

# Environmental Product Declaration (EPD)



Declaration code EPD-RDK-GB-76.0



Roto Frank DST  
Produktions-GmbH

## Roof windows

### Plastic roof window Designo R6/R8



Basis:

DIN EN ISO 14025  
EN 15804 + A2  
Company EPD  
Environmental  
Product Declaration

Publication date:  
04.12.2023

Valid until:  
04.12.2028



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Declaration code EPD-RDK-GB-76.0

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<b>Declaration code</b>	EPD-RDK-GB-76.0		
<b>Designation of declared product</b>	Plastic roof window Designo R6/R8		
<b>Scope</b>	Pitched roof windows allow a view to the outside, effective ventilation of the attic and provide access to natural daylight.		
<b>Basis</b>	This EPD was prepared on the basis of EN ISO 14025:2011 and DIN EN 15804:2012+A2:2019. In addition, the "Allgemeiner Leitfaden zur Erstellung von Typ III Umweltproduktdeklarationen" (General guideline for preparation of Type III Environmental Product Declarations) applies. The Declaration is based on the PCR documents "PCR Part A" PCR-A-0.3:2018 and "Windows, flat roof windows, rooflights and light bands" PCR-FE-3.0:2023 as well as EN 17213 „PCR for Windows and Doors."		
<b>Validity</b>	Publication date:	Last revision:	Valid until:
	04.12.2023	15.01.2024	04.12.2028
	This verified Company Environmental Product Declaration (company EPD) applies solely to the specified products and is valid for a period of five years from the date of publication in accordance with DIN EN 15804.		
<b>LCA Basis</b>	The LCA was prepared in accordance with DIN EN ISO 14040 and DIN EN ISO 14044. The data are based on both the data compiled from two production sites of Roto Frank DST Produktions-GmbH and the generic data derived from the "LCA for Experts 10" database. LCA calculations were carried out for the included "cradle to grave" including all upstream chains (e.g. raw material extraction, etc.).		
<b>Notes</b>	The "Conditions and Guidance on the Use of ift Test Documents" apply. The declaration holder assumes full liability for the underlying data, certificates and verifications.		

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## 1 General Product Information

### Product definition

The EPD relates to the product group Roof windows and applies to:

### 1 m<sup>2</sup> Plastic roof window Designo R6/R8 of company Roto Frank DST Produktions-GmbH

They are subdivided into following product groups (PG):

<sup>1</sup> Bold = Reference products

Product group	Designation <sup>1</sup>		Reference size
<b>PG 1</b> Designo R6/R8 plastic double glazing	R88C K200 R88C K200 MW i88C K2EF R88C K2SA R68C K200 R68C K200MW R68C K2E_ R68C K2EF R68C K2SF R68C K2E_MW R68C K2EFMW R68C K2SFMW R88G K200 i88G K2EF	R88G K2SA R68G K200 R68G K2E_ R68G K2EF R68G K2SF R88_K200MR R88_K200AR1 R88_K200AR2 R88_K200AB <b>R88_K2SAMR</b> R68_K200MR R68_K2E_MR R68_K2EFMR R68_K2SFMR	1.23 m * 1.48 m
<b>PG 2</b> Designo R6/R8 plastic triple glazing	R89G K200 R89G K200MW i89G K2EF R89G K2SA R89G K200MR <b>R89G K2SAMR</b> R69G K200 R69G K200MW R69G K2E_ R69G K2EF R69G K2SF R69G K2E_MW R69G K2EFMW R69G K2SFMW R69G K200MR R69G K2E_MR R69G K2EFMR R69G K2SFMR R89P K200 R89P K200MW i89P K2EF	R89P K2DL R89P K2DR R89P K2SA R89P K200MR R89P K200AR1 R89P K200AR2 R89P K200AB R89P K200AB R89P K2SAMR R69P K200 R69P K200MW R69P K2E_ R69P K2EF R69P K2SF R69P K2E_MW R69P K2EFMW R69P K2SFMW R69P K200MR R69P K2E_MR R69P K2EFMR R69P K2SFMR	1.23 m * 1.48 m
<b>PG 3</b> Designo R6/R8 plastic acoustic glazing	<b>R86E K200</b> i86E K2EF		1.23 m * 1.48 m

Abbreviations:

Material: "K" - plastic

Drive unit: "00" - without drive; "E\_" - wired drive; "EF" - radio-controlled drive; "SF" - solar drive

Other: "MW" - Customised roof windows; "MR" - Customised renovation windows; "AR1" - Renovation windows for old Roto windows from 1968-1994; "AR2" - Renovation windows for old Roto windows from 1994-2010; "AB" - Renovation windows for Braas Atelier from 1986-2001; "SA" - Safety exit can be used as an emergency exit, from an opening angle of approx. 30° the window is always fully opened with gas spring support, extended opening angle compared to the standard window

**Table 1** Product groups

The declared unit is obtained by summing up:

PG	Assessed product	Declared unit	Surface weight	Thickness
PG 1	R88_ K2SAMR	1 m <sup>2</sup>	49.02 kg/m <sup>2</sup>	175.82 mm
PG 2	R89G K2SAMR	1 m <sup>2</sup>	54.61 kg/m <sup>2</sup>	175.82 mm
PG 3	R86E K200	1 m <sup>2</sup>	67.04 kg/m <sup>2</sup>	175.82 mm

**Table 2** Functional unit per reference product

The average unit is declared as follows:

Directly used material flows are determined using standardized sizes (1.23 m \* 1.48 m) and allocated to the declared unit. All other inputs and outputs in the production were scaled to the declared unit in their entirety since no direct assignment to the standardized size is possible. The reference period is the year 2022.

The validity of the EPD is not restricted to the following series:

- R8 Residential roof hatch (door opening), hardware on the left
- R8 Residential roof hatch (door opening), hardware on the right

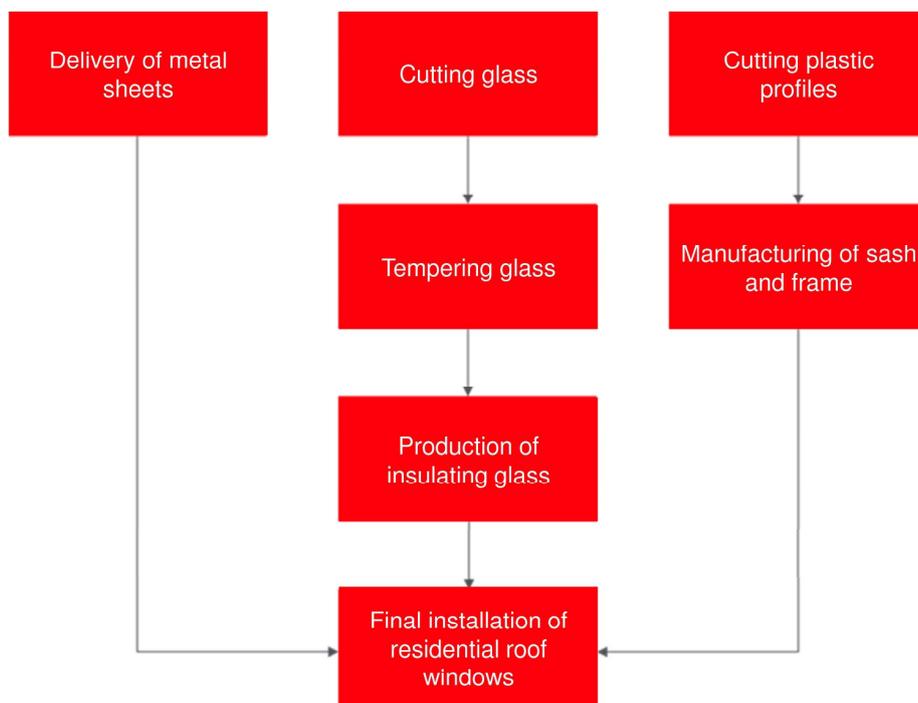
## Product description

Roof window with plastic hollow chamber profile with central horizontal pivot axis (R6) or horizontal pivot axis at top (R8, i8), for pitched roofs.

Overall frame dimensions (mm)	Overall insulation block dimension (mm)	Frame clear dimension (mm)	Inner lining clear dimension (mm)
540/780 – 1,340/1,600	800/840 – 1,400/1,660	450/690 - 1,250/1,510	480/720 - 1,280/1,540
Overall casement dimensions plastic (mm)	Casement clear dimension (mm)	Light area (m <sup>2</sup> )	Ventilation area (m <sup>2</sup> with 600 mm opening width)
442/682 - 1,242/1,502	328/568 - 1,128/1,388	0.19 - 1.57	0.40 - 1.21
Type of opening / opening direction	Frame material	Construction type	Surface
R6: Central horizontal pivot axis R8,i8: Top hung pivot window with horizontal pivot axis at top	PVC multi-chamber profile	Horizontal pivot window (R6); top-hung pivot window (R8,i8)	Plastic roof window in white as standard, decorative foils are also available
Sealing systems			
2x sash gaskets, sealants made of TPE and TPV			

For a detailed product description refer to the manufacturer specifications or the product specifications of the respective offer/quotation.

**Product manufacture**



**Illustration 1** Product manufacture of plastic windows

**Application**

Plastic roof windows for installation in pitched roofs with a roof inclination of 20° to 65°. With its top-hung technology, the roof window Designo R8 guarantees effective ventilation of the loft, convenient access to fresh air and an unrestricted view of the outside. The horizontal pivot window Designo R6 is ideal as a supplement to the top-hung pivot window Designo R8 in combination installation.

**Management systems**

The following management systems are held:

- Quality management system according to DIN EN ISO 9001:2015

**Additional information**

For additional verifications of applicability or conformity refer to the CE marking and the documents accompanying the product, if applicable.

Plastic roof window Designo R6/R8 meet the following building physics performance characteristics\*:

Thermal insulation value of window (Uw value as per DIN EN ISO 10077, DIN EN ISO 12567-2)	Sound reduction index in dB (RWP value (C; Ctr) as per EN ISO 20140-3, EN ISO 717-1)
1	43 (-2;-6) dB
Sound reduction class / sound reduction grade (as per VDI guideline 2719) 52	Air permeability class (as per DIN EN 12207)
4	4

Thermal insulation value of pane1 (U <sub>g</sub> -value as per DIN EN 673)	Total solar energy transmittance (g-value in % as per DIN EN 410)
0.7	38
Light transmittance (TL value in % as per DIN EN 410)	Resistance to wind load (as per DIN EN 12210)
56	C3
Resistance to snow (permanent load)	Reaction to fire (as per DIN EN 13501-1)
TSG4/10/HSG3/10/LSG6	B,s3-d0
Resistance to external fire (as per DIN EN 13501-5)	Watertightness (as per DIN EN 12208)
Broof(t1)	E 1200
Impact resistance class (as per DIN EN 13049)	Load-bearing capacity of safety devices (as per DIN EN 14609:2004)
5 - 950 mm	350 N

\* The performance characteristics listed here vary from product to product. The values given are the maximum performance achieved within the product group.

## 2 Materials used

### Primary materials

The raw materials used can be found in Section 6.2 Inventory analysis (Inputs).

The primary materials used are listed in the LCA (see Section 6).

### Declarable substances

No substances according to REACH candidate list are included (declaration of 06.11.2023).

All relevant safety data sheets can be obtained from company Roto Frank DST Produktions-GmbH.

## 3 Construction process stage

### Processing recommendations, installation

Operating and maintenance instructions can be found at <https://www.roto-frank.com/de/dst/profi/bedienungs-und-wartungsanleitungen>.

## 4 Use stage

### Emissions to the environment

No emissions to water and soil are known. A test report for the assessment of emissions of Volatile Organic Compounds (VOC) according to ISO 16000 is available. Test results were taken into account in the life cycle assessment (see Annex/B1).

### Reference service life (RSL)

The RSL information was provided by the manufacturer. The RSL must be established under specified reference conditions of use and relate to the declared technical and functional performance of the product within the building. It must be determined according to all specific rules given in European product standards or, if none are available, according to a c-PCR. It must also take into account ISO 15686-1, -2, -7 and -8. If there is guidance on deriving RSLs from European Product Standards or a c-PCR, then such guidance must take precedence.

If it is not possible to determine the service life as the RSL in accordance with ISO 15686, the BBSR table "Nutzungsdauer von Bauteilen zur Lebenszyklusanalyse nach BNB" (service life of building components for life cycle assessment in accordance with the sustainable construction evaluation system) can be used. For further information and explanations refer to [www.nachhaltigesbauen.de](http://www.nachhaltigesbauen.de).

For this EPD the following applies:

For a "cradle to grave" EPD and Module D (A + B + C + D), a reference service life (RSL) must be specified.

The service life of the Plastic roof window Designo R6/R8 of company Roto Frank DST Produktions-GmbH is specified with 40 years according to the manufacturer.

The service life is dependent on the characteristics of the product and in-use conditions.

The service life solely applies to the characteristics specified in this EPD or the corresponding references.

The RSL does not reflect the actual life time, which is usually determined by the service life and the redevelopment of a building. It does not give any information on the useful life, warranty referring to performance characteristics or guarantees.

## 5 End-of-life stage

### Possible end-of-life stages

The Plastic roof window Designo R6/R8 are sent to central collection points. There the products are usually shredded and sorted into their constituents. The end-of-life stage depends on the site where the products are used and is therefore subject to the local regulations. Observe the locally applicable regulatory requirements.

In this EPD, the modules of after-use are presented according to the market situation (according to EN 17213).

Metals, glass and plastics are recycled to certain parts. Other plastics are thermally recycled, residual fractions are sent to landfill.

A reuse scenario for the Dekura and Rewindo recycling initiatives is also depicted.

### Disposal routes

The LCA includes the average disposal routes.

**All life cycle scenarios are detailed in the Annex.**

## 6 Life Cycle Assessment (LCA)

Environmental product declarations are based on life cycle assessments (LCAs) which use material and energy flows for the calculation and subsequent representation of environmental impacts.

