TRIDONIC

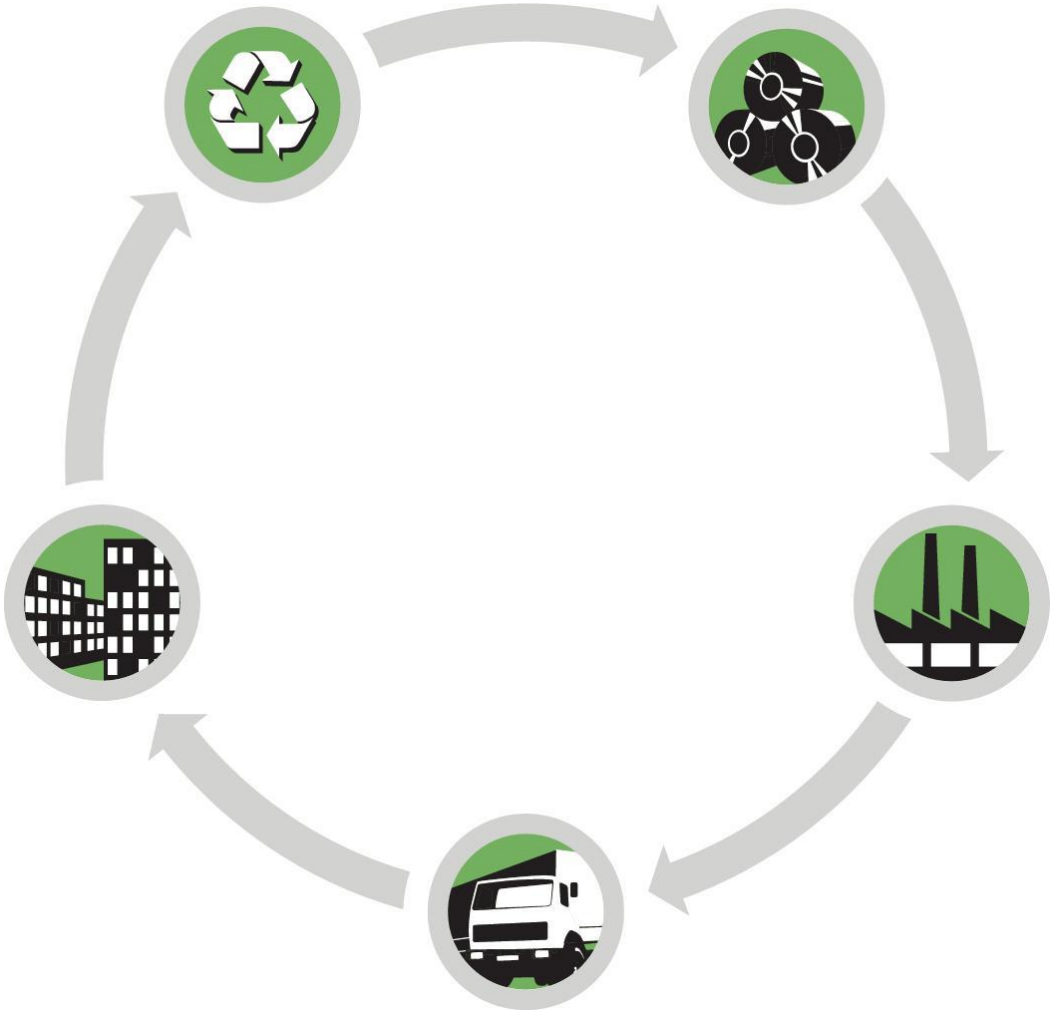
Environmental Product Declaration

According to ISO 14025 and EN 15804

Declaration Holder:	Tridonic GmbH & Co KG
Program Holder:	Institute Construction and Environment (IBU) e.V.
Declaration number:	ECO-ZGR-89602080-Component-EU-2015-05-12
Date of Issue:	2015-05-12
Validity Date:	2020-05-11

Institut Bauen und Umwelt e.V.

89602080 **LLE 24x280mm 2000lm 865 EXC**



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ecolution
An initiative of TRIDONIC

Tridonic enables its customers around the world to develop energy-efficient and economic lighting applications and solutions. Through our lighting components, lighting management systems, connection technology and LED solutions we ensure the highest level of quality, competent advice and outstanding service.

Our initiative „ecolution“ not solely stands for our economic product solutions, but also for a responsible approach to the environment. By careful analysis we are controlling all production processes and aim to improve them continuously. The following information details environmental aspects of the products throughout the whole life cycle.

