Environmental Product Declaration

BREG EN EPD No.: 000069 Issue: 01

This is to certify that this verified Environmental Product Declaration provided by:

VELUX Company Ltd

Is in accordance with the requirements of:

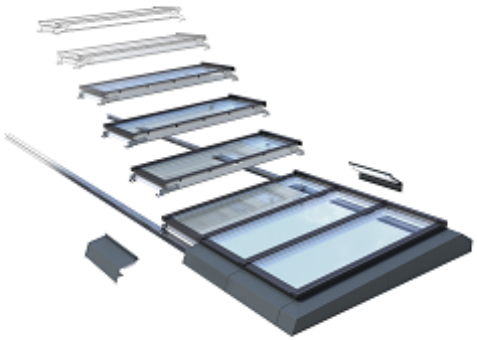
EN 15804:2012+A1:2013

This declaration is for:

VELUX modular skylights - double-glazed (HFC 080220 0010)

Company Address

Woodside Way
Glenrothes
Fife
KY7 4ND



Signed for BRE Global Ltd	Laura Critien Operator	15 December 2015 Date of this Issue
15 December 2015 Date of First Issue		15 December 2020 Expiry Date

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To check the validity of this EPD please visit www.greenbooklive.com/check or contact us.

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EPD verification and LCA details

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

LCA Consultant	Verifier
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General Information

Summary

This environmental product declaration is for 1 square metre of VELUX modular skylights - double-glazed (HFC 080220 0010) produced by VELUX Company Ltd at the following manufacturing facilities:

VELUX A/S
Ådalsvej 99

Hørsholm
DK-2970
Denmark

This is a Cradle to gate with options EPD. The life cycle stages included are as shown below (X = included, MND = module not declared):

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

Programme Operator

BRE Global, Watford, Herts, WD25 9XX, United Kingdom.
This declaration is based on the BRE Environmental Profiles 2013 Product Category Rules for Type III environmental product declaration of construction products to EN 15804:2012+A1:2013.

Comparability

Environmental declarations from different programmes may not be comparable if not compliant with EN 15804:2012+A1:2013. Comparability is further dependent on the product category rules used and the source of the data, e.g. the database. See EN 15804:2012+A1:2013 for further guidance.

Construction Product

Product Description

VELUX modular skylights are sash-frame constructed single skylights with a high-insulating glazing unit. VMS are delivered as prefabricated modules with factory-finished flashings to ensure superior water tightness. Made from a composite material VMS ensures excellent energy performance and high strength. VMS are available as fixed and venting modules. Venting skylights are top-hung with a number of sizes are also approved for smoke ventilation. http://www.modularskylights.velux.com/

Technical Information

Property	Value	Unit
Thermal transmittance - Uw	1.4	W/(m²K)
Total solar energy transmittance - g	0.58	-

Product Contents

Material/Chemical Input	%
Insulating glass unit	57.4
Composite frame, glass fiber	18.5
Aluminium	7.1
Wood	7.0
Plastics	5.6
Other metals	3.4
Other materials	1.0