As a basis for this, life cycle assessments were prepared for Plastic roof window Designo R6/R8. These LCAs are in conformity with the requirements set out in DIN EN 15804 and the international standards DIN EN ISO 14040, DIN EN ISO 14044, ISO 21930 and EN ISO 14025.

The LCA is representative of the products presented in the Declaration and the specified reference period.

### 6.1 Definition of goal and scope

#### Aim

The goal of the LCA is to demonstrate the environmental impacts of the products. In accordance with DIN EN 15804, the environmental impacts covered by this Environmental Product Declaration are presented for the entire product life cycle in the form of basic information. Environmental impacts for "pure windows" and drive units are stated separately.

#### Data quality, data availability and geographical and time-related system boundaries

The specific data originate exclusively from the 2022 fiscal year. They were collected on-site at the plant located in Bad Mergentheim and originate in parts from company records and partly from values directly obtained by measurement. Validity of the data was checked by the ift Rosenheim.

The generic data originates from the professional database and building materials database software "LCA for Experts 10". The last update of both databases was in 2023. Data from before this date originate also from these databases and are not more than 5 years old. No other generic data were used for the calculation.

Generic data are selected as accurately as possible in terms of geographic reference. If no country-specific data sets are available or if the regional reference cannot be determined, European or globally valid data sets are used.

Data gaps were either filled with comparable data or conservative assumptions, or the data were cut off in compliance with the 1% rule.

The life cycle was modelled using the sustainability software tool "LCA for Experts" for the development of life cycle assessments.

The data quality complies with the requirements of prEN 15941:2022.

**Scope / system boundaries**

The system boundaries refer to the supply of raw materials and purchased parts, manufacture/production, use and end-of-life stage of the Plastic roof window Designo R6/R8.

For float glass (FG), laminated safety glass (LSG) and separately issued environmental impacts for drive units, additional specific data for production at the pre-suppliers was taken into account (FG: M-EPD-FEV-002000; LSG: M-EPD-MIG-002000; drive units: M-EPD-AZR-103).

No additional data from pre-suppliers or other sites were taken into consideration.

**Cut-off criteria**

All company data collected, i.e. all commodities/input and raw materials used, the thermal energy and electricity consumption, were taken into consideration.

The boundaries cover only the product-relevant data. Building sections/parts of facilities that are not relevant to the manufacture of the products, were excluded.

The transport distances of the pre-products used were taken into consideration as a function of 100% of the mass of the products.

The transport distances for auxiliary materials are not recorded in the company, but are mapped in the LCA assuming a transport mix. The transport mix is consisted as follows and is derived from the research project "EPDs for transparent components":

- Truck, 26 – 28 t total weight / 18.4 t payload, Euro 6, freight, 85% capacity used, 100 km,
- Truck-trailer, 28 – 34 t total weight / 22 t payload, Euro 6, 50% capacity used, 50 km,
- Freight train, electrical and diesel driven; D 60%, E 51% capacity used, 50 km,
- Seagoing vessel, consumption mix, 50 km.

No transportation routes for waste recycling in A3 were taken into account.

The criteria for the exclusion of inputs and outputs as set out in DIN EN 15804 are fulfilled. From the data analysis it can be assumed that the total of negligible processes per life cycle stage does not exceed 1% of the mass/primary energy. This way the total of negligible processes does not exceed 5% of the energy and mass input. The life cycle calculation also includes material and energy flows that account for less than 1%.

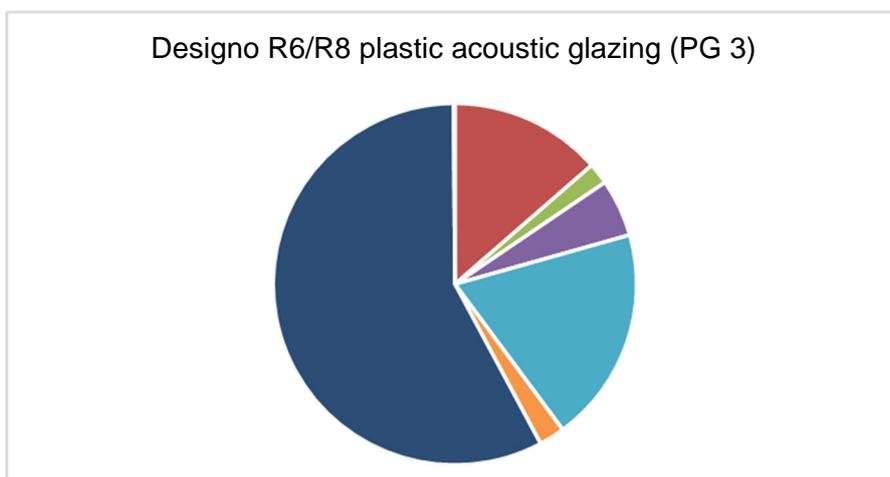
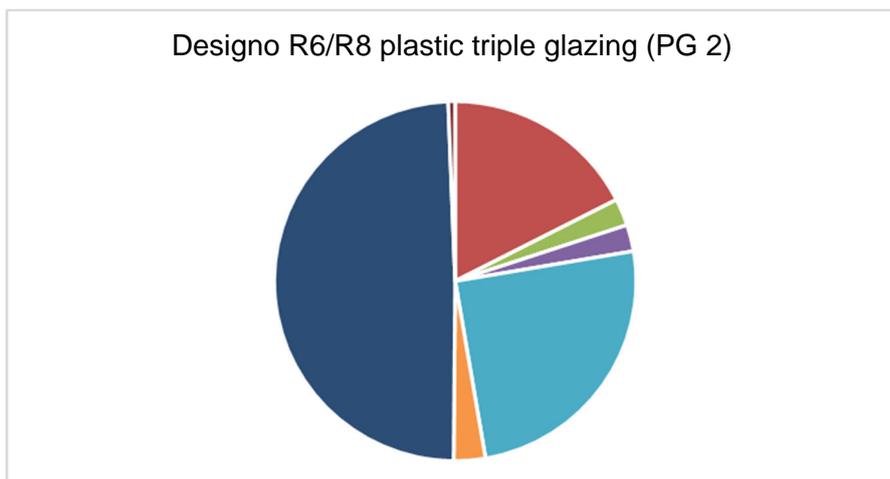
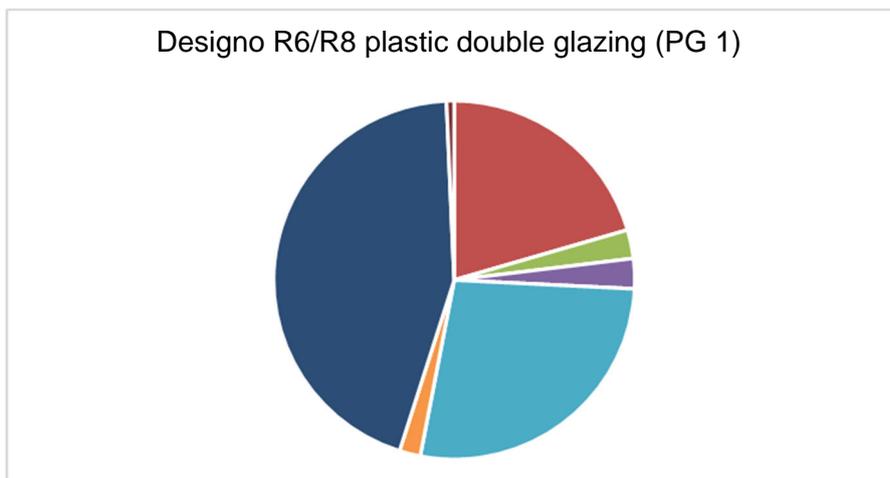
**6.2 Inventory analysis****Aim**

All material and energy flows are described below. The processes covered are presented as input and output parameters and refer to the declared units.

<b>Life cycle stages</b>	The complete life cycle of Plastic roof window Designo R6/R8 is shown in the annex. The product stage "A1 – A3", construction process stage "A4 – A5", use stage "B1 – B7", end-of-life stage "C1 – C4" and the benefits and loads beyond the system boundaries "D" are considered.
<b>Benefits</b>	<p>The below benefits have been defined as per DIN EN 15804:</p> <ul style="list-style-type: none"> <li>• Benefits from recycling</li> <li>• Benefits (thermal and electrical) from incineration</li> </ul>
<b>Allocation of co-products</b>	<p>Allocations occur during production. The allocation was based on production costs (economic value).</p>
<b>Allocations for re-use, recycling and recovery</b>	<p>If the products are reused/recycled and recovered during the product stage (rejects), the elements are shredded, if necessary and then sorted into their constituents. This is done by various process plants, e.g. magnetic separators. The system boundaries were set following their disposal, reaching the end-of-waste status.</p>
<b>Allocations beyond life cycle boundaries</b>	<p>The use of recycled materials in the manufacturing process was based on the current market-specific situation. In parallel to this, a recycling potential was taken into consideration that reflects the economic value of the product after recycling (recyclate). Secondary materials that enter the production process as input are calculated in module A1 as input without loads. No benefits are assigned to Module D, but consumption to Modules C3 and C4 (worst case consideration). The system boundary set for the recycled material refers to collection.</p>
<b>Secondary material</b>	The use of secondary material in Module A3 was considered for Roto Frank DST Produktions-GmbH. Secondary materials are used.
<b>Inputs</b>	<p>The LCA includes the following production-relevant inputs per 1 m<sup>2</sup> Plastic roof window Designo R6/R8:</p> <p><b>Energy</b> The "electricity mix Germany 2021" is used for the electricity mix in plant 97980 Bad Mergentheim. For self-generated electricity (solar energy), "electricity from photovoltaic Germany" is used. The input material of heating oil is based on "Thermal energy from heating oil".</p> <p>A portion of the process heat is used for space heating. This can, however, not be quantified, hence a "worst case" figure was taken into account for the product.</p> <p><b>Water</b> In the individual process steps for production, the water consumption is 17 l (R88_ K2SAMR), 27 l (R89G K2SAMR) as well as 146 l (R86E K200) per m<sup>2</sup> element.</p>

**Raw material/Pre-products**

The chart below shows the share of raw materials/pre-products in percent.

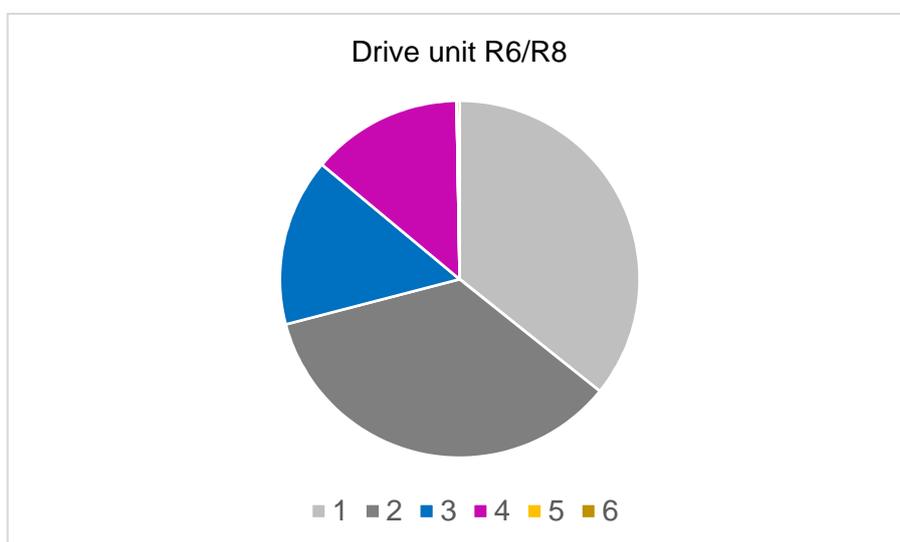


**Illustration 2** Percentage of individual materials per declared unit

- 1 Wood (sash and frame)
  - 2 Plastic (sash and frame)
  - 3 Plastics (sealants)
  - 4 Plastics (other)
- 5 Metals (hardware components)
  - 6 Metals (other)
  - 7 Glazing
  - 8 Others

No.	Material	Mass in %		
		PG 1	PG 2	PG 3
1	Wood (sash and frame)	0	0	0
2	Plastic (sash and frame)	20	18	14
3	Plastics (sealants)	3	2	2
4	Plastics (other)	3	2	5
5	Metals (hardware components)	27	25	19
6	Metals (other)	2	3	2
7	Glazing	44	49	58
8	Others	1	1	0

**Table 3** Percentage of individual materials per declared unit



**Illustration 3** Percentage of individual materials of the individual materials of drive unit per declared unit

No.	Material	Mass in %
		Drive unit R6/R8
1	Drive unit D+H	36
2	Other electrical components	35
3	Metals	15
4	Plastics	14
5	Wood	0
6	Paper/cardboard	< 1

**Table 4** Percentage of individual materials of drive unit in % per declared unit

**Ancillary materials and consumables**

There are < 1 g (PG 1), < 1 g (PG 2) and 3 g (PG 3) of ancillary materials and consumables.

### Product packaging

The amounts used for product packaging are as follows:

No.	Material	Mass in kg		
		PG 1	PG 2	PG 3
1	Styrofoam	0.18	0.28	1.53
2	Cardboard	1.73	2.79	15.12
3	Pallets	1.39	2.23	12.11

**Table 5** Weight in kg of packaging per declared unit

No additional packaging is required for balanced drive units and (electrical) components.

### Biogenic carbon content

According to EN 16449, the following amounts of biogenic carbon are generated:

No.	Part	Content in kg C per m <sup>2</sup>		
		PG 1	PG 2	PG 3
1	In product	0.12	0.12	0.03
2	In the associated packaging	1.24	2.00	10.83

**Table 6** Biogenic carbon content in product and packaging at the factory gate

## Outputs

The LCA includes the following production-relevant outputs per 1 m<sup>2</sup> Plastic roof window Designo R6/R8:

### Waste

Secondary raw materials were included in the benefits.  
See Section 6.3 Impact assessment.

