ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A2*

Owner of the Declaration	Grundfos Holding A/S
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-GRU-20230052-CBC2-EN
Issue date	31/08/2023
Valid to	30/08/2028

MAGNA3 50-40/60/80 (Cast Iron)

Grundfos Holding A/S

Institut Bauen und Umwelt e.V.

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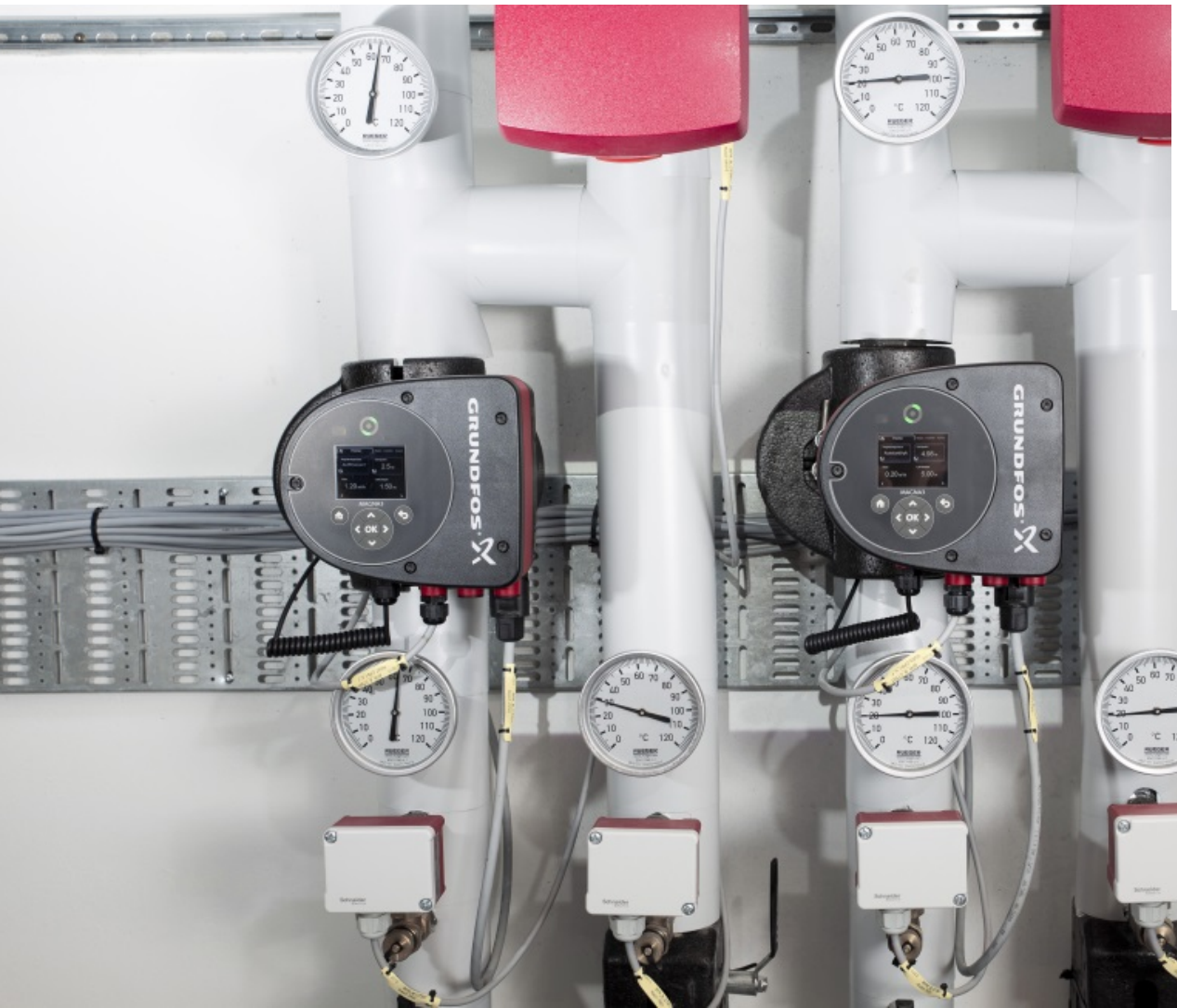

General Information

Grundfos Holding A/S

Programme holder

IBU – Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

Declaration number

EPD-GRU-20230052-CBC2-EN

This declaration is based on the product category rules:

Pumps for liquids and liquids with solids, 01/08/2021
(PCR checked and approved by the SVR)

Issue date

31/08/2023

Valid to

30/08/2028

Dipl.-Ing. Hans Peters
(Chairman of Institut Bauen und Umwelt e.V.)

Florian Pronold
(Managing Director Institut Bauen und Umwelt e.V.)

MAGNA3 50-40/60/80 (Cast Iron)

Owner of the declaration

Grundfos Holding A/S
Poul Due Jensens Vej 7
8850 Bjerringbro
Denmark

Declared product / declared unit

1 PCS. of MAGNA3 50-40/60/80 (Cast Iron)

Scope:

The declaration applies to 1 piece of MAGNA3 (Cast Iron) pump.

The product is produced in Wahlstedt, Germany, and the life cycle assessment is based on data collected at the production site. Production has been modeled using annual production data from 2021. The declaration covers three different types of the MAGNA3 50- product (40/60/80).
The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

The EPD was created according to the specifications of EN 15804+A2. In the following, the standard will be simplified as *EN 15804*.

Verification

The standard EN 15804 serves as the core PCR
Independent verification of the declaration and data according to ISO 14025:2011
☐ internally ☒ externally

Mrs Kim Allbury,
(Independent verifier)

Product

Product description/Product definition

The Grundfos MAGNA3 circulator pumps are designed for circulating liquids in heating systems, air conditioning and cooling systems and domestic hot water systems. However, the pump range can also be used in ground source heat pump systems and solar heating systems.

The MAGNA3 pump is a centrifugal pump powered by an electrical motor. It has a high-performance neodymium magnet rotor which increases motor efficiency and an insulation shell to reduce heat loss from the cast iron pump housing with threaded connections.

The declaration covers three types of the MAGNA3 pump. They are grouped as shown below. The group reference in the technical data and scenarios refers also to these.

GROUP 1 - MAGNA 3 50-40 GROUP 2 - MAGNA 3 50-60 GROUP 3 - MAGNA 3 50-80

These are all the same physical products and 100 % identical in terms of design, dimensions and materials as well as supply chain and manufacturing processes, i.e., all cradle to gate processes (A1-A3).

The products are also identical in terms of packaging, distribution, reference service life and end-of-life treatment.

The only thing that differentiates the products from each other is the software which controls how the pump operates in the system in which it is installed, making them fit for different applications. Hence, all life cycle modules are identical, except use stage module B6, which will change, as the applied scenarios for electricity consumption changes.

For the placing on the market in the European Union/European Free Trade Association (EU/EFTA) (with the exception of Switzerland) the following legal provisions apply:

Machinery Directive (2006/42/EC)

Standard used: *EN 809:1998 + A1:2009.*

Radio Equipment Directive (2014/53/EU)

Standards used:
EN 60335-1:2012/AC:2014 + A11:2014, EN 60335-2-51:2003 + A1:2008 + A2:2012, EN 62233:2008.

EN 55014-1:2006 + A1:2009 + A2:2011, EN 55014-1:2017, EN 61000-6-2:2005, EN 61000-3-2:2014, EN 61000-3-3:2013, ETSI EN 301 489-1 V2.2.0, ETSI EN 301 489-17 V3.2.0. ETSI EN 300 328 V2.1.1

Electromagnetic Compatibility (EMC) Directive (2014/30/EU)

Standards used:
EN 55014-1:2017, EN 55014-2:2015,

EN 61000-3-2:2014/2019, EN 61000-6-2:2008/2019,

EN 61000-3-3:2013 A1:2019

RoHS Directive 2011/65/EU and 2015/863//EU

Standard: *EN 50581:2012.*

Ecodesign Directive (2009/125/EC)

Commission Regulation (EC) No: 641/2009 and

Commission Regulation (EU) 622/2012

Standards used:
EN 16297-1:2012, EN 16297-2:2012, EN 16297-3:2012.

The CE marking takes into account the proof of conformity with the respective harmonized norms based on the legal provisions above.
MAGNA3 pumps are not harmonized in accordance with the *CPR.*

Application

For the application and use the respective national

provisions apply.

The pump is designed for circulating liquids in the

following systems:

· heating systems

· domestic hot-water systems

· air-conditioning and cooling systems

· ground-source heat-pump systems

· solar-heating systems

The pump is suitable for thin, clean, non-aggressive and non-explosive liquids, not containing solid particles or fibres that may attack the pump mechanically or chemically. In heating systems, the water must meet the requirements of accepted standards on water quality in heating systems. The pumps are also suitable for domestic hot-water systems.

Technical Data

The performance data of the product according to the harmonised norms, based on the harmonisation provisions above apply.
The relevant technical specifications according to the *PCR Part B* are given in the table below.
Characteristics that are the same for all three product groups are only given once. Others are given individually for all three groups.

Constructional data

Name	Value	Unit
Frequency	50	Hz
Voltage	230	V
Pumped liquid (e.g. water)	Clean Water	-
Energy Efficiency Index Gr.1	0,20	
Energy Efficiency Index Gr. 2	0,19	
Energy Efficiency Index Gr. 3	0,18	
Flow range Gr. 1 (max)	18,0	m^3/h
Flow range Gr. 2 (max)	24,5	m^3/h
Flow range Gr. 3 (max)	27,0	m^3/h
Head max. Gr.1	4	m
Head max. Gr.2	6	m
Head max. Gr.3	8	m
Power input Gr. 1 Average (from load profile describing use)	0,067	kW
Power input Gr. 2 Average (from load profile describing use)	0,111	kW
Power input Gr. 3 Average (from load profile describing use)	0,143	kW
Nominal capacity Gr.1	0,138	kW
Nominal capacity Gr. 2	0,249	kW
Nominal capacity Gr. 3	0,328	kW

Performance data of the product according to the

harmonized standards, based on provisions for harmonization.

Base materials/Ancillary materials

Base materials / Ancillary materials

Name	Value	Unit
Aluminium	16	%
Cast iron	48	%
Ceramics	0,3	%
Copper	3	%
Electronics	0,3	%
Magnet Nd	1	%
Paper	1	%
PCB	4	%
Plastics	0,4	%
Plastics, foam	1	%
Plastics GF	6	%
Rubber	0,2	%
Stainless steel	5	%
Steel	6	%
Cardboard	7	%
Plastic film	0,1	%
TOTAL	100	%

REACH

This product/article/at least one partial article contains

substances listed in the *ECHA candidate list* (date:

10.06.2022) exceeding 0.1 percentage by mass: **no**

The Wahlstedt production has been assessed and certified as meeting the requirements in *ISO 14001, ISO 50001, ISO 45001 and ISO 9001.*

Reference service life

No use stage scenario which refers to the lifetime of the product is declared. However, to facilitate building calculations, an estimated RSL of 10 years can be used.
This is an EU consensus-based estimation, referenced on page 37 in Appendix 7: *Lot 11 – Circulators in Buildings*, prepared by AEA Energy & Environment for the European Commission in the context of the Eco Design Directive:

There is no definitive information on the average circulator life available, there is consensus within the industry that it is at least 12 years. However, this is complicated by many factors, including many being scrapped prematurely when e.g. the boiler they are connected to is replaced.

From the estimated stock (140Mpa) and annual sales (14Mpa), the average lifetime of the circulator is taken as 10 years for the purposes of this study.

The RSL of the declared product is not directly influencing the results in this study, as no declared use stage scenario is dependent on the RSL; The use stage sub-module B6 is declared per year as required by the *PCR Part B.*

LCA: Calculation rules

Declared Unit

The declared unit is 1 piece (pcs.) of MAGNA3 (Cast iron) pump.

Declared unit

Name	Value	Unit
Declared unit	1	pce.
Mass reference	19.87	kg/pce
Conversion factor [Mass/Declared Unit]	19.87	-

For IBU core EPDs (where clause 3.6 is part of the EPD): for average EPDs, an estimate of the robustness of the LCA values must be made, e.g. concerning the variability of the production process, geographical representativeness and the influence of background data and preliminary products compared to the environmental impacts caused by the actual production.

System boundary

System boundary

This EPD is Cradle-To-Grave. The system boundaries

of the EPD follow the modular approach in *EN 15804*. By decision no. 20170712-n of the *SVR*, the modules B3, B4 and B5 are by default declared as "MNR" (module not relevant).

The product stage (A1-A3) comprises raw material extraction and processing, transport processes as well as the manufacturing process. The final production and assembly of the MAGNA3 pump takes place at a Grundfos manufacturing site in Germany. However, the full supply-chain leading to the finished product at the gate is rather complex and includes a large amount of raw materials, components and semi-finished parts which come from both external suppliers as well as other Grundfos production facilities

The product stage is included in the study, and according to *EN 15804* the system boundary with nature is set to include those

processes that provide the material and energy inputs into the system and the following manufacturing, transport up to the factory gate as well as the processing of any waste arising from those processes.

Wastes and losses are included in the modules where they occur according to the polluter pays principle and the modular approach of *EN 15804.*

The product includes:

· A1 Extraction and processing of raw materials;

· A1 Reuse of products or materials from a previous product system;

· A1 Processing of secondary materials;

· A1 Generation of electricity, steam and heat from primary energy resources, also including their extraction, refining and transport;

· A1 Energy recovery and other recovery processes from secondary fuels;

· A2 Transportation up to the factory gate and internal transport;

· A3 Production of ancillary materials or pre products;

· A3 Manufacturing of products and coproducts;

· A3 Manufacturing of packaging;

· A1-A3 processing up to the end-of-waste state or disposal of final residues.

For secondary material inputs, the system boundary to the previous system (providing the secondary material) is set where outputs reach the end-of-waste state. The recycling of secondary material into new raw materials is included in the system boundary of this study. Waste

materials from production processes that are recycled without any modification of the material's inherent characteristics are modelled as closed-loop within A1-A3. This is done up to the input mass flow that was used during production.

Waste for incineration arising in the product stage is accounted for in the module where the waste is produced. The environmental loads from the incineration process are declared in the module where it occurs and the electricity and heat which is produced from the incineration are considered as closed-loop within A1-A3, as described in *PCR Part A,* 5.5.1. The input of biogenic carbon from the production of packaging material is inventoried in A3. As required by *PCR Part A*, the corresponding end-of-life module of the packaging material, A5, is also declared and the emissions of biogenic carbon are inventoried.

The construction process stage (A4-A5) includes:

A4:

· Transportation from factory gate to distribution centre:

· Consumption of electricity, thermal energy and water at distribution centre;

· Transportation from distribution centre to construction site;

· Wastage during distribution.

A5:

· Installation process;

· Transport of packaging waste to the treatment site;

· Waste treatment of packaging.