Manufacturing Process

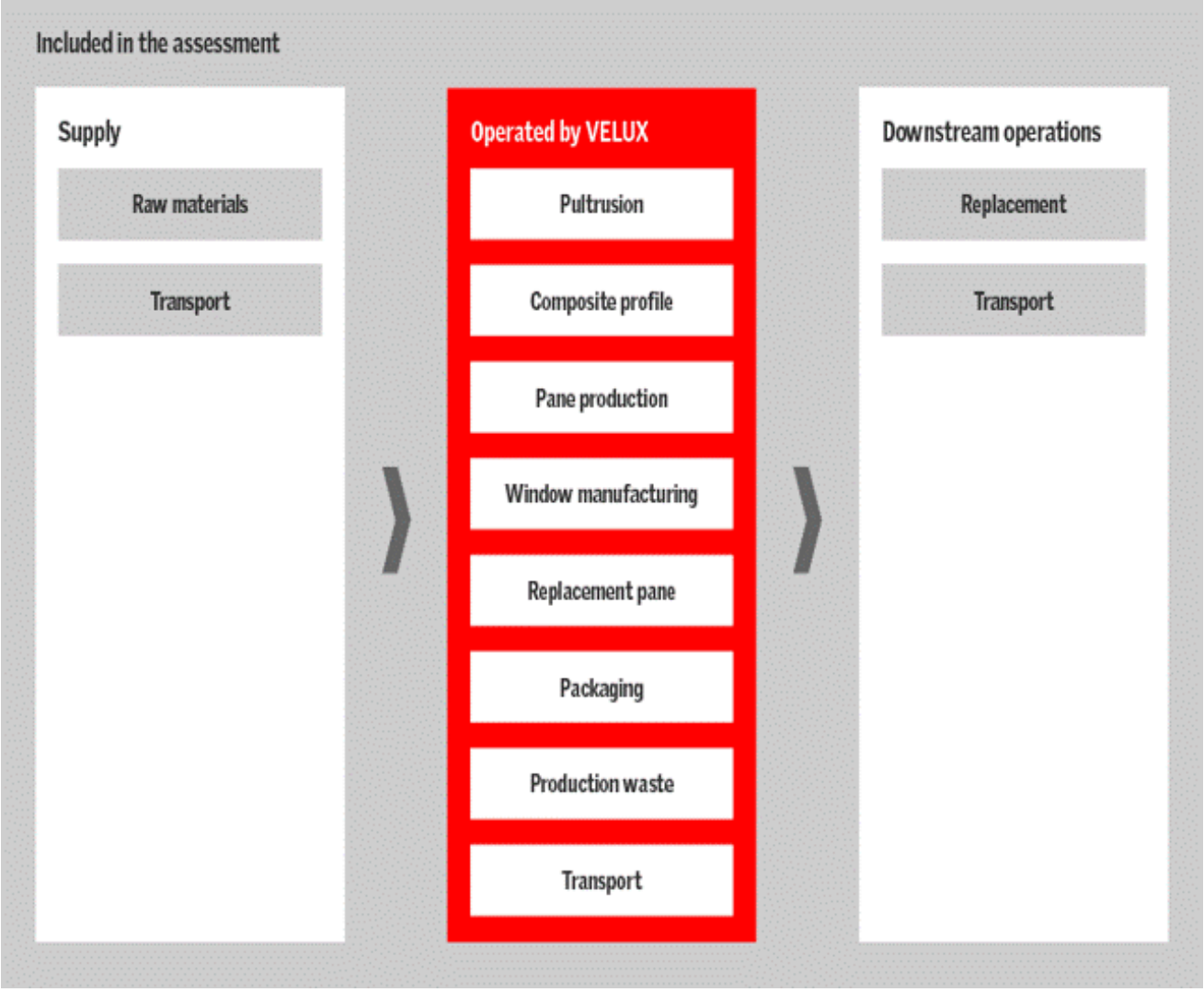
The key processes in the production of VMS, i.e. pultrusion of composite frames and assembly of final products, currently take place within the VELUX Group, ensuring that high data quality of the foreground processes are available. In practice, all energy flows are calculated from the detailed environmental accounting system and the weight of the materials are determined from adequate bills of materials, including also the packaging solution.

The pultrusion process starts with racks or creels holding rolls of doffs of fiber roving. The PUR resin is a mixture of isocyanate and polyol which is injected directly into the die where the fiber reinforcement becomes fully impregnated. As the resin rich fiber exits the resin impregnation system, the un-cured composite material is guided through a series of tooling.
Once the resin impregnated fiber is organized and removed of excess resin, the composite will pass through a heated steel die. Precisely machined and often chromed, the die is heated to a constant temperature, and has several zones of temperature through-out its length, which will cure the thermosetting resin. The profile that exits the die is now a cured pultruded Fiber Reinforced Polymer (FRP) composite.

Panes for VMS are sourced from external suppliers. A Bill of Materials from the supplier has been used to account for the raw materials consumed in the production.

Manufacturing of final VMS products includes shortening of profiles; drilling of holes; clamping and gluing of frame; mounting of gaskets and brackets, pane, etc.; and finaly stacking on pallets.

The process flow diagram is shown below:



Reference Service Life

The reference service life is set to 40 year. The skylight module has an estimated service life of 40 years while the pane only have a service life of 20 years. Hence the pane is replaced once in the life of the frame, using a specially developed replacement kit.
The estimated service life is in line with published information, e.g. BRE FB66: Environmental Impact of Windows.

