# Environmental Product Declaration

as per ISO 14025 and EN 15804

| | |
|---|---|
| Owner of the declaration: | HEWI Heinrich Wilke GmbH |
| Publisher: | Kiwa-Ecobility Experts |
| Programme operator: | Kiwa-Ecobility Experts |
| Registration number: | EPD-Kiwa-EE-000388-EN |
| Issue date: | 18.04.2024 |
| Valid until: | 18.04.2029 |

## Door and window hardware S 111/162 Polyamide

## 1. General information

**HEWI Heinrich Wilke GmbH**

**Door and window hardware S 111/162 Polyamide**

**Programme operator:**
Kiwa-Ecobility Experts
Kiwa GmbH, Ecobility Experts
Wattstraße 11-13
13355 Berlin
Germany

**Owner of the declaration:**
HEWI Heinrich Wilke GmbH
Hagenstrasse 2
34454 Bad Arolsen
Germany

**Registration number:**
EPD-Kiwa-EE-000388-EN

**Declared product / Reference unit:**
1 piece of door and window hardware (net mass of 0.692 kg)

**Product category rules:**
PCR A: General Product Category Rules for Construction Products from the EPD program of Kiwa-Ecobility Experts; Version 2.1
DIN EN 17610:2022-11: Building hardware - Environmental product declarations - Product category rules complementary to EN 15804 for building hardware; German version EN 17610:2022

**Scope:**
This EPD (type: cradle to grave and module D (A, B, C and D)) is based on the life cycle assessment (LCA) of the "Door and window hardware S 111/162 Polyamide" produced by HEWI Heinrich Wilke GmbH in Bad Arolsen (Germany). The used geographical area is Germany.
The owner of the declaration shall be liable for the underlying information and evidence. Kiwa-Ecobility Experts assumes no liability for manufacturer's information, LCA data and evidence.

**Issue date:**
18.04.2024

**Valid until:**
18.04.2029

**Verification:**
The European standard EN 15804+A2:2019 serves as the core PCR.
Independent verification of the declaration and data according to ISO 14025:2010.
☐internally ☒externally

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## 2. Product

### 2.1 Product description

The “Door and window hardware S 111/162 Polyamide” by HEWI Heinrich Wilke GmbH (see Figure 1) in R-technology with roses is constructed from polyamide material in accordance with DIN 18255, EN 1906, DIN EN 179 and DIN 18273.

**Figure 1: Door and window hardware S 111/162 Polyamide by HEWI Heinrich Wilke GmbH**

### 2.2 Application

Door and window hardware S 111/162 Polyamide covers the designs for full-leaf doors, profile doors and window handles.

### 2.3 Technical data

The product is designed and tested for the projects segment, user category in accordance with EN 1906 - Class 4. The fire door fitting with 9 mm square spindle meets the requirements of DIN 18273. In Table 1 the technical data of “Door and window hardware S 111/162 Polyamide” are listed.

**Table 1: Technical data of "Door and window hardware S 111/162 Polyamide"**

| Description | Class |
|---|---|
| User category | 4 |
| Durability | 7 |
| Door mass | No classification specified |
| Fire resistance | D1 |
| Safety | 1 |
| Corrosion resistance | 5 |
| Burglary protection | 0 |
| Design-type | U |

### 2.4 Placing on the market/ Application rules

For quality assurance purposes, the fire door fitting is regulated according to DIN EN 179 and marked with a CE mark by the manufacturer. For the placing on the market the regulation (EU) No. 305/2011 of March 9, 2011 applies. For the use of the products the national regulations apply.

### 2.5 Raw materials

The raw materials for "Door and window hardware S 111/162 Polyamide" are shown in Table 2.

**Table 2: Mass percentages of the raw materials for "Door and window hardware S 111/162 Polyamide"**

| Raw material | Value | Unit |
|---|---|---|
| Steel | 64.5 | m% |
| Polyamide 6 | 33.5 | m% |

The product does not contain any substances from the candidate list of substances of very high concern for authorisation (SVHC).

### 2.6 Manufacturing

The manufacturing of the "Door and window hardware S 111/162 Polyamide" takes place in Bad Arolsen, Germany. The raw material is transported to the production site there, and the handles and roses are produced by injection moulding and surface treatment. Then, the product is assemblied and packaged. Afterwards, the product is transported to the building site and installed there. A simplified process flow chart is shown in Figure 2.