The packaging material does not reach the end of waste state but is incinerated as waste. According to European statistics, the average R1 value of incineration plants is > 0.6. Therefore, it is assumed

that packaging material is treated thermally in an incineration

plant with R1 > 0.6. The loads from the combustion process of packaging are declared in module A5 and the resulting energy benefits in module

D, as required by the *PCR Part A*, 5.5.2.

Use stage (B1-B7):

The use stage, related to the building fabric includes:

· B1, use or application of the installed product;

· B2, maintenance.

The use stage related to the operation of the building

includes:

· B6, operational energy use;

· B7, operational water use.

In this study, all use stage modules are assessed, though B1, B2 and B7 are assessed to be zero. By decision no. 20170712-n of the *SVR*, the modules B3, B4 and B5 are by default declared as "MNR" (module

not relevant).
The modules include the provision and transport of all materials, products and related energy and water use, as well as waste processing up to the end-of-waste state or disposal of final residues during the use stage. They also include all impacts and

aspects related to the losses during the use stage (i.e. production, transport, waste processing and disposal of the lost products and materials).

Generally, the geographical coverage of the datasets used matches the actual processes taking place. Meaning, that when modelling taking place in Grundfos Bjerringbro, the Danish electricity grid mix is used in the model and thermal energy from natural gas. These are generally of very high quality with very good technological, temporal and geographical representativeness.

Contributions to operational energy use during the use stage (B6) come from the electricity consumption of the product. The annual electricity consumption is calculated by multiplying the average power input, which is based on a defined load profile, with the annual running hours. For use stage (B6) European Average electricity grid mix has been used. These values are declared in the scenarios section.

The End-of-Life stage (C1-C4) includes all activities from when the product reaches the end of its service life and no longer provides any functionality and until all materials and components are processed for

reuse/recycling or disposed of.

According to *EN 15804* and the *PCR Part A,* the end-of-life stage includes:

· C1 deconstruction of the product from the

· building, including initial on-site sorting of the

· materials;

· C2 transportation of the discarded product to a recycling site and transportation of waste to final disposal;

· C3 waste processing, collection of waste fractions from the deconstruction and waste processing of material flows intended for reuse, recycling and energy recovery;

· C4 waste disposal including physical pretreatment and management of the disposal site.

At end of life, the MAGNA3 pump is manually disassembled from the piping system in which it has been installed. The definition of the applied end-of-life scenario in this EPD follows the requirements in the

PCR Part A, 6.2 regarding complex products, with a combination of recycling, thermal waste treatment and landfilling. 100 % of the material is considered in the end of life scenario as required by the *PCR*. An overall collection rate of 90 % has been assumed.

Materials from which energy is recovered in an incineration process with an R1-value above 0.60 are in this study included with the environmental burdens from the incineration process inventoried in C3, the recovered energy is declared as exported energy in C3

and the energy benefits are declared in D. This procedure is according to the *PCR Part A*, 5.5.6. C3 includes the mechanical separation of the product followed by a series of sorting steps. Metal fractions are recycled and plastics, cardboard and electronics are assumed incinerated with energy recovery. The residual fractions are landfilled and declared in C4.

The specific amounts are shown in the scenarios

section.

Beyond system boundary (D): According to *EN 15804* module D includes the reuse, recovery and/or recycling potentials, expressed as net impacts and benefits. Any declared benefits and loads from net

flows leaving the product system that have not been allocated as co-products and that have passed the end-of-waste state are included in module D.

Contributions to module D comes from waste incineration processes in A5 and C3 as well as material recycling in C3. The specific fractions and net flows are shown in the scenarios section.

Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to *EN 15804* and the building context, respectively the product-specific characteristics of performance, are taken into account.

Geographic Representativeness

Land or region, in which the declared product system is manufactured, used or handled at the end of the product´s lifespan: Germany

Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to *EN 15804* and the building context, respectively the product-specific characteristics of performance, are taken into account. Software and databases used: *GaBi ts*

9.2.1.68 (database schema 8007) *Ecoinvent v3.5*

LCA: Scenarios and additional technical information

Characteristic product properties of biogenic carbon

The biogenic carbon content quantifies the amount of biogenic carbon in a construction product leaving the factory gate, and it will be separately declared for the product and for any accompanying packaging, as required from the *PCR Part A*. The Carbon content of Cardboard and Paper is assumed to 0.46 kg C. Overall, there is an amount of 9 weight-% Carbon in the product leaving the factory gate and has to be considered

Information on describing the biogenic Carbon Content at factory gate

Note: 1 kg of biogenic carbon is equivalent to 44/12 kg of CO2.

Name	Value	Unit
Biogenic carbon content in product	-	kg C
Biogenic carbon content in accompanying packaging	0.74	kg C

The following technical scenario information is required for the declared modules and optional for non-declared modules. Modules for which no information is declared can be deleted; additional information can also be listed if necessary.

The following technical information is a basis for the declared modules or can be used for developing specific scenarios in the context of a building assessment if modules are not declared (MND).

A5 is not declared including the disposal of the packaging material on the construction site, the amounts of packaging materials included in the LCA calculations must be declared as technical scenario information for Module A5.

Transport from the gate to the site (A4)

Name	Value	Unit
Litres of fuel	0,052	l/100km
Transport distance	2003	km
Capacity utilisation (including empty runs)	85	%
Gross density of products transported	383	kg/m^3
Wastage during distribution	0,02	%

Installation into the building (A5)

Name	Value	Unit
Packaging waste for incineration (LDPE film)	0,031	kg
Packaging waste for incineration (Paper/Cardboard)	1,6	kg

An estimated RSL of 10 years can be used to facilitate building calculations. This is an EU consensus-based estimation, referenced in Appendix 7: Lot 11 – Circulators in Buildings, prepared by AEA Energy & Environment for the European Commission in the context of the Eco Design Directive.

Reference service life

Name	Value	Unit
Life Span according to the manufacturer	10	a

Operational energy use (B6)

Name	Value	Unit
Electricity consumption Group 1	335	kWh/a
Electricity consumption Group 2	555	kWh/a
Electricity consumption Group 3	715	kWh/a
Average power input, Group 1	0,067	kW
Average power input, Group 2	0,111	kW
Average power input, Group 3	0,143	kW
Running hours (all groups)	5.000	h/a

End of life (C1-C4)

Name	Value	Unit
Collected as mixed construction waste	18,24	kg
Transportation distance (C2)	500	km
Aluminium for recycling	2,8	kg
Steel for recycling	9,5	kg
Copper for recycling	0,51	kg
Stainless steel for recycling	0,91	kg
Plastics for incineration w/energy	1,33	kg
Electronics for incineration w/energy	0,81	kg
Landfilling	2,38	kg

Reuse, recovery and/or recycling potentials (D), relevant scenario information

Name	Value	Unit
A5, incineration w/energy recov. (LDPE foil)	3,6	MJ
A5, incineration w/energy recov. (Paper/Cardboard)	6,53	MJ
C3, steel for recycling (net amounts)	-1,2	kg
C3, stainless steel for recycling (net amounts)	0,52	kg
C3, aluminium for recycling (net amounts)	-0,383	kg
C3, copper for recycling (net amounts)	0,221	kg
C3, plastics for incineration, w/ energy recov.	1,33	kg
C3, electronics for incineration, w/ energy recov.	0,814	kg

LCA: Results

Characterization model: *EN 15804* - 2012+A2 - 2019, PEF. By Decision no. 20170712-n of the IBU SVR, the modules B3, B4, B5 are marked as MNR (module not relevant) as default. The LCA results in module B6 are given on a period of one year, according to *PCR Part B*. To obtain the results from module B6 over the entire life cycle, the LCA results of module B6 must be multiplied by the estimated RSL of 10 years. The indicator results for module B6 are declared for Group 1. B6 indicator results for other groups can be derived by multiplying the B6 indicator results with the following factors:
Group 2: 1,64
Group 3: 2,12

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; ND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

Product stage			Construction process stage		Use stage							End-of-life stage				Benefits and loads beyond the system boundaries
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
X	X	X	X	X	MND	MND	MNR	MNR	MNR	X	MND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1PCS of MAGNA3 50-40/60/80 (Cast Iron)

Parameter	Unit	A1	A2	A3	A4	A5	B6	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq	9.65E+01	1.24E+00	1.14E+00	1.24E+00	2.35E+00	1.36E+02	0	5.08E-01	6.11E+00	1.21E-01	-1.07E-01
GWP-fossil	kg CO_2 eq	9.6E+01	1.24E+00	3.75E+00	1.24E+00	1.39E-01	1.35E+02	0	5.05E-01	6.1E+00	1.25E-01	-1.02E-01
GWP-biogenic	kg CO_2 eq	3.48E-01	-1.62E-03	-2.65E+00	-2.5E-03	2.21E+00	4.5E-01	0	-8.52E-04	5.46E-03	-3.76E-03	-2.47E-03
GWP-luluc	kg CO_2 eq	1.51E-01	8.79E-03	3.43E-02	9.77E-03	8E-05	1.95E-01	0	4.11E-03	2.73E-03	1.1E-04	-2.57E-03
ODP	kg CFC11 eq	9.27E-08	2.14E-16	4.06E-09	1.93E-11	4.32E-16	2.97E-12	0	9.31E-17	4.1E-14	2.81E-16	-7.57E-13
AP	mol H^+ eq	5.42E-01	9.94E-03	1.63E-02	7.19E-03	6.75E-04	2.98E-01	0	2.98E-03	4.82E-03	3.88E-04	-1.12E-02
EP-freshwater	kg P eq	1.6E-03	3.34E-06	5.6E-05	4.01E-06	9.88E-08	3.6E-04	0	1.54E-06	7.22E-06	1.36E-05	-4.05E-06
EP-marine	kg N eq	6.78E-02	3.35E-03	2.98E-03	3.43E-03	2.46E-04	6.61E-02	0	1.44E-03	1.18E-03	8.95E-05	-3.88E-04
EP-terrestrial	mol N eq	7.12E-01	3.7E-02	2.99E-02	3.8E-02	3.06E-03	6.95E-01	0	1.59E-02	1.33E-02	9.81E-04	-3.78E-03
POCP	kg NMVOC eq	2.1E-01	7.85E-03	8.68E-03	6.53E-03	6.43E-04	1.81E-01	0	2.73E-03	3.22E-03	2.88E-04	-1.32E-03
ADPE	kg Sb eq	1.31E+03	1.63E+01	5.21E+01	1.66E+01	8.12E-01	2.37E+03	0	6.77E+00	3.35E+01	1.79E+00	-1.62E+01
ADPF	MJ	5.58E-03	9.17E-08	5.95E-05	1.23E-06	7.19E-09	3.9E-05	0	4.1E-08	5.4E-07	8.44E-09	-6.17E-04
WDP	m^3 world eq deprived	2.55E+01	1.09E-02	1.49E-01	1.79E-02	2.89E-01	2.94E+01	0	4.95E-03	8.4E-01	-1.38E-03	-3.84E-01

GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential)

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1PCS of MAGNA3 50-40/60/80 (Cast Iron)

Parameter	Unit	A1	A2	A3	A4	A5	B6	C1	C2	C3	C4	D
PERE	MJ	3.5E+02	8.43E-01	4.31E+01	1.04E+00	1.4E-01	1.05E+03	0	3.91E-01	1.45E+01	1.26E-01	5.28E+00
PERM	MJ	0	0	0	0	0	0	0	0	0	0	0
PERT	MJ	3.5E+02	8.43E-01	4.31E+01	1.04E+00	1.4E-01	1.05E+03	0	3.91E-01	1.45E+01	1.26E-01	5.28E+00
PENRE	MJ	1.31E+03	1.64E+01	5.21E+01	1.67E+01	8.13E-01	2.37E+03	0	6.79E+00	3.35E+01	1.79E+00	-1.61E+01
PENRM	MJ	0	0	0	0	0	0	0	0	0	0	0
PENRT	MJ	1.31E+03	1.64E+01	5.21E+01	1.67E+01	8.13E-01	2.37E+03	0	6.79E+00	3.35E+01	1.79E+00	-1.61E+01
SM	kg	1.47E+01	0	2.31E-01	2.99E-03	0	0	0	0	0	0	0
RSF	MJ	1.46E-23	0	0	2.91E-27	0	0	0	0	0	0	0
NRSF	MJ	1.71E-22	0	0	3.42E-26	0	0	0	0	0	0	0
FW	m^3	7.8E-01	9.87E-04	2.14E-02	1.29E-03	6.82E-03	1.21E+00	0	4.56E-04	2.69E-02	2.28E-05	2.62E-02

PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1PCS of MAGNA3 50-40/60/80 (Cast Iron)

Parameter	Unit	A1	A2	A3	A4	A5	B6	C1	C2	C3	C4	D
HWD	kg	2.54E-04	6.72E-07	1.22E-04	8.19E-07	4.21E-09	9.81E-07	0	3.14E-07	1.72E-08	7.18E-09	-3.23E-04
NHWD	kg	4.02E+00	2.49E-03	2.81E-01	3.16E-03	7.86E-02	1.68E+00	0	1.08E-03	5.73E-01	2.05E+00	1.45E+00
RWD	kg	5.46E-02	2.89E-05	1.44E-03	4.53E-05	3.9E-05	3.6E-01	0	1.25E-05	4.95E-03	2.14E-05	-1.38E-03
CRU	kg	0	0	0	0	0	0	0	0	0	0	0
MFR	kg	0	0	0	0	0	0	0	0	1.37E+01	0	0
MER	kg	0	0	0	0	0	0	0	0	0	0	0
EEE	MJ	0	0	0	0	3.6E+00	0	0	0	7.14E+00	0	0
EET	MJ	0	0	0	0	6.53E+00	0	0	0	1.29E+01	0	0

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

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: 1PCS of MAGNA3 50-40/60/80 (Cast Iron)

Parameter	Unit	A1	A2	A3	A4	A5	B6	C1	C2	C3	C4	D
PM	Disease incidence	6.51E-06	1.22E-07	2.28E-07	4.28E-08	3.83E-09	2.5E-06	0	1.75E-08	4.09E-08	3.95E-09	-2.78E-07
IR	kBq U235 eq	6.02E+00	4.25E-03	2.26E-01	6.33E-03	6E-03	5.9E+01	0	1.85E-03	8.12E-01	3.04E-03	-9.35E-02
ETP-fw	CTUe	8E+02	1.22E+01	1.73E+01	1.22E+01	4.11E-01	1.01E+03	0	5.06E+00	1.46E+01	1.26E+00	-5.66E+00
HTP-c	CTUh	1.64E-06	2.49E-10	6.46E-07	7.09E-10	2.02E-11	2.8E-08	0	1.05E-10	4.49E-10	7.23E-11	-6.74E-08
HTP-nc	CTUh	2.38E-06	1.35E-08	5.33E-08	1.48E-08	9.63E-10	1.03E-06	0	6.01E-09	1.82E-08	6.31E-09	-2.85E-09
SQP	SQP	3.69E+02	5.09E+00	7.98E+01	5.75E+00	2.21E-01	7.55E+02	0	2.38E+00	1.06E+01	1.29E-01	-1.5E+01

PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); SQP = Potential soil quality index

Disclaimer 1 – for the indicator 'Potential Human exposure efficiency relative to U235'. 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 or 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. Disclaimer 2 – for the indicators 'abiotic depletion potential for non-fossil resources', 'abiotic depletion potential for fossil resources', 'water (user) deprivation potential, deprivation-weighted water consumption', 'potential comparative toxic unit for ecosystems', 'potential comparative toxic unit for humans – cancerogenic', 'Potential comparative toxic unit for humans - not cancerogenic', 'potential soil quality index'. The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high as there is limited experience with the indicator.