Life Cycle Assessment Calculation Rules

Declared / Functional unit

The declared unit is "1 square meter of double-glazed window skylight construction in Europe for a period of 40 years".
VMS consists of individual skylight modules linked together to form a continuous longlight. The reference flows for the declared unit have been established using a longlight with 8 modules (HFC 080220 0010), representing an average installed configuration, normalised to one squre meter:
- 2 end modules left/right (0.8 m x 2.2 m)
- 6 middle modules (0.8 m x 2.2 m)

System boundary

The LCA is “Cradle to gate with options”, with production of a replacement kit (pane). The study thus includes all activities until the VMS products leave the gates of VELUX (A1-A3 and B4).
The LCA does not include activities beyond this point. All other stages (e.g. transport, installation, use and end-of-life) are excluded from the LCA. Processes up to end-of-waste state for production waste are included and in modules A3 and B4.

Data sources, quality and allocation

The data for the main production processes (foreground system) taking place at VELUX is optained from:
- VELUX environmental accounting system (1 January to 31 December 2014) for tracking and allocating consumption of resources and emissions in production of individual VELUX products, and
- conservative transportation scenario (distance and payload utilisation) representing current production within the EU-27.
The generic data used in the calculations (background system) are taken from GaBi6-databases and indcludes raw material provision, transportation, energy supply, and waste management.

Waste generated in the key processes shall be considered as co-products and economic allocation shall according to EN 15804 be used to distribute the environmental impacts.

Data quality has been assessed applying the pedigree matrix which is slightly modified from Weidema and Wesnæs (1996) with respect to Technology, Time, Geography, Completeness and Reliability. The data quality for most indicators appears to be “Very Good” or “Good”. This is in agreement with the aim for data quality achievement, and there is no doubt that the full production system is well represented by the data used.

To the best of our knowledge there are no missing data.

Cut-off criteria

No input of materials or energy has been omitted from the calculations. Transportation includes transport of raw materials, internal components and production waste. The exception is a small amount of waste from manufacturing of e.g. plastic components. This waste constitutes less than 1% of the total input of raw materials, with a low missing distance (100km), compared to 1000 km as default value for raw materials. Its transportation is therefore considered to be of very minor importance.

LCA Results

(INA = Indicator not assessed, AGG = Aggregated, NA = Not Applicable)

Indicator	Unit	A1	A2	A3	B4
		Raw Material supply	Transport to factory	Manufacturing	Replacement
Environmental impacts per declared/functional unit					
GWP	kg CO_2 eq.	175	3.60	19.8	138
ODP	kg CFC 11 eq.	1.60E-05	1.70E-11	1.60E-08	1.40E-05
AP	kg SO_2 eq.	0.90	0.00	0.10	0.70
EP	kg $(PO_4)^{3-}$ eq.	0.09	0.00	0.00	0.08
POCP	kg C_2H_4 eq.	0.06	-0.01	0.00	0.03
ADPE	kg Sb eq.	0.00284	1.37E-07	2.12E-06	2.12E-06
ADPF	MJ eq.	2300	50.00	235	1760
GWP = Global Warming Potential (Climate Change); ODP = Ozone Depletion Potential; AP = Acidification Potential for Soil and Water; EP = Eutrophication Potential; POCP = Photochemical Ozone Creation; ADPE = Abiotic Depletion Potential – Elements; ADPF = Abiotic Depletion Potential – Fossil Fuels					
Resource use					
PERE	MJ	364	2.00	53.00	186
PERM	MJ	83.00	0.00	0.00	0.00
PERT	MJ	447	2.00	53.00	186
PENRE	MJ	2580	51.00	341	1980
PENRM	MJ	283	0.00	0.00	203
PENRT	MJ	2860	51.00	341	2180
SM	kg	0.60	0.00	3.30	1.00
RSF	MJ	-0.1	0.00	0.00	0.00
NRSF	MJ	-0.9	0.00	0.10	0.30
FW	m^3	1.21	0.051	0.195	0.80
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 = Net use of fresh water					
Waste to disposal					
HWD	kg	0.24	0.00	0.10	0.12
NHWD	kg	333	0.00	66.00	279
TRWD	kg	0.11	0.00	0.04	0.08
RWDHL	kg	INA	INA	INA	INA
HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; TRWD = Total Radioactive waste disposed; RWDHL = Radioactive waste disposed (high-level nuclear waste)					
Other output flows					
CRU	kg	0.00	0.00	0.00	0.00
MFR	kg	0.00	0.00	1.60	2.90
MER	kg	0.00	0.00	0.70	5.30
EE	MJ	0.00	0.00	0.00	0.00
CRU = Components for reuse; MFR = Materials for recycling; MER = Materials for energy recovery; EE = Export energy					

