



ENGINEERING  
TOMORROW



## Environmental Product Declaration



### Electric Expansion Valve

### ETS 50C

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|                           |  |
|---------------------------|--|
| <b>EPD issued</b>         | 2023-01-10   |
| <b>EPD expires</b>        | 2028-01-10   |
| <b>EPD author</b>         | Danfoss Climate Solutions  |
| <b>EPD type</b>           | Cradle-to-grave  |
| <b>Declared unit</b>      | One product over 10 years  |
| <b>Products included</b>  | Electric Expansion Valve ETS 50C (code no. 034G7702)   |
| <b>Geographical scope</b> | Italy  |
| <b>Mass</b>               | 0,34 kg without packaging<br>0,61 kg with packaging  |
| <b>Dimensions (HxWxD)</b> | 139 x 50 x 66 mm without packaging<br>281 x 197 x 107 mm with packaging                                      |
| <b>Verification</b>       | <input type="checkbox"/> External <input checked="" type="checkbox"/> Internal <input type="checkbox"/> None |
| <b>Produced to</b>        | <a href="#">Danfoss Product Category Rules (2022-09)</a>   |
| <b>Verifier</b>           | Danfoss Power Electronics & Drives A/S   |

#### Disclaimer:

This EPD was prepared to the best of knowledge of Danfoss A/S. The life cycle assessment calculations were performed in accordance with ISO 14040 & 14044 and EN15804+A2.

All results were internally reviewed by independent experts. While this declaration has followed the guidance of ISO 14025, it has not been externally verified or registered by an EPD programme and therefore does not fully comply with the ISO 14025 standard.

This EPD has been published by Danfoss A/S on Danfoss Product Store and Danfoss Website. For questions, feedback or requests please contact your Danfoss sales representative.

## Product Description

This Environmental Product Declaration (EPD) follows the Danfoss Product Category Rules (PCR) (2022-09-20). These rules provide a consistent framework for calculating and reporting the environmental performance of Danfoss' products and is aligned with relevant international standards, particularly ISO 14025:2006, EN 15804+A2:2019 and EN 50598-3:2015.

This document has been produced by Danfoss A/S following an internal verification process, but it is not a third-party verified document.

### What is an EPD?

An EPD is a document used to communicate transparently, the quantified environmental impacts of a product over its lifecycle stages. This quantification is done by performing a Life Cycle Assessment (LCA) in line with a consistent set of rules known as a PCR (Product Category Rules).

An EPD provides:

- A product's carbon footprint together with other relevant environmental indicators, including air pollution, water use, energy consumption and waste, over its own life cycle (Modules A-C), as well as the expected benefits of reuse and recycling in reducing the impact of future products (Module D). See Table 1 for module descriptions.
- Environmental data allowing customers to calculate LCAs and produce EPDs for their own products.

### Type of EPD

This EPD is of the type 'cradle-to-grave' and includes all relevant modules: production (A1-A3), shipping (A4) and installation (A5); operational energy use (B6); deconstruction (C1), waste collection and transport (C2), treatment (C3) and disposal (C4). It also includes potential net benefits to future products from recycling or reusing post-consumer waste (D). The codes in brackets are the module labels from EN 15804+A2. Modules concerning use, maintenance, repair, replacement, refurbishment (B1-B5) and operational water use (B7) are excluded, following the cut-off rules from EN 15804.

**Table 1:** Modules of the product's life cycle included in the EPD

| Product stage |           |             | Installation |              | Use stage |             |        |             |               |                        |                       | End-of-life stage |           |                  |          | Benefits                                     |
|---------------|-----------|-------------|--------------|--------------|-----------|-------------|--------|-------------|---------------|------------------------|-----------------------|-------------------|-----------|------------------|----------|--|
| Raw materials | Transport | Manufacture | Transport    | Installation | Use       | Maintenance | Repair | Replacement | Refurbishment | Operational energy use | Operational water use | De-install.       | Transport | Waste processing | Disposal | Benefits and loads outside system boundaries |
| A1            | A2        | A3          | A4           | A5           | B1        | B2          | B3     | B4          | B5            | B6                     | B7                    | C1                | C2        | C3               | C4       | D  |
| X             | X         | X           | X            | X            | MNR       | MNR         | MNR    | MNR         | MNR           | X                      | MNR                   | X                 | X         | X                | X        | X  |

(X = declared module; MNR = module not relevant)

## Product Description

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The product studied in this report is the ETS Colibri, an electric stepper motor valve. The valve has been designed for precise liquid injection into evaporators for air conditioning and refrigeration applications. The valve in-line design includes balanced cage and slider assembly operated by the direct driven motor technology. This ensures solenoid tight shut-off in both flow directions, thus providing smooth operation of the system. The valve incorporates a powerful bi-polar motor which precisely controls flow regulation.

The production location is Nordborg, Denmark. See more information about the product on [Danfoss Product Store](#).

