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## Environmental **Product Declaration**

### AME 110 NL/NLX



<b>EPD issued</b>	2024-09-05
<b>EPD expires</b>	2029-09-05
<b>EPD author</b>	Danfoss Climate Solutions A/S
<b>EPD type</b>	Cradle-to-grave
<b>Declared unit</b>	One product over its Reference Service Life
<b>Products included</b>	AME110NLX (082H8124)
<b>Product covered by EPD</b>	See Annex 1
<b>Manufacturing Location</b>	Ljubljana, Slovenia
<b>Use Location</b>	European Union
<b>Application</b>	HVAC systems
<b>Mass</b>	0,49 kg without packaging 0,53 kg with packaging
<b>Dimensions (HxWxD)</b>	97 x 53 x 88 mm without 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>Internal independent 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

The product covered by this EPD is representative of AME 110 NL/NLX. The production location is the Danfoss plant in Ljubljana, Slovenia. See more information on [Danfoss Product Store](#).

The actuator AME 110 is used with the AB QM 4.0 valves DN10 to DN32 in HVAC systems. The actuator provides a closing force in one direction.

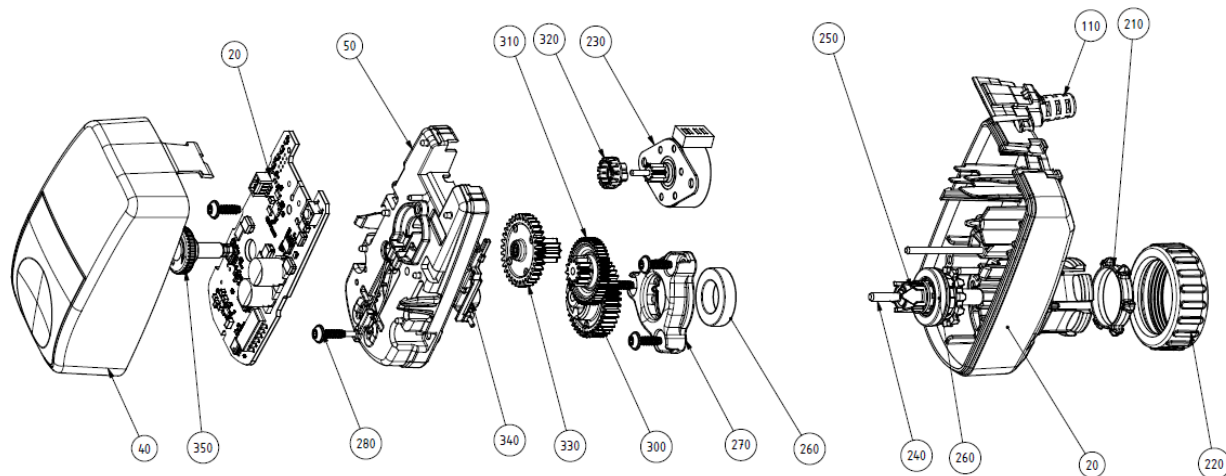
The actuator AME 110 accepts continuous modulating control signal from the controller. The actuator converts motor rotation via a gearbox to linear movement.

The product portfolio for the AME110 type actuator includes two main designs that differ in terms of how the actuator operates. The NL version of the actuator is powered and controlled by a three-wire power connection cable. The NLX version of the actuator is powered and controlled by a four-wire power connection cable.

The actuator AME110 NLX has additional wire as 0-10V output for position feedback of an operating travel. All characteristics are the same as for the AME110 NL respectively except where it is noted. The actuator has a transparent cover without a knob for manual settings of the operating travel.

The actuator's design includes a force switch-off at stem-down and a position switch-off at stem-up position.

The basic technical characteristics are as follows: The entire stroke of the actuator is 9.5 mm. The actuator has two possible, adjustable, stroke speeds. The normal stroke speed is 12s/mm, the higher stroke speed is 3s/mm. The nominal closing force achieved by the actuator is 150N.



