ENVIRONMENTAL PRODUCT DECLARATION

as per ISO 14025 and EN 15804

Owner of the Declaration	Wildeboer Bauteile GmbH
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-WIL-20150037-ICA1-EN
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Valid to	15.09.2020

Rectangular volume flow controller VKE und VK

Wildeboer Bauteile GmbH

Institut Bauen und Umwelt e.V.

www.bau-umwelt.com / https://epd-online.com

ECO PLATFORM EPD EN 15804 VERIFIED

1. General Information

Wildeboer Bauteile GmbH	Volume flow controller VKE, VK
Programme holder IBU - Institut Bauen und Umwelt e.V. Panoramastr. 1 10178 Berlin Germany	**Owner of the Declaration** Wildeboer Bauteile GmbH Marker Weg 11 DE-26826 Weener
Declaration number EPD-WIL-20150037-ICA1-EN	**Declared product / Declared unit** 1 volume flow controller with optional accessories
This Declaration is based on the Product Category Rules: Volume flow controllers and volume flow limiters for ventilation systems, 07.2014 (PCR tested and approved by the SVR) **Issue date** 16.09.2015 **Valid to** 15.09.2020	**Scope:** This document refers to the manufacture, transport, installation, operation and disposal of volume flow controllers with optional accessories for ventilation and air-conditioning systems. The products are produced exclusively at the Weener plant in Germany where production data for 2012 was recorded. 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.
Prof. Dr.-Ing. Horst J. Bossenmayer (President of Institut Bauen und Umwelt e.V.)	**Verification** The CEN Norm /EN 15804/ serves as the core PCR Independent verification of the declaration according to /ISO 14025/ ☐ internally ☒ externally
Dr. Burkhart Lehmann (Managing Director IBU)	Patricia Wolf (Independent verifier appointed by SVR)

2. Product

2.1 Product description

Electronic volume flow controllers VKE for constant and variable volume flows are maintenance-free, they can be installed independent of position in ventilation ducts for supply air as well as exhaust air in ventilation and air-conditioning systems. They are factory-adjusted for the entire volume flow range. An innovative measurement procedure uses the differential pressure and damper blade position for measuring and controlling the volume flow rate. At the same time, an efficiency signal is provided for energy-saving optimisation of the operating pressure in the ventilation system. At all pressures, the innovative measurement principle enables high control precision of ±5% to ±15% from the set point volume flow in the volume flow ranges of approx. 1:6. The casing and the centrically-mounted damper blade are made of galvanised sheet steel with a stainless steel bearing axis in special bearing bushings while the drive casing is made of plastic. The operating modes "constant", "variable" and "4-point" are possible in addition to the overriding controls "open" and "closed". The "variable" operating mode is possible in operation modes 0-10V, 2-10V and 2-8V. Parallel operation and sequential circuit are possible.

Constant mechanical VK volume flow controllers are maintenance-free mechanical controllers without auxiliary power supply for constant volume flows in ventilation and air-conditioning systems. They can be installed independent of position in ventilation ducts for supply air and exhaust air. The casing and control mechanism are made of galvanised sheet steel. The damper blade for volume flow regulation is centrically-mounted and guided into special bearing bushings via stainless steel bearing axes. The setting device features a rotary pointer, scale and locking mechanism. The volume flow set points can be actuator-driven adjusted or set manually within the volume flow ranges of Vmin to Vmax. The special control mechanism guarantees a high degree of control accuracy with deviations of only approx. ±5% to ±10%. Accordingly, in the case of variable pressures, the volume flow is kept constant throughout the entire pressure range. As an option, the VK is available with actuator-driven adjustment for two volume flow set points or with continuous actuator-driven adjustment for any volume flow set points.

More information is available in the /manufacturer's documents/ and section 7 provides information on hygiene.

2.2 Application

Volume flow controller for controlling constant and variable volume flows in ventilation and air-conditioning systems and for shutting off the ventilation ducts.

