Environmental Product Declaration

In accordance with ISO 14025:2006 and EN 15804:2012+A2:2019/AC:2021 for:

Zehnder Multicolumn Radiator

from

Zehnder Group International

Programme:	The International EPD® System, www.environdec.com
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An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.environdec.com

EPD of variety of products within one product group, based on the average results of the product group.

General information

Programme information

Programme:	The International EPD® System
Address:	EPD International AB Box 210 60 SE-100 31 Stockholm Sweden
Website:	www.environdec.com
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Accountabilities for PCR, LCA and independent, third-party verification
Product Category Rules (PCR)
CEN standard EN 15804:2012+A2:2019/AC:2021 serves as the Core Product Category Rules (PCR)
Product Category Rules (PCR): PCR 2019:14 Construction products. Version 1.3.4. The EF reference package 3.1 was used.
PCR review was conducted by: *Claudia A. Peña, University of Concepción, Chile. The review panel may be contacted via the Secretariat www.environdec.com/contact.*
Life Cycle Assessment (LCA)
LCA accountability: Zehnder Group International AG, Moortalstrasse 1, 5722 Gränichen, Switzerland
Third-party verification
Independent third-party verification of the declaration and data, according to ISO 14025:2006, via: ☒ EPD verification by individual verifier Third-party verifier: *Jane Anderson, ConstructionLCA Ltd* Jane Anderson Approved by: The International EPD® System
Procedure for follow-up of data during EPD validity involves third party verifier: ☐ Yes ☒ No

The EPD owner has the sole ownership, liability, and responsibility for the EPD.

EPDs within the same product category but registered in different EPD programmes, or not compliant with EN 15804, may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully-aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterisation factors); have equivalent content declarations; and be valid at the time of comparison. For further information about comparability, see EN 15804 and ISO 14025.

Company information

Owner of the EPD: Zehnder Group International AG, Moortalstrasse 1, 5722 Gränichen, Switzerland

Contact: Barbara Scherrer, Sustainability Engineer, barbara.scherrer@zehndergroup.com

Description of the organisation: Zehnder Group provides worldwide leading solutions for a comfortable, energy-efficient and healthy indoor climate. The products and services of the Group include heating, cooling, indoor ventilation and air cleaning. The Group develops and manufactures its products at its own factories in Europe, China, and North America.

Product-related or management system-related certifications: ISO9001, ISO50001 and ISO14001

Name and location of production site(s): Zehnder GmbH, Almweg 34, 77933 Lahr, Germany.

Product information

Product name: Zehnder Charleston

Product identification: Multicolumn Radiator. All variants (all lengths and heights) except galvanized and electric versions.

Product description: The Zehnder Charleston is a multicolumn hydronic radiator to heat a room or building. It generally comes with a custom finish, delivered in a single piece with connections to order. Height, width and length are made to order. The finish in the analysis is white.

UN CPC code: "44823","Radiators for central heating, not electrically heated, of iron or steel"

Geographical scope: The fabrication is based on the manufacturing site in Lahr, Germany (A3), the delivery of product (A4) is based on true data from 2022, while the end-of-life scenario (module C) was model according to Germany, meaning 100% recycling of the steel.

LCA information

Functional unit / declared unit: 1 kg of a multicolumn hydronic radiator.

Reference service life: Steel radiators are durable products. When used properly, their average service life exceeds the reference service of 30 years life by more than several decades. As a rule, steel radiators generally achieve a reference service life of at least 35 years (VDI 2067), although a significantly longer service life is possible. We choose to state a reference service life of 30 years, as this service life is used in our sustainability report for the scope 3 emissions.

