ENVIRONMENTAL PRODUCT DECLARATION

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

Owner of the Declaration	Wildeboer Bauteile GmbH
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-WIL-20230372-ICA1-EN
Issue date	02.01.2024
Valid to	01.01.2029

VRup/pro volume flow controller and DRpro pressure controller

Wildeboer Bauteile GmbH

Institut Bauen und Umwelt e.V.

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ECO PLATFORM EPD VERIFIED

1. General Information

Wildeboer Bauteile GmbH

Programme holder

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

Declaration number

EPD-WIL-20230372-ICA1-EN

This declaration is based on the product category rules:

Volume flow controllers and volume flow limiters for ventilation systems, 01.08.2021
(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.)

VRup/pro volume flow controller and DRpro pressure controller

Owner of the declaration

Wildeboer Bauteile GmbH
Marker Weg 11
26826 Weener
Germany

Declared product / declared unit

1 x volume flow controller with optional accessories

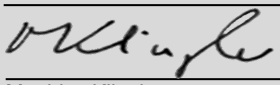
Scope:

This document refers to the manufacture, transportation, installation, operation and disposal of the declared volume flow controllers (VRpro, DN100, comprising the components casing, electrical damper blade, measuring cross, drive and control components) for ventilation and air conditioning systems.
It is also valid for the VRup volume flow controllers and the DRpro pressure controllers. The products are produced exclusively in Germany at the factory in Weener in which the production data from the year 2021/2022 was collected.
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



Matthias Klingler,
(Independent verifier)

2. Product

2.1 Product description/Product definition

VRpro volume flow controllers are maintenance-free electronic controllers for constant and variable volume flows in ventilation and air conditioning systems. They can be installed and operated in any mounting position in circular ventilation ducts for supply and exhaust air. The casing and control mechanism are made of galvanized sheet steel. The damper blade for volumetric flow control is centrally supported and equipped with a circumferential seal. The bearing axles are made of stainless steel and are guided in special bearing bushes. The measuring cross is made of aluminium. The control components comprise a controller with integrated static or dynamic sensor and an actuator with standard, quick or spring return. The controller with integrated sensor is mounted on an attachment console which can be tilted or offset manually in confined spaces. Control and electrical connection of the VRpro volume flow controller are analogue, by MP-Bus, BACnet or Modbus. All control components facilitate the operation modes 'constant' and 'variably adjustable 0 – 10 V, 2 – 10 V'.
Overrides, parallel operation and sequential circuits are possible. Factory settings can be ordered. Modifications by the user can be made using a setting device, including in conjunction with a PC or using the integrated NFC interface with a smartphone. The volume flow controllers allow for high accuracies with an approximate fluctuation of only ± 5 % to ±20 % of the actual volume flow. Accordingly, the flow rates are held constant in the overall pressure range of 5 Pa to 1000 Pa.

VRup volume flow controllers are maintenance-free electronic controllers for constant and variable volume flows in ventilation and air conditioning systems. They can be installed and operated in any mounting position in circular ventilation ducts for supply and exhaust air. The casing and control mechanism are made of galvanized sheet steel. The damper blade for volumetric flow control is centrally supported and equipped with a circumferential seal. The bearing axles are made of stainless steel and are guided in special bearing bushes. The measuring cross is made of aluminium.
Five 24 V AC/DC actuators are available.
- The AN actuator works exclusively with analogue control.
- The MP actuator is suitable for analogue control using MP-Bus, and can be set using an NFC interface.
- The KNX actuator works exclusively in KNX bus mode.
- The MOD actuator can be activated by BACnet, Modbus, MP-Bus or is suitable for analogue control.

Actuators which are suitable for analogue control can be used for the operating modes 'constant', 'variably adjustable 0–10 V, 2–10 V' and '3-level'. Overrides, parallel operation and sequential circuits are also possible. Factory settings can be ordered. Modifications by the user can be made using a setting device, including in conjunction with a PC. The volume flow controllers allow for a high accuracy with an approximate fluctuation of only ± 5 % to ±20 % of the actual volume flow. Accordingly, the flow rates are held constant in the overall pressure range of 5 Pa to 1000 Pa.