### Reference Service Life

For the purpose of this EPD the reference service life (RSL) of the product is considered to be 10 years.

### Intended market

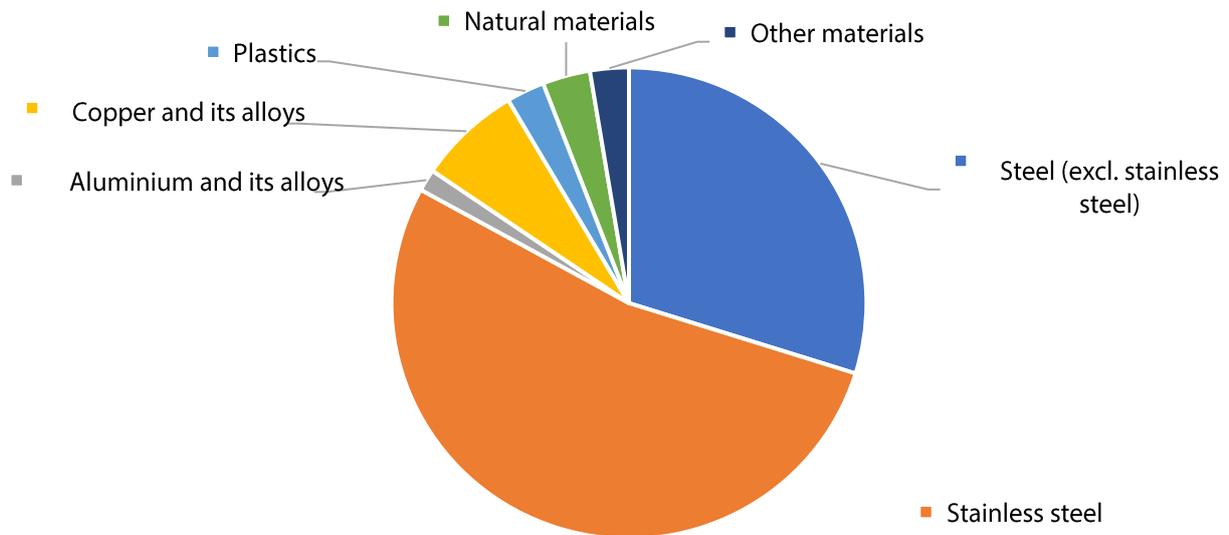
The intended market of this study is Italy, and the baseline scenario involves the distribution, installation, and end-of-life in Italy. With regards to the use stage and the end-of-life stage, this EPD is not representative of regions other than Italy.

## Product Description

**Table 2:** Product composition

| Material                          | Mass (kg)      | (%)           |
|-----------------------------------|----------------|---------------|
| <b>Metals</b>                     | <b>0,309</b>   | <b>91,42%</b> |
| Steel (excl. stainless steel)     | 0,101          | 29,88%        |
| Stainless steel                   | 0,180          | 53,25%        |
| Aluminium and its alloys          | 0,005          | 1,51%         |
| Copper and its alloys             | 0,024          | 7,04%         |
| <b>Plastics</b>                   | <b>0,00879</b> | <b>2,60%</b>  |
| Polycarbonate (unreinforced)      | 0,00091        | 0,27%         |
| Other reinforced thermoplastics   | 0,00031        | 0,09%         |
| Other unreinforced thermoplastics | 0,00757        | 2,24%         |
| <b>Natural materials</b>          | <b>0,011</b>   | <b>3,25%</b>  |
| Paper and cardboard               | 0,011          | 3,25%         |
| <b>Other materials</b>            | <b>0,0089</b>  | <b>2,64%</b>  |
| <b>Total product</b>              | <b>0,338</b>   | <b>100%</b>   |

**Figure 1:** Material Composition Overview



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## Overview of LCA study

### Data quality

Data quality of the selected datasets is generally assessed as good and very good in terms of geographical, time and technology representativeness and applicability. Background data is from GaBi database version 2022.