Disclaimer 3: *JRC Technical Reports, Version 2, 2018* Page 6, for the indicator "EP-freshwater". This indicator has been calculated as 'kg P eq' as required in the characterization model EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe;

References

Standards

Machinery Directive

DIRECTIVE 2006/42/EC OF THE EUROPEAN

PARLIAMENT AND OF THE COUNCIL of 17 May

2006 on machinery

Radio Equipment Directive

DIRECTIVE 2014/53/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 April 2014 on the harmonization of the laws of the Member States relating to the making available on the market of

radio equipment

Electromagnetic Compatibility (EMC) Directive

DIRECTIVE 2014/30/EU OF THE EUROPEAN

PARLIAMENT AND OF THE COUNCIL of 26 February

2014 on the harmonization of the laws of the Member States relating to electromagnetic compatibility

Ecodesign Directive

DIRECTIVE 2009/125/EC OF THE EUROPEAN

PARLIAMENT AND OF THE COUNCIL of 21 October

2009 establishing a framework for the setting of

ecodesign requirements for energy-related products

EC 641/2009

COMMISSION REGULATION (EC) No 641/2009 of 22 July 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for glandless standalone circulators and glandless circulators integrated in

products

EC 622/2012

COMMISSION REGULATION (EU) No 622/2012 of 11 July 2012 amending Regulation (EC) No 641/2009 with regard to ecodesign requirements for glandless standalone circulators and glandless circulators integrated in products

DIRECTIVE 2011/65/EU

DIRECTIVE 2011/65/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment

DIRECTIVE 2015/863/EU

DIRECTIVE 2015/863/EU of 31 March 2015 amending Annex II to Directive 2011/65/EU of the European Parliament and of the Council as regards the list of restricted substances

ETSI EN 301 489-1

ETSI EN 301 489-1 V2.2.0, Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements

ETSI EN 301 489-17

ETSI EN 301 489-17 V3.2.0, Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for Broadband Data Transmission Systems

ETSI EN 300 328 V2.1.1

ETSI EN 300 328 V2.1.1, Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques

EN 809

EN 809:1998-10 + A1:2009, Pumps and pump units for liquids - Common safety requirements

EN 55014-1

EN 55014-1:2017, Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission

EN 55014-2

EN 55014-2:2015, Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 2: Immunity – Product family standard (CISPR 14-2:2015)

EN 50581:2012

EN 50581:2012, Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

EN 60335-1

EN 60335-1:2012/A11:2014/A13:2017, Household and similar electrical appliances – Safety – Part 1:General requirements

EN 60335-2-51

EN 60335-2-51:2003-03 + A1:2008 + A2:2012, Household and similar electrical appliances – Safety –Part 2-51: Particular requirements for stationary circulation pumps for heating and service water installations

EN 61000-3-2

EN 61000-3-2:2014/2019, Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current =16 A per phase)

EN 61000-3-3

EN 61000-3-3:2013-08/ A1:2019, Electromagnetic compatibility (EMC) – Part 3-3:
Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low voltage supply systems, for equipment with rated current <= 16 A per phase and not subject to conditional connection

EN 61000-6-2

EN 61000-6-2:2008/2019, Electromagnetic compatibility (EMC) – Part 6-2: Generic standards –Immunity for industrial

environments

EN 16297-1

EN 16297-1:2012-10, Pumps – Rotodynamic pumps – Glandless circulators – Part 1:
General requirements and procedures for testing and calculation of energy efficiency index (EEI)

EN 16297-2

EN 16297-2:2012-10, Pumps – Rotodynamic pumps – Glandless circulators – Part 2: Calculation of energy efficiency index (EEI) for standalone circulators

EN 16297-3

EN 16297-3:2012, Pumps – Rotodynamic pumps –Glandless circulators – Part 3: Energy efficiency index (EEI) for circulators integrated in products

ISO 14001

EN ISO 14001:2015-09, Environmental management systems - Requirements with guidance for use

ISO 14025

DIN EN /ISO 14025:2011-10, Environmental labels and declarations — Type III environmental declarations — Principles and procedures

EN 15804

EN 15804:2012-04+A1 2013, Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

PCR Part A

Institut Bauen und Umwelt e.V., Berlin (pub.): Product Category Rules for Building-Related Products and Services, Product Category Rules for Construction Products from the range of Environmental Product Declarations of Institut Bauen und Umwelt (IBU), Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report, Version 1.7 (2021)

PCR Part B

Institut Bauen und Umwelt e.V., Berlin (pub.): Product Category Rules for Building-Related Products and Services, Product Category Rules for Construction Products from the range of Environmental Product Declarations of Institut Bauen und Umwelt (IBU), Part B: Requirements on the EPD for Pumps for liquids and liquids with solids, Version 1.0 (2018)

Further references

CPR

REGULATION (EU) No 305/2011 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC

CML 2001

Impact assessment characterization factors Institute of Environmental Sciences, Leiden University, Netherlands

ECHA candidate list

Candidate List of substances of very high concern (SVHCs) for authorisation, European Chemicals Agency (ECHA), Helsinki, Finland

Ecoinvent

Ecoinvent v3.5

GaBi ts

GaBi ts 9.2.1.68 (database schema 8007)

REACH

Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) (Status: 27.06.2018)

SVR

Advisory Board (formerly SVA)

Decision no.
20170712-n

The literature referred to in the Environmental Product Declaration must be listed in full.Standards already fully quoted in the EPD do not need to be listed here again.
The current version of PCR Part A and PCR Part B of the PCR document on which they are based must be referenced.

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ENVIRONMENTAL-PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A2*

Owner of the Declaration	Grundfos Holding A/S
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-GRU-20230069-CBC2-EN
Issue date	31.08.2023
Valid to	30.08.2028

MAGNA3 65-150 (Cast Iron)

Grundfos Holding A/S

Institut Bauen und Umwelt e.V.

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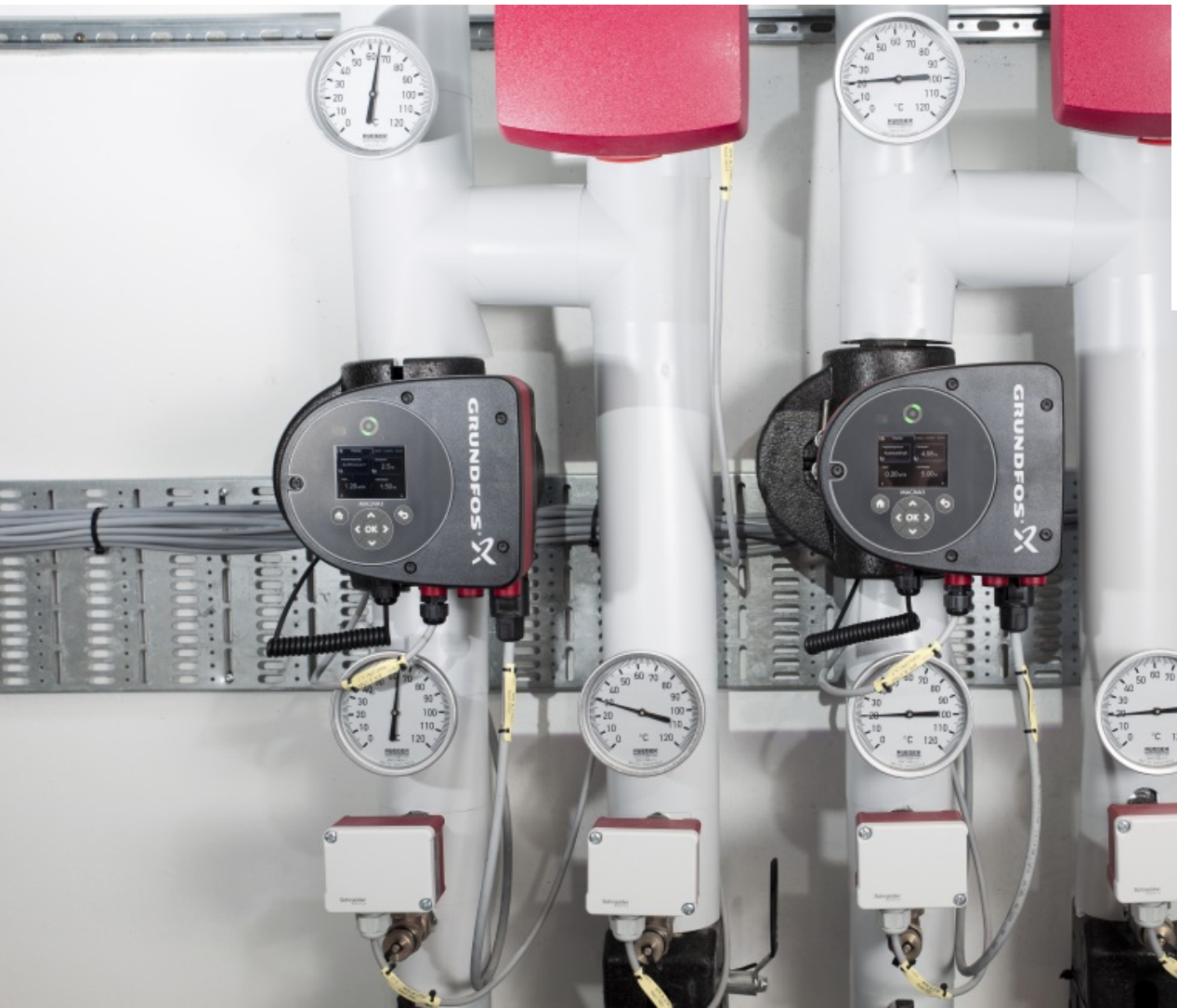

General Information

Grundfos Holding A/S

Programme holder

IBU – Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

Declaration number

EPD-GRU-20230069-CBC2-EN

This declaration is based on the product category rules:

Pumps for liquids and liquids with solids, 01.08.2021
(PCR checked and approved by the SVR)

Issue date

31.08.2023

Valid to

30.08.2028

Dipl.-Ing Hans Peters
(chairman of Institut Bauen und Umwelt e.V.)

Florian Pronold
(Managing Director Institut Bauen und Umwelt e.V.)

MAGNA3 65-150 (Cast Iron)

Owner of the declaration

Grundfos Holding A/S
Poul Due Jensens Vej 7
8850 Bjerringbro
Denmark

Declared product / declared unit

Name of declared product / declared unit

Scope:

The declaration applies to 1 piece of MAGNA3 (Cast Iron) pump.

The product is produced in Wahlstedt, Germany, and the life cycle assessment is based on data collected at the production site.

Production has been modeled using annual production data from 2021.

The declaration covers MAGNA3 65-150 product.
The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

The EPD was created according to the specifications of EN 15804+A2. In the following, the standard will be simplified as *EN 15804 bezeichnet*.

Verification

The standard EN 15804 serves as the core PCR
Independent verification of the declaration and data according to ISO 14025:2011
☐ internally ☒ externally

Mrs Kim Allbury,
(Independent verifier)

Product

Product description/Product definition

The Grundfos MAGNA3 circulator pumps are designed for circulating liquids in heating systems, air conditioning and cooling systems and domestic hot water systems. However, the pump range can also be used in ground source heat pump systems and solar heating systems.

The MAGNA3 pump is a centrifugal pump powered by an electrical motor. It has a high-performance neodymium magnet rotor which increases motor efficiency and an insulation shell to reduce heat loss from the cast iron pump housing with threaded connections.

The declaration covers MAGNA3 65-150 pump. For the placing on the market in the European Union/European Free Trade Association (EU/EFTA) (with the exception of Switzerland) the following legal provisions apply:

Machinery Directive (2006/42/EC)

Standard used: *EN 809:1998 + A1:2009.*

Radio Equipment Directive (2014/53/EU)

Standards used:
EN 60335-1:2012/AC:2014 + A11:2014, EN 60335-2-51:2003 + A1:2008 + A2:2012, EN 62233:2008.

EN 55014-1:2006 + A1:2009 + A2:2011, EN 55014-1:2017, EN 61000-6-2:2005, EN 61000-3-2:2014, EN 61000-3-3:2013, ETSI EN 301 489-1 V2.2.0, ETSI EN 301 489-17 V3.2.0. ETSI EN 300 328 V2.1.1

Electromagnetic Compatibility (EMC) Directive (2014/30/EU)

Standards used: *EN 55014-1:2017, EN 55014-2:2015,*

EN 61000-3-2:2014/2019, EN 61000-6-2:2008/2019,

EN 61000-3-3:2013 A1:2019

RoHS Directive 2011/65/EU and 2015/863//EU

Standard: *EN 50581:2012.*

Ecodesign Directive (2009/125/EC)

Commission Regulation (EC) No: 641/2009 and

Commission Regulation (EU) 622/2012

Standards used:
EN 16297-1:2012, EN 16297-2:2012, EN 16297-3:2012.

The CE marking takes into account the proof of conformity with the respective harmonized norms based on the legal provisions above.

MAGNA3 pumps are not harmonized in accordance with the *CPR.*

Application

For the application and use the respective national provisions apply.

The pump is designed for circulating liquids in the

following systems:

· heating systems

· domestic hot-water systems

· air-conditioning and cooling systems

· ground-source heat-pump systems

· solar-heating systems

The pump is suitable for thin, clean, non-aggressive and non-explosive liquids, not containing solid particles or fibres that may attack the pump mechanically or chemically. In heating systems, the water must meet the requirements of accepted standards on water quality in heating systems. The pumps are also suitable for domestic hot-water systems.

Technical Data

The performance data of the product according to the harmonized norms, based on the harmonization provisions above apply.

The relevant technical specifications according to the *PCR Part B* are given in the table below.

Note:
Electrical pumps usually falls under the scope of several internal market
directives and regulations, such as the Machinery directive, Ecodesign
Directive, Radio Equipment Directive etc. The relevant technical data given in
the EPD will vary depending on the type of product and areas of application,
and the table below should be adjusted accordingly.

Constructional data

Name	Value	Unit
Frequency	50	Hz
Voltage	230	V
Energy Efficiency Index	0,17	
Flow range	42,5	m3/h
Head max	15	m
Power input	0,562	kW
Nominal capacity	1,271	kW

The performance data of the product according to the harmonised norms, based on the harmonisation provisions above apply.