DRpro pressure controllers are maintenance-free electronic controllers for constant and variable pressures in ventilation and air conditioning systems. They can be installed and operated in any mounting position in ventilation ducts for supply and exhaust air. Casing, console and control mechanism made of galvanized sheet steel. The same applies to the centrally supported damper blade with its circumferential seal. The axles are made of stainless steel and are supported in special bushings. The control components comprise a controller with integrated static or dynamic sensor and an actuator with standard, quick or spring return. The controller with integrated sensor is mounted on an attachment console which can be tilted or offset manually in confined spaces. Control and electrical connection of the DRpro pressure controller are analogue, by MP-Bus, BACnet or Modbus. All control components facilitate the operation modes 'constant' and 'variably adjustable 0 – 10 V, 2 – 10 V'.
Overrides, parallel operation and sequential circuits are possible. Constant or variable set points which can be referenced as overpressure or negative pressure are specified. The differential pressure is measured. The positioning angle of the damper blade is then used for pressure control. Leak tightness classes 3 and 4 according to EN 1751 are achieved in the closed position. Factory settings can be ordered. Modifications by the user can be made using a setting device, including in conjunction with a PC or using the integrated NFC interface with a smartphone. DRpro pressure controllers facilitate high levels of accuracy with an approximate fluctuation of only ±5 % to ±10 % of the actual pressure. The sensor-related pressure ranges Pstart to Pnom and the pressures preset for ventilation ducts or rooms are held constant within a hysteresis. The aluminium measuring cross is only required for the optional volume flow measuring device which is available for retrofitting. Otherwise, the connections are closed.

Refer to the respective manufacturer's documents for further information, e.g. on externally certified *VDI 6022* conformity.

The respective national regulations at the location of use, in Germany, for example, the construction ordinances of the federal states and the technical rules based on these regulations, apply for use of the product.

2.2 Application

Volume flow controllers for controlling constant and variable volume flows in ventilation and air conditioning systems and for shutting off ventilation ducts.
Pressure controllers for controlling constant and variable pressures in ventilation and air conditioning systems and for shutting off ventilation ducts.
Control can be performed using room and duct pressure.

2.3 Technical Data

The requirements according to the harmonised regulations for CE marking, for electromagnetic compatibility (EMC) in accordance with EU Directive *2014/30/EU* and the requirements for performance rating according to *EN 12589:2002-01*, Ventilation for buildings - Air terminal units - Aerodynamic testing and rating of constant and variable rate terminal units and the associated requirements according to *ISO 5135, ISO 3741, ISO 5167-1* and *EN 1751* are met.

Construction data

The following data relates to the VRpro electronic volume flow controller based on assessment of a worst case. The *manufacturer's documents* include further data on the VRup electronic volume flow controller and the DPpro electronic pressure controller.

Name	Value	Unit
Supply voltage	24	V
Maximum static pressure drop	5-1000	Pa
Permissible flow velocity	12	m/s
Volume flow range	42-5430	m^3/h
Control voltage	0-10	V
Control voltage	2-10	V
Runtime for 90 ° rotation of the damper blade approx.	90	s
Connected load at rest	0.5	W
Power consumption when running	1.5	W
Leak tightness class of the casing according to EN 1751	C	-
Runtime for rotation (OPEN/CLOSED)	-	s
Leak tightness class of the damper blade according to EN 1751	3-4	-
Degree of protection IP	42	-
Casing shape (circular/rectangular)	circular	-

2.4 Delivery status

The following size variants are available: VRup/VRpro/DRpro from DN100 to DN400, length 329 to 551 mm. Depending on the product, various drives are available for delivery, lip seals and acoustic insulation shells are optional accessories. For high and continuous control accuracy, each volume flow controller and pressure controller is factory adjusted.