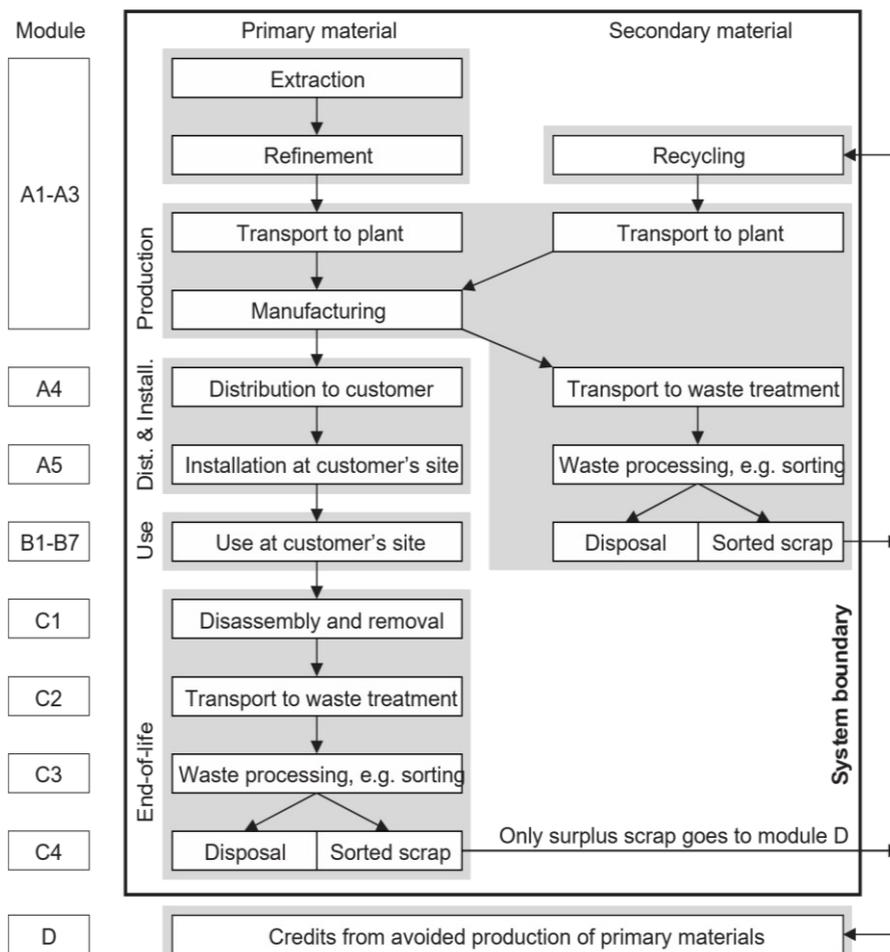
### Allocation and cut-off criteria

The allocation is made in accordance with the provisions of EN 15804+A2. All major raw materials and all the essential energy are included. All hazardous materials and substances are considered in the inventory. Data sets within the system boundary are complete and fulfil the criteria for the exclusion of inputs and output criteria.

### System boundaries

The results in this EPD are split into life cycle modules following EN 15804 (Figure 2): production (A1-A3), distribution (A4), use (B6) and the end of the product's life (C1-C4). Module D represents environmental benefits and loads that occur beyond the system boundary (i.e., in future products).

**Figure 2:** Modular structure used in this EPD (following EN 15804+A2)



## Overview of LCA study

### Product and packaging manufacture (A1-A3)

Final manufacturing occurs in Nordborg, Denmark. The facility is certified according to IATF 16949, ISO 14001, ISO 45001 and ISO 9001. Where waste generated on-site is recyclable, it is separated and recycled. For further information, [see here](#). The product is shipped in the packaging described in Table 3 below. All packaging materials can be safely recycled or incinerated if appropriate local facilities are available.

**Table 3:** Packaging materials

| Packaging material     | Mass (kg)    |
|------------------------|--------------|
| Paper and cardboard    | 0,272*       |
| Polyethylene           | 0,0001       |
| <b>Total packaging</b> | <b>0,272</b> |

\* Includes also sub-assembly packaging between production facilities

**Table 4:** Biogenic carbon content in product and packaging

|  | Total (excluding recycling) |
|--|-----------------------------|
| Biogenic carbon content in product [kg]                | 4,73E-03                    |
| Biogenic carbon content in accompanying packaging [kg] | 1,17E-01                    |

Note: 1 kg biogenic carbon is equivalent to 44/12 kg of CO<sub>2</sub>.

### Shipping and installation (A4-A5)

Distribution is assumed to occur to customers in Italy as highest quantity of this product is sold there. A distance of 1800km by truck is assumed between the factory and the final customer. The assumption is based on sales data, with reference to the year 2021.

Module A5 includes disposal of packaging materials only. The product is assumed to be installed by hand. Energy use in handheld tools during installation is not included as it falls below the cut-off criteria in the Product Core Rules.

### Use phase (B1-B6)

To set up a relevant scenario, the calculation takes into account the total number of cycles that the valve is expected to withstand over the full lifetime. This corresponds to 165.000 cycles, which should be equivalent to 10 years of valve utilization. Extreme utilization of the product would translate into a quicker wear-out of the valve (life time would be less than 10 years), but still within the estimated maximum full cycles (165.000 cycles).

During the normal operation of the valve, the energy consumption can be split into two main categories.

The first one relates to the energy used during the active mode. The "active mode" corresponds to the operation in which there is an active change in the valve opening degree. The valve requires acceleration before the stepper motor can shift position at full speed, as well as the excitation at the end of the movement to ensure that the valve reaches and holds the correct position.

