Environmental **Product Declaration**

Thermal actuators TWA

EPD owner	Danfoss A/S
EPD registration number	EPD-IES-0030954:001
Programme	The International EPD® System, www.environdec.com
Programme operator	EDP International AB
EPD Type	Cradle to gate with options, modules A4-A5, B6, modules C1–C4, and module D, EPD for multiple products based on worse case results
Version date	2026-04-09
Validity date	2031-04-09

Environmental Product Declaration in accordance with EN 15804.2012+A2:2019/AC:2021 and ISO 14025:2006

An EPD may be updated or depublished if conditions change. To find the latest version of the EPD and to confirm its validity, see www.environdec.com

ECO PLATFORM EPD VERIFIED

EPD INTERNATIONAL EPD SYSTEM

General information

EPD author	Danfoss Climate Solutions A/S
Declared unit	One product over its Reference Service Life
Product included	Thermal actuator TWA-A RA,230V-10m (088H3119)
Product covered by the EPD	See Annex 1
Manufacturing Location	Sofia, Bulgaria
Use Location	European Union
Application	On/off control of hydronic heating and cooling systems.
Mass	0,449 kg without packaging 0,480 kg with packaging
Dimensions (H×W×D)	40,5 x 40,5 x 76,6 mm without packaging
Verification	[X] External [ ] Internal [ ] None
Produced to	PCR 2019:14 version 2.0.1
External verifier	Bureau Veritas Certification Sweden, accredited by SWEDAC accr. No. 1236

Programme information	
Programme	The International EPD® System
Address	EPD International AB Box 210 60 SE-100 31 Stockholm Sweden
E-mail	support@environdec.com

General information

Product Category Rules (PCR)	
CEN standard EN 15804 serves as the Core Product Category Rules (PCR)	
Product Category Rules (PCR):	Construction products PCR 2019:14 v. 2.0.1, CPC code: 439
PCR review was conducted by:	The Technical Committee of the International EPD® System. Chair: Rob Rouwette, Greendesk (on behalf of EPD International AB). Contact via support@environdec.com
Verification	
External and independent ('third-party') verification of the declaration and data, according to ISO 14025:2006, via:	
✓ EPD verification through an EPD process certification without a pre-verified LCA/EPD tool	
Third-party verifier	Bureau Veritas Certification Sweden
Accredited by	SWEDAC with accreditation number 1236
*EPD Process Certification involves an accredited certification body certifying and periodically auditing the EPD process and conducting external and independent verification of EPDs that are regularly published. More information can be found in the General Programme Instructions on www.envrondec.com. International EPD System	
Procedure for follow-up of data during EPD validity involves third-party verifier: ☐ Yes ✓ No	
Ownership and limitations on use of the EPD	

EPDs within the same product category but published in different EPD programmes, may not be comparable. For two EPDs to be comparable, they shall be based on the same PCR (including the same first-digit version number) or be based on fully aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have identical scope in terms of included life-cycle stages (unless the excluded life-cycle stage is demonstrated to be insignificant); apply identical impact assessment methods (including the same version of characterisation factors); and be valid at the time of comparison

The EPD owner has the sole ownership, liability, and responsibility for the EPD.

Company Information

EPD owner information	
EPD owner	Danfoss A/S
Address	Nordborgvej 81 6430 Nordborg Denmark
E-mail	epd_danfoss@danfoss.com

Danfoss is empowering its customers to make decisions in favor of decarbonization by providing an EPD on its products

By providing transparency in our products, Environmental Product Declarations support data driven decision-making for customers wishing to drive the green transition. Compliant with wide-reaching regulations, EPDs support the creditability of our products footprint through verification.

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Product information

The reference product used for this EPD is representative of **Thermal actuator TWA-A RA,230V-10m.** The production location is the Danfoss plant in Sofia, Bulgaria. See more information on Danfoss Product Store.

The TWA is a small actuator for electrical on/off control, designed to operate various types of valves and floor heating manifolds. The TWA range includes actuators for 24 V (SELV*) or 230 V supply, available in both normally closed (NC) and normally open (NO) versions (valve positions with no supply voltage to the actuator). NC/S versions with an end switch are also available for certain actuator types. Each actuator is equipped with a visual position indicator to show whether the valve is open or closed. The TWA can be connected to RA, RAVL, and RAV valves from Danfoss. The TWA-K version (M30×1.5) can be connected to Heimeier, MNG, and Oventrop valves. Other valves must be verified individually to ensure correct valve closing dimensions and valve top geometry.

*SELV=Safety Extra Low Voltage

Product information	
UNCPC code	439

The product does not contain any substances from the Candidate List of Substances of Very High Concern for Authorisation of the European Union's REACH Regulation (EC 1907/2006) above the threshold of 0.1% weight/weight.