### Waste water

During production, 17 l (PG 1), 27 l (PG 2) and 146 l (PG 3) of wastewater is generated.

## 6.3 Impact assessment

### Aim

The impact assessment covers both inputs and outputs. The impact categories applied are stated below:

**Core indicators**

The models for impact assessment were applied as described in DIN EN 15804-A2.

The core indicators presented in the EPD are as follows:

- Climate change - total (GWP-t)
- Climate change - fossil (GWP-f)
- Climate change - biogenic (GWP-b)
- Climate change - land use & land use change (GWP-l)
- Ozone depletion (ODP)
- Acidification (AP)
- Eutrophication freshwater (EP-fw)
- Eutrophication salt water (EP-m)
- Eutrophication land (EP-t)
- Photochemical ozone creation (POCP)
- Depletion of abiotic resources - fossil fuels (ADPF)
- Depletion of abiotic resources - minerals and metals (ADPE)
- Water use (WDP)

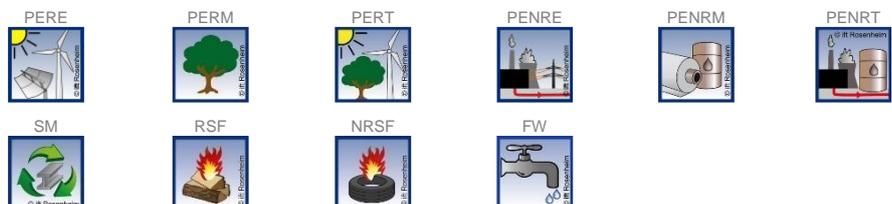


**Resource management**

The models for impact assessment were applied as described in DIN EN 15804-A2.

The following resource use indicators are presented in the EPD:

- Renewable primary energy as energy source (PERE)
- Renewable primary energy for material use (PERM)
- Total use of renewable primary energy (PERT)
- Non-renewable primary energy as energy source (PENRE)
- Renewable primary energy for material use (PENRM)
- Total use of non-renewable primary energy (PENRT)
- Use of secondary materials (SM)
- Use of renewable secondary fuels (RSF)
- Use of non-renewable secondary fuels (NRSF)
- Net use of freshwater resources (FW)



**Waste**

The waste generated during the production of 1 m<sup>2</sup> Plastic roof window Designo R6/R8 is evaluated and shown separately for the fractions trade wastes, special wastes and radioactive wastes. Since waste handling is modelled within the system boundaries, the amounts shown refer to the deposited wastes. A portion of the waste indicated is generated during the manufacture of the pre-products.

The models for impact assessment were applied as described in DIN EN 15804-A2.

The following waste categories and indicators for output closures are presented in the EPD:

- Disposed hazardous waste (HWD)
- Non-hazardous waste disposed (NHWD)
- Radioactive waste disposed (RWD)
- Components for re-use (CRU)
- Materials for recycling (MFR)
- Materials for energy recovery (MER)
- Exported electrical energy (EEE)
- Exported thermal energy (EET)



**Additional environmental impact indicators**

The models for impact assessment were applied as described in DIN EN 15804-A2.

The additional impact categories presented in the EPD are as follows:

- Particulate matter emissions (PM)
- Ionizing radiation, human health (IRP)
- Ecotoxicity – freshwater (ETP-fw)
- Human toxicity, carcinogenic effects (HTP-c)
- Human toxicity, non-carcinogenic effects (HTP-nc)
- Impacts associated with land use/soil quality (SQP)





Results per 1 m<sup>2</sup> Designo R6/R8 double plastic (PG 1)

Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
<b>Core indicators</b>															
<b>GWP-t</b>	kg CO <sub>2</sub> equivalent	129.75	1.38	1.19	0.00	3.48	0.00	2.88	0.00	0.00	0.00	0.15	13.50	0.32	-65.20
<b>GWP-f</b>	kg CO <sub>2</sub> equivalent	128.94	1.38	0.46	0.00	3.45	0.00	2.84	0.00	0.00	0.00	0.15	13.20	0.33	-65.00
<b>GWP-b</b>	kg CO <sub>2</sub> equivalent	-0.13	-1.91E-02	0.73	0.00	1.45E-02	0.00	2.13E-02	0.00	0.00	0.00	-2.13E-03	0.35	-1.09E-02	-0.12
<b>GWP-l</b>	kg CO <sub>2</sub> equivalent	8.94E-02	1.26E-02	1.14E-05	0.00	1.54E-03	0.00	2.51E-03	0.00	0.00	0.00	1.41E-03	6.95E-04	1.02E-03	-1.62E-02
<b>ODP</b>	kg CFC-11-eq.	6.62E-08	1.77E-13	1.77E-13	0.00	7.13E-10	0.00	1.65E-09	0.00	0.00	0.00	1.98E-14	9.57E-12	8.36E-13	-2.17E-10
<b>AP</b>	mol H <sup>+</sup> -eq.	0.62	1.66E-03	2.61E-04	0.00	1.42E-02	0.00	1.34E-02	0.00	0.00	0.00	1.79E-04	4.81E-03	2.33E-03	-0.27
<b>EP-fw</b>	kg P-eq.	2.98E-04	4.98E-06	5.17E-08	0.00	5.73E-06	0.00	7.01E-06	0.00	0.00	0.00	5.55E-07	2.60E-06	6.62E-07	-5.37E-05
<b>EP-m</b>	kg N-eq.	0.12	5.70E-04	9.02E-05	0.00	2.85E-03	0.00	2.61E-03	0.00	0.00	0.00	6.02E-05	1.85E-03	6.02E-04	-5.91E-02
<b>EP-t</b>	mol N-eq.	1.38	6.68E-03	1.19E-03	0.00	3.23E-02	0.00	2.99E-02	0.00	0.00	0.00	7.09E-04	2.24E-02	6.63E-03	-0.67
<b>POCP</b>	kg NMVOC-eq.	0.38	1.46E-03	2.42E-04	1.34E-06	9.03E-03	0.00	8.11E-03	0.00	0.00	0.00	1.56E-04	4.93E-03	1.82E-03	-0.17
<b>ADPF*2</b>	MJ	2181.36	18.60	0.43	0.00	67.50	0.00	43.97	0.00	0.00	0.00	2.07	17.90	4.38	-890.00
<b>ADPE*2</b>	kg Sb equivalent	5.88E-05	8.97E-08	1.60E-09	0.00	1.42E-06	0.00	1.03E-06	0.00	0.00	0.00	1.00E-08	8.80E-08	1.52E-08	-2.88E-05
<b>WDP*2</b>	m <sup>3</sup> world-eq. deprived	13.36	1.65E-02	0.13	0.00	0.38	0.00	0.34	0.00	0.00	0.00	1.84E-03	1.34	3.61E-02	-3.39
<b>Resource management</b>															
<b>PERE</b>	MJ	367.38	1.35	5.48	0.00	6.58	0.00	8.84	0.00	0.00	0.00	0.15	33.21	22.98	-133.00
<b>PERM</b>	MJ	55.27	0.00	-5.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-27.62	-22.27	0.00
<b>PERT</b>	MJ	422.65	1.35	0.10	0.00	6.58	0.00	8.84	0.00	0.00	0.00	0.15	5.59	0.71	-133.00
<b>PENRE</b>	MJ	1920.87	18.60	267.30	0.00	67.75	0.00	44.22	0.00	0.00	0.00	2.08	19.89	5.98	-891.00
<b>PENRM</b>	MJ	270.47	0.00	-266.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-1.99	-1.60	0.00
<b>PENRT</b>	MJ	2191.34	18.60	0.43	0.00	67.75	0.00	44.22	0.00	0.00	0.00	2.08	17.90	4.38	-891.00
<b>SM</b>	kg	2.70	0.00	0.00	0.00	2.38E-02	0.00	6.75E-02	0.00	0.00	0.00	0.00	0.00	0.00	-0.21
<b>RSF</b>	MJ	0.00	0.00	0.00	0.00	5.58E-22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-5.07E-21
<b>NRSF</b>	MJ	0.00	0.00	0.00	0.00	6.53E-21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-5.96E-20
<b>FW</b>	m <sup>3</sup>	0.67	1.48E-03	3.18E-03	0.00	1.80E-02	0.00	1.53E-02	0.00	0.00	0.00	1.65E-04	3.32E-02	1.11E-03	-0.21
<b>Categories of waste</b>															
<b>HWD</b>	kg	1.20E-05	5.77E-11	9.04E-12	0.00	2.90E-08	0.00	-4.15E-06	0.00	0.00	0.00	6.43E-12	-1.63E-10	9.54E-11	-1.78E-04
<b>NHWD</b>	kg	30.78	2.84E-03	6.33E-02	0.00	0.71	0.00	1.36	0.00	0.00	0.00	3.17E-04	3.77	21.90	-9.93
<b>RWD</b>	kg	9.95E-02	3.49E-05	1.95E-05	0.00	2.01E-03	0.00	2.08E-03	0.00	0.00	0.00	3.89E-06	9.30E-04	4.98E-05	-2.65E-02
<b>Output material flows</b>															
<b>CRU</b>	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>MFR</b>	kg	3.50	0.00	0.00	0.00	0.91	0.00	0.60	0.00	0.00	0.00	0.00	20.60	0.00	0.00
<b>MER</b>	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>EEE</b>	MJ	1.00	0.00	1.93	0.00	0.13	0.00	0.56	0.00	0.00	0.00	0.00	19.60	0.00	0.00
<b>EET</b>	MJ	2.34	0.00	3.48	0.00	0.23	0.00	1.03	0.00	0.00	0.00	0.00	35.50	0.00	0.00

**Key:**

**GWP-t** – Global warming potential – total      **GWP-f** – global warming potential fossil fuels      **GWP-b** – global warming potential - biogenic      **GWP-l** – global warming potential - land use and land use change      **ODP** – ozone depletion potential      **AP** - acidification potential      **EP-fw** - eutrophication potential - aquatic freshwater      **EP-m** - eutrophication potential - aquatic marine      **EP-t** - eutrophication potential - terrestrial      **POCP** - photochemical ozone formation potential      **ADPF\*2** - abiotic depletion potential – fossil resources      **ADPE\*2** - abiotic depletion potential – minerals&metals      **WDP\*2** – Water (user) deprivation potential      **PERE** - Use of renewable primary energy      **PERM** - use of renewable primary energy resources      **PERT** - total use of renewable primary energy resources      **PENRE** - use of non-renewable primary energy      **PENRM** - use of non-renewable primary energy resources      **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      **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

 <b>Results per 1 m<sup>2</sup> Designo R6/R8 double plastic (PG 1)</b>																
Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D	
<b>Additional environmental impact indicators</b>																
<b>PM</b>	Disease incidence	5.94E-06	1.18E-08	1.80E-09	0.00	1.35E-07	0.00	1.22E-07	0.00	0.00	0.00	1.30E-09	5.56E-08	2.87E-08	-2.88E-06	
<b>IRP*1</b>	kBq U235-eq.	15.78	5.20E-03	2.95E-03	0.00	0.33	0.00	0.33	0.00	0.00	0.00	5.80E-04	0.10	5.75E-03	-4.13	
<b>ETP-fw*2</b>	CTUe	2269.43	13.20	0.23	1.16E-05	49.00	0.00	52.88	0.00	0.00	0.00	1.47	10.60	2.39	-606.00	
<b>HTP-c*2</b>	CTUh	3.04E-07	2.70E-10	1.29E-11	0.00	7.55E-09	0.00	5.07E-09	0.00	0.00	0.00	3.01E-11	4.61E-10	3.68E-10	-2.60E-07	
<b>HTP-nc*2</b>	CTUh	2.30E-06	1.44E-08	8.99E-10	8.35E-14	5.85E-08	0.00	5.11E-08	0.00	0.00	0.00	1.60E-09	3.76E-08	4.04E-08	-7.11E-07	
<b>SQP*2</b>	dimensionless	505.47	7.76	0.12	0.00	5.53	0.00	12.09	0.00	0.00	0.00	0.87	4.62	1.06	-62.40	

**Key:**  
**PM** – particulate matter emissions potential    **IRP\*1** – ionizing radiation potential – human health effects    **ETP-fw\*2** - Ecotoxicity potential – freshwater    **HTP-c\*2** - Human toxicity potential – cancer effects    **HTP-nc\*2** - Human toxicity potential – non-cancer effects    **SQP\*2** – soil quality potential

**Disclaimers:**  
 \*1 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 nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.  
 \*2 The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.

