ENVIRONMENTAL PRODUCT DECLARATION

as per ISO 14025 and EN 15804

Owner of the Declaration	DORMA Hüppe Raumtrennsysteme GmbH + Co. KG
Programme Holder	Institut Bauen und Umwelt (IBU)
Publisher	Institut Bauen und Umwelt (IBU)
Declaration Number	EPD-DHR-2012211-E
Issue Date	26.10.2012
Valid to	25.10.2017

VARIFLEX Partition System
Fullwall Element
DORMA Hüppe Raumtrennsysteme GmbH + Co. KG

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und Umwelt e.V.

1 General Information

DORMA Hüppe Raumtrennsysteme GmbH + Co. KG	VARIFLEX Fullwall Element
Programme holder IBU - Institut Bauen und Umwelt e.V. Rheinufer 108 D-53639 Königswinter / Germany	**Owner of the Declaration** DORMA Hüppe Raumtrennsysteme GmbH + Co. KG Industriestr. 5 26655 Westerstede/Ocholt Germany
Declaration Number EPD-DHR-2012211-E	**Declared Product / Declared Unit** The declared unit is 1 m² of the fullwall element of the VARIFLEX partition system (movable wall), excluding the associated fixing components and sealants at the interfaces with the stationary wall, floor and ceiling. The basic system is a fullwall element with direct coating on a particle board.
This declaration is based on the Product Category Regulations Room partition systems, 07-2012 (PCR tested and approved by the Independent Advisory Board (SVA))	**Scope of application** The life cycle assessment (LCA) is based on data acquired for the 2011-2012 financial year (June 30 to June 30) at the production site in Westerstede/Ocholt, Germany.
Issue date 26.10.2012	
Valid to 25.10.2017	**Verification** The CEN standard EN 15804 serves as the core PCR Independent verification of the declaration and data according to IS0 14025 ☐ internal ☒ external
Prof. Dr.-Ing. Horst J. Bossenmayer (President of IBU – Institut Bauen und Umwelt e.V.)	
Prof. Dr.-Ing. Hans-Wolf Reinhardt (Chairman of SVA)	Dr. Wolfram Trinius (Independent tester appointed by SVA)

2 Product

2.1 Product description

The VARIFLEX is a horizontally operable sound-insulating partition system of steel and aluminium construction comprised of independently moving individual elements with the following characteristics:

- Wide range of design alternatives
- Freely oscillating mounted cover panels for optimum acoustic performance
- Element heights up to 14.5 m

2.2 Application

The separate, independently operable elements are moved into the required position on ceiling-mounted tracks. The elements feature a manual crank-operated spindle mechanism enabling them to be clamped in position for enhanced stability and effective sealing against the floor, wall and ceiling track.

The partition system offers flexible, transparent room occupancy with multifunctional and open spatial configuration:

- Areas and rooms can be divided by operable VARIFLEX partitions
- Room sizes can be adapted to group size
- High level of sound insulation means different events can be held simultaneously in adjacent rooms
- Areas and rooms can be used with greater efficiency

Applications include: Offices, hotels, conference centres, fairs and exhibitions, schools, religious amenities and studios

2.3 Technical data

- Sound insulation index R in [dB] = 38 dB to 57 dB per DIN EN ISO 140-3:2005
- Heat transfer coefficient (U value) in [W/(m²K)] = 0.55 to 0.67 – calculated in accordance with ISO 6946
- Load arising from the partition weight in [kN/m²] = 0.36 to 0.59

2.4 Placing on the market / Application rules

- 89/106/EWG/EEC/CEE Building Products
- 2006/42/EC Machinery Directive
- Ball Impact Test to DIN 18032 Part 3
- TÜV Type Test

2.5 Delivery status

The VARIFLEX partition system is customizable. The model on which this EPD is based has the following technical data:

	Dimensions
Element width	3,000 mm
Element height	1,100 mm
Area	3.3 m²
Product weight	148.127 kg
Packaging	26 kg

2.6 Base materials / Ancillary materials

Excluding production waste and packaging, 1m² of the VARIFLEX fullwall element is comprised as follows:

Components	Proportion [%]
Particle board	53.5%
Bitumen sheet	22.1%
Steel components	11.3%
Anodized alu profiles	6.7%
Glass wool	2.7%
Plastics components	2.3%
Zinc die-cast components	0.8%
Paper	0.6%
Copper components	< 0.1%
TOTAL	**100.0%**

The surface coating is applied directly to the particle board substrate.