This Environmental Product Declaration (EPD) follows the PCR 2.0.1 Construction products. These rules provide a consistent framework for calculating and reporting the environmental performance of Danfoss' product and is aligned with relevant standards, particularly ISO 14025:2006, EN 15804+A2: 2019 and EN 50598-3:2015.

This document has been produced by Danfoss A/S and an external third-party verification is conducted.

Tharmal actuator TWA-A

Tharmal actuator TWA-

Tharmal actuator TWA-V

Tharmal actuator TWA-L

Figure 1: Thermal actuators TWA

Content declaration

Table 1: Product composition

Material	Mass (kg)	%	Post-consumer scrap (%)
Metals	**3,2E-02**	**7,2%**	**0%**
Steel (excl. stainless steel)	1,5E-02	3,4%	0%
Stainless steel	1,0E-03	0,2%	0%
Copper and its alloys	1,6E-02	3,6%	0%
Plastics & Rubbers	**5,0E-02**	**11,1%**	**0%**
Plastic with no GF	5,3E-03	1,2%	0%
Plastic with GF	4,3E-02	9,6%	0%
EPDM	1,3E-03	0,3%	0%
Electrical/electronic	**3,6E-01**	**81,3%**	**0%**
Cables	3,6E-01	81,1%	0%
EEE	1,0E-03	0,2%	0%
Other materials	**2,0E-03**	**0,4%**	**0%**
Wax	2,0E-03	0,4%	0%
Total product	**4,5E-01**	**100,0%**	**0%**

Table 2: Packaging composition

Material	Mass (kg)	Mass versus product (%)
Cardboard	2,0E-02	64,5%
Polyethylene	1,1E-02	35,5%
Packaging Total	**3,1E-02**	**100,0%**
Total (Product + Packaging)	**4,8E-01**	

Figure 2: Product + Packaging material composition overview

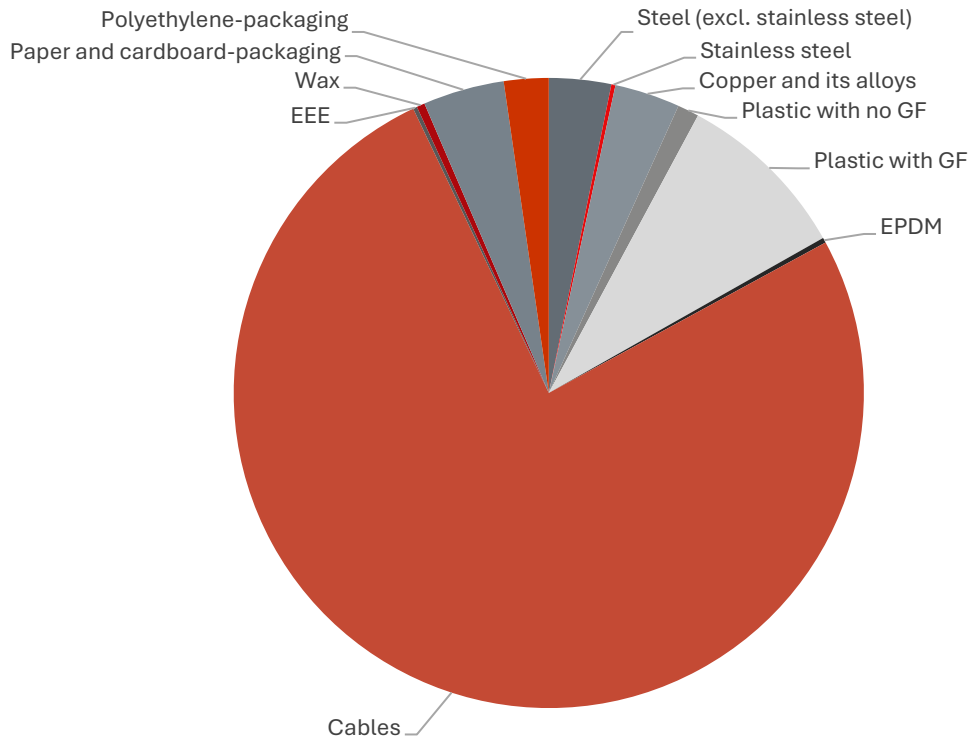


Table 3: Biogenic and recycled content overview

Biogenic content in the product [kg]	**0**
Biogenic content in the packaging [kg]	**8,6E-03**