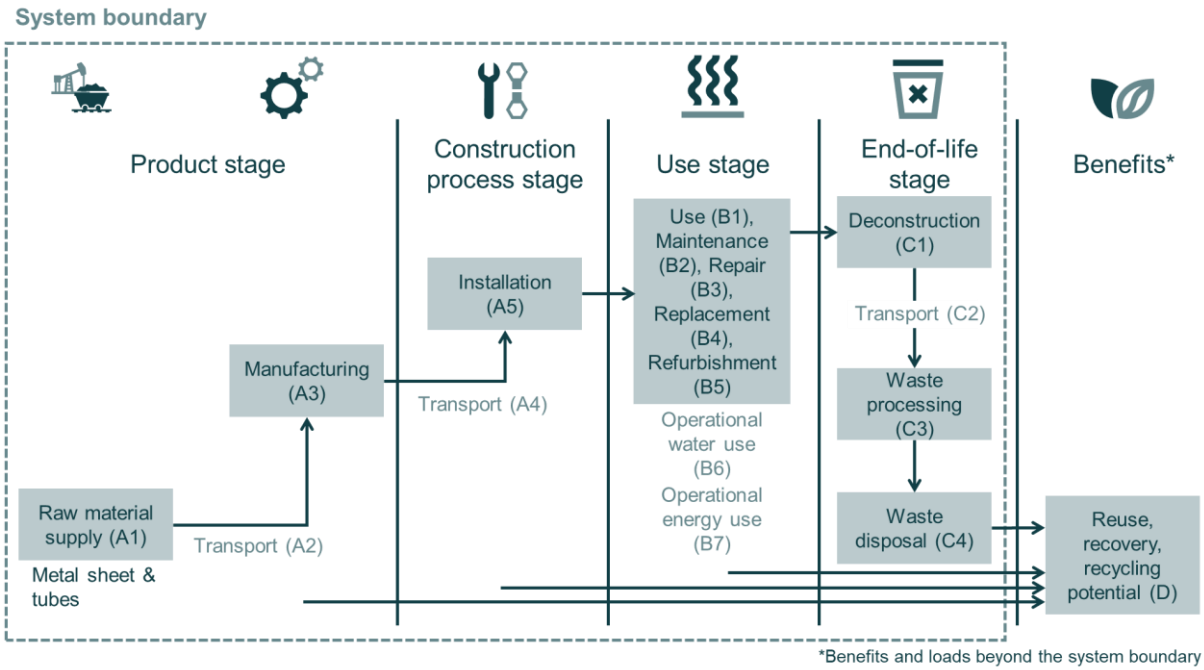
Time representativeness: 2022

Database(s) and LCA software used: LCA for Experts - Product Sustainability Software (version 10.7.0.183) with Professional Database (2023).

Description of system boundaries:

Cradle to grave and module D (A + B + C + D).

System diagram:



More information:
For further information on this product please visit the webpage under the following link: Zehnder Charleston - Hydronic operation | Zehnder Group Sales International (zehnder-systems.com).

Modules include impacts and aspects related to losses or/and waste in the module in which the losses or waste occur (i.e. production, transport and waste processing and disposal of the lost waste products and materials). Impacts and aspects related to waste are considered in the module in which the waste occurs.

Module A1 to A3:

The product stage includes the raw material extraction and production, transport to the manufacturing site, and manufacturing and assembly of components. It considers the demand of energy, auxiliary and operational materials, packaging, as well as waste treatment to end-of-waste condition or disposal of end residues during the product stage.
The processing steps are illustrated as video here: https://youtu.be/uUhLzT4TmcQ.
The following dataset was used for the certified green energy: DE: Electricity from hydro power, Sphera with 0.00605 kg CO_2 eq. / kWh.

Module A4 to A5:

The construction process stage includes transportation to the installation site by truck and installation. It considers the energy demand and auxiliary material including related Volatile Organic Compound (VOC) emissions. Transport to building site (A4) considers the specific average distance (831 km) by truck transport to site (Truck, Euro 0 - 6 mix, 20 - 26t gross weight / 17,3t payload capacity, 55% utilization, 5% biogenic C in fuel).
Treatment and disposal of packaging material in A5. Credits for potential avoided burdens due to energy substitution of electricity and thermal energy generation by the packaging waste are declared in module D and affects only the rate of primary material (no secondary materials). Installation into the building is done with simple tools and is therefore neglected.

