ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A2*

Owner of the Declaration	RHEINZINK GmbH & Co. KG
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-RHE-20230365-IBA1-EN
Issue date	02.01.2024
Valid to	01.01.2029

RHEINZINK-CLASSIC® bright-rolled

RHEINZINK GmbH & Co. KG

Institut Bauen und Umwelt e.V.

www.ibu-epd.com | https://epd-online.com

ECO PLATFORM EPD VERIFIED

RHEINZINK®

1. General Information

RHEINZINK GmbH & Co. KG

Programme holder

IBU – Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

Declaration number

EPD-RHE-20230365-IBA1-EN

This declaration is based on the product category rules:

Building metals, 04.07.2023
(PCR checked and approved by the SVR)

Issue date

02.01.2024

Valid to

01.01.2029

Dipl.-Ing. Hans Peters
(Chairman of Institut Bauen und Umwelt e.V.)

Florian Pronold
(Managing Director Institut Bauen und Umwelt e.V.)

RHEINZINK-CLASSIC® bright-rolled

Owner of the declaration

RHEINZINK GmbH & Co. KG
Bahnhofstraße 90
45711 Datteln
Germany

Declared product / declared unit

1 kg of RHEINZINK-CLASSIC® bright-rolled

Scope:

The Life Cycle Assessment (LCA) was carried out according to DIN ISO 14044. Specific data from the company RHEINZINK in Datteln, Germany, and from the data base /Sphera LCA FE/ were used. The LCA was carried out for the manufacturing phase of the products, taking into account all background data such as raw material production and transports ('cradle to gate'). The use phase of the titanium zinc sheets is divided into several application areas: roofing applications, roof drainage and facade claddings. The treatment for the titanium zinc sheets was modelled in re-melting furnaces for the end-of-life phase. Thereby resulting credit of extracted zinc is counted as a replacement for primary zinc.

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.

The EPD was created according to the specifications of EN 15804+A2. In the following, the standard will be simplified as *EN 15804*.

Verification

The standard EN 15804 serves as the core PCR
Independent verification of the declaration and data according to ISO 14025:2011
☐ internally ☒ externally

Ms Jane Anderson,
(Independent verifier)

2. Product

2.1 Product description/Product definition
The basis of the RHEINZINK®-CLASSIC bright-rolled is electrolytic high-grade fine zinc in accordance with EN 1179. Added to this are small amounts of titanium and copper based on EN 988. In addition to other factors, the alloy composition is not only important for the technological material properties of RHEINZINK®, but also for the colour of its patina.

For the placing on the market in the EU and European Free Trade Association (EFTA) (with the exception of Switzerland) the Regulation (EU) No. 305/2011 applies. The products need a Declaration of Performance taking into consideration EN 14782 or EN 14783 respectively and the CE-marking.

For the application and use the respective national provisions apply.

2.2 Application
• Titanium zinc sheets, strips and profiles for roofing and facade cladding according to EN 14782 -Self-supporting metal sheet for roofing, external cladding and internal lining, EN 14783 - Fully supported metal sheet and strip for roofing, external cladding and internal lining. The products are CE-marked based on these standards.

• Roof drainage systems (roof gutters, pipes and accessories) according to EN 612 - Eaves gutters with bead stiffened fronts and rainwater pipes with seamed joints made of metal sheet.

2.3 Technical Data
The following table gives conversion data from product surface mass per unit area for the relevant product systems in roofing, facade cladding and roof drainage.

System	Area of Application	Thickness of Metal	Weight per m²
Double standing seam	Roof	0,70 mm	5,6 kg
Roll-cap system	Roof	0,70 mm	5,8 kg
Square tiles	Roof	0,70 mm	7,7 kg
Gutter	Roof drainage	0,70 mm	1,7 kg
Downpipe	Roof drainage	0,70 mm	1,6 kg
Angle standing seam	Façade cladding	0,70 mm	5,7 kg
Angle standing seam	Façade cladding	0,80 mm	6,6 kg
Flat-lock tiles	Façade cladding	0,70 mm	7,0 kg
Reveal panel	Façade cladding	1,00 mm	9,8 kg
Horizontal panel	Façade cladding	1,00 mm	9,8 kg
Shipboard panel	Façade cladding	1,00 mm	10,4 kg

Performance data of the product in accordance with the respective declaration of performance with respect to its essential characteristics according to EN 14782 and EN 14783 respectively.