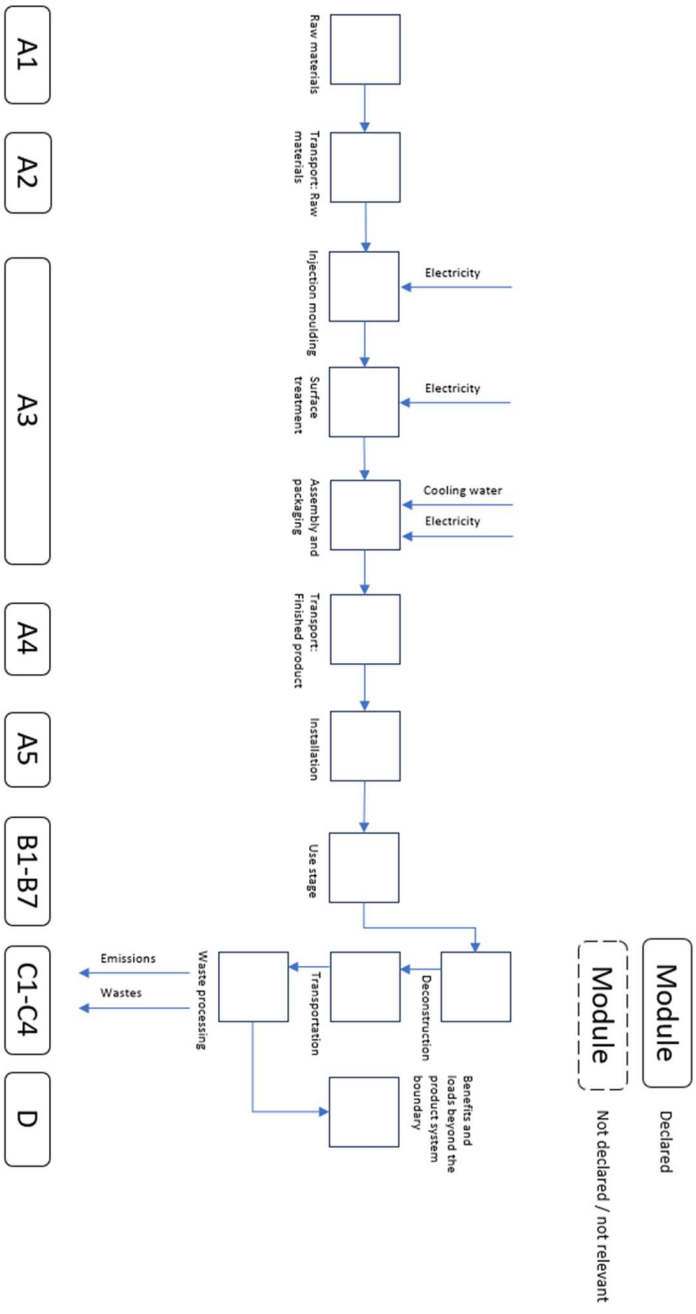


**Figure 2: Process flow chart**

### 2.7 Packaging

For the packaging of the product, paper, cardboard boxes, and drilling templates are considered.

### 2.8 Reference service life (RSL)

The durability of HEWI door fittings is tested in accordance with DIN EN 1906 in an durability test with up to 1,000,000 test cycles by an independent testing institute. The RSL is 30 years according to the typical duration of functionality and product-specific RSL for lever handles and knob furniture listed in the PCR B.

### 2.9 Other information

Further information on the product can be found on the manufacturer's website (www.hewi.com).

## 3. LCA: Calculation rules

### 3.1 Functional unit

This declaration refers to a representative door and window hardware manufactured by HEWI Heinrich Wilke GmbH, covering the designs for full-leaf doors, profile doors and window handles. As the top seller, the level handle model 111 forms the basis for calculating the representative life cycle assessment. Through the standardized specifications and requirements for product use, the manufacturing processes and primary materials in the product group S 111/162 are comparable. HEWI fire door fitting 111R11.230 in R technology is the largest variant in the product group S 111/162 and is included in the calculation of the EPD. The total weight of the representative door and window hardware is 0.692 kg, which includes two level handles with roses as a fitting set.

According to PCR B “DIN EN 17610:2022-11: Building hardware - Environmental product declarations - Product category rules complementary to EN 15804 for building hardware; German version EN 17610:2022”, the functional unit is to ensure the function of opening and holding doors and windows in buildings in the closed position by using a door handle or window handle with a net mass of 0,692 kg over the reference service life of 30 years, which corresponds to a minimum of 100 000 cycles of use.

**Table 3: Conversion factors**

| Description | Value | Unit |
|---|---|---|
| Reference unit | 1 | piece |
| Mass reference | 0.692 | kg/piece |
| Conversion factor to 1 kg | 1.445086705 | - |

### 3.2 System boundary

This EPD was created in accordance with DIN EN 15804. It monitors the production stage, the construction process stage, the use stage and the end-of-life stage as well as the benefits and loads beyond the system boundary. According to DIN EN 15804 this corresponds to the product phases A1-A3, A4-A5, B1-B7, C1-C4 and D. Therefore, the type of the EPD is “cradle to grave and module D”. Table 4 provides an overview of the declared information modules or product life phases, which are included in the LCA.