2.5 Base materials/Ancillary materials

Percent by weight, all specifications are approximate specifications

VRpro - casing, damper blade, measuring cross (without drive)
Steel, galvanized: 71 %
Steel, black: < 1 %
Plastic: 3 %
Stainless steel: 9 %

VRpro - drive Steel: 49 %
Plastic: 40 %
Electronic components (circuit boards etc.): 3 %
Copper: 7 %
Brass: 2 %

VRpro - controller Steel: 49 %
Plastic: 40 %
Electronic components (circuit boards etc.): 3 %
Copper: 7 %
Brass: 2 %

VRup - casing, damper blade, measuring cross (without drive)
Steel, galvanized: 62 %
Steel, black: < 1 %
Plastic: 24 %
Stainless steel: 14 %

VRup - drive Steel: 49 %
Plastic: 40 %
Electronic components (circuit boards etc.): 3 %
Copper: 7 %
Brass: 2 %

DRpro - casing, damper blade, measuring cross (without drive)
Steel, galvanized: 71 %
Steel, black: < 1 %
Plastic: 3 %
Stainless steel: 9 %

DRpro - drive Steel: 49 %
Plastic: 40 %
Electronic components (circuit boards etc.): 3 %
Copper: 7 %
Brass: 2 %

DRpro - controller Steel: 49 %
Plastic: 40 %
Electronic components (circuit boards etc.): 3 %
Copper: 7 %
Brass: 2 %

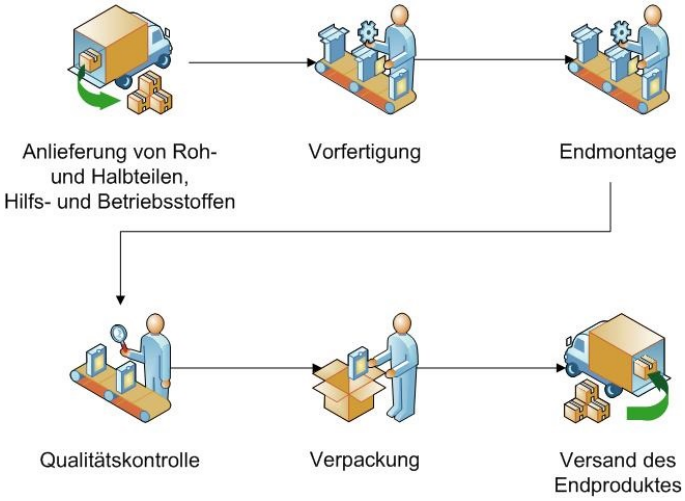
The product contains substances on the *ECHA* list of the substances of very high concern (SVHC) for approval (date 08/07/2021) above 0.1 wt. %: no.

The product contains further CMR substances of category 1A or 1B which are not on the candidate list above 0.1 wt. % in at least one subassembly: no.

Biocidal products were added to the construction product in question or it has been treated with biocidal products (it is thus classed as treated goods in accordance with the Biocidal Products Regulation (EU) no. 528/2012): no.

2.6 Manufacture

Production is performed at a single location in the factory in Weener. The necessary raw parts and semi-finished parts as well as auxiliary and operating materials are supplied by suppliers and enter into production. The production of semi-finished parts is performed in pre-fabrication with conventional production methods. Metal parts are punched and edged to shape. Cuts are optimised accordingly to prevent waste. Waste which is then still produced, is collected and, wherever possible, recycled by appropriate companies, or disposed of as domestic waste and incinerated. Lubricants are collected, treated and re-used in production as far as possible. Dusts and fumes are extracted and collected on-site. The parts from pre-fabrication are assembled in final assembly together with purchased parts to form the volume flow controllers, checked within the scope of quality assurance according to ISO 9001, packaged and dispatched. For high and continuous control accuracy, each volume flow controller is factory adjusted. Operation is subject to an energy management system.



2.7 Environment and health during manufacturing

At no time during the entire manufacturing process are occupational health and safety measures going beyond those stipulated by law required. Waste is prevented as far as possible using optimised cuts, lubricants are re-used using recycling measures.

2.8 Product processing/Installation

The *manufacturer's documents*, such as manuals, installation regulations and operating instructions provided by **Wildeboer Bauteile GmbH** must be adhered to. Moreover, the safety and processing regulations, for example for ventilation systems engineering or electrical work, and the legal occupational health and safety regulations must be observed.