**Table 7** Overall results table Designo double plastic (PG 1)



Results per 1 m<sup>2</sup> Designo R6/R8 triple plastic (PG 2)

Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
<b>Core indicators</b>															
<b>GWP-t</b>	kg CO <sub>2</sub> equivalent	137.32	1.58	1.91	0.00	3.58	0.00	2.99	0.00	0.00	0.00	0.17	13.30	0.37	-72.40
<b>GWP-f</b>	kg CO <sub>2</sub> equivalent	138.02	1.59	0.73	0.00	3.58	0.00	2.97	0.00	0.00	0.00	0.17	12.90	0.39	-72.20
<b>GWP-b</b>	kg CO <sub>2</sub> equivalent	-0.22	-2.19E-02	1.18	0.00	1.46E-02	0.00	3.02E-02	0.00	0.00	0.00	-2.38E-03	0.35	-1.28E-02	-0.13
<b>GWP-l</b>	kg CO <sub>2</sub> equivalent	9.53E-02	1.45E-02	1.84E-05	0.00	1.60E-03	0.00	2.71E-03	0.00	0.00	0.00	1.57E-03	6.57E-04	1.20E-03	-1.86E-02
<b>ODP</b>	kg CFC-11-eq.	1.02E-07	2.03E-13	2.86E-13	0.00	6.88E-10	0.00	2.55E-09	0.00	0.00	0.00	2.20E-14	9.23E-12	9.78E-13	-2.24E-10
<b>AP</b>	mol H <sup>+</sup> -eq.	0.70	1.90E-03	4.21E-04	0.00	1.57E-02	0.00	1.50E-02	0.00	0.00	0.00	1.99E-04	4.56E-03	2.73E-03	-0.33
<b>EP-fw</b>	kg P-eq.	3.23E-04	5.71E-06	8.33E-08	0.00	5.80E-06	0.00	7.62E-06	0.00	0.00	0.00	6.19E-07	2.50E-06	7.75E-07	-5.85E-05
<b>EP-m</b>	kg N-eq.	0.14	6.52E-04	1.45E-04	0.00	3.13E-03	0.00	2.92E-03	0.00	0.00	0.00	6.70E-05	1.73E-03	7.05E-04	-7.00E-02
<b>EP-t</b>	mol N-eq.	1.55	7.65E-03	1.92E-03	0.00	3.58E-02	0.00	3.32E-02	0.00	0.00	0.00	7.90E-04	2.11E-02	7.76E-03	-0.79
<b>POCP</b>	kg NMVOC-eq.	0.42	1.67E-03	3.90E-04	1.34E-06	9.80E-03	0.00	8.91E-03	0.00	0.00	0.00	1.74E-04	4.62E-03	2.13E-03	-0.20
<b>ADPF*2</b>	MJ	2290.70	21.30	0.70	0.00	69.50	0.00	45.41	0.00	0.00	0.00	2.31	17.10	5.12	-997.00
<b>ADPE*2</b>	kg Sb equivalent	7.09E-05	1.03E-07	2.57E-09	0.00	1.71E-06	0.00	1.29E-06	0.00	0.00	0.00	1.11E-08	8.50E-08	1.77E-08	-3.20E-05
<b>WDP*2</b>	m <sup>3</sup> world-eq. deprived	14.59	1.89E-02	0.22	0.00	0.39	0.00	0.37	0.00	0.00	0.00	2.04E-03	1.32	4.22E-02	-3.98
<b>Resource management</b>															
<b>PERE</b>	MJ	384.01	1.55	5.57	0.00	6.58	0.00	9.65	0.00	0.00	0.00	0.17	48.09	38.52	-149.00
<b>PERM</b>	MJ	85.76	0.00	-5.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-42.67	-37.69	0.00
<b>PERT</b>	MJ	469.77	1.55	0.17	0.00	6.58	0.00	9.65	0.00	0.00	0.00	0.17	5.42	0.84	-149.00
<b>PENRE</b>	MJ	2038.57	21.30	257.03	0.00	69.50	0.00	45.66	0.00	0.00	0.00	2.31	20.17	7.85	-999.00
<b>PENRM</b>	MJ	262.13	0.00	-256.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-3.07	-2.72	0.00
<b>PENRT</b>	MJ	2300.70	21.30	0.70	0.00	69.50	0.00	45.66	0.00	0.00	0.00	2.31	17.10	5.13	-999.00
<b>SM</b>	kg	3.96	0.00	0.00	0.00	2.80E-02	0.00	9.90E-02	0.00	0.00	0.00	0.00	0.00	0.00	-0.33
<b>RSF</b>	MJ	0.00	0.00	0.00	0.00	6.58E-22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-7.77E-21
<b>NRSF</b>	MJ	0.00	0.00	0.00	0.00	7.73E-21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-9.12E-20
<b>FW</b>	m <sup>3</sup>	0.73	1.69E-03	5.12E-03	0.00	1.83E-02	0.00	1.62E-02	0.00	0.00	0.00	1.84E-04	3.25E-02	1.29E-03	-0.25
<b>Categories of waste</b>															
<b>HWD</b>	kg	1.14E-05	6.61E-11	1.46E-11	0.00	3.23E-08	0.00	-4.24E-06	0.00	0.00	0.00	7.16E-12	-1.71E-10	1.12E-10	-1.82E-04
<b>NHWD</b>	kg	36.64	3.25E-03	0.10	0.00	0.82	0.00	1.58	0.00	0.00	0.00	3.53E-04	3.56	25.60	-13.70
<b>RWD</b>	kg	0.10	3.99E-05	3.15E-05	0.00	1.97E-03	0.00	2.06E-03	0.00	0.00	0.00	4.33E-06	9.10E-04	5.83E-05	-3.04E-02
<b>Output material flows</b>															
<b>CRU</b>	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>MFR</b>	kg	4.44	0.00	0.00	0.00	1.03	0.00	0.68	0.00	0.00	0.00	0.00	22.70	0.00	0.00
<b>MER</b>	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>EEE</b>	MJ	1.61	0.00	3.11	0.00	0.13	0.00	0.60	0.00	0.00	0.00	0.00	19.40	0.00	0.00
<b>EET</b>	MJ	3.77	0.00	5.61	0.00	0.24	0.00	1.11	0.00	0.00	0.00	0.00	35.10	0.00	0.00

**Key:**

**GWP-t** – Global warming potential – total      **GWP-f** – global warming potential fossil fuels      **GWP-b** – global warming potential - biogenic      **GWP-l** – global warming potential - land use and land use change      **ODP** – ozone depletion potential      **AP** - acidification potential      **EP-fw** - eutrophication potential - aquatic freshwater      **EP-m** - eutrophication potential - aquatic marine      **EP-t** - feutrophication potential - terrestrial      **POCP** - photochemical ozone formation potential      **ADPF\*2** - abiotic depletion potential – fossil resources      **ADPE\*2** - abiotic depletion potential – minerals&metals      **WDP\*2** – Water (user) deprivation potential      **PERE** - Use of renewable primary energy      **PERM** - use of renewable primary energy resources      **PERT** - total use of renewable primary energy resources      **PENRE** - use of non-renewable primary energy      **PENRM** - use of non-renewable primary energy resources      **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      **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

 <b>Results per 1 m<sup>2</sup> Designo R6/R8 triple plastic (PG 2)</b>																
Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D	
<b>Additional environmental impact indicators</b>																
<b>PM</b>	Disease incidence	6.74E-06	1.35E-08	2.90E-09	0.00	1.48E-07	0.00	1.39E-07	0.00	0.00	0.00	1.44E-09	5.29E-08	3.36E-08	-3.41E-06	
<b>IRP*1</b>	kBq U235-eq.	16.23	5.96E-03	4.76E-03	0.00	0.32	0.00	0.32	0.00	0.00	0.00	6.46E-04	9.82E-02	6.73E-03	-4.92	
<b>ETP-fw*2</b>	CTUe	2384.17	15.10	0.37	1.16E-05	54.00	0.00	55.13	0.00	0.00	0.00	1.64	10.10	2.79	-767.00	
<b>HTP-c*2</b>	CTUh	3.48E-07	3.09E-10	2.08E-11	0.00	8.60E-09	0.00	5.75E-09	0.00	0.00	0.00	3.35E-11	4.41E-10	4.30E-10	-3.01E-07	
<b>HTP-nc*2</b>	CTUh	2.60E-06	1.65E-08	1.45E-09	8.35E-14	6.68E-08	0.00	5.77E-08	0.00	0.00	0.00	1.79E-09	3.56E-08	4.73E-08	-7.83E-07	
<b>SQP*2</b>	dimensionless	609.36	8.88	0.19	0.00	5.88	0.00	14.66	0.00	0.00	0.00	0.96	4.46	1.24	-66.30	

**Key:**  
**PM** – particulate matter emissions potential    **IRP\*1** – ionizing radiation potential – human health effects    **ETP-fw\*2** - Ecotoxicity potential – freshwater    **HTP-c\*2** - Human toxicity potential – cancer effects    **HTP-nc\*2** - Human toxicity potential – non-cancer effects    **SQP\*2** – soil quality potential

**Disclaimers:**  
 \*1 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 nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.  
 \*2 The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.

**Table 8** Overall results table Designo triple plastic (PG 2)



Results per 1 m<sup>2</sup> Designo R6/R8 Acoustic Plastic (PG 3)

Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D	
<b>Core indicators</b>																
<b>GWP-t</b>	kg CO <sub>2</sub> equivalent	230.49	2.52	10.40	0.00	4.83	0.00	5.57	0.00	0.00	0.00	0.21	17.50	0.50	-80.30	
<b>GWP-f</b>	kg CO <sub>2</sub> equivalent	230.48	2.54	3.98	0.00	4.80	0.00	5.41	0.00	0.00	0.00	0.21	17.40	0.51	-80.20	
<b>GWP-b</b>	kg CO <sub>2</sub> equivalent	-0.12	-3.51E-02	6.40	0.00	2.34E-02	0.00	0.16	0.00	0.00	0.00	-2.92E-03	8.91E-02	-1.69E-02	-0.17	
<b>GWP-l</b>	kg CO <sub>2</sub> equivalent	0.19	2.31E-02	9.97E-05	0.00	2.90E-03	0.00	5.22E-03	0.00	0.00	0.00	1.92E-03	6.48E-04	1.58E-03	-1.75E-02	
<b>ODP</b>	kg CFC-11-eq.	1.60E-07	3.25E-13	1.55E-12	0.00	1.75E-09	0.00	3.99E-09	0.00	0.00	0.00	2.70E-14	9.26E-12	1.30E-12	-2.76E-10	
<b>AP</b>	mol H <sup>+</sup> -eq.	1.22	3.04E-03	2.28E-03	0.00	2.40E-02	0.00	2.79E-02	0.00	0.00	0.00	2.45E-04	4.45E-03	3.62E-03	-0.34	
<b>EP-fw</b>	kg P-eq.	8.36E-04	9.12E-06	4.51E-07	0.00	1.01E-05	0.00	2.04E-05	0.00	0.00	0.00	7.60E-07	2.51E-06	1.03E-06	-6.73E-05	
<b>EP-m</b>	kg N-eq.	0.24	1.04E-03	7.87E-04	0.00	4.63E-03	0.00	5.36E-03	0.00	0.00	0.00	8.23E-05	1.56E-03	9.34E-04	-8.05E-02	
<b>EP-t</b>	mol N-eq.	2.68	1.22E-02	1.04E-02	0.00	5.28E-02	0.00	6.08E-02	0.00	0.00	0.00	9.69E-04	2.02E-02	1.03E-02	-0.91	
<b>POCP</b>	kg NMVOC-eq.	0.70	2.67E-03	2.11E-03	1.34E-06	1.40E-02	0.00	1.58E-02	0.00	0.00	0.00	2.13E-04	4.23E-03	2.82E-03	-0.21	
<b>ADPF*2</b>	MJ	3961.90	34.00	3.77	0.00	92.25	0.00	85.81	0.00	0.00	0.00	2.83	17.20	6.79	-1130.00	
<b>ADPE*2</b>	kg Sb equivalent	9.37E-05	1.64E-07	1.40E-08	0.00	2.02E-06	0.00	1.83E-06	0.00	0.00	0.00	1.37E-08	8.54E-08	2.35E-08	-3.51E-05	
<b>WDP*2</b>	m <sup>3</sup> world-eq. deprived	29.76	3.02E-02	1.17	0.00	0.62	0.00	0.77	0.00	0.00	0.00	2.51E-03	1.67	5.60E-02	-4.39	
<b>Resource management</b>																
<b>PERE</b>	MJ	702.51	2.47	2.23	0.00	12.05	0.00	25.91	0.00	0.00	0.00	0.21	220.51	221.66	-181.00	
<b>PERM</b>	MJ	436.92	0.00	-1.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-215.05	-220.55	0.00	
<b>PERT</b>	MJ	1139.43	2.47	0.91	0.00	12.05	0.00	25.91	0.00	0.00	0.00	0.21	5.46	1.11	-181.00	
<b>PENRE</b>	MJ	3647.33	34.10	296.86	0.00	92.25	0.00	86.06	0.00	0.00	0.00	2.84	32.70	22.68	-1130.00	
<b>PENRM</b>	MJ	324.47	0.00	-293.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-15.50	-15.89	0.00	
<b>PENRT</b>	MJ	3971.80	34.10	3.78	0.00	92.25	0.00	86.06	0.00	0.00	0.00	2.84	17.20	6.79	-1130.00	
<b>SM</b>	kg	13.90	0.00	0.00	0.00	4.43E-02	0.00	0.35	0.00	0.00	0.00	0.00	0.00	0.00	-0.18	
<b>RSF</b>	MJ	0.00	0.00	0.00	0.00	1.03E-21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-4.30E-21	
<b>NRSF</b>	MJ	0.00	0.00	0.00	0.00	1.21E-20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-5.05E-20	
<b>FW</b>	m <sup>3</sup>	1.34	2.71E-03	2.78E-02	0.00	2.70E-02	0.00	3.22E-02	0.00	0.00	0.00	2.26E-04	4.07E-02	1.71E-03	-0.25	
<b>Categories of waste</b>																
<b>HWD</b>	kg	1.11E-05	1.06E-10	7.89E-11	0.00	5.33E-08	0.00	-4.00E-06	0.00	0.00	0.00	8.80E-12	-1.80E-10	1.48E-10	-1.71E-04	
<b>NHWD</b>	kg	62.46	5.20E-03	0.55	0.00	1.24	0.00	2.45	0.00	0.00	0.00	4.33E-04	3.51	34.00	-10.90	
<b>RWD</b>	kg	0.26	6.39E-05	1.71E-04	0.00	4.43E-03	0.00	5.82E-03	0.00	0.00	0.00	5.32E-06	9.30E-04	7.73E-05	-3.80E-02	
<b>Output material flows</b>																
<b>CRU</b>	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
<b>MFR</b>	kg	19.39	0.00	0.00	0.00	1.39	0.00	1.12	0.00	0.00	0.00	0.00	25.50	0.00	0.00	
<b>MER</b>	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
<b>EEE</b>	MJ	8.72	0.00	16.90	0.00	0.13	0.00	1.33	0.00	0.00	0.00	0.00	27.40	0.00	0.00	
<b>EET</b>	MJ	20.40	0.00	30.40	0.00	0.23	0.00	2.50	0.00	0.00	0.00	0.00	49.30	0.00	0.00	