**Table 4: Overview of the considered information modules showing all phases of the building life cycle according to EN 15804 (X = module declared; MND = module not declared)**

| Production phase | | | Construction phase | | Use phase | | | | | | | End-of-life phase | | | | Benefits and loads beyond the system boundary |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Raw material supply | Transport | Manufacturing | Transport | Construction/Installation process | Use | Maintenance | Repair | Replacements | Renewal | Operational energy use | Operational water use | De-construction demolition | Transport | Waste processing | Disposal | Reuse-, Recovery-, Recyclingpotential |
| A1 | A2 | A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
| X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |

The modules include:

- A1: Extraction of the raw materials
- A2: Transport of the raw material to the production site by the suppliers
- A3: Auxiliary materials and energy for the different processing steps; Production waste; Packaging materials
- A4: Transport from the manufacturing site to the customers
- A5: According to HEWI Heinrich Wilke GmbH only human labour is needed for the construction/installation process and thus nothing is considered; Packaging waste
- B1: No processes can be expected in module “use”
- B2: No processes can be expected in module “maintenance”
- B3: No processes can be expected in module “repair”
- B4: No processes can be expected in module “replacements”
- B5: No processes can be expected in module “renewal”
- B6: No processes can be expected in module “operational energy use”
- B7: No processes can be expected in module “operational water use”
- C1: Diesel burned in the building machine for demolition considered
- C2: Transport for waste treatments based on NMD waste scenarios
- C3: Waste processing based on NMD waste scenarios
- C4: Disposal based on NMD waste scenarios
- D: Loads due to landfill, incineration and recycling; Benefits due to incineration and recycling

For the declared life phases, all inputs (raw materials, intermediate products, energy and auxiliary materials) as well as the waste produced were considered.

### 3.3 Estimates and assumptions

For all raw materials used (raw materials, operating materials, packaging), the transportation distances were recorded, except for Polyamide 6 from the company BASF. It was estimated that 50% of Polyamide 6 was produced in Ludwigshafen, Germany and transported by trucks, while the rest was produced in China, which was tranported by container ships and trucks. A payload factor of 50% was used for all truck transports (suppliers, disposal transports and internal transports), corresponding to a full delivery and empty return journey.

For Module C1, it was estimated that 0.043 MJ/kg diesel was burned in the building machine for demolition. For the rest modules of the end-of-life stage, waste scenarios based on the Dutch Nationale Milieudatabase (NMD) were used.

### 3.4 Cut-off criteria

For process modules A1 to A3, all process-specific data was collected. All flows could be assigned potential environmental impacts through the Ecoinvent database 3.6. Production, supply, disposal, maintenance and end-of-life treatment of capital goods are included. In the used Ecoinvent database 3.6 infrastructure and capital goods are included. All flows that contribute more than 1% of the total mass, energy or environmental impact of the system have been included in the LCA. It can be assumed that the neglected processes contributed less than 5% to the impact categories considered. It is assumed that the contribution of capital goods to each individual environmental impact category of the module (A1-A3) is less than 5%.

As this EPD is not a declaration at company level, but a declaration at product level, the manufacturing of equipment used in production, buildings or any other capital goods are excluded, along with the transport of personnel to the plant and the transportation of personnel within the plant. Additionally, research and development activities, long-term emissions, as well as energy and water consumption associated with company management and sales, are excluded.

### 3.5 Period under review

All process-specific data were collected for the operating year 2023.

### 3.6 Comparability

In principle, a comparison or assessment of the environmental impact of different products is only possible if they have been produced in accordance with EN 15804. For the assessment of comparability, the following aspects in particular must be taken into account: PCR used, functional or declared unit, geographical reference, definition of the system boundary, declared modules, data selection (primary or secondary data, background database, data quality), scenarios used for the use and disposal phases, and the life cycle inventory (data collection, calculation methods, allocations, validity period).

### 3.7 Background data

All the background data is taken from the Ecoinvent database version 3.6 (2019). The life cycle was modelled with the help of the EPD & LCA tool R<THiNK. Almost all consistent datasets contained in the Ecoinvent database version 3.6 (2019) are documented and can be viewed in the online documentation.

### 3.8 Data quality

Overall, the quality of the data can be considered as good. In the operating data survey, all relevant process-specific data could be collected. The data were provided by the manufacturer HEWI Heinrich Wilke GmbH.