This declaration is an Environmental Product Declaration (EPD) according to ISO 14025 and describes the specific environmental impacts of the mentioned product. The declaration is based on the document Product Category Rules (PCR) for 'Luminaires, lamps and components for luminaires' and takes into account the development of EN 15804. The Life-Cycle-Assessment (LCA) was performed according to ISO 14040. 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. It is independently verified according to ISO 14025. EPDs of construction products are only comparable if figures are calculated according to the same PCR. This EPD refers to the IBU master EPD for the Zumtobel Group at http://bau-umwelt.de/hp4234/Luminaires-lamps.htm.

Assessment parameter	Unit	Product Stag	Construction Process Stage	Use-stage	End-of-Life Stage	Benefits and loads beyond the system boundary
		A1-A3	A4, A5	B6	C2-C4	D
Acidification Potential (AP)	[kg SO_2 eq]	5,77E-03	2,24E-05	2,72E+00	3,17E-05	-2,32E-04
Eutrophication Potential (EP)	[kg PO_4^{3-} eq]	6,67E-04	2,70E-06	1,45E-01	2,92E-06	-1,11E-05
Global Warming Potential (GWP100)	[kg CO_2 eq]	9,20E-01	2,64E-02	5,83E+02	2,90E-02	-3,33E-02
Primary energy, renewable	[MJ]	9,66E-01	9,74E-03	1,72E+03	1,51E-02	-5,45E-02
Primary energy, non renewable	[MJ]	1,01E+01	9,62E-02	1,03E+04	1,37E-01	-4,72E-01

For a comprehensive description of the results please refer to chapter 3 Life Cycle Assessment Results.

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1 Product

- Ideal for linear and panel lights in industrial applications
- Reliable, high life-time solution and extended temperatur range in combination with the INDUSTRY control gears
- Luminous flux range from 2,230 – 6,300 lm
- LED system solution with outstanding system efficacy up to 131 lm/W
- Efficacy of the module up to 154 lm/W
- High colour rendering index CRI > 80
- Small colour tolerance (MacAdam 3)
- Colour temperatures 3,000, 4,000, 5,000 and 6,500 K
- Perfectly uniform light, even if several LED modules are used together in a line
- Push terminals for simple wiring
- Broad portfolio from extruded lenses and covers available
- Simple installation via clips or screws
- Long life-time
- 8-year guarantee

Additional information is available at http://www.tridonic.com/89602080.

Material Composition

Materials	weight [kg]	weight [%]	Materials	weight [kg]	weight [%]
Brass	4,45E-05	0,18	Gold	2,32E-09	0,00
Epoxy resin	3,48E-03	14,06	Nickel	1,69E-06	0,01
Silicon dioxide (SiO_2)	3,48E-03	14,06	Copper	6,99E-03	28,23
Silicon	7,46E-09	0,00	PA6	2,38E-03	9,60
Tin	8,17E-03	32,96	Silver in alloy	8,41E-06	0,03
Copper alloys	1,26E-06	0,01	Silicone	2,49E-07	0,00
Tetrabromobisphenol A (TBBA)	1,40E-05	0,06	Not Considered	0,00E+00	0,00
Tin in alloy	2,01E-04	0,81	Total Weight	2,48E-02	100,00

Manufacturing

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

Manufacturing includes the extraction of raw materials, extraction of energy carriers, generation of thermal and electrical energy, production of ancillary materials or pre-products, manufacturing processes of the products and all components.

Delivery

Products are mostly delivered in Europe. Delivery is described as a standard model, where the distance from plant to customer is assumed to be 1500 km. The mode of delivery is by truck.

Packaging	**weight [kg]**	**weight [%]**
PS	2,66E-04	1,61
PA6	5,75E-06	0,03
Cardboard/Paper	1,63E-02	98,36

Packaging	weight [kg]	weight [%]
Not Considered	0,00E+00	0,00
Total Weight	1,65E-02	100,00

Use-stage

During the use-stage, consumption of electricity is taken into account. The calculations are based on the PCR document „Luminaires, lamps and components for luminaires“.

Use-stage model	
Total active time [hours]	80 000
Total passive time [hours]	80 000
Correction factors F_{CP}/F_D for dimming	1/1
Energy Mix	EU

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

The minimal nominal power required to produce light from the supply voltage is used for the calculation.

Energy consumption in the use-stage according to the use-stage model	
Nominal Power [W]	15,9
Passive Power [W]	0,0
Constant Illuminance Control	False
Dimmable	False
Total Energy Consumption [kWh]	1 272,0
Primary energy demand due to Total Energy Consumption [MJ]	12 021,0

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.