**Key:**

**GWP-t** – Global warming potential – total      **GWP-f** – global warming potential fossil fuels      **GWP-b** – global warming potential - biogenic      **GWP-l** – global warming potential - land use and land use change      **ODP** – ozone depletion potential      **AP** - acidification potential      **EP-fw** - eutrophication potential - aquatic freshwater      **EP-m** - eutrophication potential - aquatic marine      **EP-t** - eutrophication potential - terrestrial      **POCP** - photochemical ozone formation potential      **ADPF\*2** - abiotic depletion potential – fossil resources      **ADPE\*2** - abiotic depletion potential – minerals&metals      **WDP\*2** – Water (user) deprivation potential      **PERE** - Use of renewable primary energy      **PERM** - use of renewable primary energy resources      **PERT** - total use of renewable primary energy resources      **PENRE** - use of non-renewable primary energy      **PENRM** - use of non-renewable primary energy resources      **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      **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

 <b>Results per 1 m<sup>2</sup> Designo R6/R8 Acoustic Plastic (PG 3)</b>															
Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
<b>Additional environmental impact indicators</b>															
<b>PM</b>	Disease incidence	1.14E-05	2.16E-08	1.57E-08	0.00	2.21E-07	0.00	2.56E-07	0.00	0.00	0.00	1.77E-09	5.36E-08	4.45E-08	-3.29E-06
<b>IRP*1</b>	kBq U235-eq.	39.59	9.52E-03	2.58E-02	0.00	0.72	0.00	0.90	0.00	0.00	0.00	7.93E-04	0.10	8.92E-03	-5.66
<b>ETP-fw*2</b>	CTUe	4329.60	24.10	2.01	1.16E-05	80.00	0.00	103.16	0.00	0.00	0.00	2.01	10.10	3.70	-790.00
<b>HTP-c*2</b>	CTUh	4.27E-07	4.94E-10	1.13E-10	0.00	1.01E-08	0.00	7.25E-09	0.00	0.00	0.00	4.11E-11	4.56E-10	5.70E-10	-3.43E-07
<b>HTP-nc*2</b>	CTUh	3.29E-06	2.64E-08	7.86E-09	8.35E-14	7.05E-08	0.00	7.54E-08	0.00	0.00	0.00	2.19E-09	3.54E-08	6.27E-08	-8.41E-07
<b>SQP*2</b>	dimensionless	1814.90	14.20	1.01	0.00	10.18	0.00	44.51	0.00	0.00	0.00	1.18	4.55	1.65	-92.00

**Key:**  
**PM** – particulate matter emissions potential    **IRP\*1** – ionizing radiation potential – human health effects    **ETP-fw\*2** - Ecotoxicity potential – freshwater    **HTP-c\*2** - Human toxicity potential – cancer effects    **HTP-nc\*2** - Human toxicity potential – non-cancer effects    **SQP\*2** – soil quality potential

**Disclaimers:**  
 \*1 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 nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.  
 \*2 The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.

**Table 9** Overall results table Designo acoustic plastic (PG 3)

Addition: Overall results table for drive units and (electrical) components for (optional) drive-controlled window variants with designation code E\_, EF, SF:



Results for drive units and (electrical) components used per 1 m<sup>2</sup> Windows of the model series R6/R8

Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D	
<b>Core indicators</b>																
<b>GWP-t</b>	kg CO <sub>2</sub> equivalent	16.22	7.28E-02	0.00	0.00	6.08E-03	0.00	0.27	0.00	0.38	0.00	0.00	8.65E-03	0.81	1.29E-02	-6.36
<b>GWP-f</b>	kg CO <sub>2</sub> equivalent	16.22	7.31E-02	0.00	0.00	6.98E-03	0.00	0.27	0.00	0.37	0.00	0.00	8.69E-03	0.80	1.33E-02	-6.36
<b>GWP-b</b>	kg CO <sub>2</sub> equivalent	1.40E-02	-1.01E-03	0.00	0.00	-9.25E-04	0.00	2.95E-04	0.00	3.95E-03	0.00	0.00	-1.20E-04	9.42E-03	-4.40E-04	1.22E-02
<b>GWP-l</b>	kg CO <sub>2</sub> equivalent	2.56E-02	6.67E-04	0.00	0.00	4.93E-06	0.00	4.22E-04	0.00	4.18E-05	0.00	0.00	7.93E-05	2.08E-05	4.12E-05	-9.67E-03
<b>ODP</b>	kg CFC-11-eq.	1.96E-09	9.36E-15	0.00	0.00	3.78E-11	0.00	2.99E-11	0.00	7.70E-12	0.00	0.00	1.11E-15	3.25E-12	3.37E-14	-1.67E-09
<b>AP</b>	mol H <sup>+</sup> -eq.	8.44E-02	8.77E-05	0.00	0.00	2.50E-05	0.00	1.31E-03	0.00	1.18E-03	0.00	0.00	1.01E-05	6.75E-04	9.40E-05	-3.34E-02
<b>EP-fw</b>	kg P-eq.	2.11	2.63E-07	0.00	0.00	4.58E-02	0.00	3.21E-02	0.00	1.58E-06	0.00	0.00	3.13E-08	6.74E-07	2.67E-08	-1.92
<b>EP-m</b>	kg N-eq.	1.18E-02	3.01E-05	0.00	0.00	4.55E-06	0.00	1.88E-04	0.00	2.04E-04	0.00	0.00	3.39E-06	1.43E-04	2.43E-05	-4.64E-03
<b>EP-t</b>	mol N-eq.	0.12	3.53E-04	0.00	0.00	4.85E-05	0.00	1.96E-03	0.00	2.14E-03	0.00	0.00	4.00E-05	1.79E-03	2.67E-04	-4.85E-02
<b>POCP</b>	kg NMVOC-eq.	3.71E-02	7.69E-05	0.00	0.00	1.35E-05	0.00	5.94E-04	0.00	5.60E-04	0.00	0.00	8.79E-06	3.83E-04	7.33E-05	-1.42E-02
<b>ADPF*2</b>	MJ	218.65	0.98	0.00	0.00	0.11	0.00	3.58	0.00	7.85	0.00	0.00	0.12	3.38	0.18	-82.60
<b>ADPE*2</b>	kg Sb equivalent	1.89E-03	4.74E-09	0.00	0.00	6.53E-07	0.00	2.84E-05	0.00	7.60E-08	0.00	0.00	5.64E-10	3.18E-08	6.11E-10	-7.70E-04
<b>WDP*2</b>	m <sup>3</sup> world-eq. deprived	4.93	8.70E-04	0.00	0.00	6.00E-06	0.00	8.50E-02	0.00	7.20E-02	0.00	0.00	1.03E-04	9.65E-02	1.45E-03	-1.63
<b>Resource management</b>																
<b>PERE</b>	MJ	56.19	7.14E-02	0.00	0.00	3.30E-02	0.00	0.92	0.00	5.40	0.00	0.00	8.49E-03	2.34	5.86E-02	-22.80
<b>PERM</b>	MJ	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-8.97E-02	-2.99E-02	0.00
<b>PERT</b>	MJ	56.31	7.14E-02	0.00	0.00	3.30E-02	0.00	0.92	0.00	5.40	0.00	0.00	8.49E-03	2.25	2.87E-02	-22.80
<b>PENRE</b>	MJ	210.94	0.98	0.00	0.00	0.11	0.00	3.58	0.00	7.85	0.00	0.00	0.12	9.17	2.11	-82.60
<b>PENRM</b>	MJ	7.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-5.79	-1.93	0.00
<b>PENRT</b>	MJ	218.66	0.98	0.00	0.00	0.11	0.00	3.58	0.00	7.85	0.00	0.00	0.12	3.38	0.18	-82.60
<b>SM</b>	kg	0.12	0.00	0.00	0.00	0.00	0.00	2.95E-03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>RSF</b>	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>NRSF</b>	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>FW</b>	m <sup>3</sup>	0.14	7.81E-05	0.00	0.00	2.11E-07	0.00	2.36E-03	0.00	2.38E-03	0.00	0.00	9.30E-06	2.55E-03	4.46E-05	-4.42E-02
<b>Categories of waste</b>																
<b>HWD</b>	kg	1.53E-05	3.05E-12	0.00	0.00	1.53E-10	0.00	2.37E-07	0.00	-7.40E-10	0.00	0.00	3.63E-13	-2.99E-10	3.84E-12	-5.81E-06
<b>NHWD</b>	kg	1.54	1.50E-04	0.00	0.00	4.28E-03	0.00	4.58E-02	0.00	7.08E-03	0.00	0.00	1.78E-05	1.70E-02	0.88	-0.63
<b>RWD</b>	kg	5.76E-03	1.84E-06	0.00	0.00	6.18E-06	0.00	9.14E-05	0.00	1.24E-03	0.00	0.00	2.19E-07	5.09E-04	2.01E-06	-2.77E-03
<b>Output material flows</b>																
<b>CRU</b>	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>MFR</b>	kg	9.27E-03	0.00	0.00	0.00	2.17E-02	0.00	3.99E-02	0.00	0.00	0.00	0.00	0.00	1.59	0.00	-8.46E-03
<b>MER</b>	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>EEE</b>	MJ	0.00	0.00	0.00	0.00	0.00	0.00	2.75E-02	0.00	0.00	0.00	0.00	0.00	1.10	0.00	0.00
<b>EET</b>	MJ	0.00	0.00	0.00	0.00	0.00	0.00	6.30E-02	0.00	0.00	0.00	0.00	0.00	2.52	0.00	0.00

**Key:**

**GWP-t** – Global warming potential – total    **GWP-f** – global warming potential fossil fuels    **GWP-b** – global warming potential - biogenic    **GWP-l** – global warming potential - land use and land use change    **ODP** – ozone depletion potential    **AP** - acidification potential    **EP-fw** - eutrophication potential - aquatic freshwater    **EP-m** - eutrophication potential - aquatic marine    **EP-t** - eutrophication potential - terrestrial    **POCP** - photochemical ozone formation potential    **ADPF\*2** - abiotic depletion potential – fossil resources    **ADPE\*2** - abiotic depletion potential – minerals&metals    **WDP\*2** – Water (user) deprivation potential    **PERE** - Use of renewable primary energy    **PERM** - use of renewable primary energy resources    **PERT** - total use of renewable primary energy resources    **PENRE** - use of non-renewable primary energy    **PENRM** - use of non-renewable primary energy resources    **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    **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

 <b>Results for drive units and (electrical) components used per 1 m<sup>2</sup> Windows of the model series R6/R8</b>																
Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D	
<b>Additional environmental impact indicators</b>																
<b>PM</b>	Disease incidence	8.77E-07	6.24E-10	0.00	0.00	3.60E-10	0.00	1.36E-08	0.00	1.04E-08	0.00	0.00	7.31E-11	5.27E-09	1.16E-09	-3.49E-07
<b>IRP*<sup>1</sup></b>	kBq U235-eq.	0.71	2.75E-04	0.00	0.00	1.05E-03	0.00	1.07E-02	0.00	0.12	0.00	0.00	3.27E-05	4.76E-02	2.33E-04	-0.36
<b>ETP-fw*<sup>2</sup></b>	CTUe	131.19	0.70	0.00	0.00	3.53E-04	0.00	2.21	0.00	3.18	0.00	0.00	8.28E-02	1.36	9.62E-02	-45.20
<b>HTP-c*<sup>2</sup></b>	CTUh	8.24E-08	1.43E-11	0.00	0.00	1.65E-12	0.00	1.15E-09	0.00	1.39E-10	0.00	0.00	1.70E-12	6.36E-11	1.48E-11	-3.66E-08
<b>HTP-nc*<sup>2</sup></b>	CTUh	3.96E-07	7.61E-10	0.00	0.00	6.35E-11	0.00	6.31E-09	0.00	2.93E-09	0.00	0.00	9.04E-11	1.61E-09	1.63E-09	-1.49E-07
<b>SQP*<sup>2</sup></b>	dimensionless	55.29	0.41	0.00	0.00	4.85E-02	0.00	0.91	0.00	3.55	0.00	0.00	4.87E-02	1.50	4.28E-02	-21.90

**Key:**  
**PM** – particulate matter emissions potential    **IRP\*<sup>1</sup>** – ionizing radiation potential – human health effects    **ETP-fw\*<sup>2</sup>** - Ecotoxicity potential – freshwater    **HTP-c\*<sup>2</sup>** - Human toxicity potential – cancer effects    **HTP-nc\*<sup>2</sup>** - Human toxicity potential – non-cancer effects    **SQP\*<sup>2</sup>** – soil quality potential

**Disclaimers:**  
\*<sup>1</sup> 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 nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.  
\*<sup>2</sup> The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.

**Table 10** Overall results table for drive units and (electrical) components across all life cycle phases - model series R6/R8

The results presented serve as an initial orientation for estimating the additional environmental impacts of drive-controlled window variants. The environmental impact of installed drive units is based on M-EPD-AZR-103. Purchased electrical components were recognized exclusively through the cost of materials.

Optional drive units are installed for all window variants with designation code E\_, EF or SF. For these, the values of the determined environmental impacts from Table 10 must be added. Solar and line-operated drive units are installed (see legend under Table 1). The worst case was determined in a preliminary study (for model series R6/R8: drive variant electric radio "EF" in "i8" windows, see background report, Section 3.3.2), so the environmental impacts from Table 10 cover all named drive variants. The drives and other electrical components and other components associated with the drive unit were included in the balance.