2.7 Manufacture

The element frame is constructed from vertical aluminium profiles and horizontal steel profiles. The aluminium vertical profiles are cut to size and provided at the end with recesses for the PU end caps and the sealing strips. Holes are stamped at the positions where the horizontal steel profiles are connected. The steel profiles are sawn to length, stamped and recessed.

Sealing extrusions and magnetic strips are inserted in the chambers of the vertical profiles.

The top and bottom sealing strips are provided by assembling together cut aluminium profiles and PU mouldings.

Thrust tubes of steel and compression springs for operating the sealing strips are prefabricated by pressure-joining the individual components to create an interference fit.

The horizontal steel profiles and the vertical aluminium profiles are secured to an assembly bench. The vertical profiles are bolted at the ends to the horizontal profiles. Thus completes assembly of the baseframe for the partition element.

An actuator in the form of a spindle system (pre-assembled by the subsupplier) based on the same operating principle as a car jack is fitted to the centre horizontal profile. The prefabricated thrust tubes and an operating tube are welded to this actuator. The pre-assembled sealing strips are mounted on the top and bottom ends of the thrust tubes by means of split pins.

Mineral wool is inserted in the cavities of the element frame thus created. The mineral wool is covered on both sides of the element frame with adhesive-bonded kraft paper.

Coated particle board is cut to the required size to create the cover panels for the two faces of the element. Sawdust, chips, swarf and residues are vacuumed up and collected.

Suspension-type attachments are bolted at the required position on the back of the particle board cover panels to enable subsequent attachment to the element frame.

The cover panels and the element frames are packed on pallets. Due to the high weights of the individual components and assemblies, they are packed separately for transport to and handling at the site.

The elements are made up by simply hanging and clamping the cover panels to the frames on site.

The offcuts are collected and sent to a disposal company for recycling (see section 2.16).

2.8 Environmental and health during manufacture

The production processes are permanently monitored and continuously improved on the basis of a quality management system certified to DIN EN ISO 9001:2008.

2.9 Product processing / Installation

The following machinery, plant, tools and equipment are used together with the noise protection measures indicated in each case:

- Saws for steel and aluminium, cordless screwdrivers, box column drilling machines
- Acoustic cabins for saws, acoustic partitions in the woodworking area (CNC saw and edge machining)
- Extraction systems installed at all saw locations in the woodworking area
- Extraction systems are provided at all welding stations, welding stations are protected by partitions (anti-glare protection)
- CNC punches for steel and aluminium profiles

2.10 Packaging

The VARIFLEX fullwall element is supplied ex works with the following transportation packaging:

Components	Proportion [%]
Wooden pallet	85%
Polystyrene padding	4%
PU sheeting	7%
Corrugated cardboard	4%
TOTAL	**100%**

For further information, please consult section 2.16.

2.11 Service condition

A little grease to lubricate the scissor-type actuator mechanism is needed when using and maintaining the partition system. An annual service e.g. to carry out adjustment work is recommended by the manufacturer. As a rule, repairs and replacements are not required. The cleaning requirement is negligible.

2.12 Environmental and health during use

At the current time, there are no known relationships or interactions between the product, the environment and human health. For further information, please refer to section 7.

2.13 Reference service life

According to empirical values acquired by DORMA Hüppe Raumtrennsysteme GmbH + Co. KG, the reference service lifetime is 25 years based on around 50 closing cycles/year. This figure has been calculated on the basis of DORMA's 50 years of business success and accumulated expertise.

2.14 Extraordinary effects

Fire

The construction product falls under building material class B2 and can also be supplied if requested to Euroclass B-s2-d0.

Water

Unforeseen water contact can be regarded as having no environmental consequences.

Mechanical destruction

Unforeseen mechanical destruction can be regarded as having no environmental consequences.

2.15 Re-use phase

With reference to the composition of materials incorporated in the product system as detailed in section 2.6, the possibilities are as follows:

Re-use

The complete partition system can be re-used within the reference service lifetime. Removal from the building is performed for remuneration by DORMA Hüppe Raumtrennsysteme GmbH + Co. KG.

Recycling of materials

The metal fractions can be separated at a cost and recycled as materials.

Energy recovery

The particle board and plastic fractions can be disposed of via the incineration route for energy recovery, subject to appropriate flue gas cleaning.

Landfill disposal

As the product contains no substances harmful to the environment or human health, the entire system can be safely placed in a landfill site in cases where no waste recycling technologies are available.

2.16 Disposal

Cutting waste produced during manufacturing

The offcuts produced during the manufacturing phase are recycled for metallurgical and energy recovery. The offcuts are collected separately and collected by disposal companies.