Secondary data were taken from the Ecoinvent database version 3.6 (2019). The database is regularly checked and thus complies with the requirements of DIN EN ISO 14044 (background data not older than 10 years). The background data meets the requirements of EN 15804. The quantities of raw materials, consumables and supplies used as well as the energy consumption have been recorded and averaged over the entire year of operation.

The general rule has been complied that specific data from specific production processes or average data derived from specific processes must be given priority when calculating an EPD or Life Cycle Assessment. Data for processes that the manufacturer cannot influence or choose, were backed up with generic data.

The selection of the best fitting data sets is based on research and the help of experts. The transport distances for the waste treatments as well as the used environmental profiles for loads and benefits are based on the data from the NMD.

### 3.9 Allocation

Allocation was generally avoided. The energy consumption during the production is calculated based on the total consumption at the production site in 2023 (for all products manufactured) and is converted into the amount of the number of units produced. Specific information about allocations within the background data is included in the documentation of the Ecoinvent datasets.

### 3.10 Data collection

The data collection was performed according to ISO 14044:2006, section 4.3.2. According to the target definition, all significant input and output flows that occur in connection with the products under consideration were identified and quantified. The inputs and outputs were attributed to the process in which they occur. For the process stages A1, A2 and A3, the input and output streams could be clearly assigned.

The results of the operational data collection can be seen in the following tables. In addition to the process-specific data, the tables also provide information on the respective background data used.

### 3.11 Calculation methods

For the life cycle assessment, the calculation methods described in the ISO 14044:2006, section 4.3.3 have been applied. The evaluation is based on the phases in the system boundaries and the processes contained therein.

### 3.12 Electricity mix and $CO_2$ certificates

The electricity used was modelled using the market-based approach. HEWI purchases electricity from a supplier whose generation is certified as renewable. For the modelling of green electricity, it was assumed that the mix corresponds to the EEG mix in 2023 (German Renewable Energy Sources Act, reference year 2023). The $CO_2$ emission of the electricity production was calculated as 0.23 kg $CO_2$ eq./kWh.

## 4. LCA: Scenarios and additional technical information

### 4.1 Transport to construction site (A4)

For the transport from production place to assembly/user, the following scenario is assumed for module A4 of this EPD. As the EPD should be representative for Germany, Germany is considered for the transport to the customers (Module A4). Based on the geographic centre of Germany and the production location, a distance of 138 km was calculated.

**Table 5: Transport conveyances for waste treatments for the waste scenarios**

| | **Value and unit** |
|---|---|
| Vehicle type used for transport | Lorry (Truck), unspecified (default) \| market group for (GLO) |
| Fuel type and consumption of vehicle | not available |
| Distance | 138 km |
| Capacity utilisation (including empty returns) | 50% (loaded up and return empty) |
| Bulk density of transported products | Inapplicable |
| Volume capacity utilisation factor | 1 |

### 4.2 Assembly (A5)

The following information describes the scenarios for flows entering the system and flows leaving the system at module A5.

**Flows entering the system**

There are no significant environment impacts as a result of materials or energy used in the construction stage (A5).

**Flows leaving the system**

The following output flows leaving the system at module A5 are assumed.

**Table 6: Output flows leaving the system at module A5**

| Description | **Value** | **Unit** |
|---|---|---|
| Output materials as result of loss during construction | 0 | % |
| Output materials as result of waste processing of materials used for installation/assembly at the building site | 0.000 | kg |
| Output materials as result of waste processing of used packaging | 0.100 | kg |

### 4.3 Use stage (B1-B7)

No significant environment impact in the use stage modules, because there is no (significant) emission to air, soil or water. No input or output flows are modeled for maintenance. Repair, replacement or refurbishment are not applicable within the functional unit to achieve the reference service life. For modules “operational energy use” and “operational water use” nothing is considered.

### 4.4 De-Construction/ Demolition (C1)

The following information describes the scenario for demolition at end of life.

**Table 7: Scenarios for demolition**

| Description | Amount | Unit |
|---|---|---|
| Diesel, burned in machine (incl. emissions) | 0.001 | l |

### 4.5 Transport End-of-life (C2)

The following distances and transport conveyance are assumed for transportation during end of life for the different types of waste processing, which are based on the Dutch Nationale Milieudatabase (NMD).

**Table 8: Transport for waste treatments**

| Waste Scenario | Transport conveyance | Not removed (stays in work) [km] | Landfill [km] | Incineration [km] | Recycling [km] | Re-use [km] |
|---|---|---|---|---|---|---|
| Steel, light (NMD ID 73) | Lorry (Truck), unspecified (default) \| market group for (GLO) | 0 | 100 | 150 | 50 | 0 |
| Plastics, via residue (NMD ID 43) | Lorry (Truck), unspecified (default) \| market group for (GLO) | 0 | 100 | 150 | 50 | 0 |

The transport conveyances used in the scenarios for transport during end of life has the following characteristics.