Constructional data

Name	Value	Unit
Coefficient of thermal expansion	22	$10^{-6}K^{-1}$
Tensile strength /EN 10002-1/	≥150	N/mm^2
Modulus of elasticity	≥80000	N/mm^2
Melting point	420	°C
Thermal conductivity	109	W/(mK)
Electrical conductivity at 20°C	17x10^6	$\Omega^{-1}m^{-1}$
Density	7200	kg/m^3

2.4 Delivery status
The material RHEINZINK® is delivered in thicknesses from 0.5 – 1.5 mm. The maximum width of strips and sheets is 1.000 mm. The standard sheets are delivered in 1x2 m and 1x3 m, coils are delivered with a maximum weight of 1 t. Finished products are delivered to customer specifications.

Application rules
EN 988, Zinc and zinc alloys - Specification for rolled flat products for building

EN 506, Roofing products from metal sheet- specification for self-supporting products of copper and zinc sheet

EN 612, Eaves gutters with bead stiffened fronts and rainwater pipes with seamed joints made of metal sheet

2.5 Base materials/Ancillary materials
-Components of RHEINZINK-alloy

- Special-High-Grade zinc 99.995% (Z1 according to DIN EN 1179)
- Copper: 0.1 - 0.18%
- Titanium: 0.07 - 0.12%
- Aluminium: ≤ 0.015%

-Auxiliary substances
RHEINZINK® is an alloy of zinc with small amounts of copper and titanium. No compound of the alloy > 0.1% is listed in the 'Candidate List of Substances of Very High Concern for Authorisation' (SVHC) dated 01/2018. The product does not contain any substances with carcinogenic, mutagenic, reprotoxic (CMR) properties > 0.1%. RHEINZINK products do not contain biocide properties as defined by the (EU) Ordinance on Biocide Products No. 528/2012). Lubricant emulsion (rolling process): 0.08 kg/t zinc

2.6 Manufacture
Structure of the manufacturing process:
The manufacturing process comprises seven steps:

Pre-alloy:
To improve the quality, and for energy-saving reasons, a pre-alloy is produced at 760 °C in an induction crucible (melting of SHG zinc, copper, titanium and aluminium). The pre-alloy blocks produced contain the titanium and copper portions of the subsequently rolled alloy.

Melting:
The pre-alloy blocks and SHG zinc are melted in large melting furnaces (induction furnaces) at 500 – 550 °C and mixed by induction currents.

Casting:
The final alloy is cooled down below melting point with a closed water circuit in the casting machine, resulting in a solid cast string.

Rolling:
There is a cooling distance between the casting machine and the roller racks. The rolling is done by 5 roller pairs, so-called roller racks. With adequate pressures the material thickness is reduced by up to 50% at each of these roller racks. Simultaneously, the material is cooled and greased using a special emulsion.

Coiling:
Subsequently, the finished rolled RHEINZINK® is wound up into coils of 20 to. They are still at a temperature of 100-150 °C and are stored for further cooling.

Stretching and cutting:
The tensions developed inside the RHEINZINK® bands during rolling are 'stretched out' by a stretching-bending-straightening process.

The trimming scrap produced during the manufacturing of the material is 100% remelted at RHEINZINK GmbH & Co. KG and processed into new products.

Quality control:
Control by the manufacturer. Quality management according to ISO 9001.

2.7 Environment and health during manufacturing

Environmental management according to ISO 14001. Energy management according to ISO 50001. These management systems ascertain that the legal requirements concerning worker health and environmental protection are fulfilled. Best Available Technology is used throughout the plant.

2.8 Product processing/Installation

Basic principles:
During transportation and storage, RHEINZINK® must be kept dry and ventilated to avoid the formation of zinc hydroxide. For the same reason, when laying RHEINZINK® on wet surfaces or in the rain it should be ensured that the base material does not have hygroscopic properties.

The thermic stretching of the material has to be taken into consideration when handling/installing the product.

Due to the typical brittleness of zinc under cold conditions, the temperature of the product during installation should be 10 °C. In other cases, adequate mechanical equipment should be used, e.g. hot air blasts.