Base materials/Ancillary materials

Name	Value	Unit
Aluminium	15	%
Cast iron	48	%
Ceramics	0,3	%
Copper	5	%
Electronics	0,2	%
Magnet Nd	1	%
Paper	0,4	%
PCB	3	%
Plastics	0,3	%
Plastics, foam	1	%
Plastics GF	5	%
Rubber	0,1	%
Stainless steel	4	%
Steel	11	%
Cardboard	7	%
Plastic film	0,1	%
TOTAL	100	%

REACH

This product/article/at least one partial article contains

substances listed in the *ECHA candidate list* (date: 10.06.2022) exceeding 0.1 percentage by mass: **no**

The Wahlstedt production has been assessed and certified as meeting the requirements in *ISO 14001, ISO 50001, ISO 45001 and ISO 9001.*

Environment and health during use

Reference service life

No use stage scenario which refers to the lifetime of the product is declared. However, to facilitate building calculations, an estimated RSL of 10 years can be used.
This is an EU consensus-based estimation, referenced on page 37 in Appendix 7: *Lot 11 – Circulators in Buildings*, prepared by AEA Energy & Environment for the European Commission in the context of the Eco Design Directive:

There is no definitive information on the average circulator life available, there is consensus within the industry that it is at least 12 years. However, this is complicated by many factors, including many being scrapped prematurely when e.g. the boiler they are connected to is replaced.

From the estimated stock (140Mpa) and annual sales (14Mpa), the average lifetime of the circulator is taken as 10 years for the purposes of this study.

The RSL of the declared product is not directly influencing the results in this study, as no declared use stage scenario is dependent on the RSL; The use stage sub-module B6 is declared per year as required by the *PCR Part B.*

LCA: Calculation rules

Declared Unit

The declared unit is 1 piece (pcs.) of MAGNA3 (Cast Iron) pump.

Declared unit

Name	Value	Unit
Declared unit	1	pce.
Mass reference	26.3	kg/pce
Conversion factor [Mass/Declared Unit]	26,3	

For IBU core EPDs (where clause 3.6 is part of the EPD): for average EPDs, an estimate of the robustness of the LCA values must be made, e.g. concerning variability of the production process, geographical representativeness and the influence of background data and preliminary products compared to the environmental impacts caused by actual production.

System boundary

This EPD is Cradle-To-Grave. The system boundaries

of the EPD follow the modular approach in *EN 15804*. By decision no. 20170712-n of the *SVR*, the modules B3, B4 and B5 are by default declared as "MNR" (module not relevant).

The product stage (A1-A3) comprises raw material extraction and processing, transport processes as well as the manufacturing process. The final production and assembly of the MAGNA3 pump takes place at a Grundfos manufacturing site in Germany. However, the full supply-chain leading to the finished product at the gate is rather complex and includes a large amount of raw materials, components and semi-finished parts which come from both external suppliers as well as other Grundfos production facilities.

The product stage is included in the study, and according to *EN 15804* the system boundary with nature is set to include those processes that provide the material and energy inputs into the system and the following manufacturing, transport up to the factory gate as well as the processing any waste arising from those processes.

Wastes and losses are included in the modules where they occur according to the polluter pays principle and the modular approach of *EN 15804.*

The product includes:

· A1 Extraction and processing of raw materials;

· A1 Reuse of products or materials from a previous product system;

· A1 Processing of secondary materials;

· A1 Generation of electricity, steam and heat from primary energy resources, also including their extraction, refining and transport;

· A1 Energy recovery and other recovery processes from secondary fuels;

· A2 Transportation up to the factory gate and internal transport;

· A3 Production of ancillary materials or pre products;

· A3 Manufacturing of products and coproducts;

· A3 Manufacturing of packaging;

· A1-A3 processing up to the end-of-waste state or disposal of final residues.

For secondary material inputs, the system boundary to the previous system (providing the secondary material) is set where outputs reach the end-of-waste state. The recycling of secondary material into new raw materials is included in the system boundary of this study. Waste

materials from production processes that are recycled without any modification of the material's inherent characteristics are modelled as closed-loop within A1-A3. This is done up to the input mass flow that was used during production.

Waste for incineration arising in the product stage is accounted for in the module where the waste is produced. The environmental loads from the incineration process are declared in the module where it occurs and the electricity and heat which is produced from the incineration are considered as closed-loop within A1-A3, as described in *PCR Part A,* 5.5.1. The input of biogenic carbon from the production of packaging material is inventoried in A3. As required by *PCR Part A*, the corresponding end-of-life module of the packaging material, A5, is also declared and the emissions of biogenic carbon are inventoried.

The construction process stage (A4-A5) includes:

A4:

· Transportation from factory gate to distribution centre:

· Consumption of electricity, thermal energy and water at distribution centre;

· Transportation from distribution centre to construction site;

· Wastage during distribution.

A5:

· Installation process;

· Transport of packaging waste to treatment site;

· Waste treatment of packaging.

The packaging material does not reach the end of waste state but is incinerated as waste.
According to European statistics, the average R1 value of incineration plants is > 0.6. Therefore, it is assumed

that packaging material is treated thermally in an incineration plant with R1 > 0.6. The loads from the combustion process of packaging are declared in module A5 and the resulting energy benefits in module

D, as required by the *PCR Part A*, 5.5.2.

Use stage (B1-B7):

The use stage, related to the building fabric includes:

· B1, use or application of the installed product;

· B2, maintenance.

The use stage related to the operation of the building

includes:

· B6, operational energy use;

· B7, operational water use.

In this study, all use stage modules are assessed, though B1, B2 and B7 are assessed to be zero. By decision no. 20170712-n of the *SVR*, the modules B3, B4 and B5 are by default declared as "MNR" (module

not relevant).
The modules include the provision and transport of all materials, products and related energy and water use, as well as waste processing up to the end-of-waste state or disposal of final residues during the use stage. They also include all impacts and

aspects related to the losses during the use stage (i.e. production, transport, and waste processing and disposal of the lost products and materials).

Generally, the geographical coverage of the datasets used matches the actual processes taking place. Meaning, that when modelling taking place in Grundfos Bjerringbro, the Danish electricity grid mix is used in the model and thermal energy from natural gas. These are generally of very high quality with very good technological, temporal and geographical representativeness.

Contributions to operational energy use during the use stage (B6) comes from the electricity consumption of the product. The annual electricity consumption is calculated by multiplying the average power input, which is based on a defined load profile, with the annual running hours. For use stage (B6) European Average electricity grid mix has been used. These values are declared in the scenarios section.

The End-of-Life stage (C1-C4) includes all activities from when the product reaches the end of its service life and no longer provides any functionality and until all materials and components are processed for

reuse/recycling or disposed of.

According to *EN 15804* and the *PCR Part A,* the end-of-life stage includes:

· C1 deconstruction of the product from the

· building, including initial on-site sorting of the

· materials;

· C2 transportation of the discarded product to a recycling site and transportation of waste to final disposal;

· C3 waste processing, collection of waste fractions from the deconstruction and waste processing of material flows intended for reuse, recycling and energy recovery;

· C4 waste disposal including physical pretreatment and management of the disposal site.

At the end of life, the MAGNA3 pump is manually disassembled from the piping system in which it has been installed. The definition of the applied end-of-life scenario in this EPD follows the requirements in the

PCR Part A, 6.2 regarding complex products, with a combination of recycling, thermal waste treatment and landfilling. 100 % of the material is considered in the end of life scenario as required by the *PCR*. An overall collection rate of 90 % has been assumed.

Materials from which energy is recovered in an incineration process with an R1-value above 0.60 are in this study included with the environmental burdens from the incineration process inventoried in C3, the recovered energy is declared as exported energy in C3

and the energy benefits are declared in D. This procedure is according to the *PCR Part A*, 5.5.6. C3 includes the mechanical separation of the product followed by a series of sorting steps. Metal fractions are recycled and plastics, cardboard and electronics are assumed incinerated with energy recovery. The residual fractions are landfilled and declared in C4.

The specific amounts are shown in the scenarios section.

Beyond system boundary (D): According to *EN 15804* module D includes the reuse, recovery and/or recycling potentials, expressed as net impacts and benefits. Any declared benefits and loads from net

flows leaving the product system that have not been allocated as co-products and that have passed the end-of-waste state are included in module D.

Contributions to module D comes from waste incineration processes in A5 and C3 as well as material recycling in C3. The specific fractions and net flows are shown in the scenarios section.

Geographic Representativeness

Land or region, in which the declared product system is manufactured, used or handled at the end of the product´s lifespan: Germany

Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to *EN 15804* and the building context, respectively the product-specific characteristics of performance, are taken into account. Software and databases used: *GaBi ts* 9.2.1.68 (database schema 8007) *Ecoinvent v3.5.*.

LCA: Scenarios and additional technical information

Characteristic product properties
Information on biogenic carbon

The biogenic carbon content quantifies the amount of biogenic carbon in a construction product leaving the factory gate, and it will be separately declared for the product and for any accompanying packaging, as required from the *PCR Part A.* The Carbon content of Cardboard and Paper is assumed to 0.46 kg C. Overall, there is an amount of 9 weight-% Carbon in the product leaving the factory gate and has to be considered.

Information on describing the biogenic Carbon Content at factory gate

Note: 1 kg of biogenic carbon is equivalent to 44/12 kg of CO2.

Name	Value	Unit
Biogenic carbon content in accompanying packaging	0.74	kg C

The following technical scenario information is required for the declared modules and optional for non-declared modules. Modules for which no information is declared can be deleted; additional information can also be listed if necessary.

The following technical information is a basis for the declared modules or can be used for developing specific scenarios in the context of a building assessment if modules are not declared (MND).

A5 is not declared including the disposal of the packaging material on the construction site, the amounts of packaging materials included in the LCA calculations must be declared as technical scenario information for Module A5.

Transport from the gate to the site (A4)

Name	Value	Unit
Litres of fuel	0,052	l/100km
Transport distance	2003	km
Capacity utilisation (including empty runs)	85	%
Gross density of products transported	506	kg/m^3
Wastage during distribution	0,02	%

Installation into the building (A5)

Name	Value	Unit
Packaging waste for incineration (LDPE film)	0,031	kg
Packaging waste for incineration (Paper/Cardboard)	1,96	kg

An estimated RSL of 10 years can be used to facilitate building calculations. This is an EU consensus-based estimation, referenced in Appendix 7: Lot 11 – Circulators in Buildings, prepared by AEA Energy & Environment for the European Commission in the context of the Eco Design Directive.

Reference service life

Name	Value	Unit
Life Span according to the manufacturer	10	a

Operational energy use (B6)

Name	Value	Unit
Electricity consumption	2810	kWh/a
Average power input,	0,562	kW
Running hours (all groups)	5.000	h/a

End of life (C1-C4)

Name	Value	Unit
Collected as mixed construction waste	24,3	kg
Transportation distance (C2)	500	km
Aluminium for recycling	3,4	kg
Steel for recycling	13,6	kg
Copper for recycling	1,05	kg
Stainless steel for recycling	0,89	kg
Plastics for incineration w/energy	1,39	kg
Electronics for incineration w/energy	0,81	kg
Landfilling	3,15	kg

Reuse, recovery and/or recycling potentials (D), relevant scenario information

Name	Value	Unit
A5, incineration w/energy recov. (LDPE foil)	4,37	MJ
A5, incineration w/energy recov. (Paper/Cardboard)	7,91	MJ
C3, steel for recycling (net amounts)	-0,54	kg
C3, stainless steel for recycling (net amounts)	0,52	kg
C3, aluminium for recycling (net amounts)	-0,469	kg
C3, copper for recycling (net amounts)	0,451	kg
C3, plastics for incineration, w/ energy recov.	1,39	kg
C3, electronics for incineration, w/ energy recov.	0,81	kg

LCA: Results

Characterization model: *EN 15804* - 2012+A2 - 2019, PEF. By Decision no. 20170712-n of the IBU SVR, the modules B3, B4, B5 are marked as MNR (module not relevant) as default. The LCA results in module B6 are given on a period of one year, according to *PCR Part B*. To obtain the results from module B6 over the entire life cycle, the LCA results of module B6 must be multiplied by the estimated RSL of 10 years.

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; ND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
X	X	X	X	X	MND	MND	MNR	MNR	MNR	X	MND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1PCS of MAGNA3 65-150 (Cast Iron)

Parameter	Unit	A1	A2	A3	A4	A5	B6	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq	1.12E+02	1.56E+00	8.53E-01	1.64E+00	2.86E+00	1.14E+03	0	6.77E-01	6.91E+00	1.57E-01	-1.43E+00
GWP-fossil	kg CO_2 eq	1.11E+02	1.55E+00	4.1E+00	1.63E+00	1.53E-01	1.13E+03	0	6.72E-01	6.9E+00	1.62E-01	-1.43E+00
GWP-biogenic	kg CO_2 eq	4.56E-01	-2.15E-03	-3.28E+00	-3.26E-03	2.7E+00	3.77E+00	0	-1.13E-03	7.29E-03	-4.87E-03	1.85E-03
GWP-luluc	kg CO_2 eq	1.88E-01	1.14E-02	3.67E-02	1.29E-02	9.69E-05	1.64E+00	0	5.47E-03	3.62E-03	1.42E-04	-4.31E-03
ODP	kg CFC11 eq	9.52E-08	2.72E-16	4.07E-09	1.99E-11	5.23E-16	2.49E-11	0	1.24E-16	5.45E-14	3.63E-16	-9.19E-13
AP	mol H^+ eq	6.08E-01	1.11E-02	1.73E-02	9.49E-03	8.22E-04	2.5E+00	0	3.97E-03	6.2E-03	5.02E-04	-2.52E-02
EP-freshwater	kg P eq	1.63E-03	4.31E-06	6.45E-05	5.21E-06	1.2E-07	3.02E-03	0	2.06E-06	9.57E-06	1.76E-05	-5.04E-06
EP-marine	kg N eq	7.61E-02	3.86E-03	3.33E-03	4.53E-03	3E-04	5.55E-01	0	1.92E-03	1.49E-03	1.16E-04	-1.31E-03
EP-terrestrial	mol N eq	8E-01	4.27E-02	3.33E-02	5.02E-02	3.73E-03	5.83E+00	0	2.12E-02	1.65E-02	1.27E-03	-1.36E-02
POCP	kg NMVOC eq	2.38E-01	8.86E-03	9.55E-03	8.62E-03	7.83E-04	1.52E+00	0	3.64E-03	4.07E-03	3.73E-04	-4.76E-03
ADPE	kg Sb eq	7.51E-03	1.17E-07	6.1E-05	1.64E-06	8.71E-09	3.27E-04	0	5.46E-08	7.17E-07	1.09E-08	-1.26E-03
ADPF	MJ	1.49E+03	2.06E+01	5.68E+01	2.19E+01	9.85E-01	1.99E+04	0	9.01E+00	4.44E+01	2.32E+00	-2.67E+01
WDP	m^3 world eq deprived	2.73E+01	1.39E-02	2.45E-01	2.25E-02	3.52E-01	2.47E+02	0	6.59E-03	9.88E-01	-1.79E-03	-7.85E-01

GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential)