2.3 Technical Data

The requirements in accordance with the harmonised regulations governing CE marking relating to electromagnetic compatibility (EMC) in line with EU Guideline /2004/108/EC/, the performance rating according to /DIN EN 12589/ and the associated requirements according to /DIN EN ISO 5135/, /DIN EN ISO 3741/, /DIN EN ISO 5167-1/ and /DIN EN 1751/ are fulfilled.

Technical construction data

The following data refers to a “worst-case” analysis of the electronic volume flow controller VKE. Further data – including concerning the constant mechanical volume flow controller VK – is available in the /manufacturer's documents/.

Name	Value	Unit
Supply voltage	24	V
Static pressure control range	20 - 1000	Pa
Permissible flow velocity	12	m/s
Volume flow range	34 - 5430	m3/h
Control voltage	0 - 10	V
Control voltage	2 - 8	V
Control voltage	2 - 10	V
Run time for 90° rotation of the damper blade approx.	90	s
Connected load (stationary)	0.5	W
Power consumption (in case of controlling)	1.5	W
Casing tightness class according to /DIN EN 1751/	C	-
Damper blade tightness class according to /DIN EN 1751/	3 - 4	-
Protection class IP	50 - 54	-
Casing design (circular/square)	rectangular	

2.4 Placing on the market / Application rules

The requirements according to the harmonised regulations governing CE marking relating to electromagnetic compatibility (EMC) in line with /2004/108/EU/ “Guideline 2004/108/EC of the European Parliament and Council of 15 December 2004 for approximating the legal guidelines of the member states for electromagnetic compatibility” and the statutory guidelines are fulfilled. Use is governed by the respective national regulations. The /manufacturer's documents/ must be observed.

2.5 Delivery status

The following sizes are available: VKE from W x H 200 x 100 mm to 800 x 400 mm, length 275 to 525 mm. VK from W x H 200 x 100 mm to 600 x 300 mm, length 300 to 500 mm. Optional accessories include an electric set point adjustment, lip seals and acoustic insulation. Each volume flow controller is factory-adjusted to ensure a high and consistent degree of control accuracy.

2.6 Base materials / Ancillary materials

Per cent by weight; all details are approximate.

VKE - casing, damper blade, measuring cell (excl. drive)
Steel, galvanised: 94% to 99%
Plastic: < 1% to 2%
Electronic components: < 1%
Stainless steel: < 1% to 2%

VKE - drive
Steel, galvanised: 30%
Plastic: 26%
Electronic components (circuit boards etc.): 17%
Steel, manganese phosphated: 16%
Stainless steel: 8%
Brass: 2%
Machining steel (lathe tool): 1%

VKE - acoustic insulation
Steel, galvanised: 84% to 85%
Insulation: 15% to 17%

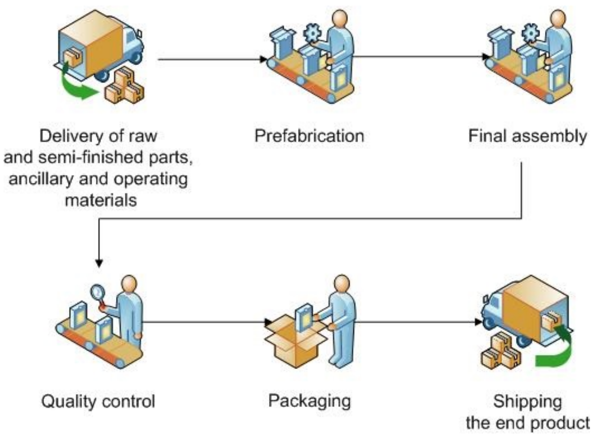
VK - casing, damper blade, set point adjustment
Steel, galvanised: 93% to 95%
Plastic: 1% to 2%
Stainless steel: 4%
Machining steel (lathe tool): ≤ 1%