2.9 Packaging

The packaging materials in use, paper/cardboard, polyethylene (PE foils), polypropylene (PP foils) and steel, are recyclable (non-reusable wooden pallets, reusable wooden and metal pallets). If gathered separately, return in Germany is organized by INTERSEROH which collects the packaging material at given sites with exchangeable containers upon request and complies with legal regulations. The reusable wooden and steel pallets are taken back and reimbursed by RHEINZINK GmbH & Co. KG and the wholesale trade (refund system).
The total mass of packaging is 0,026 kg/kg product.

2.10 Condition of use

RHEINZINK® is UV-resistant and does not rot. It is resistant to a rust film, non-flammable and resistant to radiating heat and against most of the chemical substances used in building construction. Effects on the durability of RHEINZINK® products with regard to snow, rain and hail are not known. The effects of snow and rain may be neglected.

This material has a repellent effect to electro-smog (electromagnetic radiation in excess of 98%).

RHEINZINK® develops a superficial protective coating, the so-called patina, which darkens only slightly over the years and which is responsible for the high resistance of zinc against corrosion. In the chemical process that forms this patina, zinc oxide develops in contact with the oxygen in the air. Next, due to the influence of water (precipitation), zinc hydroxide develops, which will be transformed into a tight, strongly adhering and non-water-soluble coating of basic zinc carbonate (patina) in reaction with the carbon dioxide in the air. Therefore RHEINZINK® does not require any maintenance and cleaning during the period of use.

2.11 Environment and health during use

Environmental aspects:
The transfer of zinc ions via rain water is constantly reduced due to the development of the natural protecting coat of zinc carbonate (Patina). The further transfer of zinc ions depends mainly on air contamination with 'acid' pollutants, particularly with SO_2. As a result of the reduction of SO_2 concentration in the air to 20-% of the former values during the last 30 years, the zinc concentration of precipitation has subsequently been reduced by the same amount in the rainwater. The runoff rate is 2,0 - 3,0 g/m²/year. The total-zinc-concentration has been lower than the prescriptive limits for drinking water.
In aquatic systems only a small part of the total-zinc-concentration is available for an organism - this amount is called bioavailable. It is related to the physical-chemical conditions of the receiving water body. The bioavailability is for example influenced by the amount of zinc which is organically or inorganically bound, linked to particles or competes with other ions.

Health aspects:
There will be no effects on health if the RHEINZINK® products are used according to their designated function. Zinc, like iron, belongs to the essential metals. Zinc is not accumulated in the body. The recommended daily intake of zinc according to the Deutsche Gesellschaft für Ernährung (DGE - German Society for Nutrition) is 15 mg.

Lit.: R. H. J. Korenromp et al, "Diffusive Emissions of zinc due to atmospheric corrosion of zinc and coated (galvanised) materials", TNO-MEP R99/441 (1999)

2.12 Reference service life

Service lifetime according to BBSR (the Federal Office for Building and Regional Planning): > 50 years, theoretical lifetime according to available literature > 100 years. The standard ISO 15686 has not been considered.

2.13 Extraordinary effects

Fire
The RHEINZINK® products comply with DIN 4102, Part 1 and to DIN EN 13501-1 the Requirements of Building Material Class A1 'non-combustible'.

Fire protection

Name	Value
Building material class EN 13501, DIN 4102	A1
Burning droplets EN 13501	D0
Smoke gas development EN 13501	-

Smoke production/smoke concentration:
When heated above 650 °C vaporization as zinc oxide (ZnO) occurs.

Toxicity of the fumes:
The ZnO smoke may cause zinc fever (diarrhoea, fever, dry throat) when inhaled over a longer period of time, this disappears completely 1 to 2 days after inhalation.

Water
Zinc is not classified as hazardous for the aquatic environment, WFD -European water framework directive.

Mechanical destruction
None

2.14 Re-use phase

End of life
When renovating or disassembling a building end of life, RHEINZINK® products can easily be collected. The cuttings occurring at building sites as well as used zinc from renovation sites are gathered and may be sent directly or via scrap-gathering organizations to secondary melting plants - several exist in Germany. The energy necessary for recycling titanium zinc sheets is only 5% of the primary energy content of zinc. The demand for zinc scrap, resulting from zinc recycling's low energy requirement, is also mirrored by the fact that generally about 70% of the value of the zinc content is reimbursed. According to the newest information, the total recycling rate is up to 96%.