**Figure 1:** The exploded illustration of the AME 110 NLX with its main components.

## Product Description

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### Reference Service Life

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

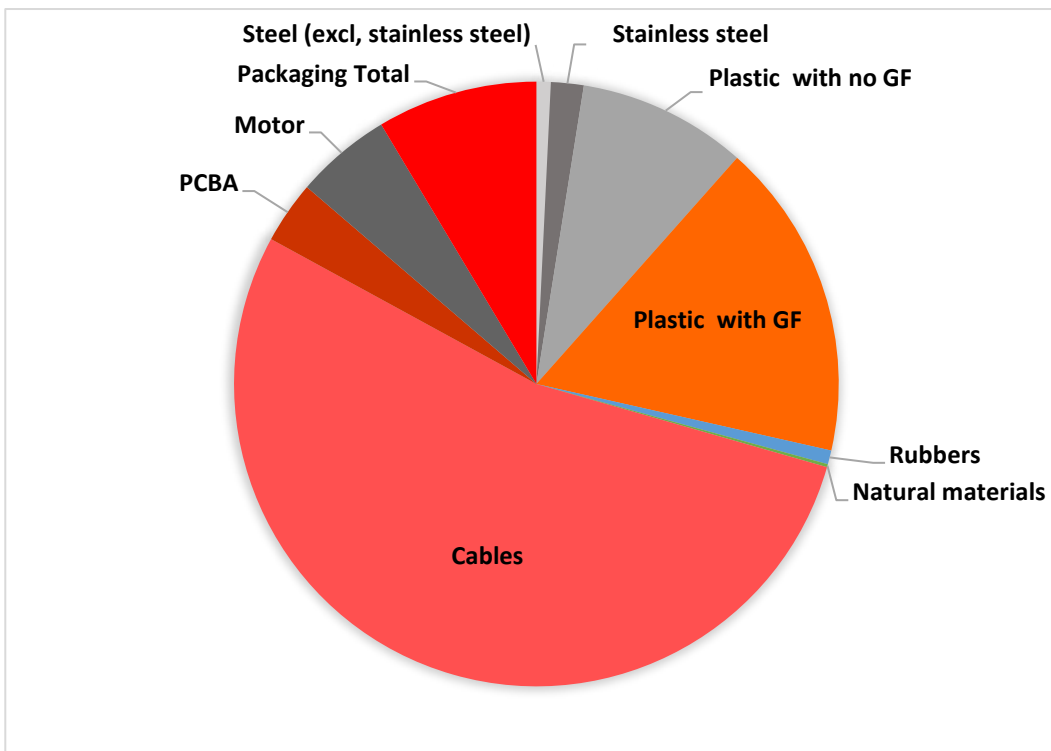
### Intended market

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

## Product Description

**Table 2:** Product composition

Materials	Mass (kg)	%
<b>Metals</b>	<b>0,013</b>	<b>2,7%</b>
Steel (excl, stainless steel)	0,004	0,8%
Stainless steel	0,009	1,9%
<b>Plastics &amp; Rubbers</b>	<b>0,143</b>	<b>29,3%</b>
Plastic with no GF	0,048	9,9%
Plastic with GF	0,091	18,6%
Rubbers	0,004	0,8%
<b>Natural materials</b>	<b>0,001</b>	<b>0,2%</b>
Paper and cardboard	0,001	0,2%
<b>Electrical/electronic</b>	<b>0,331</b>	<b>67,8%</b>
Cables	0,286	58,5%
PCBA	0,018	3,6%
Motor	0,027	5,6%
<b>Product Total</b>	<b>0,489</b>	<b>100,0%</b>
Paper and cardboard	0,046	100,0%
<b>Packaging Total</b>	<b>0,046</b>	<b>100,0%</b>
<b>Total (Product + Packaging)</b>	<b>0,534</b>	