LCA Information

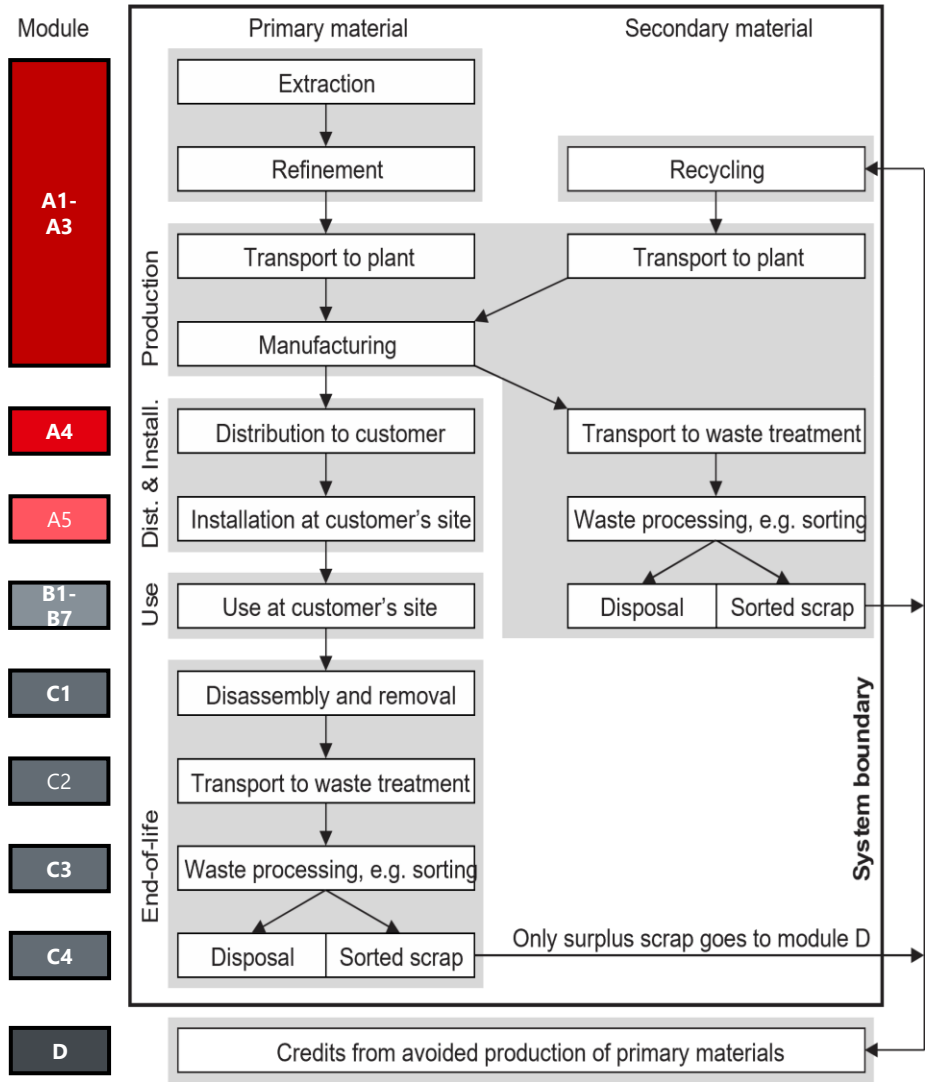
An EPD is a document used to communicate transparently, the quantified environmental impacts of a product over its lifecycle stages. This quantification is done by performing a Life Cycle Assessment (LCA) in line with a consistent set of rules known as a PCR (Product Category Rules).

This EPD is of the type 'cradle-to-gate with options' 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 4: Module of the product's life cycle included in the EPD

	Production stage			Installation		Use stage							End-of-life-stage				Benefits
	Raw material supply	Transport	Manufacture	Transport	Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Optional energy use	Optional water use	De-installation	Transport	Waste processing	Disposal	Benefits and loads outside system boundaries
Module	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Module declared	X	X	X	X	X	ND	ND	ND	ND	ND	X	ND	X	X	X	X	X
Geography	EU-27	EU-27	BG	EU-27	EU 27	-	-	-	-	-	EU-27	-	EU 27	EU 27	EU 27	EU 27	EU 27
Primary data used	14%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation products	74%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation sites	0%			-	-	-	-	-	-	-	-	-	-	-	-	-	-

Figure 3: Modular structure used in this EPD (EN15804+A2)



LCA Information

Product and packaging (A1-A3)

Final manufacturing occurs in the Danfoss Sofia plant, Bulgaria. 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. All packaging materials can be safely recycled or incinerated if appropriate local facilities are available. The on-site data was gathered for 2025. Danfoss Sofia plant, Bulgaria uses residual mix electricity with a GWPT of 5,31E-01 kgCO2eq/kWh.

Shipping and installation (A4-A5)

Distribution is assumed to occur to customers within the European Union. Transportation at 4112 km distance by truck is assumed between the factory and the final customer. The EPD calculation takes into account the distance from the product's production location in Sofia plant, Bulgaria, to the Danfoss central warehouse for finished products in Rodekro, Denmark, as transportation to the final customer in the European Union.

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 under the cut-off criteria.