VK - electric set point adjustment
Steel, galvanised: 37%
Plastic: 36%
Electric cable: 18%
Electronic components (circuit boards etc.): 8%
Brass: 1%

VK - acoustic insulation
Steel, galvanised: 83% to 85%
Insulation: 15% to 17%

2.7 Manufacture

Production is at one location in the Weener plant. The necessary raw and semi-finished parts, ancillary materials and operating materials are delivered by suppliers and are integrated in production. Semi-finished parts are manufactured in a prefabrication using standard manufacturing methods. Metal parts are punched and edged to shape. Blanks are optimised accordingly in order to avoid waste. Any waste incurred is collected and where possible recycled by the corresponding companies, or disposed of and incinerated as domestic waste. Lubricants are largely collected, treated and re-used in production. Dust and fumes are extracted and collected on site. Prefabricated parts are assembled along with bought-in parts to volume flow controllers, inspected within the framework of quality assurance to /DIN EN ISO 9001/, packed and shipped. Each volume flow controller is factory-adjusted to ensure a high and consistent degree of control accuracy. The plant is subject to an energy management system.



2.8 Environment and health during manufacturing
During the entire manufacturing process, no measures extending over statutory industrial safety are required. Waste is largely avoided by means of optimised blanks and lubricants are re-used in the form of recycling measures.

2.9 Product processing/Installation
The /manufacturer's documents/ such as manuals, installation guidelines and operating instructions issued by *Wildeboer Bauteile GmbH* must be observed. Furthermore, the safety and processing guidelines for ventilation system construction or electrical work, for example, must be followed as well as the statutory guidelines for industrial occupational health and safety.

2.10 Packaging
The products are transported on re-usable pallets and packed in PE foil. Alternatively, transport is in boxes made of recycled paper. With the exception of pallets, disposal is handled by local recycling companies. Pallets are re-used on an exchange basis. Only as much packaging material is used as required and packaging is optimised accordingly.

2.11 Condition of use
Material composition does not alter during use. Exceptions are represented by unusual impacts suchas extreme salty air or chemical effects which can cause changes.

2.12 Environment and health during use
No negative impacts on the environment and health are to be anticipated during use. Lubrication is not necessary during use as the products are maintenance-free. Because of the design, no deposits of soiling are incurred. A hygiene certificate is available (see section 7).

2.13 Reference service life
The operating life duration of volume flow controllers depends on the respective design, the materials used and the ambient conditions. When used as designated, the reference service life is 20 years on average.

2.14 Extraordinary effects

Fire
Not of relevance.

Water
Not of relevance.

Mechanical destruction
Not of relevance.

2.15 Re-use phase
After use, volume flow controllers can be removed and theoretically re-used. In line with the composition of volume flow controllers, the metal and electronic components can be recycled. The remaining components (e.g. plastics) can be directed to thermal utilisation.

2.16 Disposal
Disposal can be classified in accordance with the KPIs of the Ordinance on the European list of wastes /AVV/: steel (17 04 05), insulation material (17 06 04), plastic (17 02 03), electrical components (20 01 36).

2.17 Further information
www.wildeboer.de

3. LCA: Calculation rules

3.1 Declared Unit
This declaration refers to the manufacture of one volume flow controller VKE including drive, electric control unit and the optional acoustic insulation according to /IBU PCR, Part B/. Other volume flow controllers, type VKE and VK, whose variants and varying dimensions deviate from the reference products analysed here can be calculated using a weight chart provided by *Wildeboer Bauteile GmbH* and scaling the results.