**Figure 2:** Material Composition Overview

## Overview of LCA study

### Data quality

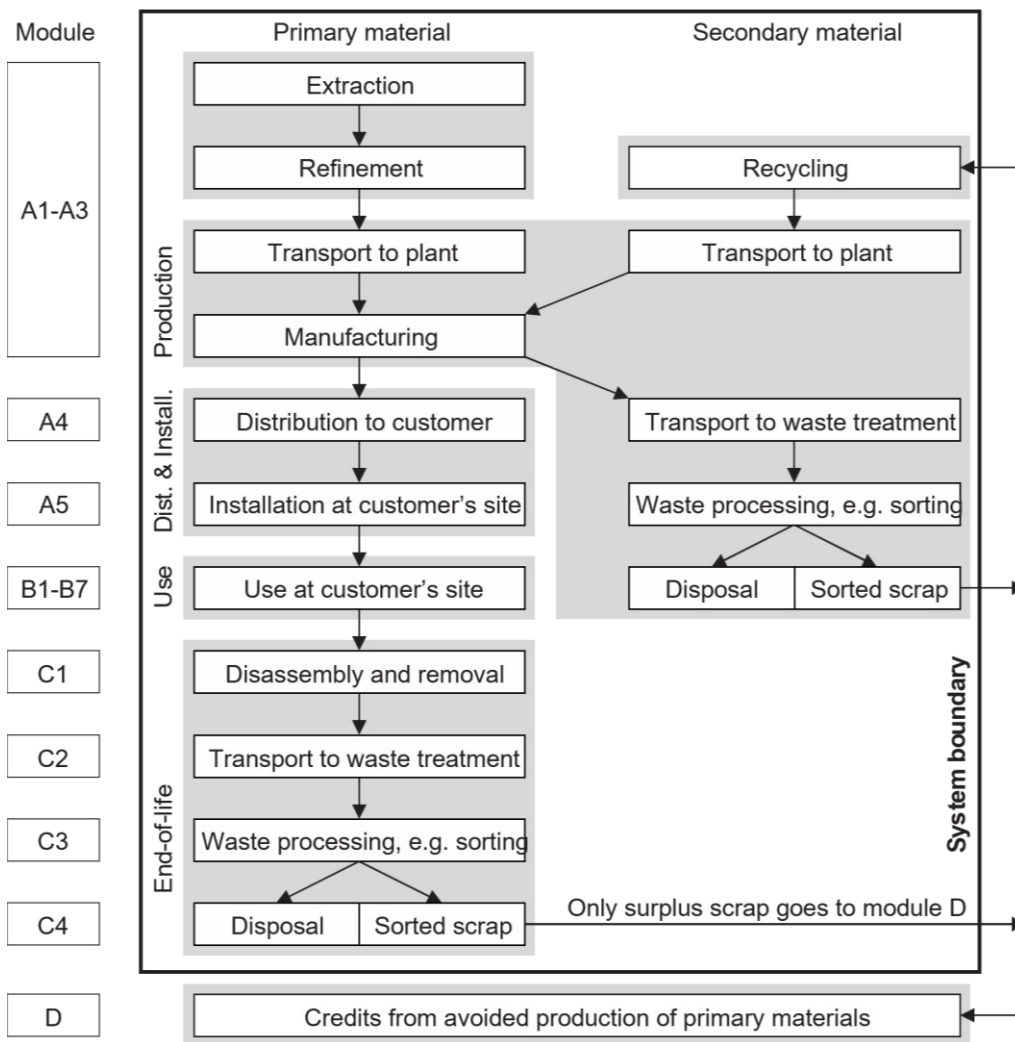
Data quality of the selected datasets is generally assessed as good and very good in terms of geographical, time and technology representativeness and applicability. Background data is from *LCA for Experts*© database version 2024.1.

### 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 1): 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 3:** Modular structure used in this EPD (following EN 15804+A2)

## Overview of LCA study

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

Final manufacturing occurs in the Ljubljana plant, Slovenia Europe. The facility is certified according to IATF 16949, ISO 14001 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 as described in Table 1. All packaging materials can be safely recycled or incinerated if appropriate local facilities are available. The on-site data was gathered for 2024

**Table 3:** Biogenic carbon content in product and packaging

	Total (excluding recycling)
Biogenic carbon content in product [kg]	3,73E-04
Biogenic carbon content in accompanying packaging [kg]	1,97E-02

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 within EU. The actuator is delivered from the production location of Danfoss, Slovenia to the central warehouse of the finished products in Rodekro, Denmark. From the warehouse location the actuator is delivered to the EU Market. For the estimated distance of transport by truck, 1921 Km is considered. The average distance was calculated using sales data.

Module A5 includes disposal of packaging materials only, the benefits from e.g., energy recovered after plastic incineration are allocated to module D. The product is assumed to be installed by hand. Energy use in handheld tools during installation is not included as it falls under the cut-off criteria.

### Use phase (B1-B6)

The estimated lifetime of the Actuator is 10 years. The estimated operating time of the actuator per day is 2,5 hours. The actuator is in standby mode for 21,5 hours per day.

In the LCA calculation for the use phase, GWP for EU grid electricity from LCA for Experts© was applied.