2.15 Disposal

A small amount of zinc is weathered away, and another small amount might be lost during collection and erroneously disposed. All in all, this amounts to less than 4%. The European Waste Code according to Commission decision 2000/532/EC2 for zinc is 17 04 04.

2.16 Further information

Additional information: www.rheinzink.de

3. LCA: Calculation rules

3.1 Declared Unit

Declared unit

The declared unit is 1kg of RHEINZINK-CLASSIC® bright-rolled.

Name	Value	Unit
Declared unit	1	kg
Gross density	7200	kg/m3

3.2 System boundary

Type of the EPD: cradle to gate - with options In this study, the product stage information modules A1, A2, and A3 are considered. These modules include production of raw material extraction and processing (A1), transport of the raw materials to the manufacturer (A2), manufacturing of the product (A3) and packaging materials (A3). Modul A5 covers the waste treatment of the packaging materials (incineration of paper, plastic and wood). The transport to module C4 is considered under module C2. There is no activity in C3.
Module C4 takes into account the non-recovered scrap due to losses and sorting efficiency as described in 2.15.
The EoL of the product (Module D) is also included. The treatment (re-melting process of zinc scrap) and credits for avoided primary production are grouped into module D.

3.3 Estimates and assumptions

No assumptions and estimations were necessary for the LCA.

3.4 Cut-off criteria

In the assessment, all available data from the production process are considered, i.e. all raw materials used, utilised thermal energy, and electric power consumption using the best available LCI datasets. Thus, material and energy flows contributing less than 1% of mass or energy are considered. The sum of the excluded material flows does not exceed 5% of mass, energy or environmental relevance.

3.5 Background data

The background data has been taken from the latest available Sphera LCA FE (GaBi) database CUP 2023.1. Special High-Grade Zinc of the International Zinc Association (IZA) has been used.

3.6 Data quality

The process data and the used background data are consistent.
Regarding foreground data, this study is based on high-quality primary data, collected by RHEINZINK. Data were delivered in form of Excel tables and were checked for plausibility. Therefore, the data quality can be described as good.

3.7 Period under review

Modelling is based on production data from 2022. Background data refer from 2019 to 2024.

3.8 Geographic Representativeness

Land or region, in which the declared product system is manufactured, used or handled at the end of the product´s lifespan: Germany

3.9 Allocation

In this study, allocation was avoided wherever possible. However,
the following allocations had to be done:

- Economical allocation for zinc dross in the zinc sheet production (Module A3) (0,5%)
- Credits from energy recovery of production waste (Module A3)
- Credits from recycling from the end of life of the product (Module D)

3.10 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 background data has been taken from the latest available Sphera LCA FE (GaBi) database CUP 2023.1.

4. LCA: Scenarios and additional technical information

Characteristic product properties of biogenic carbon
The total mass of biogenic carbon-containing materials, in this case, cardboard and wooden pallets, is less than 5% of the total mass of the product and accompanying packaging

Information on describing the biogenic carbon content at factory gate

Name	Value	Unit
Biogenic carbon content in product	-	kg C
Biogenic carbon content in accompanying packaging	0.011	kg C

Note: 1 kg of biogenic carbon is equivalent to 44/12 kg of CO_2.

Scenario Modul A5
Cardboard: 0,004 kg/kg product sent to incineration
Wooden pallets: 0,02 kg/kg product sent to incineration (exported Energy credited in Modul D)
Plastic film: 0,0001 kg sent to incineration (exported Energy credited in Modul D)
steel wrapping band: 0,000136 kg sent to recycling (material recycling credited in Modul D)
Modul C1:
No activity declared
Modul C2:
500 km transport by 40 to truck, EURO 6, 61% average utilization (C2)
Modul C3:
The material reaches the end of waste state after transport to the remelters so there is no activity.
Modul C4:
500 km transport by 40 to truck, EURO 6, 61% average utilization (C2)

The credits given in Module D result from the 100% recyclability of each zinc product. After the scrap collection (a collection rate of 95% was assumed), zinc scrap is sent to a re-melting process, where the scrap is converted to secondary zinc. The credit for the zinc gained through re-melting is calculated with the dataset of the primary production.