Declared unit: VKE

Name	Value	Unit
Declared unit	1	pce.
Ground reference	4.91	kg/pce.
Conversion factor to 1 kg	0.203665	-

3.2 System boundary
The “cradle to grave” EPD system boundary has a modular design according to /EN 15804/. The LCA for the products under review considers Modules A, B, C and D:

A1-A3 (Product stage): Raw material supply, transport to the manufacturer, production (incl. provision of energy and water, provision of ancillary materials, disposal of waste)

A4-A5 (Construction process): Transport to construction site, installation in the building, recycling packaging waste

B1-B5 (Use stage): Use of the installed product

B6-B7 (Use stage – building operation): Use of electrical energy for the product

C1-C4 (End-of-life stage): De-constructing the product, transport to waste processing, waste treatment, disposal

D (Credits): Recycling potential

3.3 Estimates and assumptions
During the incineration of packaging waste (A5), thermal and electrical energy is generated and a credit is allocated accordingly.

During the RSL of 20 years, maintenance (B2), repair (B3) of the volume flow controllers and/or replacement of individual components (B4) or refurbishment of the entire volume flow controllers (B5) is not necessary.

The electrical energy required for operation is allocated to Module B6.

No environmental impact is to be anticipated for installation (A5) or de-construction of the product (C1) as these processes do not involve any additional ancillary materials or resources.

Steel scrap incurred in production is directed to recycling in Modules (A1-A3) *("loop")*. After collection, the volume of steel scrap required for steel production is saturated by the scrap at the End-of-Life phase ("closed loop"). The production scrap and EoL scrap incurred in the system give rise to the so-called net scrap volume. A credit to the value of the scrap is allocated in Module D for the remaining net scrap volume.

3.4 Cut-off criteria

All data from the operating data survey was taken into consideration in the analysis, i.e. all starting materials used according to the recipe, the thermal energy used as well as electricity and diesel. No emission measurements were made on site. The specific emissions associated with the provision of thermal and electric energy are taken into consideration in the upstream chains of energy provision. It can be assumed that additional emissions arising during manufacture are very low and therefore irrelevant, nor do they have any harmful impact on the environment. Assumptions were made as regards the transport expenses associated with all input and output data taken into consideration or the actual transport distances were applied.

The cut-off criteria for inputs and outputs outlined in /IBU PCR, Part A/ are therefore fulfilled.

The manufacture of machinery, plants and other infrastructure required for production of the items under review was not considered in the LCAs.

3.5 Background data

GaBi 6 – the software system for comprehensive analysis developed by PE INTERNATIONAL AG – was used for modelling the life cycle for the manufacture and disposal of declared products manufactured by *Wildeboer Bauteile GmbH* /GaBi 6 2013/. The consistent data sets contained in the GaBi data base are documented and can be viewed in the online GaBi documentation /GaBi 6 2013 D/. In order to guarantee comparability of the results, exclusively the consistent background data from the GaBi data base was used in the LCA (e.g. data sets on energy, transport, auxiliaries and consumables).

As the declared volume flow controller models VK and VKE are manufactured in Germany, background data for Germany as a reference area was used for the LCA (e.g. provision of electrical energy). If no Germany-specific data sets were available, European data sets were used, whereby specific production data on the plant in Weener, input and output flows as well as energy and water consumption levels were made available as annual averages by *Wildeboer Bauteile GmbH* (reference year 2012). Products are manufactured in independent production lines with the result that the production data is specifically allocated to each product. Transport modes and distances for raw materials and auxiliaries were also available as primary data for modelling.

3.6 Data quality

All of the background data sets of relevance for the LCA were taken from the GaBi 6 software, primary data was made available by *Wildeboer Bauteile GmbH*. The background data used was last revised less than 10 years ago while manufacturer data is less than 5 years old.

The data quality can be regarded as good for modelling. The corresponding data sets were available in the GaBI data base for all of the relevant preliminary products and auxiliaries used.

All data in the GaBi data base is reproducible and comprehensible. The data sets used are representative in terms of geographic, time-based and technological coverage.

3.7 Period under review

Data on the volume flow controllers was recorded at the *Wildeboer Bauteile GmbH* location in Weener (Germany) for 2012.

3.8 Allocation

No co-product allocation rules are applied as no by-products are incurred during the manufacture of volume flow controllers.