### End-of-life (C1-C4)

The following end-of-life procedure has been applied:

- Manual dismantling is used to separate recyclable bulk materials, e.g. bulk metals and 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).

For this EPD an average scenario with 50% of the product sent to recycling & 50% of the product sent to landfill (C3, C4, D) was used. This scenario is designed to represent an average end-of-life scenario.

For the EPD this average scenario was chosen as it is assumed that it represents the majority of cases on

## Overview of LCA study

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average.

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.

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.

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.

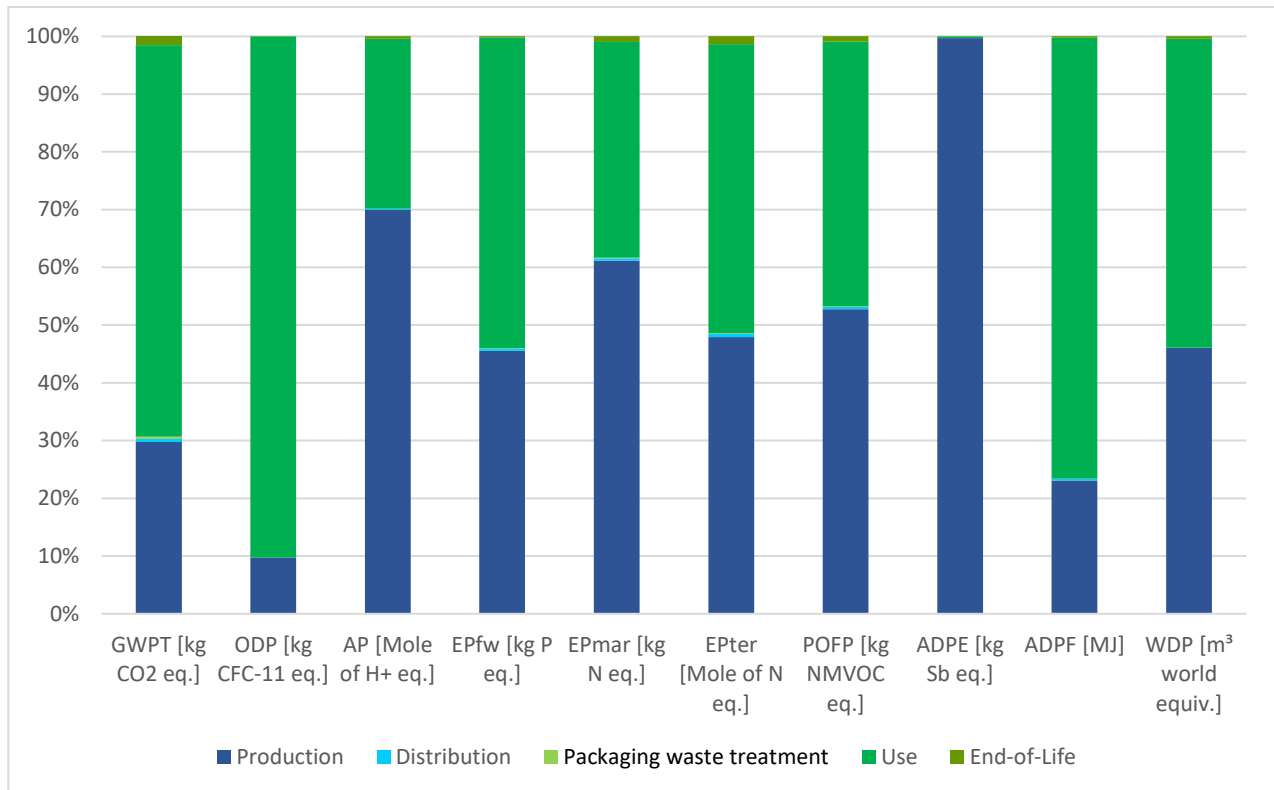
### **Benefits and loads beyond the system boundary (D)**

Module D considers the net benefit of recycling (including energy recovery) of materials in the product and packaging, taking account of losses in the recycling process and the recycled material used in the production of the product. Module D covers the two end-of-life scenarios, as described above.



## Environmental performance

This section presents the environmental performance of one AME 110NLX. Figure 4 presents the environmental impact of the AME 110NLX across a number of environmental impact categories (following EN 15804+A2:2019) per life cycle stage, over its full 10-year life cycle, including Global Warming Potential.