**Table 9: Transport conveyances for waste treatments for the waste scenarios**

| | Value and unit |
|---|---|
| Vehicle type used for transport | Lorry (Truck), unspecified (default) \| market group for (GLO) |
| Fuel type and consumption of vehicle | not available |
| Capacity utilisation (including empty returns) | 50% (loaded up and return empty) |
| Bulk density of transported products | inapplicable |
| Volume capacity utilisation factor | 1 |

### 4.6 End of life (C3, C4)

The scenarios assumed for end of life of the product are given in the following tables. First the assumed percentages per type of waste processing are displayed, followed by the assumed amounts. The scenarios included are currently in use and are representative for one of the most likely scenario alternatives. Additional declaration of representative mixes for the relevant region is permissible.

**Table 10: Assumed percentages per type of waste processing**

| Waste Scenario | Not removed (stays in work) [%] | Landfill [%] | Incineration [%] | Recycling [%] | Re-use [%] |
|---|---|---|---|---|---|
| Steel, light (NMD ID 73) | 0 | 1 | 0 | 87 | 12 |
| Plastics, via residue (NMD ID 43) | 0 | 20 | 80 | 0 | 0 |

**Table 11: Assumed amounts per type of waste processing**

| Waste Scenario | Not removed (stays in work) [kg] | Landfill [kg] | Incineration [kg] | Recycling [kg] | Re-use [kg] |
|---|---|---|---|---|---|
| Steel, light (NMD ID 73) | 0.000 | 0.004 | 0.000 | 0.388 | 0.054 |
| Plastics, via residue (NMD ID 43) | 0.000 | 0.049 | 0.197 | 0.000 | 0.000 |
| **Total** | **0.000** | **0.054** | **0.197** | **0.388** | **0.054** |

### 4.7 Benefits and loads beyond the system boundary (D)

The presented benefits and loads beyond the system boundary in this EPD are based on the following calculated net output flows in kilograms and energy recovery displayed in MJ lower heating Value.

**Table 12: Net output flows and Energy recovery at Module D**

| Waste Scenario | Net output flow [kg] | Energy recovery [MJ] |
|---|---|---|
| Steel, light (NMD ID 73) | 0.395 | 0.000 |
| Plastics, via residue (NMD ID 43) | 0.000 | 6.051 |
| **Total** | **0.395** | **6.051** |

## 5. LCA: Results

The following tables show the results of the indicators of the impact assessment, the resource input as well as the waste materials and other output-flows. The here shown results refer to the declared unit.

The results of the environmental impact indicators ETP-fw, HTP-c, HTP-nc, SQP, ADP-f, ADP-mm and WDP must be used with caution, as the uncertainties in these results are high or there is limited experience with the indicator.

The IRP impact category mainly addresses the potential effect of low dose ionising radiation on human health in the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents and occupational exposure, nor does it consider the disposal of radioactive waste in underground facilities. Potential ionising radiation from soil, radon and some building materials is also not measured by this indicator.

