Statement of Verification

BREG EN EPD No: 000845 Issue: 01

This is to verify that the Environmental Product Declaration provided by:

Vaillant Group

are in accordance with the requirements of:

EN 15804:2012+A2:2019

and

BRE Global Scheme Document SD207

This declaration is for:

1 aroTHERM pro (5kW module) VWL 55/7.1 heat pump with VWZ_AI_EBUS control unit to produce 1 kW of heating, according to the appropriate usage scenario defined in the EN 14825 standard and during the 17-year reference lifetime of the products

Company Address

Vaillant Group UK Ltd.
Nottingham Road
DE56 1JT Belper
United Kingdom





Signed for BRE Global Limited — Hayley Thomson, Operator

Date of this Issue	Date of First Issue	Expiry Date
29 September 2026	29 September 2026	28 September 2031

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BRE Global Ltd., Garston, Watford WD25 9XX
T: +44 (0)333 321 8811 F: +44 (0)1923 664603 E: Enquiries@breglobal.com

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Environmental Product Declaration

EPD Number: 000845

General Information: aroTHERM pro (5kW module) VWL 55/7.1 heat pump with VWZ_AI_EBUS control unit

EPD Programme Operator	Applicable Product Category Rules
BRE Global Watford, Herts WD25 9XX United Kingdom	BRE Environmental Profiles 2013 Product Category Rules for Type III environmental product declaration of construction products to EN 15804+A2 PN 514 Rev 3.2 PEP ecopassport®. (2025, 20 october). PSR-0013-ed3.2-EN-2025-10-20 – Product Specific Rules for thermodynamic generators with electric compression for space heating and/or cooling and/or the production of domestic hot water
Commissioner of LCA study	**LCA consultant/Tool**
Vaillant Group	Frédéric Assouad/SimaPro
Declared/Functional Unit	**Applicability/Coverage**
1 aroTHERM pro (5kW module) VWL 55/7.1 heat pump with VWZ_AI_EBUS control unit to produce 1 kW of heating, according to the appropriate usage scenario defined in the EN 14825 standard and during the 17-year reference lifetime of the products".	Product specific
EPD Type	**Background database**
Cradle to Grave	ecoinvent 3.11 cut-off by classification

Demonstration of Verification
CEN standard EN 15804 serves as the core PCR [a]
Independent verification of the declaration and data according to EN ISO 14025:2010 ☐Internal ☒ External
(Where appropriate [b])Third party verifier: Kim Albury
a: Product category rules b: Optional for business-to-business communication; mandatory for business-to-consumer communication (see EN ISO 14025:2010, 9.4)

Comparability
Environmental product declarations from different programmes may not be comparable if not compliant with EN 15804:2012+A2:2019. Comparability is further dependent on the specific product category rules, system boundaries and allocations, and background data sources. See Clause 5.3 of EN 15804:2012+A2:2019 for further guidance

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Information modules covered

Product			Construction		Use stage							End-of-life					Benefits and loads beyond the system boundary
					Related to the building fabric					Related to the building							
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4		D
Raw materials supply	Transport	Manufacturing	Transport to site	Construction – Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction demolition	Transport	Waste processing	Disposal		Reuse, Recovery and/or Recycling potential
☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑		☑

Note: Ticks indicate the Information Modules declared.

Manufacturing site(s)

The products are manufacturing in Slovakia:

Pplk. Pľjušťa 826/45, Skalica, 909 01 Skalica, Slovakia

Construction Product:

Product Description

The data has been calculated for each product. The system under consideration is a heat pump consisting of a VWZ AI (control unit) indoor unit and an aroTHERM pro-outdoor unit. The studies are for an air-to-water heat pump producing heating only.

- Outside unit: aroTHERM pro VWL 55/7.1 – 8000022167 - https://www.vaillant.fr/produits/arothermpro/
- Indoor unit: VWZ AI EBUS – 8000035574 - https://kontakt.vaillant.de/produkte/neue-arotherm-plus/8000041970-00-3055297.pdf

Technical Information

Property	aroTHERM pro VWL 55/7.1 + VWZ-AI-EBUS
Pn (nominal power in kW)	4,9
SCOP at 35°C (seasonal coefficient of performance for heating according to EN 14 825)	44,8
Packaging weight (kg)	14,1
Product Weight without packaging (kg)	85,6
Refrigerant fluid	R290 - 0,5 kg
System type	Air-to-Water
Reference service lifetime	17 years