Module B1 to B7:

The use stage of the products has no direct emissions (B1) and is designed so that no maintenance is required (B2) or parts need to be replaced (B4). Furthermore, no standard repairs (B3) or

refurbishments (B5) are foreseen. The use of the product does not require any electricity consumption (B6) and water consumption (B7) as water use of the heating system is part of the heating system and not the radiator. These effects are therefore stated as zero.

Module C1 to C4:

The end-of-life stage includes the deconstruction, considering the energy demand and auxiliary materials, the transportation by truck to waste processing facilities, the waste processing, considering sorting, and the waste disposal, considering a scenario with recycling, incineration, and landfill. The removal of the radiator is made with simple tools and is therefore neglected and stated as zero. The transport of end-of-life (EOL) stage (C2) considers 300 km for the shipment of collected waste to approved treatment centres by truck (Truck, Euro 0 - 6 mix, 20 - 26t gross weight / 17,3t payload capacity, 55% utilization, 5% biogenic C in fuel). The considered scenario is where the steel (0.977 kg) of the radiator is 100% recycled without further treatment and, therefore, stated as zero.

Modules declared, geographical scope, share of specific data (in GWP-GHG results) and data variation (in GWP-GHG results):

	Product stage			Construction process stage		Use stage							End of life stage				Resource recovery stage
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
Module	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Modules declared	X	X	X	X	X	NR	NR	NR	NR	NR	NR	NR	X	X	X	X	X
Geography	DE	DE	DE	GLO	GLO												
Specific data used	8% GWP- GHG					-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	<10%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	0%			X	NR	-	-	-	-	-	-	-	-	-	-	-	-

X: Module declared, ND: Module not declared, NR= Module not relevant, DE: Germany, GLO: Global,

In this document an average on the bases of two reference models is made. Both models (3060-16 and 2180-8) are among the most sold sizes and are a very good representation of the whole portfolio. The two products below have undergone detailed analysis, and an average assessment based on the two models weighted equally has been conducted for an average kilogram (kg) of radiator with packaging.

Cut-off Criteria

The cut-off rule excludes irrelevant flows of material or energy from system boundaries. Some auxiliary flows were cut-off; accounting for less than 0.15% in total. The considered scenario was where the steel (0.977 kg) of the radiator is 100% recycled without further treatment. The steel recycling of the radiator material is included till the production of Steel billet / slab / bloom. The production of capital equipment, facilities and infrastructure needed for production are not the subject of this assessment. Long-term emissions (> 100 years) are not taken into consideration in the impact estimate.

Allocation

The production process does not deliver any co-products. Information about allocation procedure of single datasets for background data is documented in https://sphera.com/product-sustainability-gabi-data-search/.

Data collection and reference time period

The foreground data refer to annual data for 2022.

Estimates and assumptions

All relevant process steps are considered and modelled to represent the specific situations. The process chain is considered sufficiently complete regarding the goal and scope of this study.
The end fittings (0.5 kg per radiator) are averaged over the whole portfolio. Control equipment is not included in this analyis.
The data quality of the inventory is assessed based on its precision (measured, calculated, literature values or estimated), completeness (e.g., unreported emissions), consistency (degree of uniformity of the methods used) and representativeness (geographical, temporal, technological).
In order to do justice to these aspects and thus ensure reliable results, first-hand industrial data were used together with consistent background data from the Sphera LCA FE (GaBi) 2022 databases. The inventory data from the Sphera LCA FE (GaBi) databases are widely used in the Sphera LCA FE (GaBi) software. The data sets are used worldwide in LCA models both internally and in many critically reviewed and published studies for industrial and scientific purposes. As part of the data provision, the data sets are compared with those of other databases as well as data from industry and science.