## Overview of LCA study

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The “active mode” energy consumption is calculated using the nominal power as well as the time in which the valve will operate in this mode. Nominal power is set at 7,4 W, while the utilization time is calculated based on the duration of a full cycles (from 0% opening degree (OD) to 100% OD, and then again to 0% OD, including acceleration and excitation as well). This is estimated to take approximately 5,2 s. By considering the total estimated maximum number of full cycles, it translates into approximately 239 hours. The energy consumption due to active mode in the full life cycle is expected to be equal to 1,78 kWh.

The second category called “idle mode” relates to the energy that the valve needs to hold the position after it has reached the correct setting, while the controller does not give any signal to move. For this specific product, there are no specifications that suggest any need for holding current mode, thus the product is assumed to not have an idle mode during the use phase of this study.

**Table 5:** CO2 emissions per use phase

|                  | ETS 50C  |
|------------------|----------|
| Use [kg]         | 6,92E-01 |
| Active mode [kg] | 6,92E-01 |
| Idle mode [kg]   | N/A      |

The major limitation of the impact calculations for the use phase is that the electricity grid mix in use is assumed to remain at the same carbon intensity over time. Following the plans for the decarbonization of the grid across Europe, the environmental impacts are expected to decrease over time within the course of the next 10 years. However, as decarbonization will occur in the future and as the pace of decarbonization is uncertain, the use of the emission intensity of today’s grid should prove to be a “worst-case”, conservative assumption.

## Overview of LCA study

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### End of life (C1-C4)

The standard end-of-life procedure from EN 50598-3 has been applied:

- Manual dismantling is used to separable recyclable bulk materials, such as bulk metals and bulk plastics.
- Shredding is used for the remaining parts, such as printed circuit board assemblies.
- Ferrous metals, non-ferrous metals and bulk plastics are recovered through recycling.
- The remaining materials go to either energy recovery or landfill.

In line with EN 15804+A2, only the 'net scrap' (i.e., the leftover recyclable materials remaining after inputs of recycled content required in the manufacturing phase are first satisfied) is used to calculate the benefits and loads beyond the system boundary (Module D).

Two scenarios are examined for the end-of-life.

1. Recycling scenario with 100% of the product sent to recycling at the end-of-life, excluding fractions that cannot be recycled or incinerated (e.g., glass reinforcing in glass-filled plastics) and are sent to landfill (C3.1, C4.1, D.1).

This scenario illustrates best case performance. It assumes a 100% collection rate and best available recycling technologies. Under this scenario electrical cables, and all metals, flat glass and unreinforced plastics found within the body and chassis of the product are recycled. Printed circuit board assemblies are incinerated, and the copper and precious metals (gold, silver, palladium, and platinum) are recycled.

2. Landfill scenario with 100% of the product sent to landfill (C3.2, C4.2, D.2).

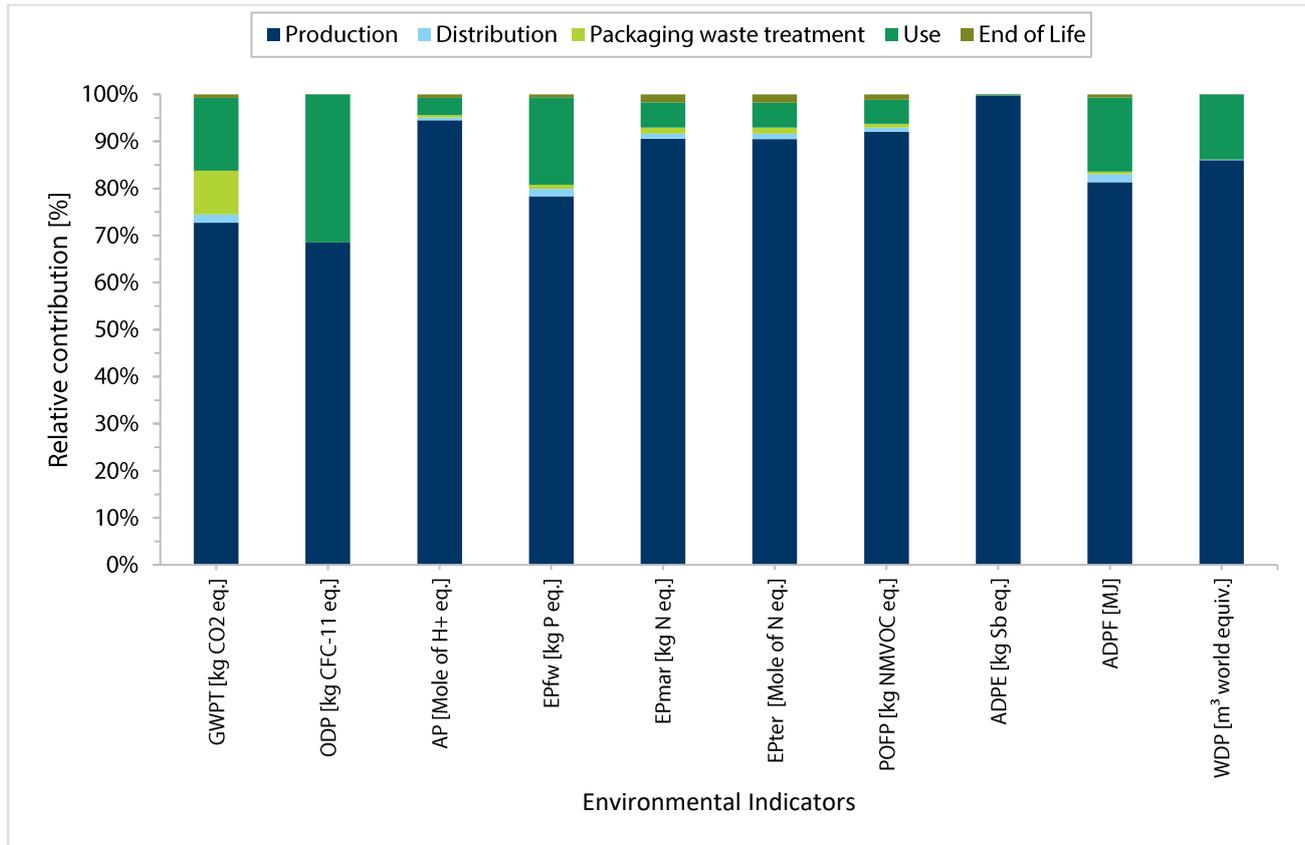
This scenario assumes that the whole product, including its packaging, is landfilled. It is designed to represent a poor end-of-life-route where valuable resources are lost.