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Main Product Contents with packaging

Material/Chemical Input	%
Steel	39,5
Wood	11,2
Copper	8,8
Aluminium	8,7
Galvanised steel	7,5
Bitumen	6,6
ASA	3,7
Cable	2,5
PP	2,4
PCB	1,4
PET	0,8
Others	6,9

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Electricity mix

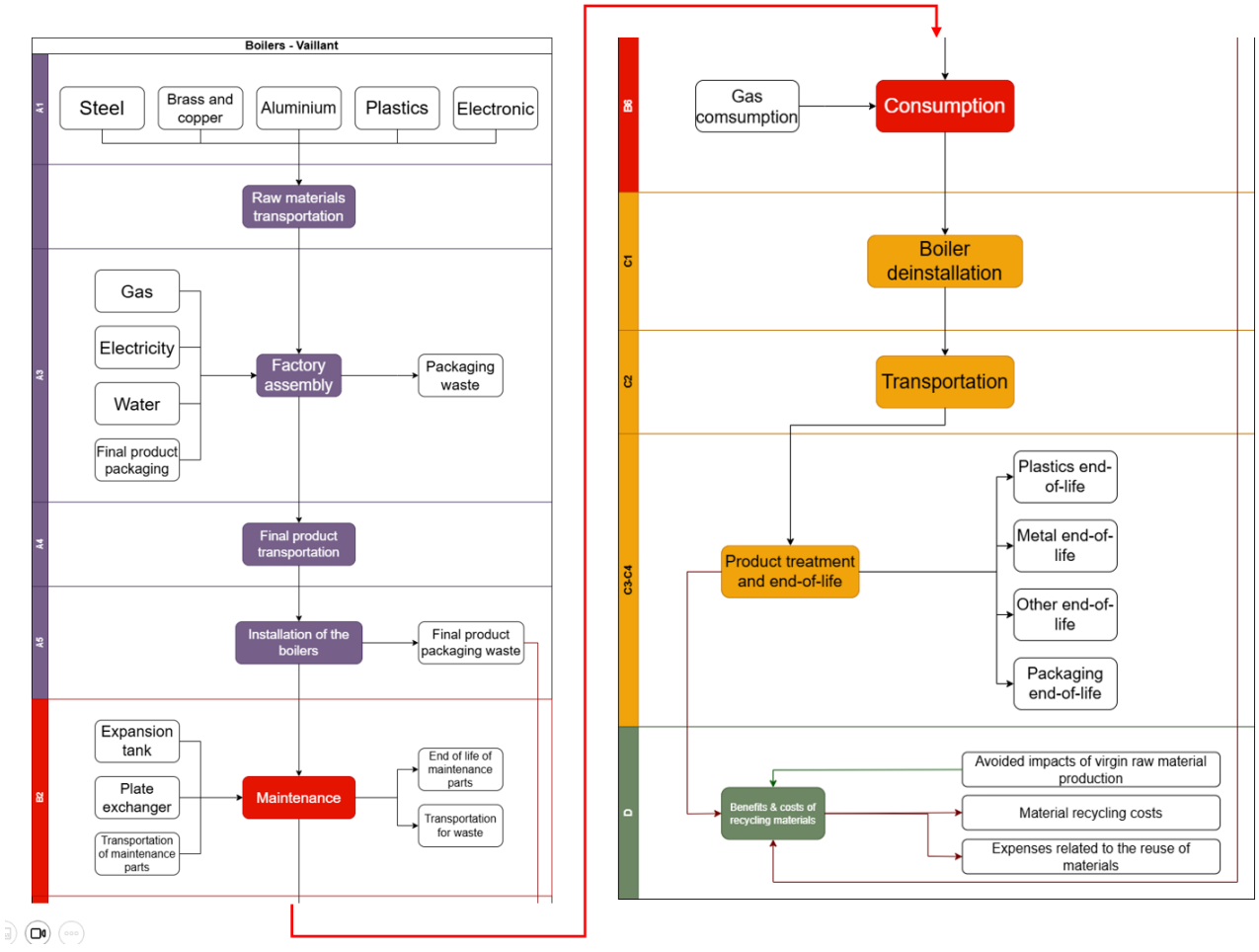
A location-based electricity mix has been used for the modelling of electricity consumption. The electricity mix reflects the average electricity generation mix of the relevant geographical location on every life cycle stages.