**Figure 4:** Breakdown of environmental impacts by life cycle stages (Average of Landfill and Recycling End-of-Life scenario/only Landfill scenario) See Table 5 and 6 for descriptions of environmental impact indicators).

## Environmental performance

**Table 4:** Environmental impact indicators

	Production	Distribution	Packaging waste treatment	Use	End-of-Life				(not included in Figure 4)	
Life cycle stages based on EN 15804+A2	A1-A3	A4	A5	B6	C1	C2	C3	C4	D	
Environmental Impact Indicators	Description	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 CO <sub>2</sub> eq.]	5,69E+00	9,09E-02	7,85E-02	1,28E+01	0,00E+00	4,98E-03	4,88E-02	2,33E-01	-1,72E+00	
GWPF [kg CO <sub>2</sub> eq.]	5,76E+00	8,94E-02	4,78E-03	1,28E+01	0,00E+00	4,98E-03	4,81E-02	2,33E-01	-1,72E+00	
GWPB [kg CO <sub>2</sub> eq.]	-7,37E-02	0,00E+00	7,37E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	
GWPLULUC [kg CO <sub>2</sub> eq.]	6,74E-03	1,45E-03	2,73E-06	1,92E-03	0,00E+00	1,20E-07	6,99E-04	5,69E-06	-2,89E-03	
ODP [kg CFC-11 eq.]	3,11E-11	1,27E-14	6,16E-16	2,87E-10	0,00E+00	5,81E-19	1,10E-13	2,69E-14	-4,61E-12	
AP [Mole of H+ eq.]	5,79E-02	1,57E-04	2,80E-05	2,44E-02	0,00E+00	6,96E-06	2,74E-04	5,08E-05	-3,93E-02	
EPfw [kg P eq.]	4,46E-05	3,68E-07	2,48E-08	5,27E-05	0,00E+00	1,08E-09	1,96E-07	9,36E-09	-1,70E-06	
EPmar [kg N eq.]	9,97E-03	6,34E-05	1,41E-05	6,09E-03	0,00E+00	2,71E-06	1,33E-04	2,03E-05	-1,97E-03	
EPter [Mole of N eq.]	6,10E-02	7,35E-04	1,55E-04	6,37E-02	0,00E+00	3,05E-05	1,47E-03	2,64E-04	-2,12E-02	
POFP [kg NMVOC eq.]	1,85E-02	1,54E-04	2,63E-05	1,61E-02	0,00E+00	6,44E-06	2,58E-04	5,12E-05	-7,58E-03	
ADPE [kg Sb eq.]	7,21E-04	7,46E-09	6,50E-10	2,27E-06	0,00E+00	1,77E-10	4,41E-09	2,25E-10	-5,60E-04	
ADPF [MJ]	8,01E+01	1,14E+00	6,41E-02	2,65E+02	0,00E+00	7,18E-02	6,43E-01	7,29E-02	-2,73E+01	
WDP [m <sup>3</sup> world equiv.]	2,96E+00	1,34E-03	2,88E-04	3,44E+00	0,00E+00	8,40E-06	1,89E-03	2,44E-02	-4,84E-01	

How to read scientific numbers:

e.g. 2,05E02 = 2,05 x 10<sup>2</sup> = 205

2,04E-01 = 2,04 x 10<sup>-1</sup> = 0,204

EPD for AME 110NL/NLX

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## Environmental performance

**Table 5:** 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 others may not be comparable.

### Carbon footprint

The total carbon footprint, cradle-to-grave, of the product is **1,90E+01** kg CO<sub>2</sub>-eq (A1-C4), based on the baseline use phase scenario. The carbon footprint of production of this product, cradle-to-gate, is **5,69E+00** kg CO<sub>2</sub>-eq (A1-A3).