Module A4, B1, B2, B3, B4, B5, reference service life, B6, B7 and C1 are not considered and declared in this study.

Service lifetime according to BBSR: > 50 years, theoretical lifetime according to available literature > 100 years. The standard ISO 15686 has not been considered.
Description of the influences on the ageing of the product when applied in accordance with the rules of technology.

End of life (C4)

Name	Value	Unit
Landfilling	5	%

Reuse, recovery and/or recycling potentials (D), relevant scenario information

Name	Value	Unit
Recycling	95	%

5. LCA: Results

The following Figure shows the relative contribution of the production stages (Module A1-A3), waste treatment (Module C2, C3, C4) and the benefits and loads beyond the product system boundary (Module D).
The production of the high-grade zinc is the dominating contributor to all indicators of the impact assessment (73%-100%) as main raw material, followed by the generation of electricity. Only for ODP, the electricity dominates the results due to the use of electricity from Photovoltaic[1].
The high credits given in module D are the results of the 100% recyclability of the zinc products. At the EoL of the zinc products a collection rate of 95% was assumed. The remaining 5% are forwarded to the waste treatment (module C4). Overall, C4 has a minimized contribution.
In the case of the ODP, module D is positive since the Zinc-scrap re-melting process uses electricity with a higher share of photovoltaic than the credited Zinc production. The electricity from Photovoltaic dominates the ODP (same as in module A1-A3) due to the emission of emission flow dichloro-1-fluoroethane (R 141b) and chlorodifluoethane (R 142b) which are the precursors of Polyvinylidene fluorine (PVDF) used in the production of PV modules.

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

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	MND	X	MND	MND	MNR	MNR	MNR	MND	MND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1 kg RHEINZINK-CLASSIC® bright-rolled

Parameter	Unit	A1-A3	A5	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq	3E+00	4.01E-02	0	7.44E-03	0	2.39E-03	-2.12E+00
GWP-fossil	kg CO_2 eq	3.03E+00	1.27E-03	0	7.42E-03	0	2.42E-03	-2.11E+00
GWP-biogenic	kg CO_2 eq	-3.39E-02	3.88E-02	0	-2.7E-05	0	-2.77E-05	-3.89E-03
GWP-luluc	kg CO_2 eq	2.84E-03	2.25E-07	0	4.41E-05	0	2.38E-06	-2.26E-03
ODP	kg CFC11 eq	2.32E-13	7.66E-15	0	1.82E-15	0	3.86E-15	1.5E-12
AP	mol H^+ eq	1.52E-02	8.77E-06	0	8.69E-06	0	7.5E-06	-1.19E-02
EP-freshwater	kg P eq	6.56E-06	2.13E-09	0	1.74E-08	0	2.12E-09	-4.69E-06
EP-marine	kg N eq	4E-03	2.37E-06	0	3.08E-06	0	1.88E-06	-2.97E-03
EP-terrestrial	mol N eq	4.26E-02	3.83E-05	0	3.69E-05	0	2.07E-05	-3.15E-02
POCP	kg NMVOC eq	1.05E-02	6.24E-06	0	7.61E-06	0	5.9E-06	-7.76E-03
ADPE	kg Sb eq	1.54E-03	5.77E-11	0	5.32E-10	0	6.4E-11	-1.38E-03
ADPF	MJ	4.07E+01	1.13E-02	0	1E-01	0	3.49E-02	-2.8E+01
WDP	m^3 world eq deprived	9.8E-01	4.5E-03	0	3.87E-05	0	-3.18E-05	-8.59E-01

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; WDP = Water (user) deprivation potential)

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1 kg RHEINZINK-CLASSIC® bright-rolled