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

Module D considers the net benefit of recycling the product, taking account of losses in the recycling process and the recycled material used in the production of the product.

This section presents the environmental performance of the ETS 50C. Figure 3 below presents a high level breakdown of the product's carbon footprint over its full 10-year life.

## Environmental performance



**Figure 3:** Breakdown of environmental impacts by life cycle stages (Average of Landfill and Recycling End-Of-Life Scenario).

The following life cycle modules from EN 15804+A2 are reported in this section:

- **A1-A3:** Manufacture of the product from 'cradle to gate'.
- **A4:** Transport of the product to the customer.
- **A5:** Installation of the product and disposal of used packaging.
- **B6:** Use of the product over its 10-year life.
- **C1:** Deinstallation of the product from the site.
- **C2:** Transport of the product to waste treatment.
- **C3:** Processing waste for recycling.
- **C4:** Disposal of waste that cannot be recycled (through landfill and incineration).
- **D:** Potential benefits and loads beyond the system boundary due to reuse, recycling, and energy recovery.



## Environmental performance

**Table 6:** Environmental impact indicators

|  | Production                                       | Distribution                             | Packaging waste treatment                                  | Use   | End-of-Life                                 |   |                                |               |   |               | (not included in Figure 3)   |              |
|--|--|--|--|---|---|---|--------------------------------|---------------|---|---------------|--|--------------|
| Life cycle stages based on EN 15804+A2 | A1-A3  | A4                                       | A5   | B6  | C1  | C2  | C3.1 Recycling                 | C3.2 Landfill | C4.1 Recycling  | C4.2 Landfill | D.1 Recycling  | D.2 Landfill |
| Environmental Impact Indicators        | Manufacture of the product from 'cradle-to-gate' | Transport of the product to the customer | Installation of the product and disposal of used packaging | Use of the product over its lifetime e.g., 10 years | Deinstallation of the product from the site | Transport of the product to waste treatment | Processing waste for recycling |               | Disposal of waste that cannot be recycled (through landfill and incineration) |               | Potential benefits and loads beyond the system boundary due to reuse, recycling, and energy recovery |              |
| GWPT [kg CO2 eq.]                      | 3,46E+00   | 8,02E-02                                 | 4,70E-01   | 6,92E-01  | N/A   | 3,06E-03                                    | 2,96E-02                       | N/A           | 1,07E-03  | 9,28E-03      | -2,46E+00  | -1,13E+00    |
| GWPF [kg CO2 eq.]                      | 3,90E+00   | 7,97E-02                                 | 2,38E-02   | 6,92E-01  | N/A   | 3,06E-03                                    | 2,94E-02                       | N/A           | 1,07E-03  | 9,27E-03      | -2,45E+00  | -1,13E+00    |
| GWPB [kg CO2 eq.]                      | -4,46E-01  | 0,00E+00                                 | 4,46E-01   | 0,00E+00  | N/A   | 0,00E+00                                    | 0,00E+00                       | N/A           | 0,00E+00  | 0,00E+00      | 0,00E+00   | 0,00E+00     |
| GWPLULUC [kg CO2 eq.]                  | 2,74E-03   | 5,45E-04                                 | 1,62E-05   | 2,47E-04  | N/A   | 7,27E-08                                    | 1,99E-04                       | N/A           | 2,49E-07  | 9,53E-06      | -6,32E-03  | -3,37E-03    |
| ODP [kg CFC-11 eq.]                    | 3,09E-11   | 7,95E-15                                 | 1,79E-15   | 1,42E-11  | N/A   | 3,51E-19                                    | 2,91E-15                       | N/A           | 3,54E-16  | 1,31E-14      | -8,66E-13  | -9,18E-13    |
| AP [Mole of H+ eq.]                    | 2,45E-02   | 1,45E-04                                 | 1,33E-04   | 9,60E-04  | N/A   | 4,55E-06                                    | 1,79E-04                       | N/A           | 1,52E-06  | 5,77E-05      | -1,53E-02  | -7,40E-03    |
