epd-norge

Environmental Product Declaration

In accordance with ISO 14025 and EN 15804 +A2

Lindab®

The Norwegian
EPD Foundation

Owner of the declaration:
Lindab Ventilation AB
Stålhögavägen 115, 269 92 Båstad
Sweden

Program holder and publisher:
The Norwegian EPD foundation

Declaration number:
NEPD-3535-2124-EN

Registration Number:
NEPD-3535-2124-EN

Issue date: 01.06.2022
Valid to: 01.06.2027

Product name
Carat, passive radiant chilled beam

Manufacturer
Lindab Ventilation AB

General information

Product:
Carat

Program Operator:
The Norwegian EPD Foundation
Post Box 5250 Majorstuen, 0303 Oslo, Norway
Tlf: +47 23 08 80 00
e-mail: post@epd-norge.no

Declaration Number:
NEPD-3535-2124-EN

This declaration is based on Product Category Rules:
CEN Standard EN15804:2012+A2:2019 serves as core PCR

PART A: Construction products and services Ver 2

PART B: PCR NPCR 030

Statements:
The owner of the declaration shall be liable for the underlying information and evidence. EPD Norway shall not be liable with respect to manufacturer, life cycle assessment data and evidences.

Declared unit:
1 piece of Carat-31 product with a length of 1.2 m.

The EPD is a specific EPD for this product, and from the EPD results all other Carat products in several different lengths and sizes can be derived.

Declared unit with option:
Included modules: A1-A4, C1-C4, D

Functional unit

Verification:
Independent verification of the declaration and data, according to ISO14025:2010

internal ☐ external ☑

Charlotte Merlin, Senior project leader,
FORCE Technology
Independent verifier approved by EPD Norway

Owner of the declaration:
Lindab Ventilation AB
Contact person: Matilda Isaksson
Phone: +46 431 850 12
e-mail: matilda.isaksson@lindab.com

Manufacturer:
Lindab Ventilation AB
Stålhögavägen 115, 269 92 Båstad, Sweden
Phone: +46 431 850 00
e-mail: lindab@lindab.com

Place of production:
Grevie, Sweden

Management system:
ISO 9001, ISO 14001

Organisation no:
SE556026158701

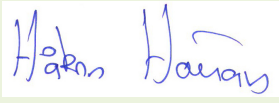
Issue date:
01.06.2022

Valid to:
01.06.2027

Year of study:
2022

Comparability:
EPDs from other programmes than The Norwegian EPD Foundation may not be comparable.

The EPD has been worked out by:
Anna Liljenroth and Lisa Hallberg, IVL Swedish Environmental Research Insitute



Approved (Manager of EPD Norway

Product

Product description:

Carat is placed above a perforated suspended ceiling and supplies cooling, with a low air velocity, to the room below.

Carat has a high radiation quotient of approx. 35% (compared to approx. 5% for traditional finned products). This gives great freedom in placing, when installing Carat, yet keeps air velocities low.

Product specification:

The material composition of the declared product is given below. This material composition is based on the specific variant Carat-31 with a length of 1.2 m.

Materials	KG	%
Aluminium	1.30	55
Copper	0.84	36
Powder coating	0.21	9

Technical data:

Lindabs active chilled beams are Eurovent-certified and tested according to EN-14518.

Market:

Europe, Australia

Reference service life, product:

The reference service life of the product is highly dependent on the conditions of use but an average lifespan under normal conditions is 20 years. This is an estimated value based on experience and scientific facts about materials in Carat.

Reference service life, building:

Not declared

LCA: Calculation rules

Declared unit:

1 piece of Carat-31 product with a length of 1.2 m.

Calculation of EPD results for other sizes and lenghts:

Carat comes in many different product configurations and sizes, the results presented in this EPD is representative for Carat-31 with a length of 1.2 m.

It was concluded that the Carat-31 (results per piece for the 1.2 m length) can be used as the reference (the results in the EPD) and that the results for all other Carat products and lengths can be obtained by multiplying with a conversion factor and the actual length of the product.

To conclude this, the 10 % rule was checked for all LCIA-indicators to check whether it was possible to declare all product variants in the same EPD or not. The 10 % rule is used in order to check that the variation in LCIA indicator results between products is not larger than ± 10 %.

The calculations for the LCIA-indicators showed that the 10 % rule was fulfilled for all environmental impact categories except ODP, ADP-M&M and WDP. For these indicators the variation is stated in the Table below. However by using the conversion factors stated below all these impact categories are overestimated and therefore this is considered as a conservative approach.