## Environmental performance

**Table 6:** Resource use

	A1-A3	A4	A5	B6	C1	C2	C3	C4	D
PERE [MJ]	2,79E+01	9,79E-02	2,78E-03	1,91E+02	0,00E+00	2,37E-04	1,16E-01	1,60E-02	-3,56E+00
PERM [MJ]	1,30E-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
PERT [MJ]	2,80E+01	9,79E-02	2,78E-03	1,91E+02	0,00E+00	2,37E-04	1,16E-01	1,60E-02	-3,56E+00
PENRE [MJ]	7,50E+01	1,14E+00	6,41E-02	2,65E+02	0,00E+00	7,19E-02	6,43E-01	7,29E-02	-2,73E+01
PENRM [MJ]	5,11E+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]	8,01E+01	1,14E+00	6,41E-02	2,65E+02	0,00E+00	7,19E-02	6,43E-01	7,29E-02	-2,73E+01
SM [kg]	4,84E-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
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
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
FW [m <sup>3</sup> ]	7,68E-02	1,09E-04	9,36E-06	1,46E-01	0,00E+00	3,80E-07	1,05E-04	5,73E-04	-1,23E-02

**Table 7:** 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

## Environmental performance

**Table 8:** Waste categories and output flows

	A1-A3	A4	A5	B6	C1	C2	C3	C4	D
HWD [kg]	1.06E-06	4.35E-11	8.68E-12	3.82E-07	0.00E00	4.94E-13	1.59E-10	3.39E-11	-9.75E-06
NHWD [kg]	9.83E-01	1.86E-04	6.32E-06	2.19E-01	0.00E00	7.19E-06	1.69E-04	1.30E-02	-2.93E-01
RWD [kg]	1.99E-03	2.07E-06	1.66E-07	4.22E-02	0.00E00	7.69E-08	1.63E-05	2.78E-06	-6.94E-05
CRU [kg]	0.00E00	0.00E00	0.00E00	0.00E00	0.00E00	0.00E00	0.00E00	0.00E00	0.00E00
MFR [kg]	0.00E00	0.00E00	0.00E00	0.00E00	0.00E00	0.00E00	0.00E00	3.73E-01	0.00E00
MER [kg]	0.00E00	0.00E00	0.00E00	0.00E00	0.00E00	0.00E00	0.00E00	0.00E00	0.00E00
EEE [MJ]	1.77E-02	0.00E00	0.00E00	0.00E00	0.00E00	0.00E00	0.00E00	0.00E00	0.00E00
EET [MJ]	0.00E00	0.00E00	0.00E00	0.00E00	0.00E00	0.00E00	0.00E00	0.00E00	0.00E00

**Table 9:** 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)

## Environmental performance

**Table 10:** Additional indicators\*

	A1-A3	A4	A5	B6	C1	C2	C3	C4	D
PM [Disease incidences]	5.80E-07	1.41E-09	1.71E-10	2.04E-07	0.00E00	4.13E-11	1.84E-09	4.52E-10	-3.37E-07
IRP [kBq U235 eq.]	2.35E-01	3.00E-04	1.41E-05	6.95E00	0.00E00	1.09E-05	2.66E-03	4.31E-04	6.48E-03
ETPfw [CTUe]	6.41E01	8.35E-01	4.95E-02	1.21E02	0.00E00	5.20E-02	4.46E-01	4.98E-02	-1.75E01
HTPc [CTUh]	2.55E-08	1.70E-11	8.56E-13	4.31E-09	0.00E00	9.68E-13	9.78E-12	3.39E-12	-2.18E-09
HTPnc [CTUh]	1.06E-07	9.54E-10	3.70E-11	9.96E-08	0.00E00	4.23E-11	5.53E-10	1.75E-10	-5.08E-08
SQP [Pt]	2.49E01	5.59E-01	1.25E-02	1.12E02	0.00E00	1.84E-04	3.10E-01	1.79E-02	-7.29E00

**Table 11:** 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 ionizing 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.

## Annex

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### Annex 1: The sales codes of all products covered in this EPD

The EPD results are presented for the product code 082H8124. Other product codes from the product line of the product differ in the length of the connecting cable and some smaller electronic components. The deviation of the environmental impact is less than 10%.

**Table 12:** AME110 sales codes, covered by this EPD

Sales code	Actuator type	Description
AME 110 NL	082H8110	24V AC/DC 1.5m cable
AME 110 NLX	082H8114	24V AC/DC 1.5m cable
AME 110 NL	082H8118	24V AC/DC 1.5m cable I-Pack
AME 110 NL	082H8119	24V AC/DC 2.5m cable I-Pack
AME 110 NL	082H8120	24V AC/DC 5m cable I-Pack
AME 110 NLX	082H8122	24V AC/DC 1.5m cable I-Pack
AME 110 NLX	082H8123	24V AC/DC 2.5m cable I-Pack
AME 110 NLX	082H8124	24V AC/DC 5m cable I-Pack

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