- EWC 03 01 05 Sawdust, shavings, cuttings, wood, particle board and veneer with the exception of those substances falling under 03 01 04
- EWC 12 01 01 Ferrous metal filings and turnings
- EWC 12 01 03 Non-ferrous metal filings and turnings
- EWC 12 01 05 Plastics shavings and turnings

Packaging

The packaging of the components installed in the building are recycled for energy recovery:

- EWC 15 01 01 paper and cardboard packaging
- EWC 15 01 02 plastic packaging
- EWC 15 01 03 wooden packaging

Disposal phase

All materials are returned for energy recovery or metallurgical recycling in accordance with the waste treatment technologies available (see section 2.15):

- EWC 10 11 03 Waste glass-based fibrous materials
- EWC 17 02 01 Construction and demolition waste (wood)
- EWC 17 02 03 Plastic
- EWC 17 03 02 Bituminous mixtures
- EWC 17 04 01 Copper, bronze, brass
- EWC 17 04 02 Aluminium
- EWC 17 04 05 Iron and steel

2.17 Further information

For further information relating to technical data and further product variants, the contact details are as follows:

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Thomas P. Wagner and Rainer Scholzen

3 LCA: Calculation Rules

3.1 Declared unit

The declared unit is 1 m^2 of the fullwall element of the VARIFLEX partition system (movable wall) including packaging materials but excluding the associated fixing materials and the interfaces with the stationary wall, floor and ceiling.

3.2 System boundary

EPD type: Cradle to grave (with options)

In accordance with EN 15804, the following modules have been given consideration:

Product stage: A1 – A3

The extraction and processing of the raw materials and biomass production and processing, including all relevant upstream activities, the provision of electricity, steam and heat from primary fuels, and also the extraction, refining and transportation of same, together with the necessary delivery

transportation to the factory gate and manufacture of the packaging are incorporated in this module. For further information, please consult section 3.8.

Construction stage: A4 – A5

This module encompasses the distribution channels and the process of energy recovery from the packaging materials.

End of Life stage: C2 – C3

Included in this module are transportation to the recycling facility and the collection, processing and recovery processes applied.

Credits: D

The resultant value streams arising from material recycling and energy recovery for the downstream product system are indicated in this module.

The life cycle assessment was prepared for the reference territory of Germany. This means that, in addition to the production processes performed under these conditions, the upstream stages relevant for Germany, such as electricity generation or fuel provision, have also been taken into account.

3.3 Estimates and assumptions

The energy consumption figures were calculated on a production-specific basis. The distribution transport distance was determined with all the distribution countries being included on a proportionate basis. The collection loss at the end of life is assumed to be 5% and the distance to the disposal site is assumed to be 75 km.

3.4 Cut-off criteria

All the details from the operating data survey and all the emission measurements available over the period of observation mentioned in section 3.7 have been taken into account. In addition, the data relating to transport operations was also gathered and modelled for all included inputs.

Due to its minor relevance, grease for lubricating the actuator scissor mechanism during the use phase is neglected throughout the entire useful life.

The infrastructure used in the manufacturing processes (referring particularly to the machines and production facilities) was not incorporated into the life cycle analysis. Transport inputs for the packaging were likewise not taken into consideration. It can be assumed that the total of non-included processes does not exceed 5% of the impact categories and can therefore be regarded as having only minor significance.

3.5 Background data

The life cycle was modelled using the Holistic Assessment software system (German acronym “GaBi”), current version 5. All the background data records used were taken from the current versions of various GaBi databases and the ecoinvent database (v2.2). The data records incorporated in the databases are documented online.

German data records were used for Modules A1-3 and corresponding European data records were used for the distribution transport operations

Due to the lack of data records for waste treatment, various material flows were combined within the data record that appeared best suited from a technical viewpoint.

The secondary and recycling operations can only be taken into account through the application of generic data records.

3.6 Data quality

The data was acquired from analyses of internal production and environmental data, the collection of LCA-relevant information within the supply chain and through notification of relevant data relating to energy provision. The data provided, arising from operational data acquisition and measurement activities were subjected to a plausibility check. Following a thorough examination, the data can be regarded as being of good representative quality.

The data records used for the assessment are generally not older than 10 years.

3.7 Observation period

The life cycle assessment is based on data acquired for the 2011-2012 financial year (June 30 to June 30) at the production site in Westerstede/Ocholt, Germany.

3.8 Allocation

There are no secondary or by-products. The outcome of the manufacturing process is a single product.

3.9 Comparability

All work carried out for the LCA complied with EN 15804. The identified environmental impacts are therefore comparable with the results of similar product systems likewise assessed to EN 15804, with the building context or product-specific performance features being duly taken into account.