#### 6.4 Interpretation, LCA presentation and critical review

##### Evaluation

The environmental impacts of

- Designo R6/R8 double plastic (PG 1)
- Designo R6/R8 triple plastic (PG 2)
- Designo R6/R8 acoustic plastic (PG 3)
- Drive unit R6/R8 (worst case: drive variant electric radio "EF" in "i8" windows)

differ considerably from each other. The differences lie primarily in the varying use of flat and laminated safety glass and the energy used for production. However, the effect of the various pre-products and raw materials used and their different weights should not be neglected, nor should the resulting significant differences in product weight.

In the area of production, the environmental impact of all roof windows results primarily from the use of laminated safety glass (LSG), followed by the use of flat glass and its upstream chains. Further environmental impacts are attributable to the steel used, followed by the use of aluminum in die cast, both of which are incorporated into the hardware. For drive units and (electrical) components in the case of drive-controlled window variants, built-in circuit boards and the copper and aluminum used are particularly important drivers. Here, even small differences in mass result in significant deviations in the environmental impact.

Furthermore, cleaning processes with a glass cleaner containing isopropanol and ethanol during the 50-year use phase are relevant in terms of environmental impact. Other significant values in the utilisation phase come from the repair of worn parts. For all products, this is in particular the replacement of laminated safety glass, followed by flat glass and hardware.

The one-off replacement of windows over a period of 50 years also plays an important role.

In scenario C4, only marginal expenditures for the physical pretreatment and the landfill operation are to be expected.

In the disposal phase, glass recycling (downcycling to container glass) can be credited with around 1% of the life cycle environmental impacts of the core indicators without WDP in scenario D. Approx. 1% is still accounted for by PVC recycling and between 1% and 2% by steel recycling, depending on the product. In addition, a benefit of around 1% is possible for aluminum.

The charts below show the allocation of the main environmental impacts.



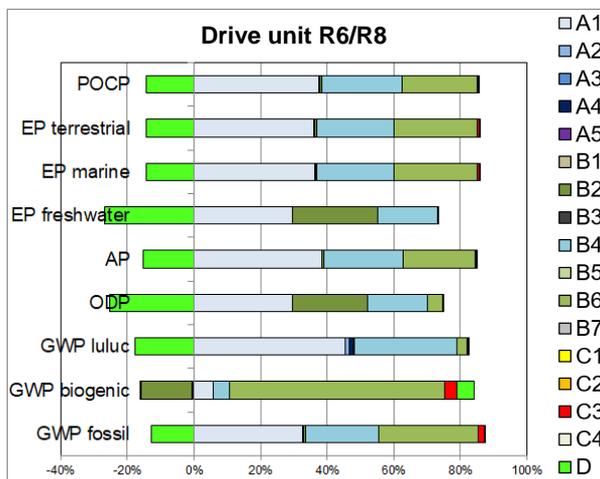
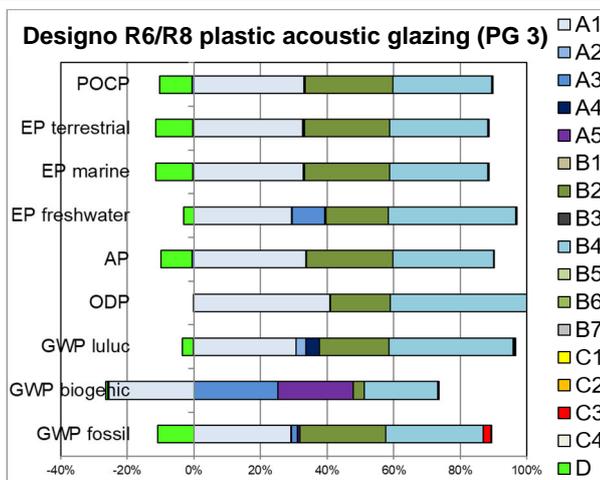


Illustration 4 Percentage of the modules in selected environmental impact indicators

**Report**

The LCA report underlying this EPD was developed according to the requirements of DIN EN ISO 14040 and DIN EN ISO 14044 as well as DIN EN 15804 and DIN EN ISO 14025. It is deposited with ift Rosenheim. The results and conclusions reported to the target group are complete, correct, without bias and transparent. The results of the study are not designed to be used for comparative statements intended for publication.

**Critical review**

The critical review of the LCA and the report took place in the course of verification of the EPD and was carried out by the external verifier Susanne Volz, M.Sc. (Graduate Business Lawyer).



## 7 General information regarding the EPD

### Comparability

This EPD was prepared in accordance with DIN EN 15804 and is therefore only comparable to those EPDs that also comply with the requirements set out in DIN EN 15804.

Any comparison must refer to the building context and the same boundary conditions of the various life cycle stages.

For comparing EPDs of construction products, the rules set out in DIN EN 15804, Clause 5.3, apply.

The detailed individual results of the products were summarised on the basis of conservative assumptions and differ from the average results. Identification of the product groups and the resulting variations are documented in the background report.

### Communication

The communications format of this EPD meets the requirements of EN 15942:2012 and is therefore the basis for B2B communication. Only the nomenclature has been changed according to DIN EN 15804.

### Verification

Verification of the Environmental Product Declaration is documented in accordance with the ift "Richtlinie zur Erstellung von Typ III Umweltproduktdeklarationen" (Guidance on preparing Type III Environmental Product Declarations) in accordance with the requirements set out in DIN EN ISO 14025.

This Declaration is based on the PCR documents "PCR Part A" PCR-A-0.3:2018 and "Windows, flat roof windows, rooflights and light bands" PCR-FE-3.0:2023 as well as EN 17213 „PCR for Windows and Doors."

The European standard EN 15804 serves as the core PCR <sup>a)</sup>
Independent verification of the declaration and statement according to EN ISO 14025:2010
Independent third party verifier: <sup>b)</sup> Susanne Volz
<sup>a)</sup> Product category rules <sup>b)</sup> Optional for business-to-business communication Mandatory for business-to-consumer communication (see EN ISO 14025:2010, 9.4).

### Revisions of this document

No.	Date	Note	Person in charge	Verifier
1	04.12.2023	External verification	Pscherer	Volz
2	15.01.2024	Formal adjustments	Pscherer	-

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## 9 Annex

### Description of life cycle scenarios for Plastic roof window Designo R6/R8

Product stage			Con- struction process stage		Use stage*							End-of-life stage				Benefits and loads beyond system boundaries
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Raw material supply	Transport	production	Transport	Construction/installation process	Use	maintenance	Repair	replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction/demolition	Transport	Waste processing	Disposal	Reuse Recovery Recycling potential
✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

\* For declared B-modules, the calculation of the results is performed taking into account the specified RSL related to one year

**Table 11** Overview of applied life cycle stages

The scenarios were calculated taking into account the defined RSL (see 4 Use stage).

The scenarios were furthermore based on the research project “EPDs for transparent building components” (1) and on EN 17213 (2).

**Note:** The standard scenarios selected are presented in bold type. They were also used for calculating the indicators in the summary table.

- ✓ Included in the LCA
- Not included in the LCA



Product group Roof windows

**A4 Transport to construction site**

No.	Scenario	Description
A4.1	Direct delivery Germany	40 t truck (Euro 0-6 mix), diesel, 27 t payload, full load <sup>1</sup> 180 km and 180 km return journey 25 % load <sup>1</sup> ; total 360 km.
A4.2	Small series via distributors	40 t truck (Euro 0-6 Mix), diesel, 27 t payload, full load <sup>1</sup> 150 km and 150 km return trip empty; 7.5 t truck (Euro 0-6 Mix), diesel, 2.7 t payload, 20 % load <sup>1</sup> , 50 km one way and 50 km return trip empty. A total of 400 km.

<sup>1</sup> Capacity used: utilized loading capacity of the truck

A4 Transport to the construction site <sup>2</sup>	Transport weight [kg/m <sup>2</sup> ]	Net density [kg/m <sup>3</sup> ]	Thickness [mm]
PG 1: Designo R6/R8 plastic double glazing	52.32	205.97	175.82
PG 2: Designo R6/R8 plastic triple glazing	59.91	248.15	175.82
PG 3: Designo R6/R8 plastic acoustic glazing	95.79	313.05	175.82
Drive unit R6/R8	2.76	--	--

<sup>2</sup> The volume utilization factor is not stated due to uncertain determination.

The scenarios were calculated per kg and can be scaled to the product group using the above masses. The values in the overall results table are shown per 1 m<sup>2</sup>.

A4 Transport to construction site	Unit	A4.1	A4.2
<b>Core indicators</b>			
GWP-t	kg CO <sub>2</sub> equivalent	2.63E-02	0.19
GWP-f	kg CO <sub>2</sub> equivalent	2.65E-02	0.19
GWP-b	kg CO <sub>2</sub> equivalent	-3.66E-04	-2.63E-03
GWP-l	kg CO <sub>2</sub> equivalent	2.41E-04	1.74E-03
ODP	kg CFC-11-eq.	3.39E-15	2.44E-14
AP	mol H <sup>+</sup> -eq.	3.17E-05	5.52E-04
EP-fw	kg P-eq.	9.52E-08	6.85E-07
EP-m	kg N-eq.	1.09E-05	2.47E-04
EP-t	mol N-eq.	1.28E-04	2.78E-03
POCP	kg NMVOC-eq.	2.78E-05	5.12E-04
ADPF	MJ	0.36	2.55
ADPE	kg Sb equivalent	1.72E-09	1.23E-08
WDP	m <sup>3</sup> world-eq. deprived	3.15E-04	2.27E-03
<b>Resource management</b>			
PERE	MJ	2.58E-02	0.19
PERM	MJ	0.00	0.00
PERT	MJ	2.58E-02	0.19
PENRE	MJ	0.36	2.56
PENRM	MJ	0.00	0.00
PENRT	MJ	0.36	2.56
SM	kg	0.00	0.00
RSF	MJ	0.00	0.00
NRSF	MJ	0.00	0.00
FW	m <sup>3</sup>	2.83E-05	2.04E-04
<b>Categories of waste</b>			
HWD	kg	1.10E-12	7.94E-12
NHWD	kg	5.43E-05	3.91E-04
RWD	kg	6.67E-07	4.80E-06

Output material flows			
CRU	kg	0.00	0.00
MFR	kg	0.00	0.00
MER	kg	0.00	0.00
EEE	MJ	0.00	0.00
EET	MJ	0.00	0.00
Additional environmental impact indicators			
PM	Disease incidence	2.26E-10	4.11E-09
IRP	kBq U235-eq.	9.94E-05	7.15E-04
ETPfw	CTUe	0.25	1.81
HTPc	CTUh	5.16E-12	3.72E-11
HTPnc	CTUh	2.75E-10	2.16E-09
SQP	dimensionless	0.15	1.07

### A5 Construction/Installation

No.	Scenario	Description
A5	Manual	<b>According to the manufacturer, the elements are installed without mechanical handling. Packaging materials are recycled.</b>

In case of deviating consumption during installation/assembly of the products which forms part of the site management, they are covered at the building level.

Ancillary materials, consumables, use of energy and water, other resource use, material losses, direct emissions as well as waste / output materials during construction / installation are negligible.

It is assumed that the packaging material in the Module construction / installation is sent to waste handling. Waste is only thermally recycled in line with the conservative approach: Benefits from A5 are specified in module D. Benefits from waste incineration: Benefits from waste incineration: electricity replaces electricity mix (RER); thermal energy replaces thermal energy from European natural gas (RER). Transport to the recycling plants is not taken into account.

Since this is a single scenario, the results are shown in the summary table.

### B1 Use

Test reports are available for the evaluation of emissions of volatile organic compounds according to ISO 16000. The following additional information is part of the life cycle assessment. The values result from a test over 28 days.

No.	Scenario	Description
B1	Normal intended use	<b>Release of substances (indoors or outdoors) into the indoor air. VOC emissions [<math>\mu\text{g}/\text{m}^3</math> (TVOC)]: 102.9</b>

Emissions to soil and water cannot be quantified. See EN 15804 Clause 5.4.4 and Clause 6.3.5.4.2. There are no horizontal standards with harmonized test methods.

Since this is a single scenario, the results are shown in the summary table. There, the results were related to one year, taking into account the reference service life.

**B2 Cleaning, maintenance and repair**

**B2.1 Cleaning**

No.	Scenario	Description
B2.1	Rarely, manual	Height of less than 2.5 m or industrial climber, manually using suitable cleaning agents and, if necessary, an (extension) pole; annually. (2) 2.5 l consumed per m <sup>2</sup> and cleaning (125 l / 50 yr). (1)

Ancillary materials, consumables, use of energy and water, material losses and waste as well as transport distances during cleaning are negligible.

Since this is a single scenario, the results are shown in the summary table. There, the results were related to one year, taking into account the reference service life.

**B2.2 Maintenance and repair**

No.	Scenario	Description
B2.2	Lubrication: <b>Low utilisation (e.g. residential construction)</b>	<b>Biennially: Functional test, visual inspection, lubrication/greasing of the building hardware, checking for damage and carrying out maintenance work* if necessary. (2)</b> <b>0.125 kg lubricant per 50 years. (1)</b>
	Replacement of worn parts: <b>Normal use and heavy use</b>	<b>According to BBSR table: One-time replacement*: Hardware, glazing, sealing. According to EN 17213: One-time replacement*: Drive units. (2)</b>

\* Assumptions for evaluation of possible environmental impacts; statements made do not constitute any guaranty or warranty of performance.

For updated information refer to the respective instructions for assembly/installation, operation and maintenance from Roto Frank DST Produktions-GmbH.

The service life of the Plastic roof window Designo R6/R8 of company Roto Frank DST Produktions-GmbH is specified as 40 years. For scenario B2, the respective components of the building elements whose useful life is less than the specified RSL are accounted for. The results were based on one year, taking into account the RSL.