Parameter	Unit	Carat-31 (6.0 m)	Carat-44 (6.0 m)	Carat-58 (6.0 m)	Carat-71 (6.0 m)	Carat-84 (6.0 m)
ODP	kg CFC-11 eq	14 % higher	15 % higher	16 % higher	13 % higher	15 % higher
ADP-M&M	kg Sb eq	32 % higher	32 % higher	31 % higher	28 % higher	31 % higher
WDP	m3	15 % higher	17 % higher	18 % higher	16 % higher	17 % higher

The result for all variants of Carat can be calculated through this formula.

Results (per 1 piece of Carat) =

*EPD results for Carat-31 1.2 m * size specific factor * length of the product*

The size specific factors are presented in the Table below:

Product size	Size specific factor
Carat-31	0.83
Carat-44	1.25
Carat-58	1.67
Carat-71	2.08
Carat-84	2.5

Data quality:

Specific data for the product composition is provided by Lindab Ventilation AB in 2022. Data for the core process is collected by Lindab in 2020. Background data is based on registered Gabi/sphera database 2022.1 and Ecoinvent 3.8. Transport data is based on data from Sphera.

Allocation:

The allocation is made in accordance with the provisions of EN 15804. Energy, water and waste in the core process are allocated equally among all products through mass allocation.

System boundary:

Cradle to Gate with options. Mandatory stages: A1-A3, A4, C1-C4, D

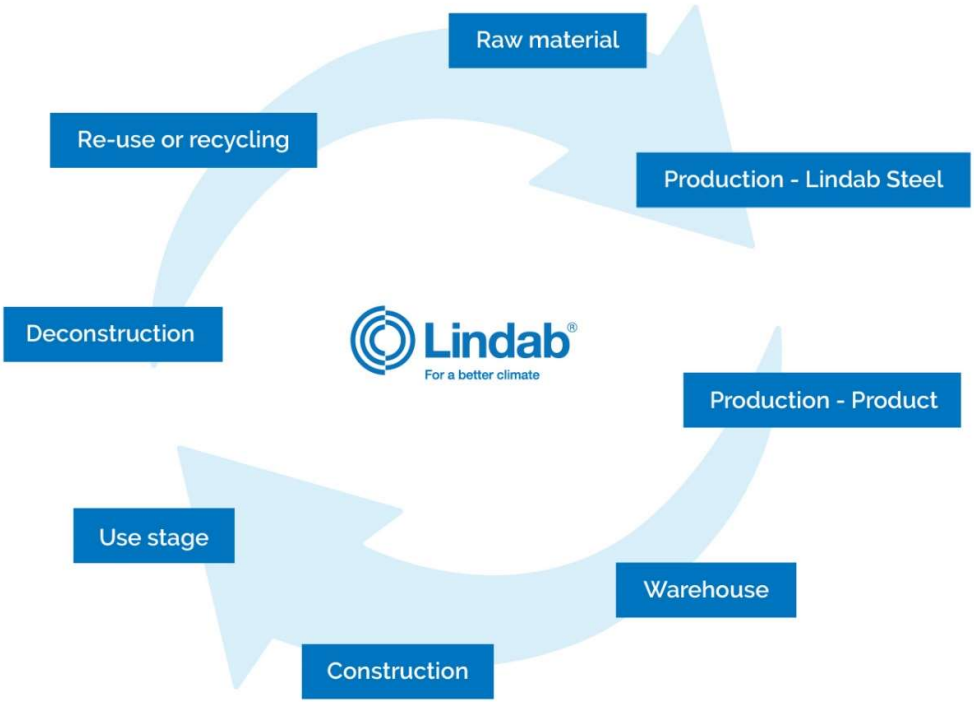
Cut-off criteria:

All raw materials and all the essential energy is included. All hazardous and toxic materials and substances are considered in the inventory even though they are below the cut off criteria.

LCA: Scenarios and additional technical information

The following information describe the scenarios in the different modules of the EPD.

Scenarios have been developed to account for downstream processes such as demolition and waste treatment in accordance with the requirements of EN 15804 and NPCR 030 Part B. See more information on next page.



A1 Raw material supply

This module takes into account the extraction and processing of all raw materials and energy which occur upstream to the studied manufacturing process. The raw material supply covers production of aluminium, copper, powder coating and packaging materials.

A2 Transport to the manufacturer

The raw materials are transported by truck and boat to the manufacturing site.