4 LCA: Scenarios and additional technical information

Transport to the building (A4)

Litres of fuel	GLO: Truck (2006 version) PE
Transport distance	680.90 km
Capacity utilisation (incl. empty runs)	85 % (GaBI)

The transport distance was determined with all the distribution countries being included on a proportionate basis. Transport to site is reflected in the corresponding fuel data records.

Installation into the building (A5)

For energy recovery	[see section 2.16] 100 %

Reference service life

Reference service life	25 years (empirical value)

End of life (C2 – C3)

To recycling	8.46 kg/m²
For energy recovery	36.15 kg/m²

An average collection loss of 5% will be considered within the LCA results.

Re-use, recycling and energy recovery potential (D)

Credits are calculated (Module D) based on material recycling of the metals, and energy recovery from the particle board and plastics.

5 LCA: Results

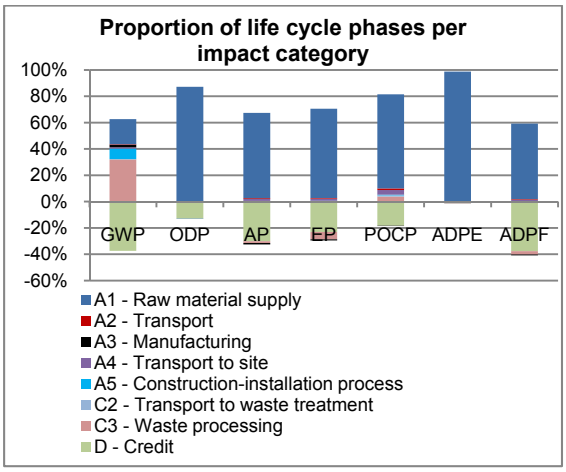
Description OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)																
Product stage			**Construction process stage**		**Use stage**							**End of Life stage**				**Benefits and loads beyond the system boundary**
Raw material supply	Transport	Manu-facturing	Transport	construction-installation process	Use	Maintenance	Repair	Replace-ment	Refurbish-ment	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	MND	MND	MND	MND	MND	MND	MND	MND	X	X	MND	X