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1PCS of MAGNA3 65-150 (Cast Iron)

Parameter	Unit	A1	A2	A3	A4	A5	B6	C1	C2	C3	C4	D
PERE	MJ	4.05E+02	1.09E+00	5.12E+01	1.36E+00	1.7E-01	8.81E+03	0	5.21E-01	1.93E+01	1.63E-01	7.86E+00
PERM	MJ	0	0	0	0	0	0	0	0	0	0	0
PERT	MJ	4.05E+02	1.09E+00	5.12E+01	1.36E+00	1.7E-01	8.81E+03	0	5.21E-01	1.93E+01	1.63E-01	7.86E+00
PENRE	MJ	1.49E+03	2.06E+01	5.68E+01	2.2E+01	9.86E-01	1.99E+04	0	9.05E+00	4.44E+01	2.32E+00	-2.66E+01
PENRM	MJ	0	0	0	0	0	0	0	0	0	0	0
PENRT	MJ	1.49E+03	2.06E+01	5.68E+01	2.2E+01	9.86E-01	1.99E+04	0	9.05E+00	4.44E+01	2.32E+00	-2.66E+01
SM	kg	1.92E+01	0	2.4E-01	3.89E-03	0	0	0	0	0	0	0
RSF	MJ	1.46E-23	0	0	2.91E-27	0	0	0	0	0	0	0
NRSF	MJ	1.71E-22	0	0	3.42E-26	0	0	0	0	0	0	0
FW	m^3	8.42E-01	1.27E-03	2.61E-02	1.66E-03	8.29E-03	1.02E+01	0	6.07E-04	3.27E-02	2.95E-05	2.64E-02

PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1PCS of MAGNA3 65-150 (Cast Iron)

Parameter	Unit	A1	A2	A3	A4	A5	B6	C1	C2	C3	C4	D
HWD	kg	3.3E-04	8.69E-07	1.22E-04	1.07E-06	5.11E-09	8.23E-06	0	4.18E-07	2.2E-08	9.29E-09	-3.28E-04
NHWD	kg	5.17E+00	3.17E-03	2.96E-01	4.73E-03	9.43E-02	1.41E+01	0	1.43E-03	6.9E-01	2.65E+00	2.13E+00
RWD	kg	6.25E-02	3.67E-05	1.57E-03	5.79E-05	4.74E-05	3.02E+00	0	1.67E-05	6.58E-03	2.78E-05	-1.06E-03
CRU	kg	0	0	0	0	0	0	0	0	0	0	0
MFR	kg	0	0	0	0	0	0	0	0	1.9E+01	0	0
MER	kg	0	0	0	0	0	0	0	0	0	0	0
EEE	MJ	0	0	0	0	4.37E+00	0	0	0	7.44E+00	0	0
EET	MJ	0	0	0	0	7.91E+00	0	0	0	1.34E+01	0	0

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

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: 1PCS of MAGNA3 65-150 (Cast Iron)

Parameter	Unit	A1	A2	A3	A4	A5	B6	C1	C2	C3	C4	D
PM	Disease incidence	7.32E-06	1.29E-07	2.42E-07	5.64E-08	4.65E-09	2.09E-05	0	2.32E-08	5.24E-08	5.11E-09	-4.01E-07
IR	kBq U235 eq	6.86E+00	5.41E-03	2.47E-01	8.14E-03	7.3E-03	4.95E+02	0	2.46E-03	1.08E+00	3.94E-03	-2.76E-02
ETP-fw	CTUe	8.72E+02	1.53E+01	1.84E+01	1.61E+01	4.97E-01	8.51E+03	0	6.74E+00	1.93E+01	1.63E+00	-1.29E+01
HTP-c	CTUh	1.65E-06	3.14E-10	6.65E-07	7.98E-10	2.44E-11	2.35E-07	0	1.4E-10	5.8E-10	9.36E-11	-7.02E-08
HTP-nc	CTUh	2.66E-06	1.71E-08	5.75E-08	1.95E-08	1.15E-09	8.66E-06	0	8E-09	2.32E-08	8.16E-09	-1.74E-08
SQP	SQP	4.39E+02	6.57E+00	9.72E+01	7.59E+00	2.68E-01	6.33E+03	0	3.16E+00	1.4E+01	1.67E-01	-2.33E+01

PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); SQP = Potential soil quality index

Disclaimer 1 – for the indicator 'Potential Human exposure efficiency relative to U235'.
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 or radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – for the indicators 'abiotic depletion potential for non-fossil resources', 'abiotic depletion potential for fossil resources', 'water (user) deprivation potential, deprivation-weighted water consumption', 'potential comparative toxic unit for ecosystems', 'potential comparative toxic unit for humans – cancerogenic', 'Potential comparative toxic unit for humans - not cancerogenic', 'potential soil quality index'. The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high as there is limited experience with the indicator.

Disclaimer 3: *JRC Technical Reports, Version 2, 2018* Page 6, for the indicator "EP-freshwater". This indicator has been calculated as 'kg P eq' as required in the characterization model EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe;

References

Standards

EN 15804

EN 15804:2012+A1 2013, Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products.

EN 15804

EN 15804:2012+A2:2019+AC:2021, Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products.

ISO 14025

EN ISO 14025:2011, Environmental labels and declarations — Type III environmental declarations — Principles and procedures.

Further References

Title of the software/database

Title of the software/database. Addition to the title, version. Place: Publisher, Date of publication [Access on access date].

IBU 2021

Institut Bauen und Umwelt e.V.: General Instructions for the EPD programme of Institut Bauen und Umwelt e.V., Version 2.0, Berlin: Institut Bauen und Umwelt e.V., 2021
www.ibu-epd.com

Standards

Machinery Directive

DIRECTIVE 2006/42/EC OF THE EUROPEAN

PARLIAMENT AND OF THE COUNCIL of 17 May

2006 on machinery

Radio Equipment Directive

DIRECTIVE 2014/53/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 April 2014 on the harmonization of the laws of the Member States relating to the making available on the market of

radio equipment

Electromagnetic Compatibility (EMC) Directive

DIRECTIVE 2014/30/EU OF THE EUROPEAN

PARLIAMENT AND OF THE COUNCIL of 26 February

2014 on the harmonistion of the laws of the Member

States relating to electromagnetic compatibility

Ecodesign Directive

DIRECTIVE 2009/125/EC OF THE EUROPEAN

PARLIAMENT AND OF THE COUNCIL of 21 October

2009 establishing a framework for the setting of

eco-design requirements for energy-related products

EC 641/2009

COMMISSION REGULATION (EC) No 641/2009 of 22 July 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to eco-design requirements for glandless standalone circulators and glandless circulators integrated in

products

EC 622/2012

COMMISSION REGULATION (EU) No 622/2012 of 11 July 2012 amending Regulation (EC) No 641/2009 with regard to eco-design requirements for glandless standalone circulators and glandless circulators integrated in products

DIRECTIVE 2011/65/EU

DIRECTIVE 2011/65/EU OF THE EUROPEAN

PARLIAMENT AND OF THE COUNCIL of 8 June 2011

on the restriction of the use of certain hazardous

substances in electrical and electronic equipment

DIRECTIVE 2015/863/EU

DIRECTIVE 2015/863/EU of 31 March 2015 amending

Annex II to Directive 2011/65/EU of the European

Parliament and of the Council as regards the list of

restricted substances

ETSI EN 301 489-1

ETSI EN 301 489-1 V2.2.0, Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements

ETSI EN 301 489-17

ETSI EN 301 489-17 V3.2.0, Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for Broadband Data Transmission Systems

ETSI EN 300 328 V2.1.1

ETSI EN 300 328 V2.1.1, Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques

EN 809

EN 809:1998-10 + A1:2009, Pumps and pump units for

liquids - Common safety requirements

EN 55014-1

EN 55014-1:2017, Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission

EN 55014-2

EN 55014-2:2015, Electromagnetic compatibility –

Requirements for household appliances, electric tools

and similar apparatus – Part 2: Immunity – Product

family standard (CISPR 14-2:2015)

EN 50581:2012

EN 50581:2012, Technical documentation for the

assessment of electrical and electronic products with

respect to the restriction of hazardous substances

EN 60335-1

EN 60335-1:2012/A11:2014/A13:2017, Household

and similar electrical appliances – Safety – Part 1: General requirements

EN 60335-2-51

EN 60335-2-51:2003-03 + A1:2008 + A2:2012, Household and similar electrical appliances – Safety –Part 2-51: Particular requirements for stationary circulation pumps for heating and service water installations

EN 61000-3-2

EN 61000-3-2:2014/2019, Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current =16 A per phase)

EN 61000-3-3

EN 61000-3-3:2013-08/ A1:2019, Electromagnetic compatibility (EMC) – Part 3-3:
Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low voltage supply systems, for equipment with

rated current <= 16 A per phase and not subject to conditional connection

EN 61000-6-2

EN 61000-6-2:2008/2019, Electromagnetic compatibility (EMC) – Part 6-2: Generic standards –Immunity for industrial environments

EN 16297-1

EN 16297-1:2012-10, Pumps – Rotodynamic pumps – Glandless circulators – Part 1:
General requirements and procedures for testing and calculation of energy efficiency index (EEI)

EN 16297-2

EN 16297-2:2012-10, Pumps – Rotodynamic pumps – Glandless circulators – Part 2: Calculation of energy efficiency index (EEI) for standalone circulators

EN 16297-3

EN 16297-3:2012, Pumps – Rotodynamic pumps –Glandless circulators – Part 3: Energy efficiency index (EEI) for circulators integrated in products

ISO 14001

EN ISO 14001:2015-09, Environmental management systems - Requirements with guidance for use

ISO 14025

DIN EN /ISO 14025:2011-10, Environmental labels and declarations — Type III environmental declarations — Principles and procedures

EN 15804

EN 15804:2012-04+A1 2013, Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

PCR Part A

Institut Bauen und Umwelt e.V., Berlin (pub.): Product Category Rules for Building-Related Products and Services, Product Category Rules for Construction Products from the range of Environmental Product Declarations of Institute Bauen und Umwelt (IBU), Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report, Version 1.7 (2021)

PCR Part B

Institut Bauen und Umwelt e.V., Berlin (pub.): Product Category Rules for Building-Related Products and Services, Product Category Rules for Construction Products from the range of Environmental Product Declarations of Institute Bauen und Umwelt (IBU), Part B: Requirements on the EPD for Pumps for liquids and liquids with solids, Version 1.0 (2018)

Further references

CPR

REGULATION (EU) No 305/2011 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 9 March 2011 laying down harmonized conditions for the marketing of construction products and repealing Council Directive 89/106/EEC

CML 2001

Impact assessment characterization factors Institute of Environmental Sciences, Leiden University, Netherlands

ECHA candidate list

Candidate List of substances of very high concern (SVHCs) for authorization, European Chemicals Agency (ECHA), Helsinki, Finland

Ecoinvent

Ecoinvent v3.5

GaBi ts

GaBi ts 9.2.1.68 (database schema 8007)

REACH

Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) (Status: 27.06.2018)

SVR

Advisory Board (formerly SVA)

Decision no.
20170712-n

Publisher

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Author of the Life Cycle Assessment

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ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A2*

Owner of the Declaration	Grundfos Holding A/S
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-GRU-20240019-CBA1-EN
Issue date	21.03.2024
Valid to	20.03.2029

MAGNA3 65-150 (Stainless Steel)

Grundfos Holding A/S

Institut Bauen und Umwelt e.V.

ECO PLATFORM EPD VERIFIED

www.ibu-epd.com | https://epd-online.com

General Information

Grundfos Holding A/S

Programme holder

IBU – Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

Declaration number

EPD-GRU-20240019-CBA1-EN

This declaration is based on the product category rules:

Pumps for liquids and liquids with solids, 01.08.2021
(PCR checked and approved by the SVR)

Issue date

21.03.2024

Valid to

20.03.2029

Dipl.-Ing. Hans Peters
(Chairman of Institut Bauen und Umwelt e.V.)

Florian Pronold
(Managing Director Institut Bauen und Umwelt e.V.)

MAGNA3 65-150 (Stainless Steel)

Owner of the declaration

Grundfos Holding A/S
Poul Due Jensens Vej 7
8850 Bjerringbro
Denmark

Declared product / declared unit

1 PCS. of MAGNA3 65-150 (Stainless Steel)

Scope:

The declaration applies to 1 piece of MAGNA3 (Stainless Steel) pump.

The product is produced in Wahlstedt, Germany, and the life cycle assessment is based on data collected at the production site.

Production has been modeled using annual production data from 2021.

The declaration covers MAGNA3 65-150 product.
The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

The EPD was created according to the specifications of EN 15804+A2. In the following, the standard will be simplified as *EN 15804*.

Verification

The standard EN 15804 serves as the core PCR
Independent verification of the declaration and data according to ISO 14025:2011
☐ internally ☒ externally

Mrs Kim Allbury,
(Independent verifier)

Product

Product description/Product definition
The Grundfos MAGNA3 circulator pumps are designed for circulating liquids in heating systems, air conditioning and cooling systems and domestic hot water systems. However, the pump range can also be used in ground source heat pump systems and solar heating systems.

The MAGNA3 pump is a centrifugal pump powered by an electrical motor. It has a high-performance neodymium magnet rotor which increases motor efficiency and an insulation shell to reduce heat loss from the cast iron pump housing with threaded connections.

The declaration covers MAGNA3 65-150 pump. For the placing on the market in the European Union/European Free Trade Association (EU/EFTA) (with the exception of Switzerland) the following legal provisions apply:

Machinery Directive (2006/42/EC)

Standard used: *EN 809:1998 + A1:2009.*

Radio Equipment Directive (2014/53/EU)

Standards used:
EN 60335-1:2012/AC:2014 + A11:2014, EN 60335-2-51:2003 + A1:2008 + A2:2012, EN 62233:2008.

EN 55014-1:2006 + A1:2009 + A2:2011, EN 55014-1:2017, EN 61000-6-2:2005, EN 61000-3-2:2014, EN 61000-3-3:2013, ETSI EN 301 489-1 V2.2.0, ETSI EN 301 489-17 V3.2.0. ETSI EN 300 328 V2.1.1

Electromagnetic Compatibility (EMC) Directive (2014/30/EU)

Standards used: *EN 55014-1:2017, EN 55014-2:2015,*

EN 61000-3-2:2014/2019, EN 61000-6-2:2008/2019,

EN 61000-3-3:2013 A1:2019

RoHS Directive 2011/65/EU and 2015/863//EU

Standard: *EN 50581:2012.*

Ecodesign Directive (2009/125/EC)

Commission Regulation (EC) No: 641/2009 and

Commission Regulation (EU) 622/2012

Standards used:
EN 16297-1:2012, EN 16297-2:2012, EN 16297-3:2012.

The CE marking takes into account the proof of conformity with the respective harmonised norms based on the legal provisions above.

MAGNA3 pumps are not harmonised in accordance with the *CPR.*

Application
For the application and use the respective national provisions apply.