2.9 Packaging

The products are transported on reusable pallets and packaged in polyethylene (PE) films. Alternatively, transportation can be performed in boxes made of recycled paper. Disposal, with the exception of the pallets, is performed by the local recycling companies. Pallets are re-used on an exchange basis. Only the genuinely necessary amount of packaging material is used, and packaging is performed in an optimised manner. A table with a list of quantities of packaging materials can be found in chapter 4.

2.10 Condition of use

The material composition does not change during use. Unusual effects, for example, air with extremely high salt levels or chemical effects, which can cause changes, are the exception.

2.11 Environment and health during use

During use, no negative effects on the environment or health are to be expected. Given that the product is maintenance-free, lubrication is not necessary during use. There are no deposits of soiling due to the design. A hygiene certificate is available (see chapter 7).

2.12 Reference service life

The duration of functionality of volume flow controllers depends on the respective design, the materials used and the ambient conditions. If used properly, the average service life is 20 years. Description of the influences on the ageing of the product when applied in accordance with the rules of technology.

2.13 Extraordinary effects

Fire
Not relevant.
Water
Not relevant.

Mechanical destruction
Not relevant.

2.14 Re-use phase

After using volume flow controllers, they can be removed and, in theory, re-used. As a result of the composition of the volume flow controllers, recycling is possible for the metal and electronic components. The other components (e.g. plastics) can be used for thermal recycling.

2.15 Disposal

Disposal can be classified in accordance with the codes of the European List of Wastes Regulation according to the Ordinance on the List of Wastes (*AVV*): Steel (17 04 05), insulation material (17 06 04), plastic (17 02 03), electrics (20 01 36).

2.16 Further information

www.wildeboer.de

3. LCA: Calculation rules

3.1 Declared Unit

The declaration refers to the manufacture of one VRpro volume flow controller DN100, including drive and electrical control unit. The declaration also applies to the DKpro pressure controller DN100.
LCA scenarios and results tables for the VRup volume flow controller are listed in the public annex of the EPD.

Declared unit VRpro

Name	Value	Unit
Declared unit	1	pce.
Mass reference	2.52	kg/pce

Other declared units are allowed if the conversion is shown transparently.

3.2 System boundary

The system boundary of the EPD of the type "from the cradle to the grave" follows the modular structure in accordance with EN 15804. The eco-balance of the assessed products takes into account modules A, B, C and D:

Product stage (A1–A3):

Provision of raw materials and transportation by truck of the raw materials to the factory. Production expenses including packaging material. Treatment of non-metallic production waste. Metallic production waste reaches the end of the waste characteristic immediately after creation, and is exported according to module D.

Construction stage (A4–A5):

Module A4: Transportation by truck to the construction site (100 km). The transportation distance can be adjusted at building level as necessary (e.g. in case of actual transportation distance of 200 km:
multiplication of the eco-balance values by a factor of 2).
Module A5: Treatment of packaging. Resultant credits in module D as necessary. Power consumption for installation (use of hand-held power tools as necessary) was not taken into account.

Use stage (B1–B5):

No emissions are released during use of the product (B1). Servicing (B2) and repair (B3) or the replacement of individual components (B4) is not relevant during the assessed life span (maintenance-free). According to manufacturer information, the product does not need to be restored during the life span (B5). Modules B1 to B5 are therefore declared with a '0'.

Use stage – operation of the building (B6–B7):

The required electrical energy for operation of the product with electric drive motor and the electrical energy for set point adjustments is declared in module B6.

Disposal stage (C1–C4):

Module C1: Manual demolition (unencumbered)
Module C2: Transportation by truck for waste treatment (50 km). The transportation distance can be adjusted at building level as necessary (e.g. in case of actual transportation distance of 100 km: multiplication of the eco-balance values by a factor of 2). The end-of-waste status of motors is achieved after processing, i.e. separation of the material fractions

contained. The expenses for processing were neglected in the product life cycle.
Module C3: Thermal treatment of raw materials with calorific value.
Module C4: Disposal of raw materials without calorific value.

Credits and debits outside the system boundaries (D):

Debits and credits from material recycling of metals (including processing) and credits for substituted thermal energy and power which have been exported from modules A1-A3, A5 and C3.