Manufacturing Process

A heat pump is made up of components manufactured and supplied directly by the manufacturer or components ready to be assembled on site. Heat pumps are assembled in Skalica, Slovakia, and distributed, installed, and used in the UK.
During stage A1, a default loss quantity is considered to consider the waste produced during the processing of raw materials by the various raw material suppliers. The percentages considered are as follow:

- 5% for plastic injection and elastomer
- 30% for any other processes

Process flow diagram



Construction Installation

Products are manufactured in Skalica and distributed in the UK. The average distance the unit can travel to the UK (1800 km) by lorry has been considered for this scenario.

The installation of the heat pumps requires no additional components.

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The packaging of the units is disposed of during the installation of the combined units. Packaging includes :

- corrugated cardboard and paper: 86,4% recycled.
- wood: 57,3% recycled
- plastic: 53,7% recycled
- Aluminium: 68,5% recycled
- Steel: 86,6% recycled

Use Information

B1: Each year, the refrigerant gas used in the heat pump emits 26g of this fluid (R290) into the air. A total of 446g over 17 years study period.
B2: An average return trip distance of 58 km covered by an operator is considered every two years for visual inspection, R290 refill. A total of 100g over 17 years study period
B3: If the heat pump is installed and maintained yearly in accordance with the manufacturer's requirements, the heat pump should not require repair throughout its reference lifetime.
B4: the heat pump has a reference lifetime of 17 years and therefore no replacement is required providing the heat pump has been installed and maintained in accordance with the manufacturer's requirement.
B5: the heat pump has a reference lifetime of 17 years and therefore no refurbishment is required providing the heat pump has been installed and maintained in accordance with the manufacturer's requirement.
B6: the energy required to operate the heat pump was considered over 17 years study period
B7: the heat pump is designed for heating only. No water considered over 17 years study period

End of Life

C3: It was assumed the following:

Materials	Recycling (%)
Steel	80
Other ferrous metals	80
Aluminium	70
Copper	60
Other non-ferrous metals	60
PP	20
PS-Hips	20
ABS	20
PU foam	0
Rubber	0
Other plastics	0

C4: No information was provided, so a conservative estimate was made. All other non-recycled materials are sent to landfill at 100%.

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Life Cycle Assessment Calculation Rules

Declared unit description

To produce heating thanks to 1 aroTHERM pro (5kW module) VWL 55/7.1 heat pump with VWZ_AI_EBUS control unit of 4,9 kW heating capacity according to the appropriate usage scenario and during the 17-year reference lifetime of the product.

System boundary

The system boundary considered in the LCA study is cradle to grave which covers all production stages (A1-A3), transportation to site (A4), installation (A5), use stages (B1-B7), and end-of-life stages (C1-C4) and D in accordance with EN 15804:2012+A2:2019. Additionally, this EPD complies with EN 50693:2019 PCR for the evaluation of electronic and electrical products and systems.
The study period of this LCA is 17 years which is same as the reference service life of the product for the entire system boundary from A1-C4.
Impacts and losses/wastage in production, transport, use stage and end of life stage are accounted in their respective modules.

Data sources, quality and allocation

Specific primary data derived from the manufacturing of the heat pumps tank process in Belper, UK factory have been modelled using Simapro v10 LCA software and data collected during the period of 2025. In accordance with the requirements of EN15804, the most current available data has been used. The manufacturer-specific data for one unit of each. Secondary data has been obtained for all other upstream and downstream processes that are beyond the control of the manufacturer (i.e. raw material production) from the ecoinvent 3.11 database. All ecoinvent datasets are complete within the context used and conform to the system boundary and the criteria for the exclusion of inputs and outputs, according to the requirements specified in EN15804. The quantities of materials have been calculated based on the components used in the unit. The amount of water, energy and waste was allocated to each product based on the total number of heat pump manufactured per year.

Specific UK datasets have been selected from the ecoinvent LCI for this LCA. The quality level of geographical and technical representativeness is therefore good. The quality level of time representativeness is good as the background LCI datasets are based on ecoinvent v3.11 (released in 2025).

The method used is Ev-DEC EF3.1 ei3.11 SP10 PEPecopassport ed4 1.18 V1.18. The characterisation factor version used is EF3.1.

The Slovak electricity mix (2023) used has an impact on the climate change indicator of 0.115 $kgCO_2eq/kWh$, the gas (2023) used for the heat pumps has an impact of 0.076 $kgCO_2eq/MJ$.