Parameter	Unit	A1-A3	A5	C1	C2	C3	C4	D
PERE	MJ	1.75E+01	3.84E-01	0	6.73E-03	0	3.14E-03	-1.46E+01
PERM	MJ	3.8E-01	-3.8E-01	0	0	0	0	0
PERT	MJ	1.79E+01	3.75E-03	0	6.73E-03	0	3.14E-03	-1.46E+01
PENRE	MJ	4.1E+01	1.72E-02	0	1.01E-01	0	3.5E-02	-2.83E+01
PENRM	MJ	5.9E-03	-5.9E-03	0	0	0	0	0
PENRT	MJ	4.11E+01	1.13E-02	0	1.01E-01	0	3.5E-02	-2.83E+01
SM	kg	0	0	0	0	0	0	9E-01
RSF	MJ	0	0	0	0	0	0	0
NRSF	MJ	0	0	0	0	0	0	0
FW	m^3	4.36E-02	1.06E-04	0	5.99E-06	0	3.94E-07	-3.74E-02

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 – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1 kg RHEINZINK-CLASSIC® bright-rolled

Parameter	Unit	A1-A3	A5	C1	C2	C3	C4	D
HWD	kg	3.79E-05	4.99E-14	0	1.69E-13	0	2.89E-12	-1.46E+01
NHWD	kg	1.46E+00	6.67E-04	0	1.5E-05	0	5.01E-02	0
RWD	kg	5.11E-03	3.87E-07	0	1.32E-07	0	4.06E-07	-1.46E+01
CRU	kg	0	0	0	0	0	0	-2.83E+01
MFR	kg	0	0	0	0	9.5E-01	0	0
MER	kg	0	2.6E-02	0	0	0	0	-2.83E+01
EEE	MJ	0	5.42E-02	0	0	0	0	9E-01
EET	MJ	0	1.01E-01	0	0	0	0	0

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

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: 1 kg RHEINZINK-CLASSIC® bright-rolled

Parameter	Unit	A1-A3	A5	C1	C2	C3	C4	D
PM	Disease incidence	2.08E-07	5.86E-11	0	6.09E-11	0	8.09E-11	-1.56E-07
IR	kBq U235 eq	4.82E-01	4.09E-05	0	1.42E-05	0	6.01E-05	-3.93E-01
ETP-fw	CTUe	1.42E+01	4.58E-03	0	7.25E-02	0	9.93E-03	-9.91E+00
HTP-c	CTUh	1.78E-05	3.99E-13	0	1.46E-12	0	1.23E-12	1.27E-08
HTP-nc	CTUh	1.13E-07	2.24E-11	0	7.41E-11	0	1.23E-10	1.54E-06
SQP	SQP	2.56E+01	4E-03	0	3.57E-02	0	3.26E-03	-1.69E+01

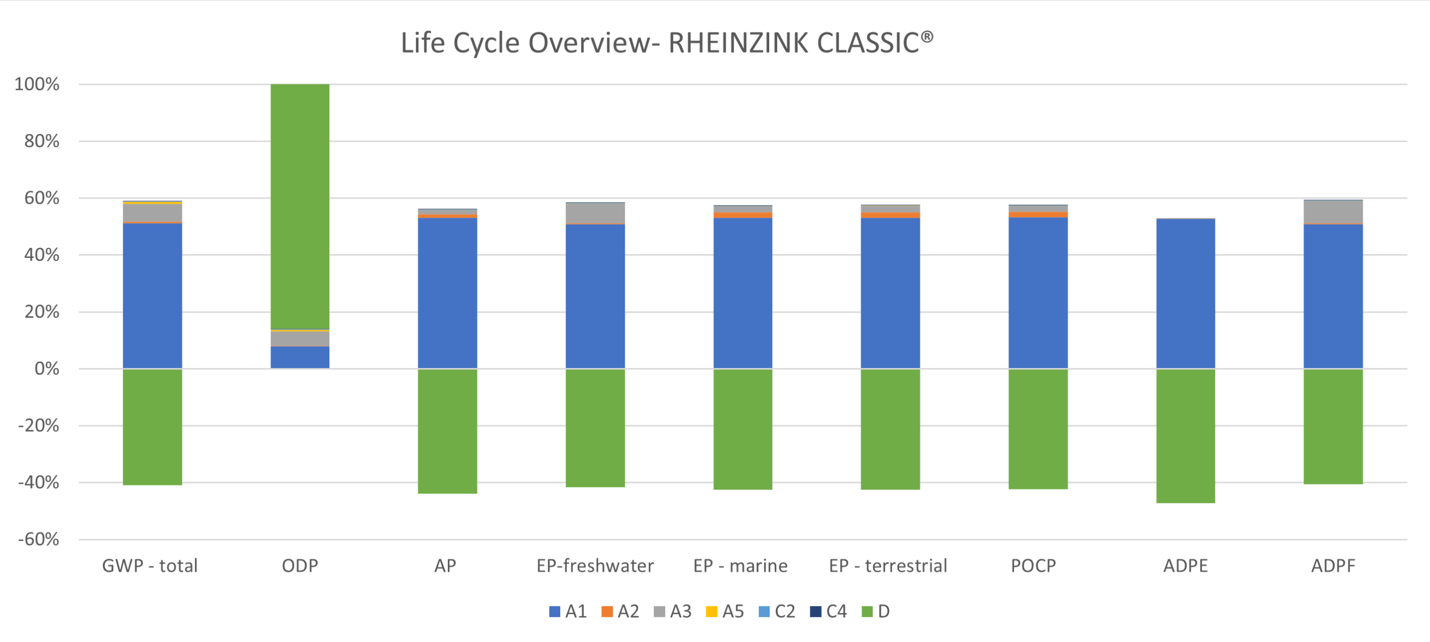
PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); SQP = Potential soil quality index