It is assumed that the replaced components will be recycled in the maintenance module. Metals and glass into the melt (material recycling), plastics to incineration plants. Drive units are partially recycled, residual materials are sent to landfill (see recycling C3). Benefits from B3 are specified in module D. Benefits from waste incineration: Benefits from waste incineration: electricity replaces electricity mix (RER); thermal energy replaces thermal energy from European natural gas (RER).  
Transport to the recycling plants is not taken into account.

Ancillary materials, consumables, use of energy and water, waste, material losses and transport distances during maintenance are negligible.

Since this is a single scenario, the results are shown in the summary table. The replacement of the drive units is shown in a separate overall results table. There, the results were related to one year, taking into account the reference service life.



**B3 Repair (not relevant)**

No.	Scenario	Description*
B3	Normal use	As the installation location is unknown, the repair of accidental damage according to EN 17213 must not be taken into account.

\* Assumptions for evaluation of possible environmental impacts; statements made do not constitute any guaranty or warranty of performance.

For updated information refer to the relevant manufacturer instructions for assembly/installation, operation and maintenance

Ancillary materials, consumables, use of energy and water, waste, material losses and transport distances during maintenance are negligible.

Since this is a single scenario, the results are shown in the summary table. There, the results were related to one year, taking into account the reference service life.

**B4 Exchange/replacement**

No.	Scenario	Description
B4	Normal, high and exceptional loads	<p><b>One-time replacement after 40 years (RSL)*:</b> The product-specific RSL of 25 years is taken into account for drive units.</p> <p>The environmental impacts of the selected scenario originate from the product, construction and disposal phases. Ancillary materials, consumables, use of energy and water, material losses, waste as well as transport distances are taken into account. <b>(Addition of A modules, C modules and module D)</b></p>

\*Assumptions for evaluation of possible environmental impacts; statements made do not constitute any guaranty or warranty of performance.

The statements made in this EPD are only informative to allow evaluation at the building level.

It is assumed that a one-time replacement will be necessary during the 40-year reference service life for windows according to BBSR table and/or 25-year reference service life for the drive units according to EN 17213 and the 50-year building service life.

For updated information refer to the relevant manufacturer “instructions for assembly/installation, operation and maintenance”.

Since this is a single scenario, the results are shown in the summary table. The replacement of the drive units and (electrical) components is shown in a separate overall results table. Results in the overall results tables were based on one year, taking into account the RSL.

Insofar as no replacement is planned, the selected scenario does not result in any relevant inputs/outputs or environmental impacts. Ancillary materials, consumables, use of energy and water, material losses, waste as well as transport distances are negligible.

**B5 Improvement/modernisation (not relevant)**

According to the manufacturer, the elements are not included in the improvement / modernisation activities for buildings.

For updated information refer to the respective instructions for assembly/installation, operation and maintenance of company Roto Frank DST Produktions-GmbH.

Ancillary materials, consumables, use of energy and water, material losses, waste as well as transport distances during replacement are negligible.

Since this is a single scenario, the results are shown in the summary table. There, the results were related to one year, taking into account the reference service life.

**B6 Operational energy use**

No.	Scenario	Description
B6.1	Manual	No energy consumed when used.
B6.2	Power-operated normal use	For window variants with drive unit, the energy consumption is taken into account as follows: per 40 years: 3.4 Wh/cycle, 1 cycle per day*. 49.07 kWh/RSL electricity (including standby mode) Electricity mix (RER). Worst case assumption via drive unit R6/R8 including all additional electrical system parts (control unit, sensors, buttons, etc.).

\* Frequencies, times of use, number of users, cycles, etc. as specified by the manufacturer

There is no transport consumption for energy use in buildings. Ancillary materials, consumables and water, waste materials and other scenarios are negligible.

In the following table, the results were based on one year, taking into account the RSL.

B6 Operational energy use		Unit	B6.1	B6.2
<b>Core indicators</b>				
GWP-t		kg CO <sub>2</sub> equivalent	0.00	0.38
GWP-f		kg CO <sub>2</sub> equivalent	0.00	0.37
GWP-b		kg CO <sub>2</sub> equivalent	0.00	3.95E-03
GWP-l		kg CO <sub>2</sub> equivalent	0.00	4.18E-05
ODP		kg CFC-11-eq.	0.00	7.70E-12
AP		mol H <sup>+</sup> -eq.	0.00	1.18E-03
EP-fw		kg P-eq.	0.00	1.58E-06
EP-m		kg N-eq.	0.00	2.04E-04
EP-t		mol N-eq.	0.00	2.14E-03
POCP		kg NMVOC-eq.	0.00	5.60E-04
ADPF		MJ	0.00	7.85
ADPE		kg Sb equivalent	0.00	7.60E-08
WDP		m <sup>3</sup> world-eq. deprived	0.00	7.20E-02
<b>Resource management</b>				
PERE		MJ	0.00	5.40
PERM		MJ	0.00	0.00
PERT		MJ	0.00	5.40

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PENRE	MJ	0.00	7.85
PENRM	MJ	0.00	0.00
PENRT	MJ	0.00	7.85
SM	kg	0.00	0.00
RSF	MJ	0.00	0.00
NRSF	MJ	0.00	0.00
FW	m <sup>3</sup>	0.00	2.38E-03
<b>Categories of waste</b>			
HWD	kg	0.00	-7.40E-10
NHWD	kg	0.00	7.08E-03
RWD	kg	0.00	1.24E-03
<b>Output material flows</b>			
CRU	kg	0.00	0.00
MFR	kg	0.00	0.00
MER	kg	0.00	0.00
EEE	MJ	0.00	0.00
EET	MJ	0.00	0.00
<b>Additional environmental impact indicators</b>			
PM	Disease incidence	0.00	1.04E-08
IRP	kBq U235-eq.	0.00	0.12
ETPfw	CTUe	0.00	3.18
HTPc	CTUh	0.00	1.39E-10
HTPnc	CTUh	0.00	2.93E-09
SQP	dimensionless	0.00	3.55

**B7 Operational water use**

No water consumption when used as intended. Water consumption for cleaning is specified in Module B2.1.

There is no transport consumption for water use in buildings. Ancillary materials, consumables, waste materials and other scenarios are negligible.

Since this is a single scenario, the results are shown in the summary table. There, the results were related to one year, taking into account the reference service life.

**C1 Deconstruction**

No.	Scenario	Description
C1.1	Deconstruction (Market situation)	<p>According to EN 17213 (Figure B.2) (2):</p> <p>Plastic roof window (PVC) Designo R6/R8: Deconstruction 75% for non-glass content Deconstruction 30% for glass Remainder to landfill.</p> <p>The worst-case scenario is assumed for drive units: Deconstruction 75% Remainder to landfill.</p> <p>Further deconstruction rates are possible, give adequate reasons.</p>

Product group Roof windows

C1.2	Recycling initiative Dekura and Rewindo	<p>Plastic roof window (PVC) Designo R6/R8: Deconstruction 100% for non-glass content Deconstruction 100% for glass</p> <p>Further deconstruction rates are possible, give adequate reasons.</p>
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No relevant inputs or outputs apply to the scenario selected. The energy consumed for deconstruction is negligible. Any arising consumption is marginal.

In case of deviating consumption the removal of the products forms part of site management and is covered at the building level.

**C2 Transport**

No.	Scenario	Description
C2	Transport	Transport to collection point using 40 t truck (Euro 0-6 Mix), Diesel, 27t payload, 80% capacity used <sup>1</sup> , 50 km. (1)

<sup>1</sup> Capacity used: utilized loading capacity of the truck

C2 Transport to recycling centre <sup>2</sup>	Transport weight [kg/m <sup>2</sup> ]	Thickness [mm]
PG 1: Designo R6/R8 plastic double glazing	49.02	175.82
PG 2: Designo R6/R8 plastic triple glazing	54.61	175.82
PG 3: Designo R6/R8 plastic acoustic glazing	67.04	175.82
Drive unit R6/R8	2.76	--

<sup>2</sup> The volume utilization factor is not stated due to uncertain determination.

Since only one scenario is used, the results are shown in the summary table.

**C3 Waste management**

No.	Scenario	Description
C3.1	Current market situation	<p>Share for recirculation of materials (2) Plastic roof window (PVC) Designo R6/R8:</p> <ul style="list-style-type: none"> <li>• 100% metals in melt</li> <li>• 100% glass in melt</li> <li>• PVC 55% thermal recycling in incineration plants</li> <li>• PVC 45% recycled material</li> <li>• Residual plastics 100% thermal recycling in incineration plants</li> </ul>

		<p><b>Drive units and (electrical) components</b></p> <ul style="list-style-type: none"> <li>• <b>Electrical components (drive unit, circuit board, control unit, sensors, buttons, etc.) 87%</b> (based on waste electrical equipment 87%; UBA, 2018)</li> <li>• <b>100% metals in melt</b></li> <li>• <b>Plastics 100% thermal recycling in incineration plants</b></li> <li>• <b>Wood 100 % thermal recycling in incineration plant</b></li> <li>• <b>Cardboard/paper 100 % thermal recycling in incineration plant</b></li> </ul> <p><b>Remainder to landfill.</b></p>
C3.2	<p>Recycling initiative Dekura and Rewindo (not considered for drive units)</p>	<p>Share for recirculation of materials (2) Plastic roof window Designo R6/R8:</p> <ul style="list-style-type: none"> <li>• 100% metals in melt</li> <li>• 100% glass in melt</li> <li>• PVC 100% recycled material</li> <li>• Residual plastics 100% thermal recycling in incineration plants</li> </ul>

Electricity consumption of recycling plant: 1.8 kWh/product.

As the products are placed on the European market, the disposal scenario is based on average European data sets.

The below table presents the disposal processes and their percentage by mass/weight. The calculation is based on the above mentioned shares in percent related to the declared unit of the product system.

C3 Disposal window variants	Unit	C3.1			C3.2		
		PG 1	PG 2	PG 3	PG 1	PG 2	PG 3
Collection process, collected separately	kg	27.14	29.00	33.10	49.02	54.61	67.04
Collection process, collected as mixed construction waste	kg	21.88	25.61	33.94	0.00	0.00	0.00
Recovery system, for re-use	kg	0.00	0.00	0.00	0.00	0.00	0.00
Recovery system, for recycling	kg	20.63	22.67	25.51	46.05	51.55	62.15
Recovery system, for energy recovery	kg	6.51	6.33	7.59	2.97	3.06	4.89
Disposal	kg	21.88	25.61	33.94	0.00	0.00	0.00

The 100% scenarios differ from the current average recovery (current market situation, in background report C3.1). The evaluation of the 100% scenarios is described in the background report.

Window variants							
C3 Disposal	Unit	C3.1 Market situation			C3.2 Recycling initiative Dekura and Rewindo		
		PG 1	PG 2	PG 3	PG 1	PG 2	PG 3
Core indicators							
<b>GWP-t</b>	kg CO <sub>2</sub> equivalent	14.00	13.30	17.50	6.75	7.09	13.00
<b>GWP-f</b>	kg CO <sub>2</sub> equivalent	13.60	12.90	17.40	6.28	6.63	12.80
<b>GWP-b</b>	kg CO <sub>2</sub> equivalent	0.35	0.35	8.91E-02	0.47	0.47	0.12
<b>GWP-l</b>	kg CO <sub>2</sub> equivalent	6.80E-04	6.57E-04	6.48E-04	6.33E-05	6.25E-05	7.58E-05
<b>ODP</b>	kg CFC-11-eq.	9.57E-12	9.23E-12	9.26E-12	3.72E-12	3.73E-12	4.00E-12

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AP	mol H <sup>+</sup> -eq.	5.62E-03	4.56E-03	4.45E-03	3.76E-03	3.56E-03	3.50E-03
EP-fw	kg P-eq.	2.56E-06	2.50E-06	2.51E-06	9.08E-07	9.04E-07	9.87E-07
EP-m	kg N-eq.	2.27E-03	1.73E-03	1.56E-03	1.62E-03	1.51E-03	1.31E-03
EP-t	mol N-eq.	2.71E-02	2.11E-02	2.02E-02	1.89E-02	1.77E-02	1.69E-02
POCP	kg NMVOC-eq.	6.01E-03	4.62E-03	4.23E-03	4.20E-03	3.92E-03	3.46E-03
ADPF	MJ	18.00	17.10	17.20	4.97	4.95	5.56
ADPE	kg Sb equivalent	8.79E-08	8.50E-08	8.54E-08	3.67E-08	3.67E-08	3.93E-08
WDP	m <sup>3</sup> world-eq. deprived	1.37	1.32	1.67	0.68	0.70	1.20
<b>Resource management</b>							
PERE	MJ	33.21	48.09	220.51	30.18	45.23	217.79
PERM	MJ	-27.62	-42.67	-215.05	-27.62	-42.67	-215.05
PERT	MJ	5.59	5.42	5.46	2.56	2.56	2.74
PENRE	MJ	19.99	20.17	32.70	6.96	8.02	21.06
PENRM	MJ	-1.99	-3.07	-15.50	-1.99	-3.07	-15.50
PENRT	MJ	18.00	17.10	17.20	4.97	4.95	5.56
SM	kg	0.00	0.00	0.00	0.00	0.00	0.00
RSF	MJ	0.00	0.00	0.00	0.00	0.00	0.00
NRSF	MJ	0.00	0.00	0.00	0.00	0.00	0.00
FW	m <sup>3</sup>	3.38E-02	3.25E-02	4.07E-02	1.62E-02	1.68E-02	2.85E-02
<b>Categories of waste</b>							
HWD	kg	-1.29E-10	-1.71E-10	-1.80E-10	0.00	0.00	0.00
NHWD	kg	3.68	3.56	3.51	0.00	0.00	0.00
RWD	kg	9.30E-04	9.10E-04	9.30E-04	0.00	0.00	0.00
<b>Output material flows</b>							
CRU	kg	0.00	0.00	0.00	0.00	0.00	0.00
MFR	kg	20.60	22.70	25.50	46.10	51.50	62.20
MER	kg	0.00	0.00	0.00	0.00	0.00	0.00
EE	MJ	20.60	19.40	27.40	0.00	0.00	0.00
EET	MJ	37.20	35.10	49.30	0.00	0.00	0.00
<b>Additional environmental impact indicators</b>							
PM	Disease incidence	5.63E-08	5.29E-08	5.36E-08	1.69E-08	1.65E-08	1.90E-08
IRP	kBq U235-eq.	0.10	9.82E-02	0.10	5.85E-02	5.88E-02	6.55E-02
ETPfw	CTUe	10.60	10.10	10.10	2.06	2.06	2.41
HTPc	CTUh	4.61E-10	4.41E-10	4.56E-10	1.08E-10	1.09E-10	1.44E-10
HTPnc	CTUh	3.74E-08	3.56E-08	3.54E-08	3.32E-09	3.33E-09	4.45E-09
SQP	dimensionless	4.61	4.46	4.55	1.87	1.88	2.10

For the separate presentation of drive units including electrical components, only the current market situation is shown.