In accordance with Annex E of EN 15804, the data quality of this study has been assessed using Table E.2, based on the data quality levels and criteria of the Product Environmental Footprint Category Rules (PEFCR).

Cut-off criteria

The cut-off rule used in this study is that defined in PCR edition 4 as follows:

- The mass of intermediate flows not considered must be less than or equal to 5% of the mass of the elements in the reference product corresponding to the Functional unit.
- Energy flows not considered must be less than or equal to 5% of the total primary energy used during the life cycle of the reference product corresponding to the Functional unit,
- The environmental impacts not considered must be less than or equal to 5% of the total environmental impacts generated throughout the life cycle of the reference product corresponding to the Functional unit.

No raw materials are excluded in this study.

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LCA Results: aroTHERM pro VWL 55/7.1 + VWZ AI EBUS

Reference: 8000022167 + 8000035574

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing environmental impacts

			GWP-total	GWP-fossil	GWP-biogenic	GWP-luluc	ODP	AP	EP-freshwater
			kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg CFC11 eq	mol H^+ eq	kg $(PO_4)^{3-}$ eq
Product stage	Raw material supply	A1	5,76E+02	5,78E+02	-3,79E+00	1,37E+00	2,80E-05	1,10E+01	6,83E-02
	Transport	A2	5,88E+01	5,88E+01	1,24E-02	1,93E-02	1,33E-06	1,22E-01	4,46E-04
	Manufacturing	A3	3,92E+01	5,68E+01	-1,77E+01	1,54E-01	1,21E-06	2,43E-01	4,63E-03
	Total (Consumption grid)	A1-3	6,74E+02	6,94E+02	-2,15E+01	1,54E+00	3,05E-05	1,14E+01	7,33E-02
Construction process stage	Transport	A4	3,35E+01	3,35E+01	7,07E-03	1,10E-02	7,59E-07	6,95E-02	2,54E-04
	Construction	A5	2,40E+01	2,48E+00	2,15E+01	1,54E-02	6,04E-08	9,09E-03	2,47E-04
Use stage	Use	B1	8,84E-03	8,84E-03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Maintenance	B2	1,64E+02	1,64E+02	7,04E-02	7,33E-02	3,97E-06	6,72E-01	2,54E-03
	Repair	B3	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Replacement	B4	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Refurbishment	B5	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Operational energy use	B6	9,23E+03	9,19E+03	2,47E+01	1,27E+01	4,31E-04	3,28E+01	1,55E-01
	Operational water use	B7	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
100% PCR ed4.0 Scenario									
End of life	Deconstruction, demolition	C1	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Transport	C2	1,68E+00	1,68E+00	3,55E-04	5,51E-04	3,81E-08	3,49E-03	1,28E-05
	Waste processing	C3	3,41E+01	3,40E+01	8,65E-02	3,68E-02	4,72E-07	7,94E-01	2,95E-03
	Disposal	C4	2,76E+01	2,76E+01	5,28E-03	3,09E-03	1,89E-07	2,24E-02	4,18E-04
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-1,79E+02	-1,79E+02	-2,44E-01	-4,17E-01	-4,55E-06	-1,15E+00	-2,97E-02

GWP-total = Global warming potential, total;
GWP-fossil = Global warming potential, fossil;
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; and
EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment

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LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing environmental impacts									
			EP-marine	EP-terrestrial	POCP	ADP-mineral& metals	ADP-fossil	WDP	PM
			kg N eq	mol N eq	kg NMVOC eq	kg Sb eq	MJ, net calorific value	m^3 world eq deprived	disease incidence
Product stage	Raw material supply	A1	8,24E-01	1,05E+01	3,32E+00	1,36E-01	8,00E+03	2,71E+02	4,77E-05
	Transport	A2	3,04E-02	3,35E-01	2,06E-01	2,09E-04	8,30E+02	3,22E+00	4,38E-06
	Manufacturing	A3	3,78E-02	3,98E-01	1,40E-01	1,03E-04	1,20E+03	1,23E+01	8,21E-07
	Total (Consumption grid)	A1-3	8,92E-01	1,12E+01	3,66E+00	1,36E-01	1,00E+04	2,87E+02	5,29E-05
Construction process stage	Transport	A4	1,73E-02	1,91E-01	1,17E-01	1,19E-04	4,74E+02	1,84E+00	2,50E-06
	Construction	A5	5,13E-03	3,12E-02	8,67E-03	1,01E-05	3,20E+01	9,81E-01	9,77E-08
Use stage	Use	B1	0,00E+00	0,00E+00	1,31E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Maintenance	B2	2,04E-01	2,26E+00	8,60E-01	1,88E-03	2,22E+03	1,41E+01	7,78E-06
	Repair	B3	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Replacement	B4	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Refurbishment	B5	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Operational energy use	B6	6,32E+00	7,43E+01	2,18E+01	1,47E-01	2,23E+05	6,99E+02	1,58E-04
	Operational water use	B7	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
100% PCR ed4.0 Scenario									
End of life	Deconstruction, demolition	C1	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Transport	C2	8,71E-04	9,59E-03	5,89E-03	5,97E-06	2,38E+01	9,24E-02	1,25E-07
	Waste processing	C3	4,95E-02	6,39E-01	2,00E-01	9,82E-03	4,55E+02	1,90E+01	3,83E-06
	Disposal	C4	5,87E-03	6,22E-02	2,36E-02	5,28E-05	8,84E+01	3,82E-01	2,45E-07
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-2,80E-01	-3,86E+00	-1,17E+00	-8,32E-03	-3,18E+03	-7,44E+01	-1,33E-05

EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment;
EP-terrestrial = Eutrophication potential, accumulated exceedance;
POCP = Formation potential of tropospheric ozone;
ADP-mineral&metals = Abiotic depletion potential for non-fossil resources;
ADP-fossil = Depletion potential of the stratospheric ozone layer;
WDP = Water (user) deprivation potential, deprivation-weighted water consumption; and
PM = Particulate matter.

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LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing environmental impacts							
			IRP	ETP-fw	HTP-c	HTP-nc	SQP
			kBq U^{235} eq	CTUe	CTUh	CTUh	dimensionless
Product stage	Raw material supply	A1	2,00E+01	1,40E+04	1,17E-06	8,87E-05	4,46E+03
	Transport	A2	3,60E-01	1,24E+02	9,36E-09	5,06E-07	5,01E+02
	Manufacturing	A3	8,01E+00	1,48E+02	2,39E-08	3,59E-07	1,59E+03
	Total (Consumption grid)	A1-3	2,83E+01	1,43E+04	1,20E-06	8,95E-05	6,56E+03
Construction process stage	Transport	A4	2,05E-01	7,10E+01	5,34E-09	2,89E-07	2,86E+02
	Construction	A5	8,40E-02	2,66E+01	7,22E-10	4,58E-08	2,30E+01
Use stage	Use	B1	0,00E+00	1,49E-03	0,00E+00	4,51E-08	0,00E+00
	Maintenance	B2	1,49E+00	7,37E+02	8,47E-08	1,88E-06	8,45E+02
	Repair	B3	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Replacement	B4	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Refurbishment	B5	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Operational energy use	B6	3,58E+03	2,13E+04	2,60E-06	1,34E-04	7,95E+04
	Operational water use	B7	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
100% PCR ed4.0 Scenario							
End of life	Deconstruction, demolition	C1	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Transport	C2	1,03E-02	3,56E+00	2,68E-10	1,45E-08	1,44E+01
	Waste processing	C3	3,03E+00	7,43E+02	1,11E-07	1,01E-05	3,82E+02
	Disposal	C4	1,33E-01	7,30E+02	2,07E-08	1,00E-07	2,22E+01
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-3,41E+00	-5,96E+03	-2,00E-08	9,34E-06	-3,05E+02

IRP = Potential human exposure efficiency relative to U235;
ETP-fw = Potential comparative toxic unit for ecosystems;
HTP-c = Potential comparative toxic unit for humans;
HTP-nc = Potential comparative toxic unit for humans; and
SQP = Potential soil quality index.