Disclaimer 1 – for the indicator "Potential Human exposure efficiency relative to U235". This impact category deals mainly with the eventual impact of low-dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure or radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – for the indicators "abiotic depletion potential for non-fossil resources", "abiotic depletion potential for fossil resources", "water (user) deprivation potential, deprivation-weighted water consumption", "potential comparative toxic unit for ecosystems", "potential comparative toxic unit for humans – cancerogenic", "Potential comparative toxic unit for humans - not cancerogenic", "potential soil quality index". The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high as there is limited experience with the indicator.

6. LCA: Interpretation

The following Figure 6-1 shows the relative contribution of the production stages (Module A1-A3), waste treatment (Module C2, C4) and the benefits and loads beyond the product system boundary (Module D).
Most statements from the EPD 2018 are still valid for this update and have only minor percental changes. The production of the high-grade zinc is still the dominating contributor to the indicators of the impact assessment as the main raw material, followed by the generation of electricity. Only for ODP, the electricity dominates the results due to the use of electricity from Photovoltaic.
The high credits given in module D are the results of the 100% recyclability of the zinc products. At the EoL of the zinc products, a collection rate of 96% was assumed. For this update, the 4% remaining are forwarded to the waste treatment (module C4). Overall, C4 has a minimized contribution.



7. Requisite evidence

Runoff rates

In a report of TNO-MEP-R99/441, a literature study was undertaken to determine the runoff rates of zinc in Europe. The following conclusions were taken in this report:

Corrosion rates refer to the loss of metallic zinc, initially accumulating as ionic zinc in the patina layer. Run-off rates refer to the 'wash-off' of ionic zinc from the patina layer, the difference being the amount of zinc remaining in the patina layer. Run-off rates will in general be lower than corrosion rates or at maximum equal to the corrosion rates.

Available data for corrosion and run-off rate result from exposure of standard test panels mounted on standard test racks. Only little data are available from testing (on) real objects under the variety of typical microclimate conditions to which they are exposed. Recent experimental data with very large test racks (simulating zinc roofs) suggest that small test racks may overestimate the run-off rate.

The decrease in the corrosion rates runs parallel to the decrease in the ambient concentrations of SO_2, which is generally accepted as the dominant air pollution factor determining the corrosion of zinc.

Corrosion rates decrease with time due to the increasing protection of the patina layer. Therefore, long-term (20 years) average corrosion rates will be substantially lower (60% of initial value) than those during the first years of fresh not patinated materials. After a period of about 10 years, the run-off rate will be approximately 2/3 of the corrosion rate.

Run-off rates can be calculated to be 3 g/m²/a in areas with higher SO_2 concentrations and 2 g/m²/a in areas with lower concentrations.