Content information

Product components	Weight, kg	Post-consumer material, weight-%	Biogenic material, weight-% and kg C/kg
Steel sheet	0.207	18.2%	0
Steel tube	0.740	18.2%	0
Steel plugs incl. thread rings	0.030	18.2%	0
Dip primer	0.002	0	0
Powder coating	0.021	0	0
TOTAL	1.000	0	0
Packaging materials	**Weight, kg**	**Weight-% (versus the product)**	**Weight biogenic carbon, kg C/kg**
LDPE film (30% recycled content)	4.9E-03	0.5%	0
Corrugated board	4.7E-02	4.7%	2.3E-02
Solid construction timber	1.6E-01	15.9%	8.0E-02
TOTAL	2.1E-01	21.1%	1.0E-01

A comparison between the 232 substances in the updated list of 17 January 2023 and our products has shown that Zehnder radiator portfolio and their accessories do not contain any substances of the ECHA-list (European Chemical Agency) for substances of very high concern (SVHC) of more than 0.1%.

Results of the environmental performance indicators

Mandatory impact category indicators according to EN 15804

Results per functional or declared unit										
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**B1-B7**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-total	kg CO_2 eq.	2.6E+00	8.6E-02	3.8E-01	0	0	3.0E-02	0	0	-2.3E+00
GWP-fossil	kg CO_2 eq.	3.0E+00	8.6E-02	1.6E-03	0	0	3.0E-02	0	0	-2.3E+00
GWP-biogenic	kg CO_2 eq.	-3.8E-01	0.0E+00	3.8E-01	0	0	0	0	0	-3.10E-04
GWP-luluc	kg CO_2 eq.	1.4E-03	5.1E-04	1.3E-07	0	0	1.7E-04	0	0	-8.0E-04
ODP	kg CFC 11 eq.	3.3E-12	2.3E-14	5.7E-15	0	0	7.9E-15	0	0	5.4E-12
AP	mol H^+ eq.	6.3E-03	1.4E-04	7.7E-06	0	0	4.9E-05	0	0	-5.2E-03
EP-freshwater	kg P eq.	4.0E-06	2.0E-07	1.5E-09	0	0	6.9E-08	0	0	-2.5E-07
EP-marine	kg N eq.	1.7E-03	6.0E-05	2.4E-06	0	0	2.0E-05	0	0	-1.2E-03
EP-terrestrial	mol N eq.	1.8E-02	6.7E-04	3.6E-05	0	0	2.3E-04	0	0	-1.3E-02
POCP	kg NMVOC eq.	5.5E-03	1.3E-04	6.2E-06	0	0	4.4E-05	0	0	-4.1E-03
ADP-minerals&metals *	kg Sb eq.	2.1E-06	6.2E-09	4.2E-11	0	0	2.1E-09	0	0	-1.1E-06
ADP-fossil*	MJ	3.0E+01	1.2E+00	8.7E-03	0	0	4.0E-01	0	0	-1.8E+01
WDP*	m^3	1.2E-01	4.9E-04	3.6E-03	0	0	1.7E-04	0	0	-1.1E-01
Acronyms	GWP-fossil = Global Warming Potential fossil fuels; GWP-biogenic = Global Warming Potential biogenic; GWP-luluc = Global Warming Potential land use and land use change; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential, Accumulated Exceedance; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption									

** Disclaimer: The results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator.*

Additional mandatory and voluntary impact category indicators

Results per functional or declared unit										
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**B1-B7**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-GHG[1]	kg CO_2 eq.	3.0E+00	8.6E-02	1.6E-03	0	0	2.96E-02	0	0	-2.34E+00
PM	Disease incidences	9.8E-08	1.8E-09	4.2E-11	0	0	6.1E-10	0	0	-7.6E-08
IR	kBq U235 eq.	1.9E-02	1.7E-04	3.0E-05	0	0	6.0E-05	0	0	3.6E-02
ETP-fw*	CTUe	6.6E+00	8.4E-01	3.4E-03	0	0	2.9E-01	0	0	-2.7E+00
HTP-c*	CTUh	3.2E-09	1.7E-11	2.4E-13	0	0	5.8E-12	0	0	-3.1E-09
HTP-nc*	CTUh	3.6E-08	8.9E-10	8.1E-12	0	0	3.0E-10	0	0	-1.7E-08
SQP*	Pt	3.0E+01	4.1E-01	3.0E-03	0	0	1.4E-01	0	0	1.3E+00
Acronyms	ETP-fw = Potential Comparative Toxic Unit for ecosys-tems; HTP-c = Potential Toxic Unit for Humans toxicity, cancer; HTP-nc = Potential Toxic Unit for humans, non-cancer; IR = Potential Human exposure efficiency relative to U235, human health; PM = Potential incidence of disease due to Particulate Matter emissions; SQP = Potential soil quality index									