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LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing resource use, primary energy

			PERE	PERM	PERT	PENRE	PENRM	PENRT
			MJ	MJ	MJ	MJ	MJ	MJ
Product stage	Raw material supply	A1	1,46E+03	5,53E+01	1,51E+03	7,73E+03	4,18E+02	7,97E+03
	Transport	A2	1,38E+01	0,00E+00	1,38E+01	8,30E+02	0,00E+00	8,30E+02
	Manufacturing	A3	1,90E+02	1,11E+02	3,01E+02	1,19E+03	-1,58E+00	1,19E+03
	Total (Consumption grid)	A1-3	1,66E+03	1,66E+02	1,83E+03	9,75E+03	4,16E+02	9,99E+03
Construction process stage	Transport	A4	7,90E+00	0,00E+00	7,90E+00	4,73E+02	0,00E+00	4,73E+02
	Construction	A5	1,54E+02	-3,25E+02	-1,71E+02	3,59E+01	-1,30E+01	2,29E+01
Use stage	Use	B1	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Maintenance	B2	6,68E+01	0,00E+00	6,68E+01	2,22E+03	0,00E+00	2,22E+03
	Repair	B3	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Replacement	B4	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Refurbishment	B5	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Operational energy use	B6	6,62E+04	0,00E+00	6,62E+04	2,23E+05	0,00E+00	2,23E+05
	Operational water use	B7	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
100% PCR ed4.0 Scenario								
End of life	Deconstruction, demolition	C1	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Transport	C2	3,97E-01	0,00E+00	3,97E-01	2,38E+01	0,00E+00	2,38E+01
	Waste processing	C3	1,17E+02	0,00E+00	1,17E+02	4,54E+02	-3,40E+01	4,20E+02
	Disposal	C4	5,10E+00	0,00E+00	5,10E+00	2,00E+02	-1,12E+02	8,82E+01
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-3,63E+02	0,00E+00	-3,63E+02	-3,17E+03	0,00E+00	-3,17E+03

PERE = Use of renewable primary energy excluding renewable primary energy 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 resource

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LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing resource use, secondary materials and fuels, use of water						
			SM	RSF	NRSF	FW
			kg	MJ net calorific value	MJ net calorific value	m^3
Product stage	Raw material supply	A1	0,00E+00	0,00E+00	0,00E+00	8,44E+00
	Transport	A2	0,00E+00	0,00E+00	0,00E+00	1,01E-01
	Manufacturing	A3	0,00E+00	0,00E+00	0,00E+00	4,87E-01
	Total (Consumption grid)	A1-3	0,00E+00	0,00E+00	0,00E+00	9,03E+00
Construction process stage	Transport	A4	0,00E+00	0,00E+00	0,00E+00	5,76E-02
	Construction	A5	0,00E+00	0,00E+00	0,00E+00	1,33E-02
Use stage	Use	B1	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Maintenance	B2	0,00E+00	0,00E+00	0,00E+00	4,41E-01
	Repair	B3	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Replacement	B4	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Refurbishment	B5	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Operational energy use	B6	0,00E+00	0,00E+00	0,00E+00	5,83E+01
	Operational water use	B7	0,00E+00	0,00E+00	0,00E+00	0,00E+00
100% PCR ed4.0 Scenario						
End of life	Deconstruction, demolition	C1	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Transport	C2	0,00E+00	0,00E+00	0,00E+00	2,89E-03
	Waste processing	C3	0,00E+00	0,00E+00	0,00E+00	6,96E-01
	Disposal	C4	0,00E+00	0,00E+00	0,00E+00	-3,29E-03
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	0,00E+00	0,00E+00	0,00E+00	-1,91E+00

SM = Use of secondary material;
RSF = Use of renewable secondary fuels;
NRSF = Use of non-renewable secondary fuels;
FW = Net use of fresh water

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LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Other environmental information describing waste categories					
			HWD	NHWD	RWD
			kg	kg	kg
Product stage	Raw material supply	A1	1,59E+01	3,32E+03	1,39E-02
	Transport	A2	2,62E-02	5,03E+01	2,33E-04
	Manufacturing	A3	9,12E-02	1,63E+01	6,49E-03
	Total (Consumption grid)	A1-3	1,60E+01	3,38E+03	2,06E-02
Construction process stage	Transport	A4	1,49E-02	2,87E+01	1,33E-04
	Construction	A5	7,47E-02	5,56E+00	6,04E-05
Use stage	Use	B1	0,00E+00	0,00E+00	0,00E+00
	Maintenance	B2	3,54E-01	1,22E+02	9,69E-04
	Repair	B3	0,00E+00	0,00E+00	0,00E+00
	Replacement	B4	0,00E+00	0,00E+00	0,00E+00
	Refurbishment	B5	0,00E+00	0,00E+00	0,00E+00
	Operational energy use	B6	1,00E+01	5,54E+03	1,49E+00
	Operational water use	B7	0,00E+00	0,00E+00	0,00E+00
100% PCR ed4.0 Scenario					
End of life	Deconstruction, demolition	C1	0,00E+00	0,00E+00	0,00E+00
	Transport	C2	7,50E-04	1,44E+00	6,66E-06
	Waste processing	C3	6,86E-01	2,75E+02	1,79E-03
	Disposal	C4	1,66E+00	2,31E+01	1,04E-04
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	7,52E+00	-5,49E+02	-2,57E-03