8. References

EN 612:2005
EN 612:2005, Eaves gutters with bead stiffened fronts and rainwater pipes with seamed joints made of metal sheet

EN 988:1996
EN 988:1996, Zinc and zinc alloys

EN 1179:2003
EN 1179:2003, Zinc and zinc alloys- Primary zinc

DIN 4102:1998
DIN 4102:1998, Fire behaviour of building materials and building components

ISO 9001:2015
ISO 9001:2015, Quality management systems – Requirements

EN 10002:2001
EN 10002:2001, Metallic materials - Tensile testing

DIN EN 13501:2019
DIN EN 13501:2019, Fire classification of construction products and building elements

ISO 14001:2015
ISO 14001:2015, Environmental management systems - Requirements with guidance for use

DIN EN ISO 14040:2021
DIN EN ISO 14040:2021, Environmental management - Life cycle assessment

DIN ISO 14044:2018
DIN ISO 14044:2018, Environmental management - Life cycle assessment – Requirements and guidelines

EN 14782:2006
EN 14782:2006, Self-supporting metal sheet for roofing,

external cladding and internal lining

EN 14783:2013
EN 14783:2013, Fully supported metal sheet and strip for roofing, external cladding and internal lining. The products are CE-marked based on these standards

ISO 15686:2011
ISO 15686:2011, Buildings and constructed assets - Service life planning

ISO 50001:2018
ISO 50001:2018, Energy Management System - Requirements with guidance for use

Bundesinstitut für Bau-, Stadt- und Raumforschung (BBSR)
'Nutzungsdauer von Bauteilen für Lebenszyklusanalysen nach BNB' (BNB: Bewertungssystem Nachhaltiges Bauen) (2011)

(EU) 305/2011
REGULATION (EU) No 305/2011 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 9 March 2011, laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC

(EU) 528/2012
REGULATION (EU) No 528/2012 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 22 May 2012, concerning the making available on the market and use of biocidal products

European waste catalogue
Commission decision 2000/532/EC2

Sphera LCA FE
Sphera LCA FE, Software and Databases for Life Cycle Engineering. Sphera Solutions GmbH, 2023

Hullmann, Heinz (Ed.):
Natürlich oxidierende Metalloberflächen; Umweltauswirkungen beim Einsatz von Kupfer und Zink in Gebäudehüllen (Naturally oxidising metal surfaces; environmental effects when using copper and zinc for buildings) ; 2003, Stuttgart, Fraunhofer ISB-Verlag, ISBN: 3-8167-6218-2.

IZA 2012
Special high grade zinc dataset, Developed by thinkstep AG, Owned by International Zinc Association, 2012, http://gabi-documentation-2018.gabi-software.com/xml-data/processes/83e3e42c-0cc9-459b-960b-5fbda1280237.xml

PCR 2022, Part A
Institut Bauen und Umwelt e.V., Berlin: Product Category Rules for Building-Related Products and Services from the range of Environmental Product Declarations of Institut Bauen und Umwelt (IBU), Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report. August 2022
www.ibu-epd.de

PCR 2023, Part B
Institut Bauen und Umwelt e.V., Berlin: Product Category Rules for Construction Products from the range of Environmental Product Declarations of Institut Bauen und Umwelt (IBU), Part B: Requirements on the EPD for Building metals. July 2023
www.ibu-epd.de

TNO-MEP-R99/441
TNO-MEP-R99/441, Diffusive emissions of zinc due to atmospheric corrosion of zinc and zinc coated (galvanized) materials, 11-1999

Directive 2000/60/EG (Water Framework Directive, WFD)
DIRECTIVE 2000/60/EG OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 23 October 2000, establishing a framework for Community action in the field of water policy

Publisher

Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

+49 (0)30 3087748- 0
info@ibu-epd.com
www.ibu-epd.com

Programme holder

Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

+49 (0)30 3087748- 0
info@ibu-epd.com
www.ibu-epd.com

Author of the Life Cycle Assessment

Sphera Solutions GmbH
Hauptstraße 111- 113
70771 Leinfelden-Echterdingen
Germany

+49 711 341817-0
info@sphera.com
www.sphera.com

Owner of the Declaration

RHEINZINK GmbH & Co. KG
Bahnhofstraße 90
45711 Datteln
Germany

+49 2363 605-0
info@rheinzink.de
www.rheinzink.de