3.3 Estimates and assumptions

One supplier of an individual component declared "other plastics" in a manufacturer data sheet. These quantities were modelled as PBT.

3.4 Cut-off criteria

All the data from the capture of operating data, i.e. all raw materials used as per the recipe, and the power and water requirement were taken into account in the balance. The transportation expenses were taken into account for all assessed inputs with the exception of packaging materials. The end-of-waste status of motors is achieved after processing, i.e. separation of the material fractions contained. The expenses for processing were neglected in the product life cycle.
Therefore, in accordance with PCR part A, material and energy flows with a percentage of < 1 percent were also taken into account.

3.5 Background data

For the calculation of the eco-balance, *Sphera MLC databases* (formerly *GaBi*) of version *CUP 2022.2* were used.

3.6 Data quality

The data quality can be regarded as high. The manufacture of the products was modelled with primary data from Wildeboer Bauteile GmbH. The respective background datasets were available in the *Sphera MLC database* (*formerly GaBi*) for all relevant used primary products. The most recent version of the data used dates back a maximum of 5 years.

3.7 Period under review

The data capture for the volume and pressure flow controllers was performed at **Wildeboer Bauteile GmbH**, at the Weener (Germany) location, in the period 2021/2022.

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

No coproducts or by-products are generated during production. Therefore, no allocation was used.

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.

4. LCA: Scenarios and additional technical information

Characteristic product properties of biogenic carbon

Information on the description of the content of biogenic carbon at the factory gate

The product does not contain any bio-based raw materials, the content of biogenic carbon thus amounts to 0 kg.

Name	Value	Unit
Biogenic carbon in the product	-	kg C
Biogenic carbon in the corresponding packaging	0.22	kg C

Note: 1 kg of biogenic carbon is equivalent to 44/12 kg CO2.

The following technical information is the basis for the declared modules or can be used for the development of specific scenarios in the context of a building evaluation if modules are not declared (MND).

The eco-balance results of variants of the declared product or products with varying dimensions can be provided by **Wildeboer Bauteile GmbH** on request.

The declared products are maintenance-free. Therefore, no scenario specifications are made for modules B1–B5.

Transportation to the construction site (A4)

Name	Value	Unit
Transportation distance	100	km
Utilisation (including unladen journeys)	61	%

Installation in the building (A5)

The quantities listed in the following table represent the packaging materials used.

Name	Value	Unit
Output materials as a result of waste treatment at the construction site (sum of packaging materials)	0.55	kg
Cardboard packaging	0.03	kg
PE film	0.01	kg
Wooden pallet	0.50	kg

Reference service life

Name	Value	Unit
Service life according to manufacturer information	20	a

Operational energy (B6) VRpro

Name	Value	Unit
Power consumption, drive at rest	0.5	W
Operation time, at rest	8723.5	h/year
Power consumption of drive when running	2.0	W
Operating time, running	36.5	h/year
Power consump. of controller (continuous power 0.3 W)	2.64	kWh/year
Total power consumption	7.08	kWh/year

The environmental impacts due to use of energy during the service life (module B6) are specified in relation to a year, and, if necessary, must be multiplied by the scheduled service life (in years) at building level.

End of the life span (C1–C4) VRpro

Name	Value	Unit
Collected separately, waste type	2.52	kg
For recycling	2.1	kg
For energy reclamation	0.42	kg
For waste disposal	-	kg

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5. LCA: Results

The following shows the results of the indicators concerning the estimated impact, of the use of resources and waste and other output flows based on a single VRpro volume flow controller DN100 [2.52 kg/pc.]. The results tables also apply to the DRpro pressure controller DN100. Results tables for the VRup volume flow controller can be viewed in the public annex of the EPD.