Table 5: Overview of LCA study

Assumptions	
Reference service life	7 years
Intended market	The European Union.The baseline scenario involves the distribution, installation, and end-of-life in the European Union.
Use-phase	One average EU-27 factor has been applied, representing a conservative scenario as the grid will decarbonize over time
Use of Proxy and supplier specific data	No supplier speciifc data was used . Datasets from Sphera LCA software were used for this LCA.
Data	LCA for Experts (Sphera) database version 2026.1.
Data quality	A data quality assessment that complies with EN 15941 and EN15804 annex E, was performed and reported in the LCA report per dataset. Data quality of the selected datasets is generally assessed as good and very good in terms of geographical, time and technology representativeness and applicability. The data was collected for a period from January to December 2025.
Allocation and cut-off criteria	The allocation is done in accordance with EN 15804+A2. All major raw materials and 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.

LCA Information

Table 6: Share of primary data, of GWP-GHG in A1-A3

Process	Source type	Source	Reference year	Data category	Primary data share (%)
Generation of electricity used in manufacturing of product	Database	Sphera my professional database 2026.1	2024	Primary data	**1,8%**
Transport of raw materials to manufacturing site	Database	Sphera my professional database 2026.1	2025	Primary data	**11,9%**
Other	Database	Sphera my professional database 2026.1	2025	Secondary data	**0,0%**
Total share of primary data, of GWP-GHG results for A1-A3					**14,0%**

The share of primary data is calculated based on GWP-GHG results. It is a simplified indicator for data quality that supports the use of more primary data, to increase the representativeness of and comparability between EPDs. Note that the indicator does not capture all relevant aspects of data quality and is not comparable across product categories.

LCA Information

Use phase (B1-B7)

For the purpose of this assessment, use within the European Union is assumed and an average European Union CO2 factor from LCA for Experts database (2026.1) is applied. Sales also occur outside of the European Union, which is important to note considering the impact the electricity grid mix can have on the emissions in the use phase. However, for the purpose of this assessment, an average China CO2 factor from LCA for Experts© database version 2026.1. is applied. This factor will differ, depending on the country and share of renewables and fossil energy sources in the corresponding local electricity grid.

The electricity consumption by the Thermal actuator TWA the use phase (B6) can vary based on the application. The use scenario considered in the calculation is an average scenario to represent a range of applications, developed according to Danfoss Climate Segment global application experts and internal sales data.

The Thermal actuator TWA is in active mode for 5,92 hours per day, which on average is 2160,8 hours/year resulting to 15125,6 hours over its 7 years lifetime. For the remaining hours, the Thermal actuators TWA is in standby mode for 18,08 hours per day which on average is 6599,2 hours/year resulting to 46194,4 hours over its 7 years lifetime.

Table 7: CO2 emissions per use phase location

Location of use	GWPT Use phase (B6), kgCO2eq
Europe, EU-27 (Baseline scenario)	2,29E+00
China	5,62E+00

LCA Information

End-of-life (C1-C4)

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 the 100% reycing scenario has been applied, due to being the most conservative in comparison to 100% landfil (based on sensisitivity anaylsis). This is due to the composition of the product, that results in lower GWPT from landfill in comparison to recylcing (processing of waste).

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.

Table 8: Characterization methods of environmental performance

Environmental impact indicators	Characterization methods
GWPT	Carbon footprint-total, GWP100, EN 15804. Version: August 2021
GWPF	Carbon footprint-fossil, GWP100, EN 15804. Version: August 2021
GWPB	Carbon footprint-biogenic, GWP100, EN 15804. Version: August 2021
GWPLULUC	Carbon footprint-land use and land use change, GWP100, EN 15804. Version: August 2021
ODP	Depletion potential of the stratospheric ozone layer, ODP, EN 15804. Version: August 2021
AP	Acidification potential, AP, CML 2001 non baseline (fate not included). Version: January 2016
EPfw	Eutrophication potential- aquatic freshwater, Ep, aquatic marine, EUTREND model EN 15804. Version: August 2021
Epmar	Eutrophication potential- aquatic marine, EP, aquatic marine, EUTREND model EN 15804. Version: August 2021
Epter	Eutrophication potential- terrestrial, EP, aquatic marine, EUTREND model EN 15804. Version: August 2021
POCP	Photochemical ozone creation potential, POPCP, LOTOS-EUROS as applied in ReCiPe, EN15804. Version: August 2021
ADPE	Depletion of abiotic resources – minerals and metals, EPD minerals & metals, EN 15804, Version: August 2021.
ADPF	Depletion of abiotic resources – fossil fuels, EPD fossil resources, EN 15804, Version: August 2021.
WDP	Water deprivation potential (deprivation-weighted water consumption), Water deprivation (Available water remaining (AWARE), EN 15804

Environmental performance

This section presents the environmental performance of one-unit Thermal actuator TWA-A RA, 230V-10m (088H3119) . Figure 4 presents the environmental impact of the Thermal actuator TWA-A RA,230V-10m (088H3119) across a number of environmental impact categories (following EN 15804+A2:2019) per life cycle stage, over its full 7-years life cycle, including Global Warming Potential.