Waste in A5 and at the EoL, e.g. plastic residue, electronic components, packaging residue, is incinerated in a waste incineration plant or landfilled. It is modelled in an input-specific manner in the model, whereby this results in thermal and/or electric energy in line with its composition and the ensuing calorific value and for which a credit is generated in Module D.

3.9 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

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

Other sizes and variants offered by *Wildeboer Bauteile GmbH* can be calculated using additional weight and aggregate charts.

Transport to construction site (A4)

Name	Value	Unit
Transport distance	500	km
Capacity utilisation (including empty runs)	85	%

Reference Service Life

Name	Value	Unit

Reference service life	20	a

Operational energy (B6) VKE

Name	Value	Unit
Power consumption, running	0.42	W
Operating time, running	24	h / day

End of Life (C1-C4) VKE

Name	Value	Unit
Collected separately (90% collection rate)	90	%
Collected as mixed construction waste	0	%
For re-use	0	%
For recycling (metal (steel scrap & brass) and electronics)	88	%
For energy recovery	0	%
For disposal (other)	12	%
Transport distance	300	km
Capacity utilisation (including empty runs)	85	%

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5. LCA: Results

The following tables depict the results of the indicators concerning the estimated impact, use of resources as well as waste and other output flows in relation to 1 VKE volume flow controller [4.91 kg/pce.]. Data can be requested from the manufacturer or a calculation tool supplied by the manufacturer can be used for calculating (scaling) to other sizes, accessories used and the VK controller (www.wildeboer.de/epd). The calculation method is explained in the conversion tool.

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

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	MND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 VKE volume flow controller with a unit weight of 4.91 kg/pce.

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	C1	C2	C3	C4	D
GWP	[kg CO_2-Eq.]	2.40E+1	1.10E-1	2.70E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	4.40E+1	0.00E+0	6.20E-2	1.20E-1	7.70E-1	-7.90E+0
ODP	[kg CFC11-Eq.]	8.30E-9	2.70E-13	2.90E-14	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	3.50E-9	0.00E+0	1.50E-13	3.20E-13	2.10E-12	2.80E-11
AP	[kg SO_2-Eq.]	1.20E-1	5.20E-4	1.10E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	8.10E-2	0.00E+0	2.80E-4	5.60E-5	2.40E-4	-2.90E-2
EP	[kg $(PO_4)^{3-}$-Eq.]	9.30E-3	1.30E-4	2.00E-6	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	9.90E-3	0.00E+0	6.80E-5	1.40E-5	2.20E-5	-2.40E-3
POCP	[kg ethene-Eq.]	1.10E-2	-1.80E-4	6.60E-7	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	5.70E-3	0.00E+0	-9.50E-5	4.30E-6	1.40E-5	-4.30E-3
ADPE	[kg Sb-Eq.]	1.80E-3	5.40E-9	1.60E-9	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	8.30E-6	0.00E+0	2.90E-9	3.70E-8	-5.80E-6	-1.30E-5
ADPF	[MJ]	3.00E+2	1.60E+0	1.10E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	4.40E+2	0.00E+0	8.40E-1	9.40E-2	4.10E-1	-7.60E+1

Caption	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

RESULTS OF THE LCA - RESOURCE USE: 1 VKE volume flow controller with a unit weight of 4.91 kg/pce.

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	C1	C2	C3	C4	D
PERE	[MJ]	1.90E+1	9.30E-2	1.10E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.30E+2	0.00E+0	5.00E-2	1.30E-2	2.90E-2	4.70E-1
PERM	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
PERT	[MJ]	1.90E+1	9.30E-2	1.10E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.30E+2	0.00E+0	5.00E-2	1.30E-2	2.90E-2	4.70E-1
PENRE	[MJ]	3.20E+2	1.60E+0	1.30E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	6.30E+2	0.00E+0	8.50E-1	1.10E-1	4.50E-1	-7.30E+1
PENRM	[MJ]	1.30E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
PENRT	[MJ]	3.30E+2	1.60E+0	1.30E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	6.30E+2	0.00E+0	8.50E-1	1.10E-1	4.50E-1	-7.30E+1
SM	[kg]	7.01E-1	-	-	-	-	-	-	-	-	-	-	-	-	-
RSF	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
NRSF	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
FW	[m^3]	1.20E-1	6.00E-5	8.00E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.80E-1	0.00E+0	3.20E-5	6.10E-4	1.40E-3	-5.10E-3