C3 Disposal Drive Unit R6/R8	Unit	C3.1
Collection process, collected separately	kg	2.07
Collection process, collected as mixed construction waste	kg	0.70
Recovery system, for re-use	kg	0.00
Recovery system, for recycling	kg	1.60
Recovery system, for energy recovery	kg	0.29
Disposal	kg	0.88

Since this is a single scenario, the results are shown in the corresponding overall results tables. There, the results were related to one year, taking into account the reference service life.

**C4 Disposal**

No.	Scenario	Description
C4.1	Disposal (Market situation)	The non-recordable amounts and losses within the re-use/recycling chain (C1 and C3) are modelled as “disposed” (RER).
C4.2	Recycling initiative Dekura and Rewindo	The non-recordable amounts and losses within the re-use/recycling chain (C1 and C3) are modelled as “disposed” (RER).

The 100% scenarios differ from the current average recovery shown here (current market situation, in background report C4.1). The evaluation of each scenario is described in the background report.

The consumption in scenario C4 results from physical pre-treatment, waste recycling and management of the disposal site. The benefits obtained here from the substitution of primary material production are allocated to Module D, e.g. electricity and heat from waste incineration.

**Window variants**

C4 Landfill	Unit	C4.1 Market situation			C4.2 Recycling initiative Dekura and Rewindo		
		PG 1	PG 2	PG 3	PG 1	PG 2	PG 3
<b>Core indicators</b>							
GWP-t	kg CO <sub>2</sub> equivalent	0.32	0.37	0.50	0.00	0.00	0.00
GWP-f	kg CO <sub>2</sub> equivalent	0.33	0.39	0.51	0.00	0.00	0.00
GWP-b	kg CO <sub>2</sub> equivalent	-1.09E-02	-1.28E-02	-1.69E-02	0.00	0.00	0.00
GWP-l	kg CO <sub>2</sub> equivalent	1.02E-03	1.20E-03	1.58E-03	0.00	0.00	0.00
ODP	kg CFC-11-eq.	8.36E-13	9.78E-13	1.30E-12	0.00	0.00	0.00
AP	mol H <sup>+</sup> -eq.	2.33E-03	2.73E-03	3.62E-03	0.00	0.00	0.00
EP-fw	kg P-eq.	6.62E-07	7.75E-07	1.03E-06	0.00	0.00	0.00
EP-m	kg N-eq.	6.02E-04	7.05E-04	9.34E-04	0.00	0.00	0.00
EP-t	mol N-eq.	6.63E-03	7.76E-03	1.03E-02	0.00	0.00	0.00
POCP	kg NMVOC-eq.	1.82E-03	2.13E-03	2.82E-03	0.00	0.00	0.00
ADPF	MJ	4.38	5.12	6.79	0.00	0.00	0.00
ADPE	kg Sb equivalent	1.52E-08	1.77E-08	2.35E-08	0.00	0.00	0.00
WDP	m <sup>3</sup> world-eq. deprived	3.61E-02	4.22E-02	5.60E-02	0.00	0.00	0.00
<b>Resource management</b>							
PERE	MJ	22.98	38.52	221.66	22.27	37.69	220.55
PERM	MJ	-22.27	-37.69	-220.55	-22.27	-37.69	-220.55
PERT	MJ	0.71	0.84	1.11	0.00	0.00	0.00
PENRE	MJ	5.98	7.85	22.68	1.60	2.72	15.89
PENRM	MJ	-1.60	-2.72	-15.89	-1.60	-2.72	-15.89
PENRT	MJ	4.38	5.13	6.79	0.00	0.00	0.00
SM	kg	0.00	0.00	0.00	0.00	0.00	0.00
RSF	MJ	0.00	0.00	0.00	0.00	0.00	0.00
NRSF	MJ	0.00	0.00	0.00	0.00	0.00	0.00
FW	m <sup>3</sup>	1.11E-03	1.29E-03	1.71E-03	0.00	0.00	0.00
<b>Categories of waste</b>							
HWD	kg	9.54E-11	1.12E-10	1.48E-10	0.00	0.00	0.00
NHWD	kg	21.90	25.60	34.00	0.00	0.00	0.00
RWD	kg	4.98E-05	5.83E-05	7.73E-05	0.00	0.00	0.00

Output material flows							
CRU	kg	0.00	0.00	0.00	0.00	0.00	0.00
MFR	kg	0.00	0.00	0.00	0.00	0.00	0.00
MER	kg	0.00	0.00	0.00	0.00	0.00	0.00
EE	MJ	0.00	0.00	0.00	0.00	0.00	0.00
EET	MJ	0.00	0.00	0.00	0.00	0.00	0.00
Additional environmental impact indicators							
PM	Disease incidence	2.87E-08	3.36E-08	4.45E-08	0.00	0.00	0.00
IRP	kBq U235-eq.	5.75E-03	6.73E-03	8.92E-03	0.00	0.00	0.00
ETPfw	CTUe	2.39	2.79	3.70	0.00	0.00	0.00
HTPc	CTUh	3.68E-10	4.30E-10	5.70E-10	0.00	0.00	0.00
HTPnc	CTUh	4.04E-08	4.73E-08	6.27E-08	0.00	0.00	0.00
SQP	dimensionless	1.06	1.24	1.65	0.00	0.00	0.00

The 100% scenarios differ from the current average recovery shown here (current market situation, in background report C4.1). The evaluation of each scenario is described in the background report.

The consumption in scenario C4 results from physical pre-treatment, waste recycling and management of the disposal site. The benefits obtained here from the substitution of primary material production are allocated to Module D, e.g. electricity and heat from waste incineration.

For the separate presentation of drive units including electrical components, only the current market situation is shown. Since this is a single scenario, the results are shown in the overall results table. There, the results were related to one year, taking into account the reference service life.

Since this is a single scenario, the results are shown in the summary table.

#### D Benefits and loads from beyond the system boundaries

No.	Scenario	Description
D1	Recycling potential (current market situation)	<p>Aluminum scrap from C3 excluding the scrap used in A3 replaces 60% of Aluminum ingots;                      Steel scrap from C3 excluding the scrap used in A3 replaces 60% of steel;                      Stainless steel scrap from C3 excluding the scrap used in A3 replaces 60% of stainless steel;                      Glass recyclate from C3 excluding the glass shards used in A3 replace 60% of container glass;                      PVC, glass fiber reinforced PVC, PS, PES recyclate from C3 excluding the plastics used in A3 replaces 60% of PVC granules;                      Electrical scrap from C3 excluding the scrap used in A3 replaces 60% of the respective electrical component.</p> <p>Benefits from incineration plant: Benefits from waste incineration: electricity replaces electricity mix (RER); thermal energy replaces thermal energy from European natural gas (RER).</p>
D2	Recycling initiative Dekura and Rewindo	<p>Aluminium recyclate from C3 excluding the recyclate used in A3 replaces 60% of aluminum ingots;                      Steel scrap from C3 excluding the scrap used in A3 replaces 60% of steel;</p>

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Stainless steel scrap from C3 excluding the scrap used in A3 replaces 60% of stainless steel sheet;  
Glass recyclate from C3 excluding the glass shards used in A3 replace 60% of container glass;  
PVC, glass fiber reinforced PVC, PS, PES recyclate from C3 excluding the plastics used in A3 replaces 60% of PVC granules;

Benefits from incineration plant: Benefits from waste incineration: electricity replaces electricity mix (RER); thermal energy replaces thermal energy from European natural gas (RER).

Window variants							
D Recycling	Unit	D1 Market situation			D2 Recycling initiative Dekura and Rewindo		
		PG 1	PG 2	PG 3	PG 1	PG 2	PG 3
<b>Core indicators</b>							
GWP-t	kg CO <sub>2</sub> equivalent	-61.40	-66.60	-76.40	-81.40	-88.90	-103.00
GWP-f	kg CO <sub>2</sub> equivalent	-61.30	-66.50	-76.30	-81.20	-88.60	-103.00
GWP-b	kg CO <sub>2</sub> equivalent	-0.11	-0.11	-0.16	-0.18	-0.19	-0.25
GWP-l	kg CO <sub>2</sub> equivalent	-1.53E-02	-1.73E-02	-1.65E-02	-2.22E-02	-2.43E-02	-2.40E-02
ODP	kg CFC-11-eq.	-2.12E-10	-2.16E-10	-2.70E-10	-3.02E-10	-3.11E-10	-3.75E-10
AP	mol H <sup>+</sup> -eq.	-0.25	-0.30	-0.32	-0.32	-0.38	-0.43
EP-fw	kg P-eq.	-5.20E-05	-5.58E-05	-6.53E-05	-7.61E-05	-8.07E-05	-9.31E-05
EP-m	kg N-eq.	-5.64E-02	-6.60E-02	-7.78E-02	-7.70E-02	-9.03E-02	-0.11
EP-t	mol N-eq.	-0.64	-0.75	-0.88	-0.87	-1.02	-1.24
POCP	kg NMVOC-eq.	-0.16	-0.18	-0.20	-0.22	-0.25	-0.28
ADPF	MJ	-835.00	-914.00	-1070.00	-1200.00	-1310.00	-1530.00
ADPE	kg Sb equivalent	-1.92E-05	-2.08E-05	-2.21E-05	-2.55E-05	-2.77E-05	-2.94E-05
WDP	m <sup>3</sup> world-eq. deprived	-2.58	-3.04	-3.57	-3.39	-3.99	-4.79
<b>Resource management</b>							
PERE	MJ	-104.00	-111.00	-151.00	-143.00	-155.00	-204.00
PERM	MJ	0.00	0.00	0.00	0.00	0.00	0.00
PERT	MJ	-104.00	-111.00	-151.00	-143.00	-155.00	-204.00
PENRE	MJ	-836.00	-915.00	-1080.00	-1200.00	-1310.00	-1530.00
PENRM	MJ	0.00	0.00	0.00	0.00	0.00	0.00
PENRT	MJ	-836.00	-915.00	-1080.00	-1200.00	-1310.00	-1530.00
SM	kg	-0.21	-0.33	-0.18	-0.21	-0.33	-0.18
RSF	MJ	0.00	0.00	0.00	0.00	0.00	0.00
NRSF	MJ	0.00	0.00	0.00	0.00	0.00	0.00
FW	m <sup>3</sup>	-0.13	-0.15	-0.18	-0.20	-0.23	-0.26
<b>Categories of waste</b>							
HWD	kg	-1.78E-04	-1.82E-04	-1.71E-04	0.00	0.00	0.00
NHWD	kg	-8.48	-11.80	-9.51	0.00	0.00	0.00
RWD	kg	-2.25E-02	-2.42E-02	-3.38E-02	0.00	0.00	0.00
<b>Output material flows</b>							
CRU	kg	0.00	0.00	0.00	0.00	0.00	0.00
MFR	kg	0.00	0.00	0.00	0.00	0.00	0.00
MER	kg	0.00	0.00	0.00	0.00	0.00	0.00
EE	MJ	0.00	0.00	0.00	0.00	0.00	0.00
EET	MJ	0.00	0.00	0.00	0.00	0.00	0.00
<b>Additional environmental impact indicators</b>							
PM	Disease incidence	-2.63E-06	-3.09E-06	-3.04E-06	-3.29E-06	-3.84E-06	-3.93E-06
IRP	kBq U235-eq.	-3.28	-3.64	-4.80	-4.55	-5.14	-6.60
ETPfw	CTUe	-584.00	-735.00	-768.00	-836.00	-1020.00	-1120.00
HTPc	CTUh	-1.31E-07	-1.50E-07	-1.67E-07	-1.67E-07	-1.92E-07	-2.16E-07



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HTPnc	CTUh	-6.65E-07	-7.18E-07	-7.93E-07	-9.07E-07	-9.80E-07	-1.09E-06
SQP	dimensionless	-59.60	-61.80	-88.20	-83.10	-87.60	-120.00

The values in Module D result from recycling of the packaging material in Module A5 and from deconstruction at the end of service life.

The 100% scenarios differ from the current average recovery shown here (current market situation, in background report D1). The evaluation of each scenario is described in the background report.

For the separate presentation of drive units including electrical components, only the current market situation is shown. Since this is a single scenario, the results are shown in the overall results table. There, the results were related to one year, taking into account the reference service life.

Since this is a single scenario, the results are shown in the summary table.

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### Notes

This EPD is mainly based on the work and findings of the Institut für Fenstertechnik e.V., Rosenheim (ift Rosenheim) and specifically on the ift-Guideline NA-01/4 "Allgemeiner Leitfaden zur Erstellung von Typ III Umweltproduktdeklarationen" (Guidance on preparing Type III Environmental Product Declarations.)

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### Layout

ift Rosenheim GmbH – 2021

### Photographs (front page)

Roto Frank DST Produktions-GmbH

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