HWD = Hazardous waste disposed;
NHWD = Non-hazardous waste disposed;
RWD = Radioactive waste disposed

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LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Other environmental information describing output flows – at end of life								
			CRU	MFR	MER	EE	Biogenic carbon (product)	Biogenic carbon (packaging)
			kg	kg	kg	MJ per energy carrier	kg C	kg C
Product stage	Raw material supply	A1	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,84E+00
	Transport	A2	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Manufacturing	A3	0,00E+00	2,07E+00	0,00E+00	0,00E+00	0,00E+00	6,66E+00
	Total (Consumption grid)	A1-3	0,00E+00	2,07E+00	0,00E+00	0,00E+00	0,00E+00	8,50E+00
Construction process stage	Transport	A4	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Construction	A5	0,00E+00	5,94E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Use stage	Use	B1	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Maintenance	B2	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Repair	B3	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Replacement	B4	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Refurbishment	B5	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Operational energy use	B6	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Operational water use	B7	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
100% PCR ed4.0 Scenario								
End of life	Deconstruction, demolition	C1	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Transport	C2	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Waste processing	C3	0,00E+00	5,01E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00
	Disposal	C4	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

CRU = Components for reuse;
MFR = Materials for recycling

MER = Materials for energy recovery;
EE = Exported Energy

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Scenarios and additional technical information

Scenarios and additional technical information			
Scenario	Parameter	Units	Results
A4 – Transport to the building site	The products are delivered by truck. A transport distance of 1800 km on maximum from the Vaillant slovakian plant is considered.		
	Fuel type / Vehicle type	Litre of fuel type per distance or vehicle type	16-32 metric ton, EURO6
	Distance:	km	1000
	Capacity utilisation (incl. empty returns)	%	36,2
	Average load	t	5,8
	Weight of vehicle + load	t	15,8
	Maximum payload	t	16,0
A5 – Installation in the building	The installation is wall-mounted and does not require any additional flows. Recycled processing waste should be modelled to the point of substitution, which includes all steps in recycling the material, until it is ready for use in another system. The table below shows what type of process is used depending on the nature of the material. The packaging of the units is disposed of during the installation of the combined units. Packaging includes:		
	Corrugated cardboard and paper	Recycled	86,4%
	Wood	Recycled	57,3%
	Plastic	Recycled	53,7%
	Aluminium	Recycled	68,5%
	Steel	Recycled	86,6%
B1	The total R290 refrigerant leakage over the product's reference service life is assumed to be 440 g based on PSR 0013 assumptions.		
B2 – Maintenance	An average return trip distance of 58 km covered by an operator is considered every two years for visual inspection, R290 refill. A total of 100g over 17 years study period		
B3 - B5	Modules B3 (Repair), B4 (Replacement), and B5 (Refurbishment) are not applicable and are therefore not considered in this study.		
B6 – Use of energy	Total energy consumption of the heat pump per functional unit over a 17-year study period. A location-based electricity mix has been used for the modelling of electricity consumption. The electricity mix reflects the average electricity generation mix of the relevant geographical location.		
B7 – Use of water	No water is consumed during the use of the product.		
	aroTHERM pro VWZ AI	kWh	33 029
C1 to C4 End of life,	The product is transported by truck over 100km. Conservative figures were used for the disposal of the various components		
	Recycled metal	%	60-80%

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Scenarios and additional technical information			
Scenario	Parameter	Units	Results
	Recycled plastic	%	0-20%
	Landfill of other components	%	100%
Module D	According to the PCR PN 514 Rev 3.2		

Additional packaging end-of-life information – A5

Raw materials	Total recycling (kg)	Total incineration (kg)	Total landfill (kg)
pack waste Wood	6,29E+00	2,34E+00	2,34E+00
pack waste Paper	1,02E+00	9,47E-02	9,47E-02
pack waste Galvanised steel	6,85E-05	1,58E-05	1,58E-05
pack waste PE	2,01E-01	8,66E-02	8,66E-02
pack waste PP	6,58E-03	2,84E-03	2,84E-03
pack waste Cardboard	1,24E+00	1,15E-01	1,15E-01
pack waste PET	1,31E-03	5,65E-04	5,65E-04
pack waste Steel	1,10E-02	2,52E-03	2,52E-03