Caption	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 – OUTPUT FLOWS AND WASTE CATEGORIES:
1 VKE volume flow controller with a unit weight of 4.91 kg/pce.

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	C1	C2	C3	C4	D
HWD	[kg]	3.00E-2	7.00E-6	1.60E-6	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.90E-1	0.00E+0	3.80E-6	2.00E-5	2.80E-5	3.80E-3
NHWD	[kg]	6.00E-1	3.00E-4	9.30E-4	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.40E-1	0.00E+0	1.60E-4	2.50E-2	8.10E-1	-1.20E-1
RWD	[kg]	1.10E-2	2.20E-6	6.20E-7	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	7.50E-2	0.00E+0	1.20E-6	7.40E-6	1.50E-5	1.20E-3
CRU	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
MFR	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	4.30E+0
MER	[kg]	0.00E+0	0.00E+0	2.20E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.60E-1	3.00E-1	-
EEE	[MJ]	0.00E+0	0.00E+0	2.60E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.00E-1	1.40E+0	-
EET	[MJ]	0.00E+0	0.00E+0	6.40E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	5.20E-1	4.00E+0	-

Caption	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; EEE = Exported thermal energy

6. LCA: Interpretation

Approx. 60% of the **Global Warming Potential (GWP, 100 years)** is attributable to energy consumption during the use phase. A further 35% is attributable to the provision of preliminary products, whereby 18% of greenhouse emissions are caused by the electric drive and 7% by the optional acoustic insulation. 96% of the entire CO_2 equiv. is attributable to fossil CO_2 emissions and 4% to biotic CO_2.

70% of the **Ozone Depletion Potential (ODP)** comes from the upstream chains (Modules A1 – A3) while 30% is incurred during the use phase. The credits for this impact category are very low due to use of the “DE scrap value” data set. The "value of scrap" data set represents a theoretical environmental profile for steel scrap. It represents the difference between manufacturing primary steel (theoretical value based on the blast furnace route, no scrap input) and manufacturing secondary steel (100% scrap input in the EAF route). Both routes represent global production mixes. The ODP value is primarily dependent on electricity consumption, whereby it is significantly based on the nuclear proportion of the electricity mix. In the EAF (electric arc furnace) route, primarily electrical energy is used as an energy carrier while the blast furnace route is based on fossil energy carriers (e.g. coal). Furthermore, the EAF power mix includes higher percentages of nuclear electricity than the blast furnace power mix (depending on the production country mix). This results in a negative ODP value for the "value of scrap" data set which leads to an additional environmental burden in terms of scrap credits.

Approx. 50% of the **Acidification Potential (AP)** is dominated by the upstream chains associated with raw material supply. The greatest effects result from manufacture of the electric drive (41%) and the acoustic insulation (9%). 41% is attributable to the use phase. The AP is primarily dominated by sulphur dioxide (65%) and nitrogen oxides (27%).

The greatest contribution to the **Eutrification Potential (EP)** is made by the use phase (45%). 42% is caused by production (A1-A3), primarily attributable to the electronics installed in the drive (25%), as well as the galvanised sheet steel used in the acoustic insulation (7%). The EP is dominated by nitrogen oxide emissions caused during electronics manufacturing.