| EPfw [kg P eq.]                        | 1,42E-05   | 2,89E-07                                 | 1,51E-07   | 3,38E-06  | N/A   | 6,51E-10                                    | 1,06E-07                       | N/A           | 2,53E-10  | 2,13E-07      | -3,39E-06  | -1,75E-06    |
| EPmar [kg N eq.]                       | 4,80E-03   | 5,78E-05                                 | 6,79E-05   | 2,83E-04  | N/A   | 1,85E-06                                    | 8,74E-05                       | N/A           | 5,08E-07  | 2,04E-05      | -2,12E-03  | -1,03E-03    |
| EPter [Mole of N eq.]                  | 5,19E-02   | 6,65E-04                                 | 7,43E-04   | 3,04E-03  | N/A   | 2,05E-05                                    | 9,69E-04                       | N/A           | 5,73E-06  | 2,12E-04      | -2,29E-02  | -1,12E-02    |
| POFP [kg NMVOC eq.]                    | 1,36E-02   | 1,29E-04                                 | 1,26E-04   | 7,47E-04  | N/A   | 4,30E-06                                    | 1,66E-04                       | N/A           | 1,26E-06  | 5,30E-05      | -6,51E-03  | -3,14E-03    |
| ADPE [kg Sb eq.]                       | 9,42E-05   | 8,15E-09                                 | 7,72E-09   | 2,01E-07  | N/A   | 1,07E-10                                    | 2,98E-09                       | N/A           | 1,76E-11  | 6,92E-10      | -4,53E-05  | 5,60E-06     |
| ADPF [MJ]                              | 5,06E+01   | 1,06E+00                                 | 3,10E-01   | 9,80E+00  | N/A   | 4,34E-02                                    | 3,88E-01                       | N/A           | 3,05E-03  | 1,26E-01      | -3,16E+01  | -1,62E+01    |
| WDP [m <sup>3</sup> world equiv.]      | 1,75E+00   | 9,05E-04                                 | 1,82E-03   | 2,81E-01  | N/A   | 5,08E-06                                    | 3,31E-04                       | N/A           | 8,67E-05  | 5,77E-04      | -9,79E-01  | -5,32E-01    |

How to read scientific numbers:

e.g.  $2,05E02 = 2,05 \times 10^2 = 205$

$2,04E-01 = 2,04 \times 10^{-1} = 0,204$

## Environmental performance

**Table 7:** Environmental impact indicator descriptions

| Acronym  | Unit                     | Indicator  |
|----------|--------------------------|--|
| GWPT     | kg CO <sub>2</sub> eq.   | Carbon footprint (Global Warming Potential) – total                        |
| GWPF     | kg CO <sub>2</sub> eq.   | Carbon footprint (Global Warming Potential) – fossil                       |
| GWPB     | kg CO <sub>2</sub> eq.   | Carbon footprint (Global Warming Potential) – biogenic                     |
| GWPLULUC | kg CO <sub>2</sub> eq.   | Carbon footprint (Global Warming Potential) – land use and land use change |
| ODP      | kg CFC-11 eq.            | Depletion potential of the stratospheric ozone layer                       |
| AP       | Mole H <sup>+</sup> eq.  | Acidification potential  |
| EPfw     | kg P eq.                 | Eutrophication potential – aquatic freshwater                              |
| EPmar    | kg N eq.                 | Eutrophication potential – aquatic marine                                  |
| EPter    | Mole of N eq.            | Eutrophication potential – terrestrial                                     |
| POFP     | kg NMVOC eq.             | Summer smog (photochemical ozone formation potential)                      |
| ADPE*    | kg Sb eq.                | Depletion of abiotic resources – minerals and metals                       |
| ADPF*    | MJ                       | Depletion of abiotic resources – fossil fuels                              |
| WDP*     | m <sup>3</sup> world eq. | Water deprivation potential (deprivation-weighted water consumption)       |

Results for module A1-A3 are specific to the product. All results from module A4 onwards should be considered as scenarios that represent one possible outcome. The true environmental performance of the product will depend on actual use.

The results in this section are relative expressions only and do not predict actual impacts, the exceeding of thresholds, safety margins, or risks. EPDs from different programmes may not be comparable.