The pump is designed for circulating liquids in the

following systems:

· heating systems

· domestic hot-water systems

· air-conditioning and cooling systems

· ground-source heat-pump systems

· solar-heating systems

The pump is suitable for thin, clean, non-aggressive and non-explosive liquids, not containing solid particles or fibres that may attack the pump mechanically or chemically. In heating systems, the water must meet the requirements of accepted standards on water quality. The pumps are also suitable for domestic hot-water systems.

Technical Data
The performance data of the product according to the harmonized norms, based on the harmonization provisions above apply.

The relevant technical specifications according to the *PCR Part B* are given in the table below.

Constructional data

Name	Value	Unit
Frequency	50	Hz
Voltage	230	V
Energy Efficiency Index	0,17	
Flow range	42,5	m3/h
Head max	15	m
Power input	0,562	kW
Nominal capacity	1,271	kW

The performance data of the product according to the harmonised norms, based on the harmonisation provisions above apply.

Base materials/Ancillary materials

Name	Value	Unit
Aluminium	14,07	%
Ceramics	0,25	%
Copper	4,37	%
Electronics	0,22	%
Magnet Nd	0,92	%
Paper	0,42	%
PCB	3,16	%
Plastics	0,31	%
Plastics, foam	1,04	%
Plastics GF	4,36	%
Rubber	0,14	%
Stainless steel	53,45	%
Steel	10,48	%
Cardboard	6,76	%
Plastic film	0,06	%
TOTAL	100	%

REACH

This product/article/at least one partial article contains substances listed in the *ECHA candidate list* (date: 10.06.2022) exceeding 0.1 percentage by mass: **no**

The Wahlstedt production has been assessed and certified as meeting the requirements in *ISO 14001, ISO 50001, ISO 45001 and ISO 9001.*

Reference service life

No use stage scenario which refers to the lifetime of the product is declared. However, to facilitate building calculations, an estimated RSL of 10 years can be used.
This is an EU consensus-based estimation, referenced on page 37 in Appendix 7: *Lot 11 – Circulators in Buildings*, prepared by *AEA Energy & Environment for the European Commission* in the context of the *Eco Design Directive*:

There is no definitive information on the average circulator life available, there is consensus within the industry that it is at least 12 years. However, this is complicated by many factors, including many being scrapped prematurely when e.g. the boiler they are connected to is replaced.

From the estimated stock (140Mpa) and annual sales (14Mpa), the average lifetime of the circulator is taken as 10 years for the purposes of this study.

The RSL of the declared product is not directly influencing the results in this study, as no declared use stage scenario is dependent on the RSL; The use stage sub-module B6 is declared per year as required by the *PCR Part B.*

LCA: Calculation rules

Declared Unit

The declared unit is 1 piece (pcs.) of MAGNA3 (Stainless Steel) pump.

Declared unit

Name	Value	Unit
Declared unit	1	pce.
Mass reference	27.24	kg/pce
Conversion factor [Mass/Declared Unit]	27.24	

System boundary

This EPD is Cradle-To-Grave. The system boundaries

of the EPD follow the modular approach in *EN 15804*. By decision no. 20170712-n of the *SVR*, the modules B3, B4 and B5 are by default declared as "MNR" (module not relevant).

The product stage (A1-A3) comprises raw material extraction and processing, transport processes as well as the manufacturing process. The final production and assembly of the MAGNA3 pump takes place at a Grundfos manufacturing site in Germany. However, the full supply-chain leading to the finished product at the gate is rather complex and includes a large amount of raw materials, components and semi-finished parts which come from both external suppliers as well as other Grundfos production facilities.

The product stage is included in the study, and according to *EN 15804* the system boundary with nature is set to include those processes that provide the material and energy inputs into the system and the following manufacturing, transport up to the factory gate as well as the processing any waste arising from those processes.

Wastes and losses are included in the modules where they occur according to the polluter pays principle and the modular approach of *EN 15804.*

The product includes:

· A1 Extraction and processing of raw materials;

· A1 Reuse of products or materials from a previous product system;

· A1 Processing of secondary materials;

· A1 Generation of electricity, steam and heat from primary energy resources, also including their extraction, refining and transport;

· A1 Energy recovery and other recovery processes from secondary fuels;

· A2 Transportation up to the factory gate and internal transport;

· A3 Production of ancillary materials or pre products;

· A3 Manufacturing of products and coproducts;

· A3 Manufacturing of packaging;

· A1-A3 processing up to the end-of-waste state or disposal of final residues.

For secondary material inputs, the system boundary to the previous system (providing the secondary material) is set where outputs reach the end-of-waste state. The recycling of secondary material into new raw materials is included in the system boundary of this study. Waste

materials from production processes that are recycled without any modification of the material's inherent characteristics are modelled as closed-loop within A1-A3. This is done up to the input mass flow that was used during production.

Waste for incineration arising in the product stage is accounted for in the module where the waste is produced. The environmental loads from the incineration process are declared in the module where it occurs and the electricity and heat which is produced from the incineration are considered as closed-loop within A1-A3, as described in *PCR Part A,* 5.5.1. The input of biogenic carbon from the production of packaging material is inventoried in A3. As required by *PCR Part A*, the corresponding end-of-life module of the packaging material, A5, is also declared and the emissions of biogenic carbon are inventoried.

The construction process stage (A4-A5) includes:

A4:

· Transportation from factory gate to distribution centre:

· Consumption of electricity, thermal energy and water at the distribution centre;

· Transportation from distribution centre to construction site;

· Wastage during distribution.

A5:

· Installation process;

· Transport of packaging waste to treatment site;

· Waste treatment of packaging.

The packaging material does not reach the end of waste state but is incinerated as waste.
According to European statistics, the average R1 value of incineration plants is > 0.6. Therefore, it is assumed

that packaging material is treated thermally in an incineration plant with R1 > 0.6. The loads from the combustion process of packaging are declared in module A5 and the resulting energy benefits in module

D, as required by the *PCR Part A*, 5.5.2.

Use stage (B1-B7):

The use stage, related to the building fabric includes:

· B1, use or application of the installed product;

· B2, maintenance.

The use stage related to the operation of the building

includes:

· B6, operational energy use;

· B7, operational water use.

In this study, all use stage modules are assessed, though B1, B2 and B7 are assessed to be zero. By decision no. 20170712-n of the *SVR*, the modules B3, B4 and B5 are by default declared as "MNR" (module

not relevant).
The modules include the provision and transport of all materials, products and related energy and water use, as well as waste processing up to the end-of-waste state or disposal of final residues during the use stage. They also include all impacts and

aspects related to the losses during the use stage (i.e. production, transport, and waste processing and disposal of the lost products and materials).

Generally, the geographical coverage of the datasets used matches the actual processes taking place. Meaning, that when modelling taking place in Grundfos Bjerringbro, the Danish electricity grid mix is used in the model and thermal energy from natural gas. These are generally of very high quality with very good technological, temporal and geographical representativeness.

Contributions to operational energy use during the use stage (B6) comes from the electricity consumption of the product. The annual electricity consumption is calculated by multiplying the average power input, which is based on a defined load profile, with the annual running hours. For use stage (B6) European Average electricity grid mix has been used. These values are declared in the scenarios section.

The End-of-Life stage (C1-C4) includes all activities from when the product reaches the end of its service life and no longer provides any functionality and until all materials and components are processed for reuse/recycling or disposed of.

According to *EN 15804* and the *PCR Part A,* the end-of-life stage includes:

· C1 deconstruction of the product from the

· building, including initial on-site sorting of the

· materials;

· C2 transportation of the discarded product to a recycling site and transportation of waste to final disposal;

· C3 waste processing, collection of waste fractions from the deconstruction and waste processing of material flows intended for reuse, recycling and energy recovery;

· C4 waste disposal including physical pretreatment and management of the disposal site.

At the end of life, the MAGNA3 pump is manually disassembled from the piping system in which it has been installed. The definition of the applied end-of-life scenario in this EPD follows the requirements in the

PCR Part A, 6.2 regarding complex products, with a combination of recycling, thermal waste treatment and landfilling. 100 % of the material is considered in the end of life scenario as required by the *PCR*. An overall collection rate of 90 % has been assumed.

Materials from which energy is recovered in an incineration process with an R1-value above 0.60 are in this study included with the environmental burdens from the incineration process inventoried in C3, the recovered energy is declared as exported energy in C3

and the energy benefits are declared in D. This procedure is

according to the *PCR Part A*, 5.5.6. C3 includes the mechanical separation of the product followed by a series of sorting steps. Metal fractions are recycled and plastics, cardboard and electronics are assumed incinerated with energy recovery. The residual fractions are landfilled and declared in C4.

The specific amounts are shown in the scenarios section.

Beyond system boundary (D): According to *EN 15804* module D includes the reuse, recovery and/or recycling potentials, expressed as net impacts and benefits. Any declared benefits and loads from net

flows leaving the product system that have not been allocated as co-products and that have passed the end-of-waste state are included in module D.

Contributions to module D comes from waste incineration processes in A5 and C3 as well as material recycling in C3. The specific fractions and net flows are shown in the scenarios section.

Geographic Representativeness

Land or region, in which the declared product system is manufactured, used or handled at the end of the product´s lifespan: Germany

Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to *EN 15804* and the building context, respectively the product-specific characteristics of performance, are taken into account. Software and databases used: *LCA for Experts 10.7.1.28*
Schema 8007
Sphera and Ecoinvent databases

LCA: Scenarios and additional technical information

Characteristic product properties of biogenic carbon

The biogenic carbon content quantifies the amount of biogenic carbon in a construction product leaving the factory gate, and it will be separately declared for the product and for any accompanying packaging, as required from the *PCR Part A*. The carbon content of cardboard and paper is assumed to 0.46 kg C. It means that 46% of paper and cardboard is assumed to be of biogenic carbon. Overall, there is an amount of weight-% Carbon in the product leaving the factory gate and has to be considered.

Information on describing the biogenic Carbon Content at factory gate

Note: 1 kg of biogenic carbon is equivalent to 44/12 kg of CO2.

Name	Value	Unit
Biogenic carbon content in accompanying packaging	0.9	kg C

Transport from the gate to the site (A4)

Name	Value	Unit
Litres of fuel	0,052	l/100km
Transport distance	2003	km
Capacity utilisation (including empty runs)	85	%
Gross density of products transported	506	kg/m^3
Wastage during distribution	0,02	%

Installation into the building (A5)

Name	Value	Unit
Packaging waste for incineration (LDPE film)	0,02	kg
Packaging waste for incineration (Paper/Cardboard)	1,96	kg

An estimated RSL of 10 years can be used to facilitate building calculations. This is an EU consensus-based estimation, referenced in Appendix 7: Lot 11 – Circulators in Buildings, prepared by AEA Energy & Environment for the European Commission in the context of the Eco Design Directive.

Reference service life

Name	Value	Unit
Life Span according to the manufacturer	10	a

Operational energy use (B6)

Name	Value	Unit
Electricity consumption	2810	kWh/a
Average power input,	0,562	kW
Running hours (all groups)	5.000	h/a

End of life (C1-C4)

Name	Value	Unit
Collected as mixed construction waste	25,26	kg
Transportation distance (C2)	500	km
Aluminium for recycling	3,38	kg
Steel for recycling	2,51	kg
Copper for recycling	1,05	kg
Stainless steel for recycling	12,84	kg
Plastics for incineration w/energy	1,4	kg
Electronics for incineration w/energy	0,81	kg
Landfilling	3,26	kg

Reuse, recovery and/or recycling potentials (D), relevant scenario information

Name	Value	Unit
A5, incineration w/energy recov. thermal energy	8,91	MJ
A5, incineration w/energy recov. electrical energy	4,92	MJ
C3, steel for recycling (net amounts)	-0,601	kg
C3, stainless steel for recycling (net amounts)	12,5	kg
C3, aluminium for recycling (net amounts)	-0,528	kg
C3, copper for recycling (net amounts)	0,45	kg
C3, incineration, w/ ecov. thermal energy	13,5	kg
C3, incineration, w/ energy recov. electrical energy	7,48	kg

LCA: Results

Characterization model: *EN 15804* - 2012+A2 - 2019, PEF. By Decision no. 20170712-n of the IBU SVR, the modules B3, B4, B5 are marked as MNR (module not relevant) as default. The LCA results in module B6 are given over a period of one year, according to *PCR Part B*. To obtain the results from module B6 over the entire life cycle, the LCA results of module B6 must be multiplied by the estimated RSL of 10 years.

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

Product stage			Construction process stage		Use stage							End of life stage				Benefits and loads beyond the system boundaries
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	X	X	MNR	MNR	MNR	X	X	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1PCS of MAGNA3 65-150

Parameter	Unit	A1	A2	A3	A4	A5	B1	B2	B6	B7	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq	1.55E+02	6.06E+00	7.37E-01	2.09E+00	3.18E+00	0	0	9.14E+02	0	0	8.66E-01	6.52E+00	1.6E-01	-4E+01
GWP-fossil	kg CO_2 eq	1.55E+02	6.06E+00	3.95E+00	2.1E+00	4.78E-01	0	0	9.06E+02	0	0	8.71E-01	6.51E+00	1.62E-01	-3.99E+01
GWP-biogenic	kg CO_2 eq	-5.21E-02	-9.05E-03	-3.25E +00	-3.07E-02	2.7E+00	0	0	7.88E+00	0	0	-1.29E-02	1.75E-02	-1.99E-03	-9.22E-02
GWP-luluc	kg CO_2 eq	1.05E-01	8.79E-03	3.05E-02	1.9E-02	9.57E-05	0	0	9.85E-02	0	0	8.08E-03	2.57E-04	1.46E-04	-7.76E-03
ODP	kg CFC11 eq	4.75E-08	4.73E-13	4.06E-09	1.08E-11	4.19E-13	0	0	1.67E-08	0	0	1.14E-13	3.8E-11	2.7E-13	-2.7E-11
AP	mol H^+ eq	1.12E+00	1.82E-01	1.97E-02	1.26E-02	8.6E-04	0	0	1.94E+00	0	0	5.24E-03	5.16E-03	4.99E-04	-3.63E-01
EP-freshwater	kg P eq	1.56E-03	4.6E-06	6.86E-05	7.84E-06	1.56E-07	0	0	3.38E-03	0	0	3.19E-06	1.08E-05	1.86E-05	-4.07E-05
EP-marine	kg N eq	1.2E-01	4.33E-02	4.09E-03	6.02E-03	3.15E-04	0	0	4.63E-01	0	0	2.55E-03	1.33E-03	1.19E-04	-4.38E-02
EP-terrestrial	mol N eq	1.3E+00	4.75E-01	4.11E-02	6.68E-02	3.95E-03	0	0	4.84E+00	0	0	2.83E-02	1.48E-02	1.31E-03	-4.73E-01
POCP	kg NMVOC eq	3.81E-01	1.23E-01	1.15E-02	1.15E-02	8.18E-04	0	0	1.24E+00	0	0	4.85E-03	3.55E-03	3.75E-04	-1.41E-01
ADPE	kg Sb eq	1.17E-02	1.09E-07	6.2E-05	2.49E-06	4.32E-09	0	0	1.4E-04	0	0	5.78E-08	3.17E-07	4.34E-09	-3.18E-03
ADPF	MJ	2.13E+03	7.54E+01	5.86E+01	2.87E+01	1.16E+00	0	0	1.91E+04	0	0	1.19E+01	4.42E+01	2.42E+00	-4.28E+02
WDP	m^3 world eq deprived	4.84E+01	1.99E-02	4.97E-02	3.59E-02	3.81E-01	0	0	2.02E+02	0	0	1.05E-02	9.09E-01	-2.25E-03	-2.29E+00

GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential)

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1PCS of MAGNA3 65-150

Parameter	Unit	A1	A2	A3	A4	A5	B1	B2	B6	B7	C1	C2	C3	C4	D
PERE	MJ	5.35E+02	1.21E+00	5.59E+01	2.23E+00	2.62E-01	0	0	1.14E+04	0	0	8.65E-01	2.59E+01	2.18E-01	5.87E+00
PERM	MJ	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PERT	MJ	5.35E+02	1.21E+00	5.59E+01	2.23E+00	2.62E-01	0	0	1.14E+04	0	0	8.65E-01	2.59E+01	2.18E-01	5.87E+00
PENRE	MJ	2.14E+03	7.56E+01	5.86E+01	2.88E+01	1.16E+00	0	0	1.91E+04	0	0	1.19E+01	4.42E+01	2.42E+00	-4.27E +02
PENRM	MJ	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PENRT	MJ	2.14E+03	7.56E+01	5.86E+01	2.88E+01	1.16E+00	0	0	1.91E+04	0	0	1.19E+01	4.42E+01	2.42E+00	-4.27E +02
SM	kg	2.17E+01	0	2.4E-01	4.38E-03	0	0	0	0	0	0	0	0	0	0
RSF	MJ	1.46E-23	0	0	2.91E-27	0	0	0	0	0	0	0	0	0	0
NRSF	MJ	1.71E-22	0	0	3.42E-26	0	0	0	0	0	0	0	0	0	0
FW	m^3	1.43E+00	1.38E-03	2.35E-02	2.57E-03	8.99E-03	0	0	9.21E+00	0	0	9.47E-04	3.14E-02	2.52E-05	6.63E-04

PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1PCS of MAGNA3 65-150

Parameter	Unit	A1	A2	A3	A4	A5	B1	B2	B6	B7	C1	C2	C3	C4	D
HWD	kg	7.02E-06	2.37E-10	1.21E-04	2.57E-08	2.93E-11	0	0	2.24E-06	0	0	3.69E-11	5.04E-09	2.02E-10	-7.76E-03
NHWD	kg	1.35E+01	7.69E-03	3.8E-01	7.3E-03	1.24E-01	0	0	1.4E+01	0	0	1.82E-03	7.07E-01	2.8E+00	3.88E+00
RWD	kg	7.16E-02	9.78E-05	1.8E-03	7.3E-05	5.3E-05	0	0	3.03E+00	0	0	2.23E-05	6.86E-03	2.84E-05	-4.73E-03
CRU	kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MFR	kg	0	0	0	0	0	0	0	0	0	0	0	1.97E+01	0	0
MER	kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
EEE	MJ	0	0	0	0	4.92E+00	0	0	0	0	0	0	7.48E+00	0	0
EET	MJ	0	0	0	0	8.91E+00	0	0	0	0	0	0	1.35E+01	0	0

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

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: 1PCS of MAGNA3 65-150

Parameter	Unit	A1	A2	A3	A4	A5	B1	B2	B6	B7	C1	C2	C3	C4	D
PM	Disease incidence	1.44E-05	3.15E-06	2.92E-07	8.15E-08	5.09E-09	0	0	0	0	0	3.32E-08	4.37E-08	5.07E-09	-8.87E-06
IR	kBq U235 eq	9.85E+00	1.41E-02	2.89E-01	1.08E-02	8.26E-03	0	0	0	0	0	3.33E-03	1.14E+00	4.2E-03	-3.69E-01
ETP-fw	CTUe	1.04E+03	5.34E+01	2.01E+01	2.02E+01	5.61E-01	0	0	0	0	0	8.51E+00	1.27E+01	1.52E+00	-5.87E+01
HTP-c	CTUh	3.7E-05	9.92E-10	6.65E-07	7.94E-09	3.06E-11	0	0	0	0	0	1.73E-10	7.03E-10	9.75E-11	-1.71E-06
HTP-nc	CTUh	2.33E-06	3.4E-08	4.29E-08	1.86E-08	1.15E-09	0	0	0	0	0	7.69E-09	1.4E-08	8.32E-09	-2.53E-07
SQP	SQP	4.81E+02	5.55E+00	1.06E+02	1.18E+01	3.42E-01	0	0	0	0	0	4.97E+00	1.71E+01	2.16E-01	-2.55E+01

PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); SQP = Potential soil quality index

Disclaimer 1 – for the indicator 'Potential Human exposure efficiency relative to U235'.
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 or radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – for the indicators 'abiotic depletion potential for non-fossil resources', 'abiotic depletion potential for fossil resources', 'water (user) deprivation potential, deprivation-weighted water consumption', 'potential comparative toxic unit for ecosystems', 'potential comparative toxic unit for humans – cancerogenic', 'Potential comparative toxic unit for humans - not cancerogenic', 'potential soil quality index'. The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high as there is limited experience with the indicator.

Disclaimer 3: *JRC Technical Reports, Version 2, 2018* Page 6, for the indicator "EP-freshwater". This indicator has been calculated as 'kg P eq' as required in the characterization model EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe; This EPD was created using a software tool.

References

Standards

EN 15804

EN 15804:2012+A1 2013, Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products.

EN 15804

EN 15804:2012+A2:2019+AC:2021, Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products.

ISO 14025

EN ISO 14025:2011, Environmental labels and declarations — Type III environmental declarations — Principles and procedures.

Further References

Title of the software/database

Title of the software/database. Addition to the title, version. Place: Publisher, Date of publication [Access on access date].

IBU 2021

Institut Bauen und Umwelt e.V.: General Instructions for the EPD programme of Institut Bauen und Umwelt e.V., Version 2.0, Berlin: Institut Bauen und Umwelt e.V., 2021 www.ibu-epd.com

Standards

Machinery Directive

DIRECTIVE 2006/42/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 May 2006 on machinery

Radio Equipment Directive

DIRECTIVE 2014/53/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 April 2014 on the harmonization of the laws of the Member States relating to the making available on the market of radio equipment

Electromagnetic Compatibility (EMC) Directive

DIRECTIVE 2014/30/EU OF THE EUROPEAN PARLIAMENT

AND OF THE COUNCIL of 26 February 2014 on the harmonistion of the laws of the Member States relating to electromagnetic compatibility

Ecodesign Directive

DIRECTIVE 2009/125/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 21 October 2009 establishing a framework for the setting of eco-design requirements for energy-related products

EC 641/2009

COMMISSION REGULATION (EC) No 641/2009 of 22 July 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to eco-design requirements for glandless standalone circulators and glandless circulators integrated in products

EC 622/2012

COMMISSION REGULATION (EU) No 622/2012 of 11 July 2012 amending Regulation (EC) No 641/2009 with regard to eco-design requirements for glandless standalone circulators and glandless circulators integrated in products

DIRECTIVE 2011/65/EU

DIRECTIVE 2011/65/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment

DIRECTIVE 2015/863/EU

DIRECTIVE 2015/863/EU of 31 March 2015 amending Annex II to Directive 2011/65/EU of the European Parliament and of the Council as regards the list of restricted substances

ETSI EN 301 489-1

ETSI EN 301 489-1 V2.2.0, Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements

ETSI EN 301 489-17

ETSI EN 301 489-17 V3.2.0, Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for Broadband Data Transmission Systems

ETSI EN 300 328 V2.1.1

ETSI EN 300 328 V2.1.1, Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques

EN 809

EN 809:1998-10 + A1:2009, Pumps and pump units for liquids - Common safety requirements

EN 55014-1

EN 55014-1:2017, Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission

EN 55014-2

EN 55014-2:2015, Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 2: Immunity – Product family standard (CISPR 14-2:2015)

EN 50581:2012

EN 50581:2012, Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

EN 60335-1

EN 60335-1:2012/A11:2014/A13:2017, Household and similar electrical appliances – Safety – Part 1: General requirements

EN 60335-2-51

EN 60335-2-51:2003-03 + A1:2008 + A2:2012, Household and similar electrical appliances – Safety –Part 2-51: Particular requirements for stationary circulation pumps for heating and service water installations

EN 61000-3-2

EN 61000-3-2:2014/2019, Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current =16 A per phase)

EN 61000-3-3

EN 61000-3-3:2013-08/ A1:2019, Electromagnetic compatibility (EMC) – Part 3-3:

Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low voltage supply systems, for equipment with rated current <= 16 A per phase and not subject to conditional connection

EN 61000-6-2

EN 61000-6-2:2008/2019, Electromagnetic compatibility (EMC) – Part 6-2: Generic standards –Immunity for industrial environments

EN 16297-1

EN 16297-1:2012-10, Pumps – Rotodynamic pumps – Glandless circulators – Part 1:

General requirements and procedures for testing and calculation of energy efficiency index (EEI)

EN 16297-2

EN 16297-2:2012-10, Pumps – Rotodynamic pumps – Glandless circulators – Part 2: Calculation of energy efficiency index (EEI) for standalone circulators

EN 16297-3

EN 16297-3:2012, Pumps – Rotodynamic pumps –Glandless circulators – Part 3: Energy efficiency index (EEI) for circulators integrated in products

ISO 14001

EN ISO 14001:2015-09, Environmental management systems - Requirements with guidance for use

ISO 14025

DIN EN /ISO 14025:2011-10, Environmental labels and declarations — Type III environmental declarations — Principles and procedures

EN 15804

EN 15804:2012-04+A1 2013, Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

PCR Part A

Institut Bauen und Umwelt e.V., Berlin (pub.): Product Category Rules for Building-Related Products and Services, Product Category Rules for Construction Products from the range of Environmental Product Declarations of Institute Bauen und Umwelt (IBU), Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report, Version 1.3.

PCR Part B

Institut Bauen und Umwelt e.V., Berlin (pub.): Product Category Rules for Building-Related Products and Services, Product Category Rules for Construction Products from the range of Environmental Product Declarations of Institute Bauen und Umwelt (IBU), Part B: Requirements on the EPD for Pumps for liquids and liquids with solids, Version 1.0 (2018)

Further references

CPR

REGULATION (EU) No 305/2011 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 9 March 2011 laying down harmonized conditions for the marketing of construction products and repealing Council Directive 89/106/EEC

CML 2001

Impact assessment characterization factors Institute of Environmental Sciences, Leiden University, Netherlands

ECHA candidate list

Candidate List of substances of very high concern (SVHCs) for authorization, European Chemicals Agency (ECHA), Helsinki, Finland

EUTREND model

Struijs et al., 2009b

AEA Energy & Environment

Circulators in Buildings

Ecoinvent

Ecoinvent v3.9.1

LCA for Experts

LCA for Experts 10.7.1.28

Schema 8007

REACH

Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) (Status: 27.06.2018)

SVR

Advisory Board (formerly SVA)

Decision no.

20170712-n

Publisher

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ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A2*

Owner of the Declaration	Grundfos Holding A/S
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-GRU-20230078-CBC1-EN
Issue date	21/11/2023
Valid to	20/11/2028

MAGNA3 65-40/60 (Cast Iron)

Grundfos Holding A/S

Institut Bauen und Umwelt e.V.

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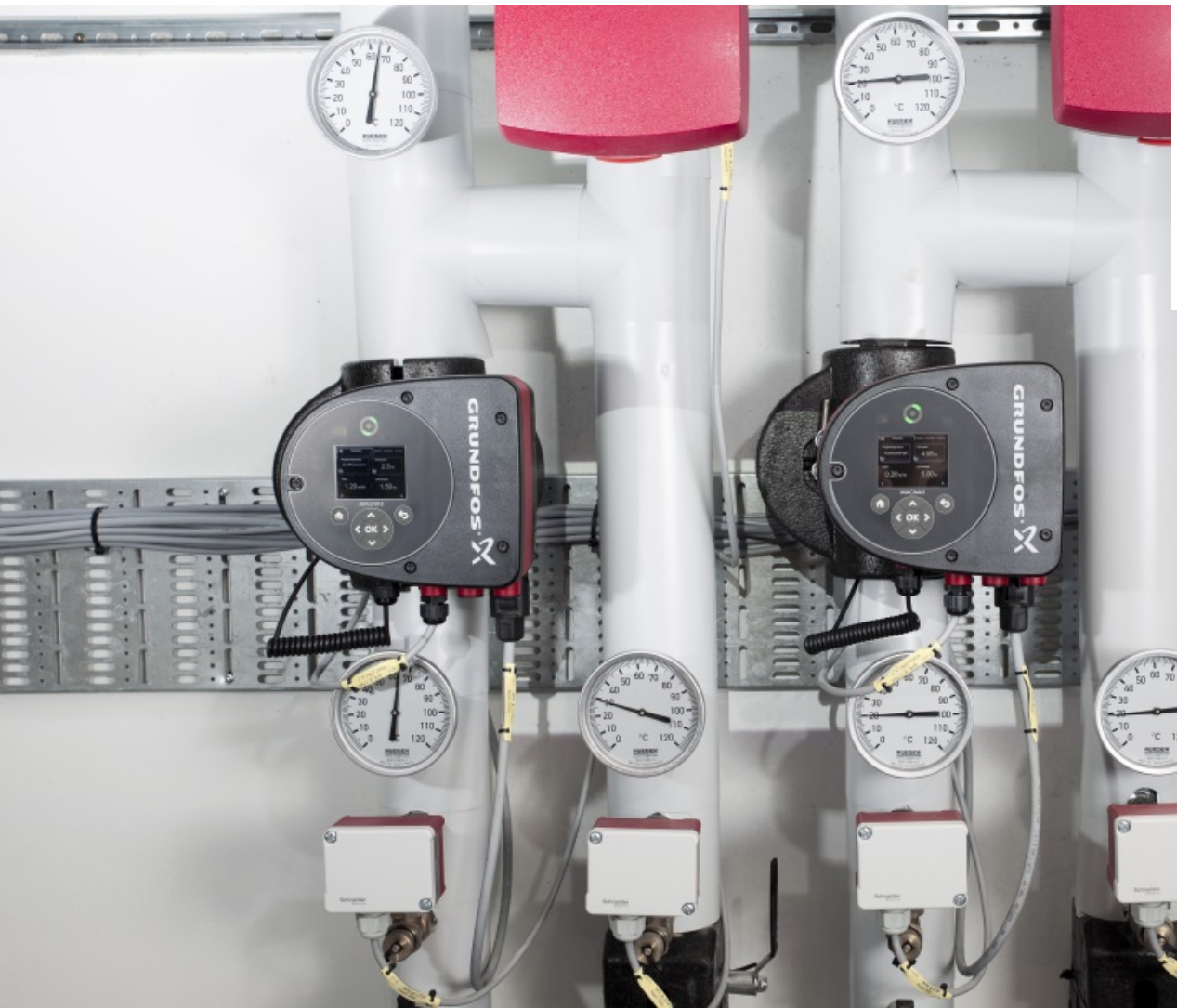

General Information

Grundfos Holding A/S

Programme holder

IBU – Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

Declaration number

EPD-GRU-20230078-CBC1-EN

This declaration is based on the product category rules:

Pumps for liquids and liquids with solids, 01/08/2021
(PCR checked and approved by the SVR)

Issue date

21/11/2023

Valid to

20/11/2028

Dipl.-Ing. Hans Peters
(Chairman of Institut Bauen und Umwelt e.V.)