Additional end-of-life information - C3-C4

Raw materials	Total recycling (kg)	Total incineration (kg)	Total landfill (kg)
Steel	36,2	0,0	9,1
Ferrous metals	0,0	0,0	0,0
Aluminium	5,8	0,0	2,5
Copper	6,0	0,0	4,0
Non-ferrous metals	0,4	0,0	0,2
PP	0,5	0,9	0,9
PS	0,0	0,0	0,0
ABS	0,4	0,7	0,7
Others plastics	0,0	3,9	3,9
Bitumen	0,0	0,0	6,3
R290 + oil	0,6	0,0	0,8
Electronics	0,0	0,0	1,7

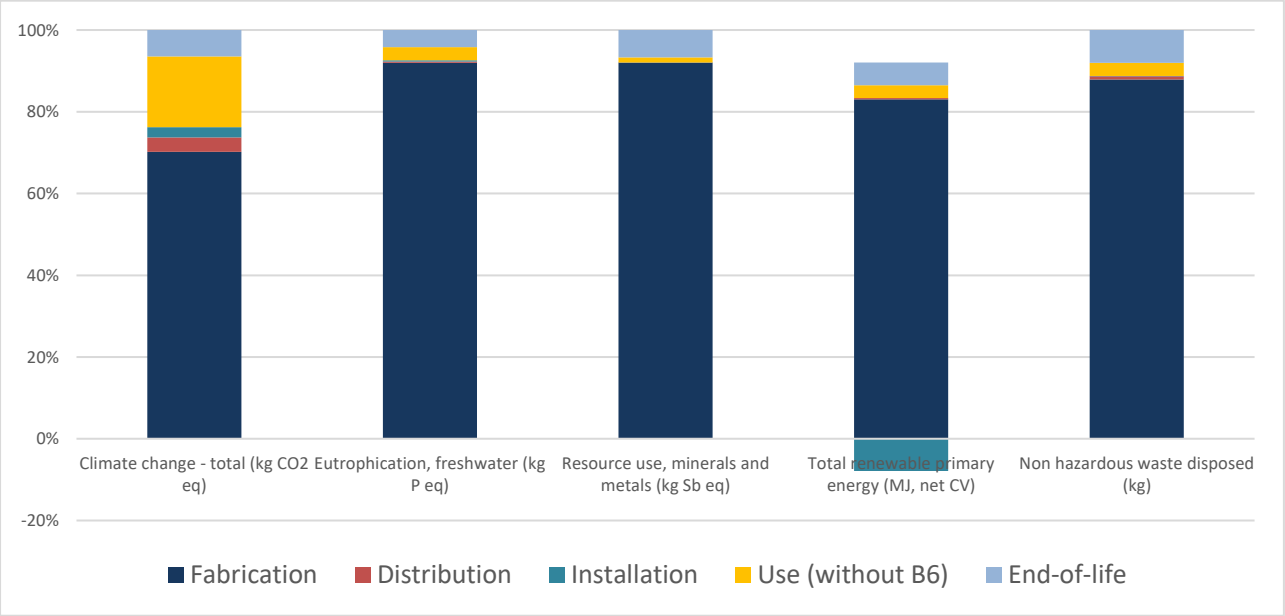
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Additional end-of-life information - modulus D

	Raw materials	Amount of recycled material (kg)
Packaging	Paper	-1,00
	Cardboard	-1,20
	LDPE	-0,15
	PP	-0,01
	Steel + Galvanised steel	-0,01
	Pallet	-3,40
Product	Galvanised steel	-5,72
	Steel	-30,21
	Copper	-5,05
	Aluminium	-5,81
	Brass	-0,20
	Cable	-1,23
	PP	-0,46

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Summary, comments and additional information



Results interpretation:

The figure shows the percentage contribution of life cycle stages to several environmental indicators, excluding module B6. Global warming potential (GWP) and non-renewable primary energy use (PENRT) are mainly driven by the fabrication stage A1-A3, with a smaller contribution from the maintenance stage B2. Freshwater eutrophication, abiotic depletion of minerals and metals, and non-hazardous waste disposal are largely dominated by the production stages A1–A3. All other stages contribute only marginally to the total impacts.

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