Scenarios and Additional Technical Information

Module B4 – Replacement			
Parameter	**Description**	**Unit**	**Value**
Replacement cycle	Service life of insulating glazing unit	year	20
Energy used during replacement, e.g., electricity for crane	Energy use during replacement is assumed to be very small and thus neglectable		

Interpretation

The list below gives a rudimentary overview of which materials and processes that have the largest contributions to the environmental impacts of the VMS:

Global Warming Potential (GWP): Production of composite & Production of float glass
Ozone Depletion: Production of isocyanate
Acidification: Production of float glass & Production of composite
Eutrophication: Production of float glass & Production of composite
Photochemical ozone formation: Production of float glass & Production of composite
Depletion of abiotic resources (elements): Production of glass fibre
Depletion of abiotic resources (fossil): Production of float glass, Production of composite & Manufactoring at VELUX A/S

The list shows a consistent picture of production of float glass and composite (PUR/glass fibers) being the largest contributors to most impact categories. It is noted here that glass fibers in general appear to give a larger contribution than the polymer matrix. The production activities (energy consumption) in the manufacturing processes accounts for 10 % of the depletion of fossil fuels and contribution to energy-related impacts like Global warming and acidification. Polysulphide can be seen to give a significant contribution (5-9 %) in most categories.

The exceptions from the general picture are Ozone depletion and Depletion of abiotic resources (elements). For Ozone depletion the large contribution is related to emissions of carbon tetrachloride in production of methyl isocyanate. For Depletion of abiotic resources the contribution is related to the use of colemanite ore used in production of borax, a raw material used in production of float glass.

Using VELUX environmental accounting system for assessment of the impacts of small components for VMS produced at VELUX is judged to give more precise data for VELUX activities than using average data as available in commercial databases.
It is acknowledged that this approach “only” can provide averages for plastic and metal components, but the impacts are established using all information available in VELUX environmental accounts. As such they represent the highest level of detail available for this type of calculations.

The hazardous waste reported in the results comes primarily from production of plastic raw materials, e.g. polyether polyol (used for production of polyurethane (PUR), expanded polystyrene (EPS) and styrene-acrylonitrile (SAN). More precisely, the contribution is related to the materials for which datasets from PlasticsEurope – as available in GaBi – have been used. Most of these datasets are from around 2000 and they contain – as opposed to other datasets in GaBi - an aggregated figure for the amounts of waste leaving the gates of the plastic producing companies, including a figure for the amounts of hazardous waste. The full documentation from PlasticsEurope can be found in reports made by Ian Boustead, presenting data from the most recent calculations.

Sources of additional information

BRE Global. BRE Environmental Profiles 2013: Product Category Rules for Type III environmental product declaration of construction products to EN 15804:2012+A1:2013. PN 514. Watford, BRE, 2014.

BSI. Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products. BS EN 15804:2012+A1:2013. London, BSI, 2013.

BSI. Environmental labels and declarations – Type III Environmental declarations – Principles and procedures. BS EN ISO 14025:2010 (exactly identical to ISO 14025:2006). London, BSI, 2010.

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BSI. Environmental management – Life cycle assessment – requirements and guidelines. BS EN ISO 14044:2006. London, BSI, 2006.

Force Technology, 2015: VELUX Life cycle model for environmental assessment of new and existing products - Version 6.1, January 2015

GaBi LCI databases, 2014: GaBi Product Sustainability Software: www.gabi-software.com

VELUX environmental accounting system for tracking and allocating consumption of resources and emissions in production of individual VELUX products

Boustead I., 2006: Eco-profiles of the European plastics industry. Polystyrene (Expandable) (EPS). Downloaded from http://www.plasticseurope.org/plasticssustainability/eco-profiles/browse-by-flowchart.aspx , July, 2014

VELUX, 2015: VMS Technical Handbook - v2, http://www.modularskylights.velux.co.uk/uk-VMS/Documents/Technical_Handbook_Vers_2.pdf

BRE, 2014: Environmental Impact of Windows. BRE FB66. Bracknell, IHS BRE Press, 2014