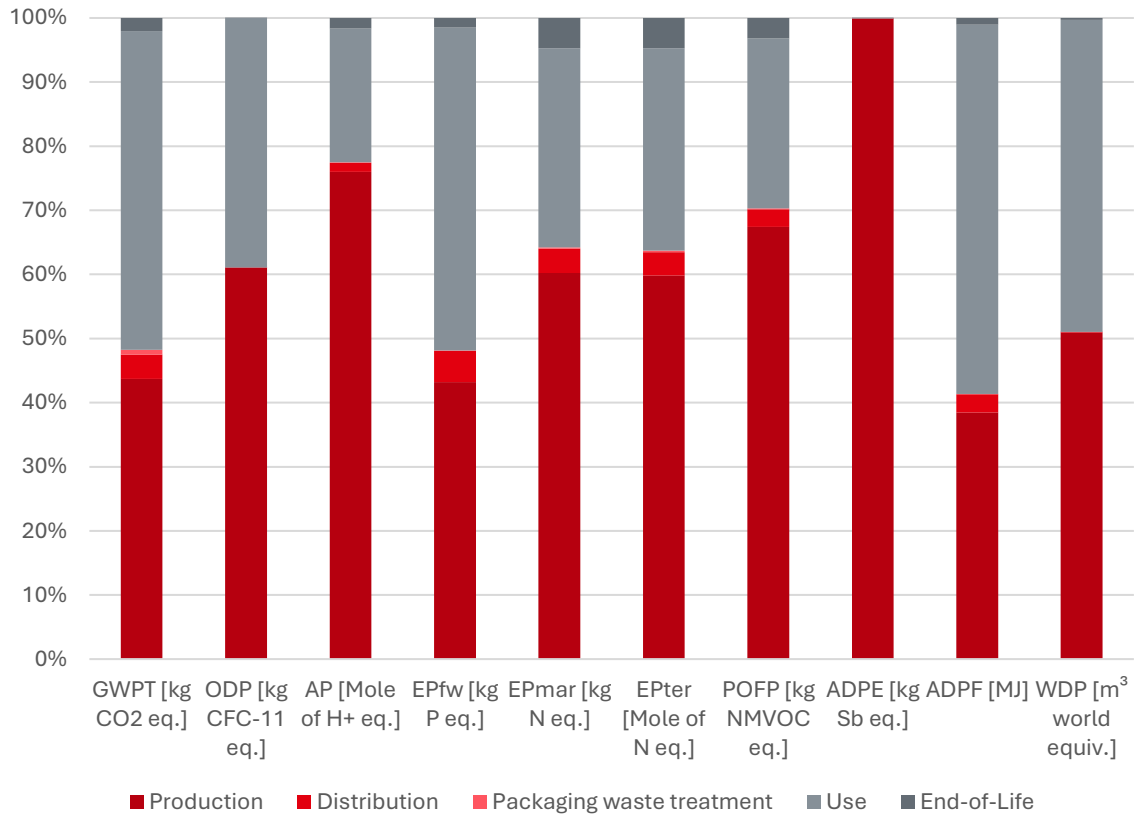
The environmental performance results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks. The results of the end-of-life stage (module C) should be considered when using the results of the production stage (modules A1-A3).

Table 9: Environmental impact indicators results per declared unit

Acronym	Indicator
GWPT	Carbon footprint (Global Warming Potential) – total
ODP	Depletion potential of the stratospheric ozone layer
AP	Acidification potential
EPfw	Eutrophication potential – aquatic freshwater
EPmar	Eutrophication potential – aquatic marine
EPter	Eutrophication potential – terrestrial
POFP	Summer smog (photochemical ozone formation potential)
ADPE*	Depletion of abiotic resources – minerals and metals
ADPF*	Depletion of abiotic resources – fossil fuels
WDP*	Water deprivation potential (deprivation-weighted water consumption)

***Disclaimer for ADPE, ADPF, WDP:** 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.

Figure 4: Breakdown of environmental impacts by life cycle stages with Module D is not included. (See Table 8&9 for descriptions of environmental impact indicators)