The **Photochemical Ozone Creation Potential (POCP)** is largely influenced by the provision of preliminary products (52%). Another key aspect is represented by the use phase accounting for 36%. Sulphur dioxide, carbon monoxide and the group of NMVOC in particular contribute to the POCP. Transport leads to a credit in terms of POCP. Due to the fact that nitrogen monoxide emissions incurred during transport have a negative characterisation factor in the impact estimate as per CML 2001 – valid as at 2010. With the result that not only the credits are negative for the creation of photo oxidants but also the loads. Despite the apparently paradox results that more transports would lead to an increased number of credits, the model does not contain any errors here. Methods other than the one selected (CML 2010) for estimating the impact of POCP (e.g. ReCiPe) have avoided negative characterisation factors in order to facilitate interpretation of the results and set the nitrogen monoxide characterisation factor at zero.

The **Abiotic Depletion Potential non-fossil resources (ADP elementary)** is exclusively caused by raw material supply; transport and energy consumption during use (B6) have hardly any influence. The manufacture of electronics (71%) makes the greatest contribution to ADP elementary in the upstream stages.

54% of the **Abiotic Depletion Potential fossil fuels (ADP fossil)** is attributable to the use phase. Another 36% is attributable to the raw material supply. The greatest contribution to Module A1 is made by the provision of steel components (33%) and electronics (15%). The greatest contribution to overall ADP fossil is made by pit coal (34%), brown coal (29%) and natural gas (26%).

Total use of primary energy resources during manufacture (A1-A3) is broken down between non-renewable (PERNT: 86%) and renewable (PERT: 14%) energy resources.

Electric energy used during the use phase accounts for 87% of the **total use of primary energy resources (PERT)**. The remaining 13% is attributable to the provision of preliminary products (A1-A3), whereby the influence of the electric drive (6%) and the acoustic insulation (2%) are apparent.

Consideration of the **total use of non-renewable energy resources (PENRT)** reveals use as a significant driver accounting for 6%. Production causes 34% of the PENRT. A total of 7% of PENRT is recorded as having recycling potential.