Singular Effects

The thermal load of the product is approximately 0,13 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 recycled in accordance with the EU Directive 2012/19/EU on waste of electric and electronic equipment (WEEE).

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

Materials which are to be recycled and prepared for use in the next system sum up to 0,01 kg. This equals 25,55 % of the mass of the product (excluding replacement components and packaging).

2 Life Cycle Assessment Framework

Life Cycle Assessment has been conducted according to the requirements of ISO 14040/44 and EN 15804. The declared unit is the product described in chapter 1.

System boundaries

For the life cycle assessment, the following stages have been considered:

Building assessment information (x = included in LCA, MND = module not declared)																
Building life cycle information																Supplementary information beyond the building life cycle
Product 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	MND	MND	X	MND	MND	X	X	X	X

- A1 extraction of raw materials and energy carriers, generation of thermal and electrical energy, production of ancillary materials and pre-products
- A2 transport processes are cut-off, due to negligible influence
- A3 manufacturing of the product and all single components, including manufacturing of packaging materials
- A4 delivery of products from plant to customer as a standard scenario, where the distance of the transport to the customer is set to an average value of 1500 km, the mode of delivery is a 20 t truck with an average payload of 17,3 t, EURO 5
- A5: effort (energy and material) and emissions of packaging incineration / landfilling
- B6 operational energy use (electricity consumption)
- C2 transport scenario for End-of-Life
- C3 waste processing
- C4 disposal
- D recovery and recycling potential

Cut-off criteria

In the assessment, all available data from production have been 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 have been considered. 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. Machines and facilities required during production are neglected. The production of etiquettes, tape and glue was also neglected.

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 6 database. The geographical representativeness of generic or average data reflects the region where the production is located.

Description of data

The energy demand of manufacturing processes is modelled with specific data, if available.

For energy consumption during manufacturing, country specific electricity mixes are taken into account. The energy mix considered for the electricity consumption during the use-stage is described in the Use-stage section.

In case specific data on manufacturing processes is not available, generic data from the GaBi 6 database is used instead. Generic data is used for the upstream processes beyond manufacturer's influence. Information on secondary material for upstream processes is available and considered for: steel, stainless steel.

Allocation

Recycling of metals is considered and resulting credits are shown in separate columns of the result tables.

3 Life Cycle Assessment Results

The evaluation is conducted according to characterization factors of CML 2010 (Center voor Milieukunde at Leiden).

Table 1: LCA results: input of resources

Assessment parameter	Unit	Product Stag	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	Constructi on installation process	Operational energy use	Transport	Waste processing	Disposal	Reuse, recovery or recycling potential
		A1-A3	A4	A5	B6	C2	C3	C4	D
PERE	[MJ]	9,66E-01	-	-	-	-	-	-	-
PERM	[MJ]	0,00E+00	-	-	-	-	-	-	-
PERT	[MJ]	9,66E-01	1,92E-03	7,82E-03	1,72E+03	1,28E-04	1,17E-02	3,25E-03	-5,45E-02
PENRE	[MJ]	9,94E+00	-	-	-	-	-	-	-
PENRM	[MJ]	1,32E-01	-	-	-	-	-	-	-
PENRT	[MJ]	1,01E+01	4,90E-02	4,72E-02	1,03E+04	3,27E-03	7,02E-02	6,33E-02	-4,72E-01
SM	[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
RSF	[MJ]	-	-	-	-	-	-	-	-
NRSF	[MJ]	-	-	-	-	-	-	-	-
FW	[kg]	-	-	-	-	-	-	-	-

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

Table 2: LCA results: environmental impacts

Assessment parameter	Unit	Product Stag	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	Constructi on installation process	Operational energy use	Transport	Waste processing	Disposal	Reuse, recovery or recycling potential
		A1-A3	A4	A5	B6	C2	C3	C4	D
ADPE	[kg Sb eq]	5,05E-05	1,32E-10	4,64E-10	8,06E-05	8,79E-12	5,48E-10	3,81E-09	-4,48E-05
ADPF	[MJ]	1,01E+01	4,90E-02	4,72E-02	1,03E+04	3,27E-03	7,02E-02	6,33E-02	-4,72E-01
AP	[kg SO_2 eq]	5,77E-03	9,68E-06	1,27E-05	2,72E+00	6,45E-07	1,88E-05	1,22E-05	-2,32E-04
EP	[kg PO_4^{3-} eq]	6,67E-04	2,03E-06	6,75E-07	1,45E-01	1,35E-07	9,92E-07	1,79E-06	-1,11E-05
GWP	[kg CO_2 eq]	9,20E-01	3,54E-03	2,28E-02	5,83E+02	2,36E-04	3,98E-03	2,48E-02	-3,33E-02
ODP	[kg R11 eq]	1,41E-09	6,18E-14	2,39E-12	5,26E-07	4,12E-15	3,57E-12	2,44E-12	-1,14E-11
POCP	[kg C_2H_4 eq]	4,64E-04	-2,59E-06	7,50E-07	1,61E-01	-1,73E-07	1,11E-06	1,76E-06	-1,42E-05