A3 Manufacturing

Aluminum strips and copper pipes are purchased from the supplier in coils. The coils from copper and aluminum are placed in the rolling mill that will produce the raw material for the product, strips. The aluminum strip and the copper tube are rolled together with high pressure and heat (metallurgical joining) so that a homogeneous strip of the materials is formed which is then rolled up on a roll.

The coil of the finished strip is placed in the "Strip machine" where the strip is rolled out, the copper pipe is inflated and the strip is cut to the correct length according to customer order.

The strip is then placed in a press where gills are punched in the material and the edges are rolled. To join several strips to a predetermined width, the strips are placed in the Carat machine where they are joined by stucco riveting along the strip. Suspension brackets of square profile are screwed in place in parallel in the process.

Connecting pipes and manifold are placed on the end of the product and soldered together with the strip. Cover plugs are placed over the connecting pipes. Finally, the product is powder coated and then packed on a wooden pallet with packaging of cellular plastic and stretch plastic.

Transport from production place to user (A4)

This module includes transport from the production gate to the user. Transport is calculated on the basis of a scenario with the parameters described in the table. The scenario is based on an assumption that 50 % of products are sold to Europe and 50 % to Australia. From this assumption two generic distances for Europe and Austrailia are combined to an average.

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance (km)	Fuel/Energy consumption (l/tkm)	value (l/t)
Truck	85	Long distance truck	224	0.016	3.6
Boat	N.R.	Container ship	11 228	0.0037	42

End of Life (C1, C3, C4)

The scenarios analysed for these modules are representative for the most likely scenario. Aluminium and copper are deconstructed and transported to waste processing and 85 % of the materials were assumed to be recycled and the rest disposed of. The powder coating is assumed to be combusted in the smelting process.

	Unit	Value
Hazardous waste disposed	kg	0
Collected as mixed construction waste	kg	0
Reuse	kg	0
Recycling	kg	1.58
Energy recovery	kg	0
To landfill	kg	0.28

Deconstruction, demolition (C1)

This is the amount of energy required for deconstruction/demolition of aluminium and copper.

Process	Fuel/energy consumption	Type of fuel/energy
Demolition of product	0.004 MJ/kg	Diesel

Transport to waste processing (C2)

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance (km)	Fuel/Energy consumption (l/tkm)	value (l/t)
Truck	85	Long distance truck	150	0.016	2.4

Benefits and loads beyond the system boundaries (D)

The Carat product is assumed to be recycled as one unit and used for manufacturing engine blocks, since this highly alloyed aluminium is good for this purpose. Engine blocks are normally made from recycled aluminium and therefore the recycled material minus recycled content in the materials are credited with a dataset for recycled aluminium.

	Unit	Value
Replacement of recycled aluminium in engine blocks	Kg	0.86

Additional technical information

No additional information

LCA: Results

System boundaries (X=included, MND= module not declared, MNR=module not relevant)

Product stage			Assembly stage		Use stage							End of life stage				Benefits & loads beoyond system boundary
Raw materials	Transport	Manufacturing	Transport	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	X	X	X	X	X

Core environmental impact indicators per 1 piece of Carat-31 1.2 m

Indicator	Unit	A1-A3	A4	C1	C2	C3	C4	D
GWP-total	kg CO2 eq.	1.06E+01	4.00E-01	6.85E-04	1.86E-02	2.58E-01	4.04E-03	-2.92E-01
GWP-fossil	kg CO2 eq.	1.06E+01	3.99E-01	6.81E-04	1.82E-02	2.64E-01	4.16E-03	-2.92E-01
GWP-biogenic	kg CO2 eq.	3.80E-02	7.05E-04	-9.45E-07	1.79E-04	-5.85E-03	-1.23E-04	-2.57E-04
GWP-LULUC	kg CO2 eq.	3.32E-03	2.79E-04	3.81E-06	1.51E-04	2.51E-05	7.68E-06	-9.31E-05
ODP	kg CFC11 eq.	8.74E-08	2.14E-14	4.11E-17	2.35E-18	4.19E-14	9.78E-15	-1.66E-12
AP	mol H^+ eq.	4.86E-02	1.43E-02	3.97E-06	1.74E-05	5.71E-05	2.95E-05	-7.18E-04
EP-freshwater	kg P eq.	1.93E-04	2.72E-07	2.04E-09	5.45E-08	5.16E-08	7.05E-09	-2.02E-07
EP-marine	kg N eq.	6.59E-03	3.63E-03	1.94E-06	5.36E-06	2.20E-05	7.54E-06	-2.21E-04
EP-terrestial	mol N eq.	7.06E-02	3.98E-02	2.15E-05	6.46E-05	2.85E-04	8.29E-05	-2.42E-03
POCP	kg NMVOC eq.	2.10E-02	1.02E-02	3.75E-06	1.50E-05	5.93E-05	2.29E-05	-6.36E-04
ADP-M&M	kg Sb eq.	1.27E-04	1.61E-08	5.73E-11	1.40E-09	5.70E-09	4.27E-10	-3.33E-08
ADP-fossil	MJ	1.59E+02	4.84E+00	9.14E-03	2.45E-01	1.79E-01	5.45E-02	-4.66E+00
WDP	m^3	1.83E+00	1.03E-03	6.14E-06	1.60E-04	2.96E-02	4.56E-04	-5.16E-03