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	X	X	X	X	X	X	X	X	X	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1 x VRpro volume flow controller DN100 with 2.52 kg/piece

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq	1.24E+01	1.52E-02	8.47E-01	0	0	0	0	0	2.92E+00	0	0	7.66E-03	8.52E-01	0	-5.11E+00
GWP-fossil	kg CO_2 eq	1.31E+01	1.5E-02	5.41E-02	0	0	0	0	0	2.92E+00	0	0	7.55E-03	8.52E-01	0	-5.11E+00
GWP-biogenic	kg CO_2 eq	-7.7E-01	1.68E-04	7.93E-01	0	0	0	0	0	1.72E-03	0	0	7.05E-05	7.28E-05	0	5.72E-03
GWP-luluc	kg CO_2 eq	5.43E-03	5.65E-05	1.56E-06	0	0	0	0	0	1.9E-04	0	0	4.24E-05	2.55E-06	0	-2.23E-03
ODP	kg CFC11 eq	2.28E-10	2.16E-15	6.19E-14	0	0	0	0	0	2.89E-11	0	0	4.55E-16	8.3E-14	0	4.99E-12
AP	mol H^+ eq	5.9E-02	1.31E-05	1.17E-04	0	0	0	0	0	4.29E-03	0	0	7.23E-06	7.35E-04	0	-1.85E-02
EP-freshwater	kg P eq	2.17E-05	3.13E-08	1.48E-08	0	0	0	0	0	1.31E-06	0	0	2.27E-08	2.58E-08	0	-2.22E-06
EP-marine	kg N eq	9.39E-03	4.15E-06	3.8E-05	0	0	0	0	0	1.17E-03	0	0	2.25E-06	3.67E-04	0	-2.91E-03
EP-terrestrial	mol N eq	9.98E-02	5.01E-05	5.59E-04	0	0	0	0	0	1.25E-02	0	0	2.71E-05	4.13E-03	0	-3.15E-02
POCP	kg NMVOC eq	2.98E-02	1.13E-05	1.03E-04	0	0	0	0	0	3.31E-03	0	0	6.3E-06	9.38E-04	0	-9.62E-03
ADPE	kg Sb eq	8.54E-04	1.56E-09	1.51E-09	0	0	0	0	0	3.48E-07	0	0	6.35E-10	2.28E-09	0	-1.94E-04
ADPF	MJ	1.71E+02	2.01E-01	1.71E-01	0	0	0	0	0	6.2E+01	0	0	1.02E-01	2.92E-01	0	-4.68E +01
WDP	m^3 world eq deprived	2.23E+00	5.97E-05	8.69E-02	0	0	0	0	0	2.18E-01	0	0	6.82E-05	9.21E-02	0	-3.14E-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 x VRpro volume flow controller DN100 with 2.52 kg/piece

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
PERE	MJ	2.65E+01	1.2E-02	8.01E+00	0	0	0	0	0	8.95E+00	0	0	5.77E-03	4.93E-02	0	-7.99E-01
PERM	MJ	7.97E+00	0	-7.97E+00	0	0	0	0	0	0	0	0	0	0	0	0
PERT	MJ	3.44E+01	1.2E-02	3.96E-02	0	0	0	0	0	8.95E+00	0	0	5.77E-03	4.93E-02	0	-7.99E-01
PENRE	MJ	1.59E+02	2.02E-01	7.97E-01	0	0	0	0	0	6.2E+01	0	0	1.02E-01	1.24E+01	0	-4.72E+01
PENRM	MJ	1.28E+01	0	-6.26E-01	0	0	0	0	0	0	0	0	0	-1.21E +01	0	0
PENRT	MJ	1.72E+02	2.02E-01	1.71E-01	0	0	0	0	0	6.2E+01	0	0	1.02E-01	2.92E-01	0	-4.72E+01
SM	kg	5.69E-01	0	0	0	0	0	0	0	0	0	0	0	0	0	2.05E+00
RSF	MJ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NRSF	MJ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FW	m^3	6.46E-02	1.04E-05	2.04E-03	0	0	0	0	0	1.36E-02	0	0	6.53E-06	2.17E-03	0	-1.44E-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 x VRpro volume flow controller DN100 with 2.52 kg/piece

