered in this context.

Precise power consumption data for specific lighting solutions or applications need to be calculated separately.

Potential replacement of parts is considered in the LCA calculations (B4) and shown here if applicable. The respective lifetimes are taken from manufacturers' data or are estimated.

End-of-life scenario (C/D)

The End of Life scenario is based on a material split and respective recycling rates. In the applied scenario it is assumed that all metals and 70 % of glass parts are to be recycled, plastics are incinerated. The remaining parts of the product are landfilled. The energy required for treatment of materials (e.g. shredding processes) is included.

End-of-Life (C1-C4) and reuse, recovery and/or recycling potentials (D), relevant scenario information

Name	Value in kg	Share in %
Collected separately (WEEE)	2,229	100,000
Recycling / Reuse in next system	1,653	74,165
Energy recovery	0,571	25,607
Landfilling	0,005	0,206

4 LCA: Life Cycle Assessment Results

The evaluation is conducted according to characterization factors of EN 15804-1+A1 (and essential addenda).

Table 1: LCA results: environmental impacts of the product

Assessment parameter	Unit	Production-Stage	Construction Process Stage		Use-stage		End-of-Life Stage			Benefits and loads beyond the system boundary
		Raw material supply and manu-facturing	Transport to building site	Construction installation process	Replacement of components	Operational energy use	Transport	Waste processing	Disposal	Reuse, recovery or recycling potential
		A1-A3	A4	A5	B4	B6	C2	C3	C4	D
ADPE	[kg Sb eq]	1,72E-03	8,28E-09	5,16E-08	0,00E+00	1,07E-04	1,18E-09	3,82E-07	5,37E-11	-1,58E-03
ADPF	[MJ]	2,29E+02	1,37E+00	5,56E-01	0,00E+00	2,70E+02	1,96E-01	3,88E+00	3,47E-03	-4,92E+01
AP	[kg SO_2 eq]	8,10E-02	2,32E-04	2,07E-04	0,00E+00	1,36E-01	3,31E-05	1,25E-03	1,10E-06	-2,45E-02
EP	[kg PO_4^{3-} eq]	6,97E-03	5,84E-05	3,38E-05	0,00E+00	2,55E-02	8,34E-06	1,19E-04	4,20E-06	-1,63E-03
GWP	[kg CO_2 eq]	1,96E+01	1,01E-01	2,37E-01	0,00E+00	4,02E+01	1,44E-02	1,74E+00	4,32E-03	-5,08E+00
ODP	[kg R11 eq]	-1,27E-08	2,75E-15	1,87E-13	0,00E+00	2,34E-09	3,93E-16	1,41E-12	6,66E-17	-1,40E-09
POCP	[kg C_2H_4 eq]	6,23E-03	-7,76E-05	1,34E-05	0,00E+00	1,62E-02	-1,11E-05	7,01E-05	1,08E-06	-1,78E-03

GWP = Global Warming Potential
ODP = Ozone Depletion Potential
AP = Acidification Potential
EP = Eutrophication Potential
POCP = Photochemical ozone creation potential
ADPE = Abiotic Depletion Potential (ADP elements)
ADPF = Abiotic Depletion Potential (ADP fossil fuels)

Table 2: LCA results: input of resources

Assessment parameter	Unit	Production-Stage	Construction Process Stage		Use-stage		End-of-Life Stage			Benefits and loads beyond the system boundary
		Raw material supply and manu-facturing	Transport to building site	Construction installation process	Replacement of components	Operational energy use	Transport	Waste processing	Disposal	Reuse, recovery or recycling potential
		A1-A3	A4	A5	B4	B6	C2	C3	C4	D
PERE	[MJ]	3,81E+01	7,59E-02	2,96E-01	0,00E+00	3,02E+03	1,08E-02	2,27E+00	2,78E-04	-3,36E+00
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
PERT	[MJ]	3,81E+01	7,59E-02	2,96E-01	0,00E+00	3,02E+03	1,08E-02	2,27E+00	2,78E-04	-3,36E+00
PENRE	[MJ]	2,42E+02	1,38E+00	8,78E-01	0,00E+00	3,86E+03	1,97E-01	2,04E+01	3,60E-03	-5,24E+01
PENRM	[MJ]	1,41E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	-1,41E+01	0,00E+00	0,00E+00
PENRT	[MJ]	2,56E+02	1,38E+00	8,78E-01	0,00E+00	3,86E+03	1,97E-01	6,31E+00	3,60E-03	-5,24E+01
SM	[kg]	2,32E-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
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
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
FW	[kg]	1,14E+02	1,40E-01	1,43E+00	0,00E+00	5,80E+03	2,00E-02	6,42E+00	5,28E-04	-1,91E+01

PERE = Use of renewable primary energy as energy source
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 as energy source
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