Environmental performance

Of one-unit Thermal actuator TWA-A RA, 230V-10m

			Production	Distribution	Packaging waste treatment	Use	End-of-Life				Benefits & Loads
			A1-A3	A4	A5	B6	C1	C2	C3	C4	D
			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
Impact category	**Environmental Impact indicators**	**Unit**									
Global Warming Potential	**Total (GWPT)**	kg CO_2 eq.	2,0E+00	1,8E-01	3,5E-02	2,3E+00	0,0E+00	4,6E-03	8,9E-02	0,0E+00	-3,6E-01
	Fossil (GWPF)	kg CO_2 eq.	2,0E+00	1,7E-01	3,0E-03	2,3E+00	0,0E+00	4,6E-03	8,8E-02	0,0E+00	-3,6E-01
	Biogenic (GWPB)	kg CO_2 eq.	-3,2E-02	0,0E+00	3,2E-02	2,3E-02	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00
	Land use & change (GWPLULUC)	kg CO_2 eq.	5,2E-03	1,8E-03	1,6E-06	7,5E-03	0,0E+00	1,1E-07	5,4E-04	0,0E+00	-7,2E-04
	Greenhouse gases (GWP-GHG)	kg CO_2 eq.	2,0E+00	1,8E-01	3,0E-03	2,3E+00	0,0E+00	4,6E-03	8,9E-02	0,0E+00	-3,6E-01
Ozone Depletion Potential	**ODP**	kg CFC-11 eq.	8,1E-11	2,9E-14	6,4E-16	5,2E-11	0,0E+00	5,4E-19	2,5E-14	0,0E+00	-2,3E-11
Acidification of soils and water	**AP**	Mole of H+ eq.	1,8E-02	3,4E-04	1,8E-05	5,0E-03	0,0E+00	6,4E-06	3,8E-04	0,0E+00	-3,7E-03
Eutrophication	**Freshwater (EPfw)**	kg P eq.	4,2E-06	4,7E-07	5,6E-09	4,9E-06	0,0E+00	1,0E-09	1,5E-07	0,0E+00	-3,3E-07
	Marine (EPmar)	kg N eq.	2,3E-03	1,5E-04	9,0E-06	1,2E-03	0,0E+00	2,5E-06	1,8E-04	0,0E+00	-2,5E-04
	Terrestrial (EPter)	Mole of N eq.	2,5E-02	1,6E-03	9,8E-05	1,3E-02	0,0E+00	2,8E-05	2,0E-03	0,0E+00	-2,7E-03
Photochemical ozone formation	**POFP (POFP)**	kg NMVOC eq.	7,5E-03	3,1E-04	1,7E-05	3,0E-03	0,0E+00	6,0E-06	3,5E-04	0,0E+00	-9,7E-04
Depletion of abiotic resources	**Minerals, metals (ADPE)**	kg Sb eq.	5,7E-04	1,2E-08	4,9E-10	4,7E-07	0,0E+00	1,6E-10	3,8E-09	0,0E+00	-1,6E-04
	Fossil fuels (ADPF)	MJ	3,1E+01	2,3E+00	4,0E-02	4,6E+01	0,0E+00	6,6E-02	7,7E-01	0,0E+00	-7,6E+00
Water deprivation	**WDP**	m^3 world equiv.	5,8E-01	8,1E-04	4,2E-05	5,6E-01	0,0E+00	7,8E-06	3,3E-03	0,0E+00	-1,2E-01

Table 10: Environmental impact indicators results per declared unit

Environmental performance

Of one-unit Thermal actuator TWA-A RA, 230V-10m

		Production	Distribution	Packaging waste treatment	Use	End-of-Life				Benefits & Loads
		A1-A3	A4	A5	B6	C1	C2	C3	C4	D
Resource Use indicator	**Unit**									
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE)	MJ	8,6E+00	1,7E-01	1,6E-03	3,2E+01	0,0E+00	2,2E-04	6,3E-02	0,0E+00	-9,7E-01
Use of renewable primary energy resources used as raw materials (PERM)	MJ	3,4E-02	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) (PERT)	MJ	8,7E+00	1,7E-01	1,6E-03	3,2E+01	0,0E+00	2,2E-04	6,3E-02	0,0E+00	-9,7E-01
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials (PENRE)	MJ	2,7E+01	2,3E+00	4,0E-02	4,6E+01	0,0E+00	6,6E-02	7,7E-01	0,0E+00	-7,6E+00
Use of non-renewable primary energy resources used as raw materials (PENRM)	MJ	4,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) (PENRT)	MJ	3,1E+01	2,3E+00	4,0E-02	4,6E+01	0,0E+00	6,6E-02	7,7E-01	0,0E+00	-7,6E+00
Use of secondary material (SM)	kg	3,1E-02	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00
Use of renewable secondary fuels (RSF)	MJ	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00
Use of non-renewable secondary fuels (NRSF)	MJ	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00
Net use of fresh water (FW)	m^3	1,4E-02	8,4E-05	1,7E-06	2,4E-02	0,0E+00	3,5E-07	9,9E-05	0,0E+00	-2,5E-03
Waste categories and output flows indicators	**Unit**									
Hazardous waste disposed (HWD)	kg	2,4E-08	9,1E-11	6,7E-12	6,0E-08	0,0E+00	4,6E-13	4,3E-11	0,0E+00	-1,9E-07
Non-hazardous waste disposed (NHWD)	kg	3,0E-01	3,2E-04	4,0E-06	3,6E-02	0,0E+00	6,7E-06	3,2E-01	0,0E+00	-6,5E-02
Radioactive waste disposed (RWD)	kg	4,9E-04	4,3E-06	1,2E-07	7,3E-03	0,0E+00	7,1E-08	2,3E-06	0,0E+00	-3,8E-06
Components for reuse (CRU)	kg	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00
Materials for recycling (MFR)	kg	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00	4,4E-01	0,0E+00	0,0E+00
Materials for energy recovery (MER)	kg	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00
Exported energy (electrical) (EEE)	MJ	8,1E-03	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00
Exported energy (thermal) (EET)	MJ	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00	0,0E+00