Disclaimer on IR: 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, from radon and from some construction materials is also not measured by this indicator.

Resource use indicators

Results per functional or declared unit										
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**B1-B7**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	MJ	3.3E+00	7.9E-02	3.3E+00	0	0	2.7E-02	0	0	2.5E+00
PERM	MJ	3.3E+00	0	-3.3E+00	0	0	0	0	0	0
PERT	MJ	6.6E+00	7.9E-02	2.8E-03	0	0	2.7E-02	0	0	2.5E+00
PENRE	MJ	3.0E+01	1.2E+00	2.1E-01	0	0	4.0E-01	0	0	-1.8E+01
PENRM	MJ	2.1E-01	0	-2.1E-01	0	0	0	0	0	0
PENRT	MJ	3.0E+01	1.2E+00	8.7E-03	0	0	4.0E-01	0	0	-1.8E+01
SM	kg	1.9E-01	0	0	0	0	0	0	0	0
RSF	MJ	0	0	0	0	0	0	0	0	0

[1] This indicator accounts for all greenhouse gases except biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. As such, the indicator is identical to GWP-total except that the CF for biogenic CO_2 is set to zero.

NRSF	MJ	0	0	0	0	0	0	0	0	0
FW	m^3	6.0E-03	7.1E-05	8.4E-05	0	0	2.4E-05	0	0	-3.0E-03
Acronyms	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 re-sources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water									

Waste indicators

Results per functional or declared unit										
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**B1-B7**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	kg	1.4E-08	4.4E-12	1.0E-13	0	0	1.5E-12	0	0	-7.8E-11
Non-hazardous waste disposed	kg	3.5E-02	1.8E-04	4.1E-04	0	0	6.1E-05	0	0	3.1E-02
Radioactive waste disposed	kg	2.3E-04	1.6E-06	2.9E-07	0	0	5.6E-07	0	0	2.4E-04

Output flow indicators

Results per functional or declared unit										
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**B1-B7**	**C1**	**C2**	**C3**	**C4**	**D**
Components for re-use	kg	0	0	0	0	0	0	0	0	0
Material for recycling	kg	2.3E-01	0	0	0	0	0	9.8E-01	0	0
Materials for energy recovery	kg	0	0	0	0	0	0	0	0	0
Exported energy, electricity	MJ	1.1E-02	0	9.5E-02	0	0	0	0	0	0
Exported energy, thermal	MJ	4.7E-03	0	4.1E-02	0	0	0	0	0	0

The results from modules A1-A3 should not be used without considering the results of module C.

The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins and/or risks.

References

General Program Instructions of the International EPD® System. Version 4.0.

PCR 2019:14	PCR 2019:14 Construction products. Version 1.3.4
EN 15804+A2	EN 15804:2012+A2:2019/AC:2021 Sustainability of construction works - Environmental Product Declarations - Core rules for the product category of construction products
Sphera LCA FE (GaBi)	Sphera LCA FE (GaBi) Version CUP2022.2 database
ISO 14025	ISO 14025:2010 Environmental labels and declarations — Type III environmental declarations — Principles and procedures
ISO 14040	ISO 14040:2006 Environmental management - Life cycle assessment - Principles and framework
ISO 14044	ISO 14044:2006 Environmental management - Life cycle assessment - Requirements and guidelines

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