### Carbon footprint

The total carbon footprint (GWPF), cradle-to-grave, of the product is **4,72E+00 kg CO<sub>2</sub>-eq** (A1-C4), based on the average End-of-Life scenario. The carbon footprint (GWPF) of production of this product, cradle-to-gate, is **3,90E+00 kg CO<sub>2</sub>-eq** (A1-A3).

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## Environmental performance

**Table 8:** Resource use

|                      | A1-A3    | A4       | A5       | B6       | C1  | C2       | C3.1<br>Recycling | C3.2<br>Landfill | C4.1<br>Recycling | C4.2<br>Landfill | D.1<br>Recycling | D.2<br>Landfill |
|----------------------|----------|----------|----------|----------|-----|----------|-------------------|------------------|-------------------|------------------|------------------|-----------------|
| PERE [MJ]            | 2,77E01  | 7,36E-02 | 1,37E-02 | 8,39E00  | N/A | 1,43E-04 | 2,69E-02          | N/A              | 2,92E-04          | 1,11E-02         | -5,92E00         | -3,44E00        |
| PERM [MJ]            | 1,66E-01 | N/A      | N/A      | N/A      | N/A | N/A      | N/A               | N/A              | N/A               | N/A              | N/A              | N/A             |
| PERT [MJ]            | 2,79E01  | 7,36E-02 | 1,37E-02 | 8,39E00  | N/A | 1,43E-04 | 2,69E-02          | N/A              | 2,92E-04          | 1,11E-02         | -5,92E00         | -3,44E00        |
| PENRE [MJ]           | 5,03E01  | 1,07E00  | 3,33E-01 | 9,81E00  | N/A | 4,34E-02 | 3,90E-01          | N/A              | 3,06E-03          | 1,26E-01         | -3,16E01         | -1,62E01        |
| PENRM [MJ]           | 3,36E-01 | N/A      | N/A      | N/A      | N/A | N/A      | N/A               | N/A              | N/A               | N/A              | N/A              | N/A             |
| PENRT [MJ]           | 5,06E01  | 1,07E00  | 3,33E-01 | 9,81E00  | N/A | 4,34E-02 | 3,90E-01          | N/A              | 3,06E-03          | 1,26E-01         | -3,16E01         | -1,62E01        |
| SM [kg]              | 1,85E-01 | N/A      | N/A      | N/A      | N/A | N/A      | N/A               | N/A              | N/A               | N/A              | N/A              | N/A             |
| RSF [MJ]             | N/A      | N/A      | N/A      | N/A      | N/A | N/A      | N/A               | N/A              | N/A               | N/A              | N/A              | N/A             |
| NRSF [MJ]            | N/A      | N/A      | N/A      | N/A      | N/A | N/A      | N/A               | N/A              | N/A               | N/A              | N/A              | N/A             |
| FW [m <sup>3</sup> ] | 5,17E-02 | 8,50E-05 | 5,84E-05 | 7,40E-03 | N/A | 2,30E-07 | 3,11E-05          | N/A              | 2,14E-06          | 1,78E-05         | -4,00E-02        | -2,20E-02       |

**Table 9:** Resource use indicator descriptions

| Acronym | Unit           | Indicator   |
|---------|----------------|---|
| PERE    | MJ             | Use of renewable primary energy excluding renewable primary energy resources used as raw materials                      |
| PERM    | MJ             | Use of renewable primary energy resources used as raw materials   |
| PERT    | MJ             | Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)     |
| PENRE   | MJ             | Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials              |
| PENRM   | MJ             | Use of non-renewable primary energy resources used as raw materials   |
| PENRT   | MJ             | Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) |
| SM      | kg             | Use of secondary material   |
| RSF     | MJ             | Use of renewable secondary fuels  |
| NRSF    | MJ             | Use of non-renewable secondary fuels  |
| FW      | m <sup>3</sup> | Net use of fresh water  |

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## Environmental performance