GWP-total: *Global Warming Potential;* ***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; See "additional Norwegian requirements" for indicator given as PO4 eq.* ***EP-marine:*** *Eutrophication potential, fraction of nutrients reaching freshwater end compartment;* ***EP-terrestial:*** *Eutrophication potential, Accumulated Exceedance;* ***POCP****: Formation potential of tropospheric ozone;* ***ADP-M&M****: Abiotic depletion potential for non-fossil resources (minerals and metals);* ***ADP-fossil:*** *Abiotic depletion potential for fossil resources;* ***WDP:*** *Water deprivation potential, deprivation weighted water consumption*

Classification of disclaimers to the declaration of core and additional environmental impact indicators

ILCD classification	Indicator	Disclaimer
ILCD type / level 1	Global warming potential (GWP)	None
	Depletion potential of the stratospheric ozone layer (ODP)	None
	Potential incidence of disease due to PM emissions (PM)	None
	Acidification potential, Accumulated Exceedance (AP)	None
ILCD type / level 2	Eutrophication potential, Fraction of nutrients reaching freshwater end compartment (EP-freshwater)	None
	Eutrophication potential, Fraction of nutrients reaching marine end compartment (EP-marine)	None
	Eutrophication potential, Accumulated Exceedance (EP-terrestrial)	None
	Formation potential of tropospheric ozone (POCP)	None
	Potential Human exposure efficiency relative to U235 (IRP)	1
ILCD type / level 3	Abiotic depletion potential for non-fossil resources (ADP-minerals&metals)	2
	Abiotic depletion potential for fossil resources (ADP-fossil)	2
	Water (user) deprivation potential, deprivation-weighted water consumption (WDP)	2
	Potential Comparative Toxic Unit for ecosystems (ETP-fw)	2
	Potential Comparative Toxic Unit for humans (HTP-c)	2
	Potential Comparative Toxic Unit for humans (HTP-nc)	2
	Potential Soil quality index (SQP)	2

Disclaimer 1 – 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 nor due to 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.

Disclaimer 2 – The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator

Resource use per 1 piece of Carat-31 1.2 m

Parameter	Unit	A1-A3	A4	C1	C2	C3	C4	D
RPEE	MJ	7.31E+01	5.24E-02	5.20E-04	1.37E-02	3.72E-02	8.18E-03	-4.15E-01
RPEM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TPE	MJ	7.31E+01	5.24E-02	5.20E-04	1.37E-02	3.72E-02	8.18E-03	-4.15E-01
NRPE	MJ	1.59E+02	4.85E+00	9.17E-03	2.45E-01	1.79E-01	5.46E-02	-4.66E+00
NRPM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TRPE	MJ	1.59E+02	4.85E+00	9.17E-03	2.45E-01	1.79E-01	5.46E-02	-4.66E+00
SM	kg	6.08E-01	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
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	m^3	1.46E-01	7.17E-05	5.89E-07	1.56E-05	6.82E-04	1.39E-05	-3.87E-04

RPEE Renewable primary energy resources used as energy carrier; RPEM Renewable primary energy resources used as raw materials; TPE Total use of renewable primary energy resources; NRPE Non renewable primary energy resources used as energy carrier; NRPM Non renewable primary energy resources used as materials; TRPE Total use of non renewable primary energy resources; SM Use of secondary materials; RSF Use of renewable secondary fuels; NRSF Use of non renewable secondary fuels; W Use of net fresh water

End of life – Waste per 1 piece of Carat-31 1.2 m

Parameter	Unit	A1-A3	A4	C1	C2	C3	C4	D
HW	KG	7.93E-08	3.56E-11	4.40E-14	1.24E-11	6.24E-12	2.80E-12	-1.19E-09
NHW	KG	2.54E+00	5.00E-04	1.31E-06	3.64E-05	1.78E-02	2.79E-01	-2.13E-02
RW	KG	1.46E-02	5.64E-06	1.13E-08	2.97E-07	8.74E-06	6.07E-07	-1.89E-04