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
HWD	kg	1.54E-06	9.31E-13	1.65E-11	0	0	0	0	0	4.43E-09	0	0	4.87E-13	4.21E-11	0	-2.23E-10
NHWD	kg	4.54E-01	3.19E-05	5.92E-03	0	0	0	0	0	1.32E-02	0	0	1.46E-05	1.76E-02	0	-2.09E-01
RWD	kg	3.78E-03	2.03E-07	1.01E-05	0	0	0	0	0	1.03E-02	0	0	1.25E-07	1.1E-05	0	-4.36E-04
CRU	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MFR	kg	5.19E-01	0	0	0	0	0	0	0	0	0	0	0	2.1E+00	0	0
MER	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EEE	MJ	0	0	1.25E+00	0	0	0	0	0	0	0	0	0	1.54E+00	0	0
EET	MJ	0	0	2.24E+00	0	0	0	0	0	0	0	0	0	2.77E+00	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 x VRpro volume flow controller DN100 with 2.52 kg/piece

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
PM	Disease incidence	7.29E-07	8.13E-11	5.82E-10	0	0	0	0	0	3.83E-08	0	0	4.38E-11	2.23E-09	0	-2.25E-07
IR	kBq U235 eq	4.29E-01	1.97E-05	1.66E-03	0	0	0	0	0	1.51E+00	0	0	1.84E-05	1.72E-03	0	-1.08E-01
ETP-fw	CTUe	6.73E+01	1.6E-01	7.55E-02	0	0	0	0	0	1.9E+01	0	0	7.05E-02	1.08E-01	0	-1.31E +01
HTP-c	CTUh	2.94E-07	3.17E-12	5.26E-12	0	0	0	0	0	3.49E-10	0	0	1.42E-12	7.13E-12	0	-7.08E-09
HTP-nc	CTUh	2.36E-07	1.57E-10	1.83E-10	0	0	0	0	0	1.78E-08	0	0	7.35E-11	3.72E-10	0	-4.39E-08
SQP	SQP	1.35E+02	6.32E-02	5.06E-02	0	0	0	0	0	5.69E+00	0	0	3.49E-02	5.7E-02	0	-3.05E +00

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 most important stages of the life cycle from an environmental point of view are the stages of manufacture and use.

In relation to the manufacturing stage, the upstream chain processes of control electronics (circuit board) and the galvanized sheet steel dominate above all environmental indicators. These two materials together have an influence of at least 50 % on the individual indicator results. The influence of these two materials is to be classified as relevant to significant in most indicators.

The stainless steel and the plastics PA6 and PBT used have a low to certain influence for most indicators. All other processes and materials show a low to negligible relevance for the product system.
When assessing a typical service life of 20 years, the environmental impacts identified in relation to one piece and year for operation (energy consumption) of the products add up accordingly. The associated environmental impacts as a result of this energy consumption are accordingly significant for a series of indicators, for example the global warming potential (GWP total).

7. Requisite evidence

7.1 Hygiene
In accordance with assessment no. W-329807k-20-AB, assessment no. W-329806k-20-AB and assessment no. W-329808k-20-AB, a *certificate of hygiene conformity inspection for the VRup/pro volume flow controllers* and a *certificate of hygiene conformity inspection for the DRpro pressure controller* are available. The hygienic requirements according to *VDI 6022-1, VDI 3803-1, DIN 1946-4, EN 16798-3, SWKI VA105-01, SWKI VA104-01 ÖNORM H 6020* and *ÖNORM H 6021* are met.

This includes certification of metabolic potential, i.e. of damage to materials as a result of microorganisms, and of resistance to cleaning agents and disinfectant during typical use.

8. References

Standards

EN 15804

EN 15804:2012+A2:2019+AC:2021, Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products.

ISO 14025
EN ISO 14025:2011, Environmental labels and declarations - Type III environmental declarations - Principles and procedures

Further literature

IBU 2021
Institut Bauen und Umwelt e.V.: General instructions for the EPD programme of Institut Bauen und Umwelt e.V., version 2.0, Berlin: Institut Bauen und Umwelt e.V., 2021 http://www.ibu-epd.com

Further standards

EN 1751
DIN EN 1751:2014-06, Ventilation for buildings - Air terminal devices - Aerodynamic testing of dampers and valves.