**Table 13: Results of the LCA – Environmental impact indicators: Door and window hardware S 111/162 Polyamide**

| Indicator (Impact Category) | Unit | A1 | A2 | A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AP | mol H+ eqv. | 1,71E-02 | 9,28E-04 | 9,39E-04 | 8,55E-05 | 3,99E-05 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 2,85E-05 | 4,25E-05 | 2,23E-04 | 4,82E-06 | -2,58E-03 |
| GWP-total | kg CO2 eqv. | 4,16E+00 | 6,32E-02 | -1,56E-02 | 1,48E-02 | 1,69E-01 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 2,72E-03 | 7,33E-03 | 5,22E-01 | 6,33E-03 | -8,28E-01 |
| GWP-b | kg CO2 eqv. | 6,24E-02 | 1,31E-05 | -1,46E-01 | 6,81E-06 | 1,63E-01 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 7,57E-07 | 3,38E-06 | 9,79E-05 | 5,30E-06 | 5,43E-03 |
| GWP-f | kg CO2 eqv. | 4,10E+00 | 6,32E-02 | 1,29E-01 | 1,47E-02 | 6,15E-03 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 2,72E-03 | 7,32E-03 | 5,22E-01 | 6,32E-03 | -8,34E-01 |
| GWP-luluc | kg CO2 eqv. | 1,07E-03 | 3,00E-05 | 1,19E-03 | 5,40E-06 | 2,14E-06 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 2,14E-07 | 2,68E-06 | 3,99E-05 | 2,71E-07 | 2,84E-04 |
| ETP-fw | CTUe | 7,26E+01 | 7,40E-01 | 7,16E+00 | 1,98E-01 | 1,62E-01 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 2,26E-02 | 9,85E-02 | 6,57E+00 | 4,69E-02 | -2,00E+01 |
| PM | disease incidence | 2,01E-07 | 4,44E-09 | 1,33E-08 | 1,33E-09 | 6,09E-10 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 7,54E-10 | 6,59E-10 | 1,67E-09 | 9,03E-11 | -3,72E-08 |
| EP-m | kg N eqv. | 3,67E-03 | 2,54E-04 | 1,97E-04 | 3,01E-05 | 1,49E-05 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 1,26E-05 | 1,50E-05 | 6,09E-05 | 3,81E-06 | -5,06E-04 |
| EP-fw | kg PO4 eqv. | 1,31E-04 | 5,12E-07 | 1,22E-05 | 1,49E-07 | 9,71E-08 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 9,91E-09 | 7,39E-08 | 1,51E-06 | 9,79E-09 | -2,21E-05 |
| EP-T | mol N eqv. | 3,78E-02 | 2,82E-03 | 2,63E-03 | 3,32E-04 | 1,62E-04 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 1,38E-04 | 1,65E-04 | 6,79E-04 | 1,77E-05 | -5,94E-03 |
| HTP-c | CTUh | 1,06E-08 | 3,03E-11 | 9,15E-10 | 6,43E-12 | 1,26E-11 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 7,89E-13 | 3,19E-12 | 9,55E-11 | 3,67E-13 | -5,39E-10 |
| HTP-nc | CTUh | 6,39E-08 | 7,59E-10 | 1,45E-08 | 2,17E-10 | 1,33E-10 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 1,94E-11 | 1,08E-10 | 2,02E-09 | 1,47E-11 | 9,38E-08 |
| IR | kBq U235 eqv. | 7,11E-02 | 3,82E-03 | 8,64E-03 | 9,32E-04 | 3,06E-04 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 1,60E-04 | 4,63E-04 | 1,53E-03 | 5,11E-05 | 6,08E-03 |
| SQP | Pt | 8,26E+00 | 5,88E-01 | 1,59E+01 | 1,93E-01 | 3,09E-02 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 4,78E-03 | 9,58E-02 | 1,10E-01 | 3,05E-02 | -8,04E+00 |
| ODP | kg CFC 11 eqv. | 1,18E-07 | 1,35E-08 | 1,35E-08 | 3,25E-09 | 1,04E-09 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 5,88E-10 | 1,62E-09 | 1,57E-08 | 1,71E-10 | -4,96E-08 |
| POCP | kg NMVOC eqv. | 1,40E-02 | 7,55E-04 | 5,84E-04 | 9,49E-05 | 4,97E-05 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 3,79E-05 | 4,71E-05 | 1,80E-04 | 6,44E-06 | -3,55E-03 |
| ADP-f | MJ | 4,76E+01 | 9,05E-01 | 1,91E+00 | 2,22E-01 | 6,92E-02 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 3,74E-02 | 1,10E-01 | 3,60E-01 | 1,30E-02 | -8,56E+00 |
| ADP-mm | kg Sb-eqv. | 5,51E-05 | 1,22E-06 | 2,78E-06 | 3,74E-07 | 1,75E-07 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 4,17E-09 | 1,86E-07 | 6,13E-07 | 5,82E-09 | -4,78E-07 |
| WDP | $m^3$ world eqv. | 1,09E+00 | 2,67E-03 | 1,29E+00 | 7,96E-04 | 6,60E-04 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 5,02E-05 | 3,95E-04 | 2,59E-02 | 5,58E-04 | -1,19E-01 |

AP = Acidification; GWP-total = Global warming potential – Total; GWP-b = Global warming potential – Biogenic; GWP-f = Global warming potential – Fossil; GWP-luluc = Global warming potential - Land use and land use change; ETP-fw = Ecotoxicity, freshwater; PM = Particulate Matter; EP-m = Eutrophication marine; EP-fw = Eutrophication, freshwater; EP-t = Eutrophication, terrestrial; HTP-c = Human toxicity, cancer; HTP-nc = Human toxicity, non-cancer; IR = Ionising radia-tion, human health; SQP = Land use; ODP = Ozone depletion; POCP = Photochemical ozone formation - human health; ADP-f = Resource use, fossils; ADP-mm = Resource use, minerals and metals; WDP = Water use