Parameter	Unit	A1	A2	A3	A4	A5	C2	C3	D
RESULTS OF THE LCA – ENVIRONMENTAL IMPACT: 1 m² VARIFLEX Fullwall Element									
Global warming potential (GWP)	[kg CO_2-Eq.]	3,49E+01	6,94E-01	3,50E+00	1,85E+00	1,46E+01	4,62E-01	5,85E+01	-6,82E+01
Depletion potential of the stratospheric ozone layer (ODP)	[kg CFC11-Eq.]	2,07E-05	4,11E-11	-9,55E-09	9,96E-11	-1,24E-08	1,71E-10	1,05E-07	-3,04E-06
Acidification potential of land and water (AP)	[kg SO_2-Eq.]	3,71E-01	3,21E-03	-6,31E-03	8,47E-03	9,32E-04	2,32E-03	-7,88E-03	-1,72E-01
Eutrophication potential (EP)	[kg PO_4^{3-}-Eq.]	3,72E-02	3,22E-04	-4,64E-04	8,42E-04	9,92E-05	2,55E-04	-3,01E-03	-1,27E-02
Formation potential of tropospheric ozone photochemical oxidants (POCP)	[kg Ethene-Eq.]	4,09E-02	7,65E-04	-1,07E-04	2,02E-03	2,67E-04	5,38E-04	2,19E-03	-1,05E-02
Abiotic depletion potential for non-fossil resources (ADPE)	[kg Sb-Eq.]	1,79E-03	3,17E-08	-1,14E-06	8,49E-08	3,57E-07	1,82E-08	-6,13E-06	-1,42E-05
Abiotic depletion potential for fossil resources (ADPF)	[MJ]	1,36E+03	9,56E+00	-1,38E+01	2,56E+01	2,15E+00	6,36E+00	-5,96E+01	-8,92E+02
RESULTS OF THE LCA – RESOURCE CONSUMPTION ASSESSMENT: 1 m² VARIFLEX Fullwall Element									
Renewable primary energy as energy carrier (PERE)	[MJ]	8,56E+02	3,81E-01	-4,23E+00	1,02E+00	1,01E-01	2,49E-01	2,30E+00	-1,32E+02
Renewable primary energy resources as material utilization (PERM)	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Total use of renewable primary energy resources (PERT)	[MJ]	8,56E+02	3,81E-01	-4,23E+00	1,02E+00	1,01E-01	2,49E-01	2,30E+00	-1,32E+02
Non-renewable primary as energy carrier (PENRE)	[MJ]	1,52E+03	9,60E+00	-1,54E+01	2,56E+01	2,15E+00	6,38E+00	-4,84E+01	-1,02E+03
Non-renewable primary as material utilization (PENRM)	[MJ]	6,64E-04	0,00E+00	2,68E-09	0,00E+00	1,98E-10	0,00E+00	2,46E-08	-2,06E-08
Total use of non-renewable primary energy resources (PERT)	[MJ]	1,52E+03	9,60E+00	-1,54E+01	2,56E+01	2,15E+00	6,38E+00	-4,84E+01	-1,02E+03
Use of secondary material (SM)	[kg]	5,73E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Use of renewable secondary fuels (RSF)	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Use of non-renewable secondary fuels (NRSF)	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Use of net fresh water (FW)	[m³]	3,55E+02	3,55E-02	-4,41E+00	9,49E-02	3,39E-01	2,40E-02	2,80E+00	-3,36E-01
RESULTS OF THE ASSESSMENT OF OUTPUT FLOWS AND WASTE CATEGORIES: 1 m² VARIFLEX Fullwall Element									
Hazardous waste disposed (HWD)	[kg]	2,18E-03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	5,95E-02	-8,04E-02
Non-hazardous waste disposed (NHWD)	[kg]	1,55E+02	5,04E-02	-4,84E+00	1,35E-01	7,72E-01	2,25E-02	-5,19E+01	-6,36E+01
Radioactive waste disposed (RWD)	[kg]	3,86E-02	1,35E-05	-6,40E-04	3,62E-05	4,29E-05	8,88E-06	3,75E-03	-4,39E-02
Components for re-use (CRU)	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for recycling (MFR)	[kg]	0,00E+00	0,00E+00	3,99E-01	0,00E+00	0,00E+00	0,00E+00	7,79E+00	0,00E+00
Materials for energy recovery (MER)	[kg]	0,00E+00	0,00E+00	2,43E+00	0,00E+00	7,88E+00	0,00E+00	3,43E+01	0,00E+00
Exported electrical energy	[MJ]	0,00E+00	0,00E+00	6,39E+00	0,00E+00	1,93E+01	0,00E+00	1,54E+02	0,00E+00
Exported thermal energy	[MJ]	0,00E+00	0,00E+00	1,88E+01	0,00E+00	4,69E+01	0,00E+00	1,39E+02	0,00E+00

6 LCA: Interpretation

In order to perform the dominance analysis, the LCA was evaluated with relative values and the lower threshold set at 10%.

Environmental impacts



In the production phase, particularly the aluminium components (anodised and in some cases powder-coated with polyester resin), the bitumen sheets, steel components and the material with the highest mass fraction – the particle board – can be regarded as predominant in terms of their environmental impacts.

Due to the low relevance of the fuels in the use phase, no environmental impacts have been calculated for the declared product. No electric power is required for the daily operation of the partition system.

Credits arise as a result of the material recycling and energy recovery potential related to the offcuts produced during manufacturing, disposal of the packaging and the disposal phase of the product.

Use of resources

The use of non-renewable energy resources in the production phase is due to the upstream processes involved in aluminium manufacture, and to the bitumen sheet. The particle board makes the biggest contribution on the renewable energy resources side. The use of water is the result particularly of the use of hydroelectricity and the upstream processes involved in aluminium production.

Due to the low relevance of the fuels in the use phase, no resources are needed for the declared product.

Credits arise as a result of recycling and the generation of thermal and electrical energy due to recovery of the offcuts produced during manufacturing, disposal of the packaging and the disposal phase of the product.

Output flows and waste categories

Nuclear and special category wastes arise primarily due to the extraction and production of aluminium, albeit that offsetting credits can be earned for the material recycling of the offcuts and of the product in the disposal phase.

Slags and ashes arise predominantly due to the incineration of the waste fraction used in this energy recovery process.

7 Requisite evidence

7.1 VOC emissions

The VARIFLEX partition system is covered by Test Report No. 18995-1 of 14.07.2008. The test body was eco-Institut GmbH, Cologne.

Summary of results of tests prescribed by the Committee for Health-related Evaluation of Building products (AgBB) (28 days [µg/m³]):

- TVOC (C6-C16) = 267 µg/m³
- Σ-SVOC (C16-C22) = 7 SERa [µg/m³h]
- Carcinogenic substances = CMR-VOC were not detectable 3 days after placement in the test chamber.

8 References

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