**Table 10:** Waste categories and output flows

|           | A1-A3    | A4       | A5       | B6       | C1  | C2       | C3.1<br>Recycling | C3.2<br>Landfill | C4.1<br>Recycling | C4.2<br>Landfill | D.1<br>Recycling | D.2<br>Landfill |
|-----------|----------|----------|----------|----------|-----|----------|-------------------|------------------|-------------------|------------------|------------------|-----------------|
| HWD [kg]  | 1,84E-07 | 5,64E-12 | 1,37E-12 | 2,07E-09 | N/A | 2,99E-13 | 2,06E-12          | N/A              | 1,09E-13          | 6,58E-12         | -2,58E-04        | -1,44E-04       |
| NHWD [kg] | 4,17E-01 | 1,74E-04 | 3,09E-05 | 1,09E-02 | N/A | 4,35E-06 | 6,35E-05          | N/A              | 8,94E-03          | 3,36E-01         | -9,44E-03        | 1,07E-02        |
| RWD [kg]  | 1,53E-03 | 1,98E-06 | 7,88E-07 | 4,39E-04 | N/A | 4,65E-08 | 7,24E-07          | N/A              | 2,75E-08          | 9,84E-07         | -2,86E-04        | -1,83E-04       |
| CRU [kg]  | N/A      | N/A      | N/A      | N/A      | N/A | N/A      | N/A               | N/A              | N/A               | N/A              | N/A              | N/A             |
| MFR [kg]  | N/A      | N/A      | N/A      | N/A      | N/A | N/A      | N/A               | N/A              | 3,18E-01          | N/A              | N/A              | N/A             |
| MER [kg]  | N/A      | N/A      | N/A      | N/A      | N/A | N/A      | N/A               | N/A              | N/A               | N/A              | N/A              | N/A             |
| EEE [MJ]  | 5,70E-05 | N/A      | N/A      | N/A      | N/A | N/A      | N/A               | N/A              | 1,38E-03          | N/A              | N/A              | N/A             |
| EET [MJ]  | N/A      | N/A      | N/A      | N/A      | N/A | N/A      | N/A               | N/A              | 2,46E-03          | N/A              | N/A              | N/A             |

**Table 11:** Waste category and output flow descriptions

| Acronym | Unit | Indicator                     |
|---------|------|-------------------------------|
| HWD     | kg   | Hazardous waste disposed      |
| NHWD    | kg   | Non-hazardous waste disposed  |
| RWD     | kg   | Radioactive waste disposed    |
| CRU     | kg   | Components for reuse          |
| MFR     | kg   | Materials for recycling       |
| MER     | kg   | Materials for energy recovery |
| EEE     | kg   | Exported energy (electrical)  |
| EET     | kg   | Exported energy (thermal)     |

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## Environmental performance

**Table 12:** Additional indicators\*

|                         | A1-A3    | A4       | A5       | B6       | C1  | C2       | C3.1<br>Recycling | C3.2<br>Landfill | C4.1<br>Recycling | C4.2<br>Landfill | D.1<br>Recycling | D.2<br>Landfill |
|-------------------------|----------|----------|----------|----------|-----|----------|-------------------|------------------|-------------------|------------------|------------------|-----------------|
| PM [Disease incidences] | 3,35E-07 | 9,24E-10 | 7,68E-10 | 8,31E-09 | N/A | 2,42E-11 | 1,07E-09          | N/A              | 1,49E-11          | 5,74E-10         | -3,16E-07        | -1,65E-07       |
| IRP [kBq U235 eq.]      | 2,10E-01 | 2,99E-04 | 6,69E-05 | 8,14E-02 | N/A | 6,59E-06 | 1,09E-04          | N/A              | 3,45E-06          | 1,20E-04         | -4,05E-02        | -2,53E-02       |
| ETPfw [CTUe]            | 2,44E01  | 7,53E-01 | 2,51E-01 | 5,47E00  | N/A | 3,14E-02 | 2,75E-01          | N/A              | 1,90E-03          | 1,86E-01         | -1,90E01         | -1,02E01        |
| HTPc [CTUh]             | 6,08E-07 | 1,55E-11 | 4,01E-12 | 1,65E-10 | N/A | 5,85E-13 | 5,69E-12          | N/A              | 1,70E-13          | 6,77E-12         | -3,44E-08        | -1,89E-08       |
| HTPnc [CTUh]            | 5,08E-08 | 8,66E-10 | 1,67E-10 | 4,67E-09 | N/A | 2,54E-11 | 3,50E-10          | N/A              | 1,75E-11          | 7,10E-10         | -2,25E-08        | -9,21E-09       |
| SQP [Pt]                | 3,96E01  | 4,50E-01 | 7,04E-02 | 5,32E00  | N/A | 1,11E-04 | 1,64E-01          | N/A              | 4,00E-04          | 1,45E-02         | -4,54E00         | -2,25E00        |

**Table 13:** Optional indicator descriptions

| Acronym | Unit              | Indicator  |
|---------|-------------------|--|
| PM      | Disease incidence | Potential incidence of disease due to particulate matter emissions |
| IRP**   | kBq U235 eq.      | Potential human exposure efficiency relative to U235               |
| ETPfw*  | CTUe              | Potential Comparative Toxic Unit for ecosystems (fresh water)      |
| HTPc*   | CTUh              | Potential Comparative Toxic Unit for humans (cancer)               |
| HTPnc*  | CTUh              | Potential Comparative Toxic Unit for humans (non-cancer)           |
| SQP*    | Dimensionless     | Potential soil quality index                                       |

\*Disclaimer for ADPE, ADPF, WDP, ETPfw, HTPc, HTPnc, SQP: The results of these environmental impact indicators shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.

\*\*Disclaimer for ionising radiation: 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.

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