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 3: LCA results: Waste categories and other output flows

		A1-A3	A4	A5	B6	C2	C3	C4	D
HWD	[kg]	-	-	-	-	-	-	-	-
NHWD	[kg]	-	-	-	-	-	-	-	-
RWD	[kg]	-	-	-	-	-	-	-	-
CRU	[kg]	-	-	-	-	-	-	-	-
MFR	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	6,33E-03	0,00E+00	-
MER	[kg]	-	-	-	-	-	-	-	-
EEE	[MJ]	0,00E+00	0,00E+00	1,32E-03	0,00E+00	0,00E+00	0,00E+00	2,58E-02	-
EET	[MJ]	0,00E+00	0,00E+00	3,18E-03	0,00E+00	0,00E+00	0,00E+00	6,21E-02	-

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

Not all of the used inventories for the calculation of the LCA support the methodological approach for the declaration of water and waste indicators. The material amounts, displayed with these inventories contribute significantly to the Product Stage. The indicators are not declared (decision of IBU advisory board 2013-01-07).

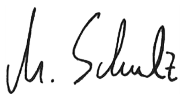
Interpretation

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 used in next systems. A credit for primary energy and to the respective impact categories is accounted for in module D.

4 Verification

The Environmental Product Declaration is based on the PCR 'Luminaires, lamps and components for luminaires' and meets the requirements of EN 15804	
Third party independent verification of the generation process of this EPD according to ISO 14025 internal	external X
Third party verifier:  Dr. Matthias Schulz, appointed by the Advisory Board of the Institute Construction and Environment (IBU) e.V.	Director:  Dr.-Ing. Burkhart Lehmann, Director of the Institute Construction and Environment (IBU) e.V.

References

CML 2010	Center voor Milieukunde at Leiden (Center for environmental science at Leiden, Netherlands), characterization factors, published 2010
EN 15193	EN 15193:2008-3 Energy performance of buildings. Energy requirements for lighting
EuP 2005	Directive 2005/32/EC of the European Parliament and of the Council of 6 July 2005 establishing a framework for the setting of ecodesign requirements for energy-using products and amending Council Directive 92/42/EEC and Directives 96/57/EC and 2000/55/EC of the European Parliament and of the Council
GaBi 2012	GaBi 6: LCA Software and database. PE INTERNATIONAL AG, Leinfelden-Echterdingen,2012
IBU 2009	Institute Construction and Environment e.V.(IBU): Leitfaden für die Formulierung der Anforderungen an die Produktkategorien der Umweltdeklarationen (Typ III) für Bauprodukte, www.bau-umwelt.com
ISO 14020	DIN EN ISO 14020: 2001: Environmental labels and declarations – General principles
ISO 14025	DIN EN ISO 14025: 2011: Environmental labels and declarations - Type III environmental declarations — Principles and procedures
ISO 14040	DIN EN ISO 14040: 2006: Environmental management – Life cycle assessment – Principles and framework
ISO 14044	DIN EN ISO 14044: 2006: Environmental management – Life cycle assessment – Requirements and guidelines
PCR	Product Category Rules for Building-Related Products and Services, Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Background Report, Version 1.2, 03.04.2013, Institut Bauen und Umwelt e.V PCR Guidance-Texts for Building-Related Products and Services, Part B: Requirements on the EPD for Luminaires, lamps and components for luminaires, Version 1.4, 09.07.2013, Institut Bauen und Umwelt e.V.
EN 15804	EN 15804: Sustainability of construction works. Environmental product declarations. Core rules for the product category of construction products
RoHS 2011	Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment
WEEE 2012	EU Directive 2012/19/EU on waste of electric and electronic equipment of 4 July 2012 (WEEE)

LCA Practitioner

PE INTERNATIONAL
EXPERTS IN SUSTAINABILITY

Leinfelden-Echterdingen