**Table 14: Results of the LCA – Resource consumption, output streams & waste categories: Door and window hardware S 111/162 Polyamide**

| Parame-ter | Unit | A1 | A2 | A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PERE | MJ | 2,38E+00 | 9,77E-03 | 1,92E+00 | 2,78E-03 | 2,45E-03 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 2,03E-04 | 1,38E-03 | 3,91E-02 | 2,29E-04 | -1,21E+00 |
| PERM | MJ | 0,00E+00 | 0,00E+00 | 1,56E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| PERT | MJ | 2,38E+00 | 9,77E-03 | 3,48E+00 | 2,78E-03 | 2,45E-03 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 2,03E-04 | 1,38E-03 | 3,91E-02 | 2,29E-04 | -1,21E+00 |
| PENRE | MJ | 4,35E+01 | 9,61E-01 | 2,01E+00 | 2,36E-01 | 7,35E-02 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 3,98E-02 | 1,17E-01 | 3,82E-01 | 1,39E-02 | -9,20E+00 |
| PENRM | MJ | 7,56E+00 | 0,00E+00 | 3,17E-02 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| PENRT | MJ | 5,10E+01 | 9,61E-01 | 2,04E+00 | 2,36E-01 | 7,35E-02 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 3,98E-02 | 1,17E-01 | 3,82E-01 | 1,39E-02 | -9,20E+00 |
| SM | kg | 4,72E-02 | 0,00E+00 | 4,72E-03 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| RSF | MJ | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| NRSF | MJ | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| FW | $m^3$ | 2,93E-02 | 9,15E-05 | 3,05E-02 | 2,71E-05 | 3,24E-05 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 1,93E-06 | 1,35E-05 | 7,63E-04 | 1,36E-05 | -2,22E-03 |
| HWD | kg | 9,54E-05 | 1,86E-06 | 4,57E-06 | 5,64E-07 | 1,91E-07 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 1,02E-07 | 2,80E-07 | 7,02E-07 | 1,98E-08 | -7,34E-05 |
| NHWD | kg | 5,96E-01 | 4,10E-02 | 5,61E-02 | 1,41E-02 | 2,38E-03 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 4,43E-05 | 7,00E-03 | 7,66E-03 | 5,37E-02 | -5,51E-02 |
| RWD | kg | 6,87E-05 | 6,05E-06 | 8,60E-06 | 1,46E-06 | 4,31E-07 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 2,60E-07 | 7,25E-07 | 1,28E-06 | 7,75E-08 | -4,49E-07 |
| CRU | kg | 0,00E+00 | 0,00E+00 | 5,36E-03 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 5,36E-02 | 0,00E+00 | 0,00E+00 |
| MFR | kg | 0,00E+00 | 0,00E+00 | 3,88E-02 | 0,00E+00 | 7,48E-02 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 3,88E-01 | 0,00E+00 | 0,00E+00 |
| MER | kg | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| EE-total | MJ | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 3,16E+00 |
| EET | MJ | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 2,00E+00 |
| EEE | MJ | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 1,16E+00 |

PERE = Renewable primary energy ex. raw materials; PERM = Renewable primary energy used as raw materials; PERT = Renewable primary energy total; PENRE = Non-renewable primary energy ex. raw materials; PENRM = Non-renewable primary energy used as raw materials; PENRT = Non-renewable primary energy total; SM = Use of secondary material; RSF = use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net 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; EE-total = Exported energy, total; EET = Exported energy thermic; EEE = Exported energy electric

**Table 15: Results of the LCA – Information on biogenic carbon content per piece: Door and window hardware S 111/162 Polyamide**

| Biogenic carbon content | Amount | Unit |
|---|---|---|
| Biogenic carbon content in the product | 0 | kg C |
| Biogenic carbon content in accompanying packaging | 0.04441 | kg C |

## 6. LCA: Interpretation

For an easier understanding, the results are processed graphically, in order to recognize relationships and connections between the data more clearly.

The following figure shows the percentage of the product phases in the environmental impact categories.