Table 3: LCA results: Waste categories and other output flows

		A1-A3	A4	A5	B4	B6	C2	C3	C4	D
HWD	[kg]	7,98E-06	7,96E-08	1,40E-09	0,00E+00	1,78E-06	1,14E-08	6,43E-09	1,85E-11	-3,95E-08
NHWD	[kg]	8,24E-01	1,15E-04	7,00E-02	0,00E+00	4,66E+00	1,65E-05	1,50E-01	3,55E-03	-2,42E-01
RWD	[kg]	1,05E-02	1,88E-06	1,28E-04	0,00E+00	1,49E+00	2,69E-07	9,64E-04	5,26E-08	-1,26E-03
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
MFR	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,65E+00	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
EEE	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,66E+00	0,00E+00	0,00E+00
EET	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	6,11E+00	0,00E+00	0,00E+00

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
EET	=	Exported thermal energy

Interpretation

The primary energy demand and environmental impact of the considered product is basically determined by the expenditure in the use-stage. This is due to the provision of light based on electricity consumption and the related upstream processes for electricity generation.

The production stage has a minor contribution on the environmental impact regarding the overall life cycle. The considered transport processes are not significant.

The heating value, resulting from the content of plastic determines the energy gain during the end-of-life scenario. Recycled material can be reused in next systems. Energie gained from incineration processes and recycled materials for succeeding systems are considered in modul D.

5 Verification

This EPD including the results of the Life-Cycle Analysis is based on an LCA modelling (EPD system), verified by an independent third party.
It's the sole responsibility of the manufacturer to secure the correctness of any input data entered into the system. The owner of the declaration is liable for the underlying data and certificates; liability of IBU is disclosed with respect to manufacturer's information, LCA data and certificates.

The CEN standard EN 15804 serves as core PCR. The verification of the generation process of this EPD was done externally by a third party independent according to EN ISO 14025.	
Third party verifier: Matthias Schulz, appointed by the Advisory Board of the Institute Construction and Environment (IBU) e.V.	Director: Dr. Alexander Röder, Director of the Institute Construction and Environment (IBU) e.V.

Literature

AgBB	Health-related Evaluation Procedure for Volatile Organic compounds Emissions (VOC and SVOC) from building Products
EN 15804	EN 15804:2012+A1:2013 Sustainability of construction works – Environmental Product Declarations – Core rules for the product category of construction products
EN 15193-1	EN 15193-1:2017 Energy performance of buildings. Energy requirements for lighting
EN ISO 14025	EN ISO 14025:2011: Environmental labels and declarations - Type III environmental declarations — Principles and procedures
EN ISO 14040	EN ISO 14040:2006: Environmental management – Life cycle assessment – Principles and framework
EN ISO 14044	EN ISO 14044:2006 + A1:2018 Environmental management – Life cycle assessment – Requirements and guidelines
GaBi	GaBi Software Family, thinkstep AG
GaBi DB	GaBi 2018, dataset documentation for the software-system and database, LBP, University of Stuttgart and thinkstep AG, Leinfelden-Echterdingen, 2018 (http://www.gabi-software.com/international/support/gabi/gabi-database-2018-lci-documentation/)
ISO 15686	ISO 15686:2011-05, Buildings and constructed assets - Service life planning - Part 1: General principles and framework
PCR part A	Product Category Rules for Building-Related Products and Services Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project report, Version 1.7,2018, Institut Bauen und Umwelt e.V. (IBU)
PCR part B	Product Category Rules for Building-Related Products and Services Part B: Requirements on the EPD for Luminaires, lamps and components for luminaires, Version 1.6, November 2017, Institut Bauen und Umwelt e.V. (IBU)
REACH	Regulation (EC) No 1907/2006 of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)
RoHS 2011	Directive 2011/65/EU of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment
Screening LCA	Screening Study Zumtobel: Influence of the energy consumption in the production phase, thinkstep 2018
WEEE 2012	Directive 2012/19/EU of 4 July 2012 on waste of electric and electronic equipment (WEEE)

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Annex A: Additional assessment parameter France

Table A 1:
Additional Data according to French requirements (supplement Table 1)

Assessment parameter	Unit	Production-Stage	Construction Process Stage		Use-stage		End-of-Life Stage			Benefits and loads beyond the system boundary
		Raw material supply and manu-facturing	Transport to building site	Construction installation process	Replacement of components	Operational energy use	Transport	Waste processing	Disposal	Reuse, recovery or recycling potential
		A1-A3	A4	A5	B4	B6	C2	C3	C4	D
ADPE (Fr)*	kg Sb-eq.	1,72E-03	8,23E-09	5,15E-08	0,00E+00	1,06E-04	1,18E-09	3,81E-07	5,25E-11	-1,58E-03
Water Pollution	m^3	2,47E+00	3,41E-02	2,74E-02	0,00E+00	4,47E+01	4,88E-03	9,17E-02	3,17E-04	-2,57E-01
Air Pollution	m^3	1,82E+03	4,40E+00	1,03E+01	0,00E+00	4,23E+03	6,29E-01	3,73E+01	1,24E+00	-4,61E+02

ADPE (fr) = Abiotic Depletion Potential (ADP elements) - French version