Table 11: Resource use, waste categories, and output flows result per declared unit.

Environmental performance

Of one-unit Thermal actuator TWA-A RA, 230V-10m

		Production	Distribution	Packaging waste treatment	Use	End-of-Life				Benefits & Loads
		A1-A3	A4	A5	B6	C1	C2	C3	C4	D
Additional indicators	**Unit**									
Potential incidence of disease due to particulate matter emissions (PM)	Disease incidences	1,8E-07	2,9E-09	1,1E-10	4,1E-08	0,0E+00	3,8E-11	2,7E-09	0,0E+00	-3,1E-08
Potential human exposure efficiency relative to U235 (IRP)**	kBq U235 eq.	5,9E-02	6,1E-04	1,0E-05	1,2E+00	0,0E+00	1,0E-05	3,1E-04	0,0E+00	2,3E-03
Potential Comparative Toxic Unit for ecosystems (fresh water) (ETPfw)*	[CTUe]	1,8E+01	2,9E+00	2,9E-02	7,8E+00	0,0E+00	4,9E-02	9,3E-01	0,0E+00	-5,7E+00
Potential Comparative Toxic Unit for humans (cancer) (HTPc)*	CTUh	8,4E-10	4,0E-11	4,5E-13	7,3E-10	0,0E+00	9,0E-13	1,3E-11	0,0E+00	-2,4E-10
Potential Comparative Toxic Unit for humans (non-cancer) (HTPnc)*	CTUh	5,3E-08	2,2E-09	1,4E-11	1,6E-08	0,0E+00	2,9E-11	6,9E-10	0,0E+00	-1,4E-08
Potential soil quality index (SQP)*	Dimensionless	1,5E+01	1,0E+00	5,9E-03	1,9E+01	0,0E+00	1,7E-04	3,1E-01	0,0E+00	-2,5E+00

Table 12: Additional indicators* results per declared unit.

***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
*****GWP-GHG** environmental indicator is calculated without the biogenic global warming potential (GWPB), the formula is GWP-GHG=GWPF+GWPLULUC

References

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Abbreviations

Abbreviation	Definition
EPD	Environmental Product Declaration
LCA	Life Cycle Assessment
EoL	End-of-Life
GHG	Greenhouse Gas
GWP	Global Warming Potential
ISO	International Organization for Standardization
PCR	Product Category Rule

Annex 1

The EPD report is prepared for the following product codes shown in Table A2 (Annex 2). The table shows the product codes and the scaling factor relative to the reference product code for which the environmental parameters were calculated. According to the Life Cycle Assessment (LCA) results, the primary difference between the individual product codes of the TWA Thermal actuators is the length of the power supply cable. Additional differences related to total mass, material composition, mechanical connection to the valve and rated supply voltage.
Product code Thermal actuator TWA 008H3119 was selected as the reference product for the LCA study. It represents the product group with the highest mass. The selection of the reference product follows a conservative approach, as the product with the highest mass is assumed to generate the highest environmental impact within the assessed product group.
Two scalar factors are defined for the adjustment of environmental impact indicators across product codes:

- The first scalar factor applies to modules A1-A5 (production and installation stage) and C1-C4 (end-of-life stage) It represents the ration between the mass of the reference product and the mass of each individual product code listed in the Table A2. This enables proportional scaling of environmental impact based on product mass.
- The second scalar factor applies to module B6 (use stage-operational electricity consumption). According to the technical specifications, electricity consumption during operation is identical for all product codes within the product group. Therefore. The scalar factor for module B6 is equal to 1 for all products shown in the Table A2.