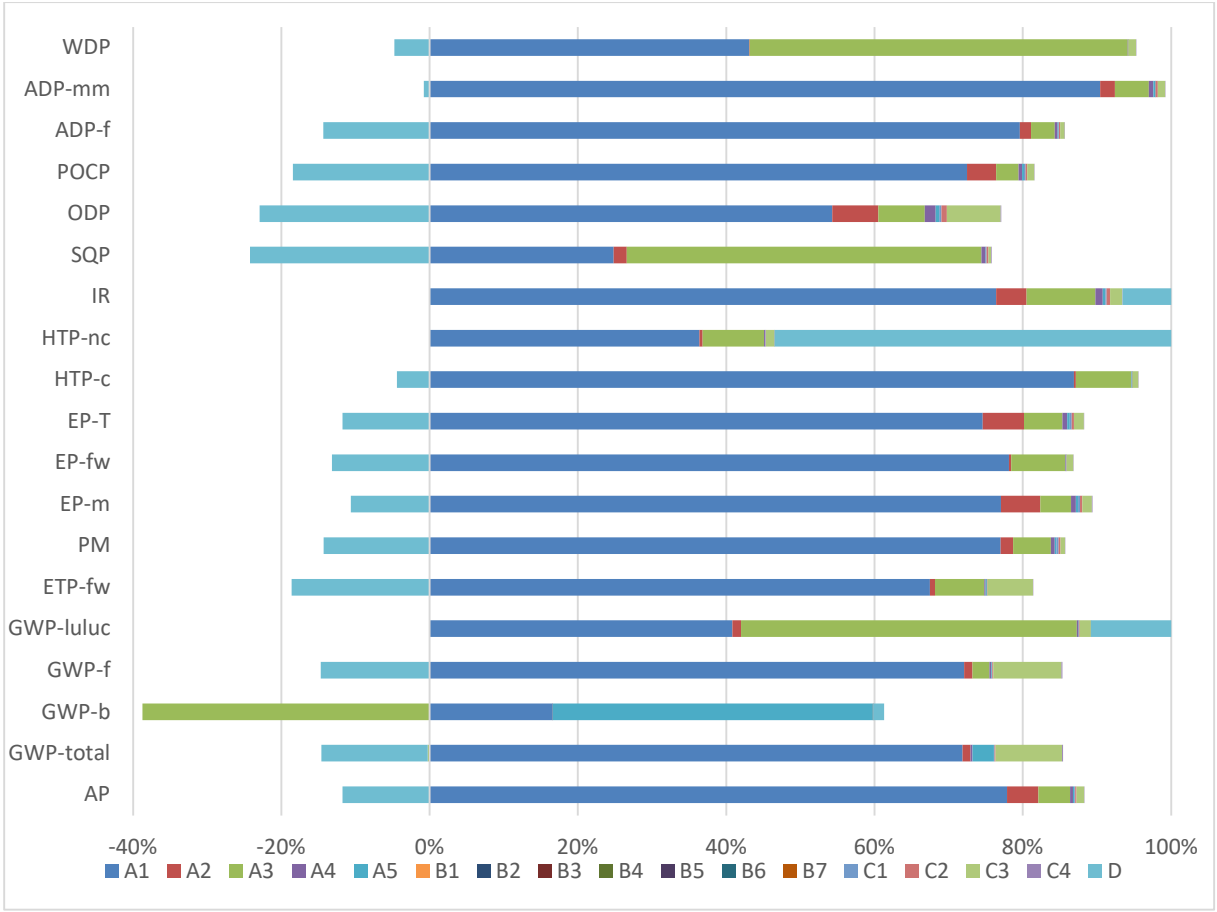


**Figure 3: Percentage of the product phases in the environmental impact categories of Door and window hardware S 111/162 Polyamide**

In almost all impact categories, the environmental impact of Door and window hardware S 111/162 Polyamide is predominantly determined by the extraction and processing of raw materials (Module A1). Within the impact category of global warming potential (GWP-total), the waste processing in the end-of-life stage (Module C3) results in the second largest environmental impact after Module A1. Among the raw materials (Module A1), Polyamide 6 granulate has the largest environmental impact, accounting for 58% of GWP-total, followed by Round bar with 23%. The negative value of the global warming potential-biogenic (GWP-b) is primarily attributed to the packaging materials (Module A3).

## 7. References


| | |
|---|---|
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| ISO 14025 | ISO 14025:2010 Environmental labels and declarations - Type III envi-ronmental declarations - Principles and procedures |
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| ISO 14044 | ISO 14044:2006 Environmental management - Life cycle assessment - Requirements and guidelines |
| NMD, 2019 | Nationale Milieudatabase (NMD). Environmental Performance Assessment Method for Construction; Version 1.1 (March 2022); Rijswijk |
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| DIN EN 1906 | DIN EN 1906:2012-12: Building hardware - Lever handles and knob furniture - Requirements and test methods; German version EN 1906:2012 |
| DIN EN 179 | DIN EN 179:2008-04: Building hardware - Emergency exit devices operated by a lever handle or push pad, for use on escape routes - Requirements and test methods; German version EN 179:2008 |
| DIN 18273 | DIN 18273:2015-07: Building hardware - Lever handle units for fire doors and smoke control doors - Terms and definitions, dimensions, requirements, testing and marking |
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