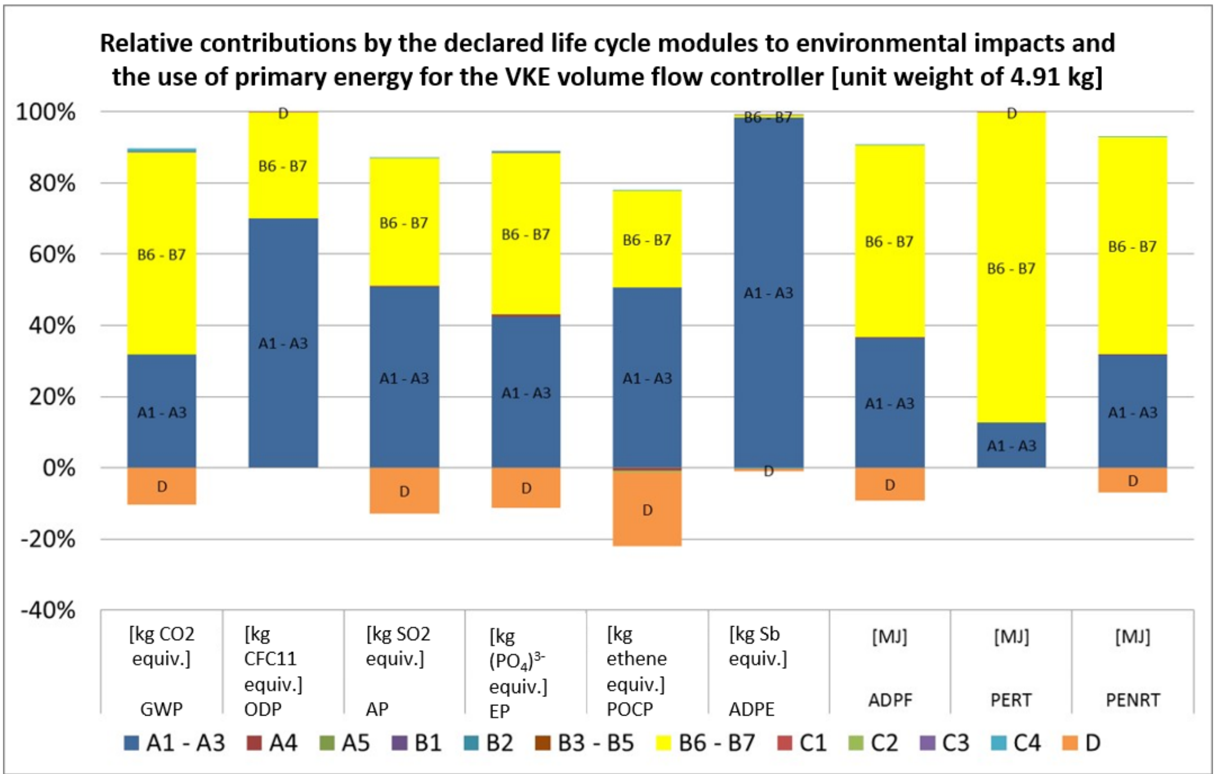

Fig. 1: Interpretation of results

7. Requisite evidence

7.1 Hygiene

According to survey nos. W-251267-14-Ho and W-251279-14-Ho, both the /hygiene conformity test certificate for VR/ and the /hygiene conformity test certificate for VRE/ are available. The hygiene requirements according to /VDI 6022-1/, /VDI 3803-1/, /DIN 1946-4/, /DIN EN 13779/, /SWKI 99-3/, /SWKI VA104-01/, /ÖNORM H 6020/ and /ÖNORM H 6021/ are fulfilled.

This includes evidence concerning metabolic potential, i.e. damage to construction materials by micro-organisms, and resistance to standard applications of cleaning agents and disinfectants.

8. References

AVV, Ordinance on the List of Wastes dated 10 December 2001 (BGBl. I, p. 3379), last amended by Article 5, section 22 of the law dated 24 February 2012 (BGBl. I, p. 212)

DIN 1946-4: 2008-12, Ventilation and air conditioning - Ventilation in rooms and buildings of health care

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

DIN EN 12589: 2002-01, Ventilation of buildings – Air terminal units – Aerodynamic testing and rating of constant and variable rate terminal units; German version EN 12589:2002-01

DIN EN 13779: 2007-09, Ventilation for non-residential buildings – Performance requirements for ventilation and room-conditioning systems

DIN EN ISO 5135: 1999-02, Acoustics – Determination of sound power levels of noise from air-terminal devices, air-terminal units, dampers and valves by measurement in a reverberation room

DIN EN ISO 3741: 2011-01, Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure – Precision methods 1 for reverberation test rooms

DIN EN ISO 5167-1: 2004-01, Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full – Part 1: General principles and requirements

DIN EN ISO 9001*:* 2008-12, Quality management systems

ÖNORM H 6020: Ventilation and air-conditioning plants for locations for medical use – Design, construction, operation, maintenance, technical and hygienic inspections

ÖNORM H 6021: 2003-09-01, Ventilation and air-conditioning plants – Specifications keeping them clean and cleaning

SWKI 99-3: 2003-05, Heating, ventilation and air-conditioning systems in hospitals (planning, construction, operation)

SWKI VA104-1: 2006-04, Hygiene requirements for ventilation and air-conditioning systems and units

VDI 3803-1: 2010-02, Air-conditioning – Central air-conditioning systems – Structural and technical principles (VDI ventilation code of practice)

VDI 6022-1: 2011-07, Hygiene requirements for ventilation and air-conditioning systems and units

GaBi 6 2013: PE INTERNATIONAL AG, GaBi 6: Software system and data base for comprehensive analysis; Copyright, TM, Stuttgart, Leinfelden-Echterdingen, 1992-2013

Manufacturer's documents on the VRE and VR volume flow controller in their respectively valid versions

Hygiene conformity test certificate for VRE (survey no. W-251267-14-Ho), Hygieneinstitut des Ruhrgebietes, Gelsenkirchen

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