Example:

Product code: **088H3105**
Scale factor (see Table A2) (A1-A5)+(C1-C4)+(D): **0,298**
Scale factor (see Table A2) (B6): **1,00**
Reference GWPT (A1-A3) (088H3119): **1,92E+00** [kg CO2-eq]
Reference GWPT (B6) (088H3119): **2,29E+00** [kg CO2-eq]

GWPT (A1-A3) (**Product code**) = Scale factor x Reference GWPT (A1-A3)
GWPT (A1-A3) (**088H3105**) = **0,298** x **1,92E+01**[kg CO2-eq] = **5,71E-01** [kg CO2-eq]

GWPT (B6) (**Product code**) = Scale factor x Reference GWPT (B6)
GWPT (B6) (**088H3105**) = **1,00** x **2,29E+00** [kg CO2-eq] = **2,29E+00** [kg CO2-eq]

Annex 1

Table A1: Product codes covered by the EPD

Product code	Product Designation	Product Mass [Kg]	Scale factor (A1-A5) (C1-C4)	Scale factor (B6)	GWPT A1-A3 [kgCO2 -eq]	GWPT B6 [kgCO2 -eq]	GWPT [kgCO2 -eq]
088H3105	TWA-K M30x1,5, 230V, 0,95	0,136	0,298	1,00	5,71E-01	2,29E+00	2,84E+00
088H3106	TWA-A RA, 230V, 0,95	0,138	0,302	1,00	5,80E-01	2,29E+00	2,85E+00
088H3110	TWA-A RA, 24V, 0,95	0,118	0,258	1,00	4,96E-01	2,29E+00	2,77E+00
088H3111	TWA-A RA, 24V, 0,95	0,120	0,263	1,00	5,04E-01	2,29E+00	2,78E+00
088H3112	TWA-A RA, 230V, 0,95	0,118	0,258	1,00	4,96E-01	2,29E+00	2,77E+00
088H3113	TWA-A RA, 230V, 0,95	0,120	0,263	1,00	5,04E-01	2,29E+00	2,78E+00
088H3114	TWA-A RA, 24V, 0,95	0,134	0,293	1,00	5,63E-01	2,29E+00	2,84E+00
088H3116	TWA-A RA, 24V, 5	0,276	0,604	1,00	1,16E+00	2,29E+00	3,41E+00
088H3117	TWA-A RA, 24V, 10	0,446	0,976	1,00	1,87E+00	2,29E+00	4,10E+00
088H3118	TWA-A RA, 230V, 5	0,268	0,586	1,00	1,13E+00	2,29E+00	3,38E+00
088H3119	TWA-A RA, 230V, 10	0,449	1,000	1,00	1,92E+00	2,29E+00	4,15E+00
088H3120	TWA-V RAV, 24V, 0,95	0,135	0,295	1,00	5,67E-01	2,29E+00	2,84E+00
088H3121	TWA-V RAV, 24V, 0,95	0,145	0,317	1,00	6,09E-01	2,29E+00	2,88E+00
088H3122	TWA-V RAV, 230V, 0,95	0,144	0,315	1,00	6,05E-01	2,29E+00	2,88E+00
088H3123	TWA-V RAV, 230V, 0,95	0,150	0,328	1,00	6,30E-01	2,29E+00	2,90E+00
088H3130	TWA-L RAVL, 24V, 0,95	0,138	0,302	1,00	5,80E-01	2,29E+00	2,85E+00
088H3131	TWA-L RAVL, 24V, 0,95	0,148	0,324	1,00	6,22E-01	2,29E+00	2,89E+00

Annex 1

Table A1: Product codes covered by the EPD

Product code	Product Designation	Product Mass [Kg]	Scale factor (A1-A5) (C1-C4)	Scale factor (B6)	GWPT A1-A3 [kgCO2 -eq]	GWPT B6 [kgCO2 -eq]	GWPT [kgCO2 -eq]
088H3132	TWA-L RAVL, 230V, 0,95	0,138	0,302	1,00	5,80E-01	2,29E+00	2,85E+00
088H3133	TWA-L-RAVL 230V, 0,95	0,147	0,322	1,00	6,18E-01	2,29E+00	2,89E+00
088H3140	TWA-K M30x1,5, 24V, 0,95	0,130	0,284	1,00	5,46E-01	2,29E+00	2,82E+00
088H3141	TWA-K M30x1,5, 24V, 0,95	0,130	0,284	1,00	5,46E-01	2,29E+00	2,82E+00
088H3142	TWA-K M30x1,5, 230V, 0,95	0,125	0,274	1,00	5,25E-01	2,29E+00	2,80E+00
088H3143	TWA-K M30x1,5, 230V, 0,95	0,125	0,274	1,00	5,25E-01	2,29E+00	2,80E+00
088H3146	TWA-K M30x1,5, 24V, 5	0,276	0,604	1,00	1,16E+00	2,29E+00	3,41E+00
088H3147	TWA-K M30x1,5, 230V, 10	0,457	1,000	1,00	1,92E+00	2,29E+00	4,15E+00
088H3148	TWA-K M30x1,5, 230V, 5	0,285	0,624	1,00	1,20E+00	2,29E+00	3,45E+00
088H3149	TWA-K M30x1,5, 24V, 10	0,455	0,996	1,00	1,91E+00	2,29E+00	4,14E+00

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Danfoss