DIN 1946-4
DIN 1946-4: 2018-09, Ventilation and air conditioning, Ventilation in hospitals.

ISO 3741
DIN EN ISO 3741: 2011-01, Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Precision methods for reverberation test rooms.

ISO 5135
DIN EN ISO 5135: 2020-12, Acoustics - Determination of sound power levels of noise from air-terminal devices, air-terminal units, dampers and valves by measurement in a reverberation test room.

ISO 5167-1
DIN EN ISO 5167-1: 2022-06, Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full - Part 1: General principles and requirements.

ÖNORM H 6020
ÖNORM H 6020: 2019-06-01, Ventilation and air conditioning plants for locations for medical use - Design, construction, operation, maintenance, technical and hygiene inspections.

ÖNORM H 6021
ÖNORM H 6021: 2016-08-15, Ventilation and air conditioning plants - Specifications keeping them clean and cleaning.

ISO 9001
DIN EN ISO 9001: 2015-11, Quality management systems.

EN 12589
DIN EN 12589: 2002-01, Ventilation for buildings - Air terminal units - Aerodynamic testing and rating of constant and variable rate terminal units.

EN 16798-3
DIN EN 16798-3: 2017-11, Ventilation of non-residential buildings – Performance requirements for ventilation, air conditioning systems and room-cooling systems.

Further sources

AVV
Ordinance on the List of Wastes (AVV) of 10 December 2001 (Federal Law Gazette I page 3379) which was last amended by article 1 of the regulation of 30 June 2020 (Federal Law Gazette I page 1533).

SWKI VA104-01
SWKI VA104-01: 2019-01, Hygiene requirements for air conditioning systems and devices.

SWKI VA105-01
SWKI VA105-01: 2015-08, Air-conditioning systems in rooms used for medical purposes (planning, implementation, qualification, operation).

VDI 3803-1
VDI 3803-1: 2020-05, Air-conditioning - Structural and technical principles - Central air conditioning systems (VDI Ventilation Code of Practice).

VDI 6022-1
VDI 6022-1: 2018-01, Hygiene requirements for ventilation and air-conditioning systems and units.

Sphera
LCA software (LCA FE) and LCA database (MLC) (formerly GaBi)
MLC database version CUP 2022.2; Sphera Solutions GmbH software system and database for integrated balancing. Copyright, TM, Stuttgart, Leinfelden-Echterdingen, 1992-2022.

Manufacturer's documents
Current versions of the manufacturer's documents on the VRE and VR volume flow controllers, here:
VRup/VRpro user manual 3.6 (2021-08) Operating instructions - VRup volume controller (2021-05) Operating instructions - VRpro volume controller (2021-08) DRpro user manual 3.7 (2021-08) Operating instructions - DRpro pressure controller (2021-04)

Hygiene conformity inspection
Certificate of hygiene conformity inspection for VRup, assessment no. W-329807k-20-AB, Hygieneinstitut des Ruhrgebietes (Ruhr District Institute of Hygiene), Gelsenkirchen
Certificate of hygiene conformity inspection for VRpro, assessment no. W-329806k-20-AB, Hygieneinstitut des Ruhrgebietes (Ruhr District Institute of Hygiene), Gelsenkirchen
Certificate of hygiene conformity inspection for DRpro, assessment no. W-329808k-20-AB, Hygieneinstitut des Ruhrgebietes Gelsenkirchen

ECHA
ECHA list: 2021-07 (expanded 2022-06)

2014/30/EU
DIRECTIVE 2014/30/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL, of 26 February 2014, on the harmonisation of the laws of the Member States relating to electromagnetic compatibility (recast).

PCR Part A
Product category rules for building-related products and services, Part A: Calculation rules for the eco-balance and requirements for the background report, version 1.3, Institut Bauen und Umwelt e.V., www.ibu-epd.com, 2022.

PCR B: volume flow controllers, volume flow limiters and pressure controllers for ventilation systems
Product category rules for building-related products and services Part B:Requirements for the EPD for volume flow controllers and volume flow limiters for ventilation systems, version 1.0, Institut Bauen und Umwelt e.V., www.ibu-epd.com, 2023.

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