HW Hazardous waste disposed; NHW Non hazardous waste disposed; RW Radioactive waste disposed

End of life – output flow per 1 piece of Carat-31 1.2 m

Parameter	Unit	A1-A3	A4	C1	C2	C3	C4	D
CR	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR	kg	2.81E-01	0.00E+00	0.00E+00	0.00E+00	1.58E+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
EEE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ETE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

CR Components for reuse; MR Materials for recycling; MER Materials for energy recovery; EEE Exported electric energy; ETE Exported thermal energy

Reading example: 9,0 E-03 = 9,0*10-3 = 0,009

Information describing the biogenic carbon content at the factory gate per 1 piece of Carat-31 1.2 m

Biogenic carbon content	Unit	Value
Biogenic carbon content in product	kg C	N.R.
Biogenic carbon content in the accompanying packaging	kg C	0.15

Additional Norwegian requirements

Greenhouse gas emission from the use of electricity in the manufacturing phase

National production mix from import, low voltage (production of transmission lines, in addition to direct emissions and losses in grid) of applied electricity for the manufacturing process(A3). In Sweden wind power is used in all manufacturing sites, guarantee of origin is available.

National electricity grid	Unit	Value
Swedish national grid mix	kg CO2 -eq/kWh	0.044

The results with using Swedish national grid mix instead, gives the value presented in the table below per 1 piece of Carat-31 1.2 m.

Indicator	Unit	A1-A3
GWP-IOBC	kg CO2 eq.	1.04E+01

Additional environmental impact indicators required in NPCR Part A for construction products

In order to increase the transparency of biogenic carbon contribution to climate impact the indicator GWP-IOBC is presented per 1 piece of Carat-31 1.2 m. This indicator excludes biogenic carbon dioxide and are sometimes called GWP-GHG.

Indicator	Unit	A1-A3	A4	C1	C2	C3	C4	D
GWP-IOBC	kg CO2 eq.	1.04E+01	3.94E-01	6.73E-04	1.81E-02	2.63E-01	4.10E-03	-2.85E-01

GWP-IOBC *Global warming potential calculated according to the principle of instantanious oxidation. In this indicator is uptake and emission of biogenic carbiondioxide set to zero, i.e. directa balanced out in the module where it appears. Alternative name of this indicator is GWP-GHG.*

Hazardous substances

The declaration is based upon reference to threshold values and/or test results and/or material safety data sheets provided to EPD verifiers. Documentation available upon request to EPD owner.

- ☑ The product contains no substances given by the REACH Candidate list or the Norwegian priority list.
- ☐ The product contains substances given by the REACH Candidate list or the Norwegian priority list that are less than 0,1 % by weight.
- ☐ The product contain dangerous substances, more then 0,1% by weight, given by the REACH Candidate List or the Norwegian Priority list, see table.
- ☐ The product contains no substances given by the REACH Candidate list or the Norwegian priority list. The product is classified as hazardous waste (Avfallsforskiften, Annex III), see table.

Indoor environment

The product meets the requirements for low emissions.

Carbon footprint

Carbon footprint has not been worked out for the product.

Bibliography

ISO 14025:2010	Environmental labels and declarations - Type III environmental declarations - Principles and procedures
ISO 14044:2006	Environmental management - Life cycle assessment - Requirements and guidelines
EN 15804:2012+A2:2019	Sustainability of construction works - Environmental product declaration - Core rules for the product category of construction products
ISO 21930:2007	Sustainability in building construction - Environmental declaration of building products
PCR PART A	Construction products and services Ver 2
NPCR 030:2021	Part B for ventilation components
LCA report	LCA methodology report for CARAT

epd-norge The Norwegian EPD Foundation	**Program Operator and Publisher**	Phone	+47 23 08 80 00
	The Norwegian EPD Foundation		
	Post Box 5250 Majorstuen, 0303 Oslo	e-post:	post@epd-norge.no
	Norway	web	www.epd-norge.no
Lindab®	**Owner of the declaration**		
	Lindab Ventilation AB		
	Stålhögavägen 115, 269 92 Båstad		
	Sweden	web	www.lindab.com
ivl Swedish Environmental Research Institute	**Author of the life cycle assessment**	Phone	+46 10-788 65 00
	IVL Swedish Environmental Research Institute	e-mail	anna.liljenroth@ivl.se
	Valhallavägen 81, 114 28 Stockholm		elisabet.hallberg@ivl.se
	Sweden	web	www.ivl.se

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