Florian Pronold
(Managing Director Institut Bauen und Umwelt e.V.)

MAGNA3 65-40/60 (Cast Iron)

Owner of the declaration

Grundfos Holding A/S
Poul Due Jensens Vej 7
8850 Bjerringbro
Denmark

Declared product / declared unit

Name of declared product / declared unit

Scope:

The declaration applies to 1 piece of MAGNA3 (Cast Iron) pump.

The product is produced in Wahlstedt, Germany, and the life cycle assessment is based on data collected at the production site.

Production has been modeled using annual production data from 2021.

The declaration covers two different types of the MAGNA3 65- product (40/60).

The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

The EPD was created according to the specifications of EN 15804+A2. In the following, the standard will be simplified as *EN 15804*.

Verification

The standard EN 15804 serves as the core PCR
Independent verification of the declaration and data according to ISO 14025:2011
☐ internally ☒ externally

Mrs Kim Allbury,
(Independent verifier)

Product

Product description/Product definition

The Grundfos MAGNA3 circulator pumps are designed for circulating liquids in heating systems, air conditioning and cooling systems and domestic hot water systems. However, the pump range can also be used in ground source heat pump systems and solar heating systems.

The MAGNA3 pump is a centrifugal pump powered by an electrical motor. It has a high-performance neodymium magnet rotor which increases motor efficiency and an insulation shell to reduce heat loss from the cast iron pump housing with threaded connections.

The declaration covers two types of the MAGNA3 pump. They are grouped as shown below. The group reference in the technical data and scenarios refers also to these.

GROUP 1 - MAGNA3 65-40

GROUP 2 - MAGNA3 65-60

These are all the same physical products and 100 % identical in terms of design, dimensions and materials as well as supply chain and manufacturing processes, i.e., all cradle to gate processes (A1-A3).

The products are also identical in terms of packaging, distribution, reference service life and end-of-life treatment.

The only thing that differentiates the products from each other is the software which controls how the pump operates in the system in which it is installed, making them fit for different applications. Hence, all life cycle modules are identical, except use stage module B6, which will change, as the applied scenarios for electricity consumption changes. For the placing on the market in the European Union/European Free Trade Association (EU/EFTA) (with the exception of Switzerland) the following
legal provisions apply:

Machinery Directive (2006/42/EC)

Standard used: *EN 809:1998 + A1:2009.*

Radio Equipment Directive (2014/53/EU)

Standards used:
EN 60335-1:2012/AC:2014 + A11:2014, EN 60335-2-51:2003 + A1:2008 + A2:2012,
EN 62233:2008.

EN 55014-1:2006 + A1:2009 + A2:2011, EN 55014-1:2017, EN 61000-6-2:2005, EN 61000-3-2:2014, EN 61000-3-3:2013, ETSI EN 301 489-1 V2.2.0, ETSI EN 301 489-17 V3.2.0. ETSI EN 300 328 V2.1.1

Electromagnetic Compatibility (EMC) Directive (2014/30/EU)

Standards used:
EN 55014-1:2017, EN 55014-2:2015,

EN 61000-3-2:2014/2019, EN 61000-6-2:2008/2019,

EN 61000-3-3:2013 A1:2019

RoHS Directive 2011/65/EU and 2015/863//EU

Standard: *EN 50581:2012.*

Ecodesign Directive (2009/125/EC)

Commission
Regulation (EC) No: 641/2009 and

Commission
Regulation (EU) 622/2012

Standards used:
EN 16297-1:2012, EN 16297-2:2012, EN 16297-3:2012.

The CE marking takes into account the proof of conformity with the respective harmonized norms based on the legal provisions above.

MAGNA3 pumps
are not harmonized in accordance with the *CPR*.

Application
For the application and use the respective national

provisions apply.

The pump is designed for circulating liquids in the

following systems:

· heating systems

· domestic hot-water systems

· air-conditioning and cooling systems

· ground-source heat-pump systems

· solar-heating systems

The pump is suitable for thin, clean, non-aggressive and non-explosive liquids, not containing solid particles or fibres that may attack the pump mechanically or chemically. In heating systems, the water must meet the requirements of accepted standards on water quality in heating systems. The pumps are also suitable for domestic hot-water systems.

Technical Data
The performance data of the product according to the harmonised norms, based on the harmonisation provisions above apply.
The relevant technical specifications according to the *PCR Part B* are given in the table below. Characteristics that are the same for all two product groups are only given once. Others are given individually for all groups.

Constructional data

Name	Value	Unit
Frequency	50	Hz
Voltage	230	V
Pumped liquid (e.g. water)	Clean Water	-
Energy Efficiency Index Gr.1	0,18	
Energy Efficiency Index Gr.2	0,17	
Flow range Gr. 1 (max)	23,0	m^3/h
Flow range Gr. 2 (max)	32,0	m^3/h
Head max. Gr.1	4	m
Head max. Gr. 2	6	m
Power input Gr. 1 Average (from load profile describing use)	0,109	m
Power input Gr. 2 Average (from load profile describing use)	0,155	m
Nominal capacity Gr.1	0,19	kW
Nominal capacity Gr.2	0,342	kW

Performance data of the product according to the harmonized standards, based on provisions for harmonization.

Base materials/Ancillary materials

Base materials / Ancillary materials

Name	Value	Unit
Aluminium	13	%
Cast iron	54	%
Ceramics	0,3	%
Copper	3	%
Electronics	0,2	%
Magnet Nd	1	%
Paper	0,5	%
PCB	4	%
Plastics	0,3	%
Plastics, foam	1	%
Plastics GF	5	%
Rubber	0,2	%
Stainless steel	4	%
Steel	5	%
Cardboard	8	%
Plastic film	0,1	%
TOTAL	100	%

REACH

This product/article/at
least one partial article contains

substances
listed in the *ECHA candidate list* (date:

10.06.2022)
exceeding 0.1 percentage by mass: **no**

many factors, including many being scrapped prematurely when e.g. the boiler they are connected to is replaced.

The Wahlstedt production has been assessed and certified as meeting the requirements in *ISO 14001, ISO 50001, ISO 45001 and ISO 9001.*

From the estimated stock (140Mpa) and annual sales (14Mpa), the average lifetime of the circulator is taken as 10 years for the purposes of this study.

Reference service life

No use stage scenario which refers to the lifetime of the product is declared. However, to facilitate building calculations, an estimated RSL of 10 years can be used. This is an EU consensus-based estimation, referenced on page 37 in Appendix 7: *Lot 11 – Circulators in Buildings*, prepared by AEA Energy & Environment for the European Commission in the context of the Eco Design Directive:

The RSL of the declared product is not directly influencing the results in this study, as no declared use stage scenario is dependent on the RSL; The use stage sub-module B6 is declared per year as required by the *PCR Part B.*

There is no definitive information on the average circulator life available, there is consensus within the industry that it is at least 12 years. However, this is complicated by

LCA: Calculation rules

Declared Unit

The declared unit is 1 piece (pcs.) of MAGNA3 (Cast Iron) pump.

Declared unit

Name	Value	Unit
Declared unit	1	pce.
Mass reference	23.17	kg/pce
Conversion factor [Mass/Declared Unit]	23.17	

For IBU core EPDs (where clause 3.6 is part of the EPD): for average EPDs, an estimate of the robustness of the LCA values must be made, e.g. concerning the variability of the production process, geographical representativeness and the influence of background data and preliminary products compared to the environmental impacts caused by the actual production.

System boundary

This EPD is Cradle-To-Grave. The system boundaries of the EPD follow the modular approach in *EN 15804*. By decision no. 20170712-n of the *SVR*, the modules B3, B4 and B5 are by default declared as "MNR" (module not relevant).

The product stage (A1-A3) comprises raw material extraction and processing, transport processes as well as the manufacturing process. The final production and assembly of the MAGNA3 pump takes place at a Grundfos manufacturing site in Germany. However, the full supply-chain leading to the finished product at the gate is rather complex and includes a large amount of raw materials, components and semi-finished parts which comes from both external suppliers as well as other Grundfos production facilities.

The product stage is included in the study, and according to *EN 15804* the system boundary with nature is set to include those processes that provide the material and energy inputs into the system and the following manufacturing, transport up to the factory gate as well as the processing any waste arising from those processes.

Wastes and losses are included in the modules where they occur according to the polluter pays principle and the modular approach of *EN 15804.*

The product includes:

. A1 Extraction and processing of raw materials;

. A1 Reuse of products or materials from a previous product system;

. A1 Processing of secondary materials;

. A1 Generation of electricity, steam and heat from primary energy resources, also including their extraction, refining and transport;

. A1 Energy recovery and other recovery processes from secondary fuels;

. A2 Transportation up to the factory gate and internal transport;

. A3 Production of ancillary materials or pre products;

. A3 Manufacturing of products and coproducts;

. A3 Manufacturing of packaging;

. A1-A3 processing up to the end-of-waste state or disposal of final residues.

For secondary material inputs, the system boundary to the previous system (providing the secondary material) is set where outputs reach the end-of-waste state. The recycling of secondary material into new raw materials is included in the system boundary of this study. Waste materials from production processes that are recycled without any modification of the material's inherent characteristics are modelled as closed-loop within A1-A3. This is done up to the input mass flow that was used during production.

Waste for incineration arising in the product stage is accounted for in the module where the waste is produced. The environmental loads from the incineration process are declared in the module where it occurs and the electricity and heat which is produced from the incineration are considered as closed-loop within A1-A3, as described in *PCR Part A,* 5.5.1. The input of biogenic carbon from the production of packaging material is inventoried in A3. As required by *PCR Part A*, the corresponding end-of-life module of the packaging material, A5, is also declared and the emissions of biogenic carbon are inventoried.

The
construction process stage (A4-A5) includes:

A4:

.
Transportation from factory gate to distribution center:

.
Consumption of electricity, thermal energy and water at distribution center;

.
Transportation from distribution center to construction site;

.
Wastage during distribution.

A5:

.
Installation process;

.
Transport of packaging waste to treatment site;

.
Waste treatment of packaging.

The packaging
material does not reach the end of waste state but is incinerated as waste.
According to European statistics, the average R1 value of incineration plants
is > 0.6. Therefore, it is assumed

that packaging
material is treated thermally in an incineration plant with R1 > 0.6. The
loads from the combustion process of packaging are declared in module A5 and
the resulting energy benefits in module

D, as required
by the *PCR Part A*, 5.5.2.

Use stage
(B1-B7):

The use stage,
related to the building fabric includes:

.
B1, use or application of the installed product;

.
B2, maintenance.

The use stage
related to the operation of the building

includes:

.
B6, operational energy use;

.
B7, operational water use.

In this study,
all use stage modules are assessed, though B1, B2 and B7 are assessed to be
zero. By decision no. 20170712-n of the *SVR*, the modules B3, B4 and B5
are by default declared as "MNR" (module

not relevant).
The modules include the provision and transport of all materials, products and
related energy and water use, as well as waste processing up to the
end-of-waste state or disposal of final residues during the use stage. They
also include all impacts and

aspects related
to the losses during the use stage (i.e. production, transport, and waste
processing and disposal of the lost products and materials).

Generally, the
geographical coverage of the datasets used matches the actual processes taking
place. Meaning, that when modelling taking place in Grundfos Bjerringbro,
the Danish electricity grid mix is used in the model and thermal energy
from natural gas. These are generally of very high quality with very good
technological, temporal and geographical representativeness.

Contributions
to operational energy use during the use stage (B6) come from the electricity
consumption of the product. The annual electricity consumption is calculated by
multiplying the average power input, which is based on a defined load profile,
with the annual running hours. For use stage (B6) European Average
electricity grid mix has been used. These values are declared in the scenarios
section.

The End-of-Life
stage (C1-C4) includes all
activities from when the product reaches the end of its service life and no
longer provides any functionality and until all materials and components are
processed for

reuse/recycling
or disposed of.

According to *EN*
15804 and the *PCR Part A,* the end-of-life stage
includes:

.
C1 deconstruction of the product from the

.
building, including initial on-site sorting of the

.
materials;

.
C2 transportation of the discarded product to a recycling site and
transportation of waste to final disposal;

.
C3 waste processing, collection of waste fractions from the deconstruction and
waste processing of material flows intended for reuse, recycling and energy
recovery;

.
C4 waste disposal including physical pretreatment and management of the
disposal site.

At the end of life,
the MAGNA3 pump is manually disassembled from the piping system in which it has
been installed. The definition of the applied end-of-life scenario in this EPD
follows the requirements in the

PCR Part A, 6.2 regarding complex products, with a combination
of recycling, thermal waste treatment and landfilling. 100 % of the material is
considered in the end of life scenario as required by the *PCR*. An
overall collection rate of 90 % has been assumed.

Materials from
which energy is recovered in an incineration process with an R1-value above 0.60
are in this study included with the environmental burdens from the incineration
process inventoried in C3, the recovered energy is declared as exported energy

in C3

and the energy
benefits are declared in D. This procedure is according to the *PCR Part A*,
5.5.6. C3 includes the mechanical separation of the product followed by a
series of sorting steps. Metal fractions are recycled and plastics, cardboard
and electronics are assumed incinerated with energy recovery. The residual
fractions are landfilled and declared in C4.

The specific
amounts are shown in the scenarios section.

Beyond system boundary (D): According to *EN 15804* module D includes the reuse, recovery and/or recycling potentials,
expressed as net impacts and benefits. Any declared benefits and loads from net

flows leaving
the product system that have not been allocated as co-products and that have
passed the end-of-waste state are included in module D.

Contributions
to module D comes from waste incineration processes in A5 and C3 as well as
material recycling in C3. The specific fractions and net flows are shown in the
scenarios section.

Geographic Representativeness

Land or region, in which the declared product system is manufactured, used or handled at the end of the product´s lifespan: Europe

Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to *EN 15804* and the building context, respectively the product-specific characteristics of performance, are taken into account. Software and databases used: *GaBi ts*

9.2.1.68
(database schema 8007) *Ecoinvent v3.5.*.

LCA: Scenarios and additional technical information

Characteristic product properties of biogenic carbon

The biogenic
carbon content quantifies the amount of biogenic carbon in a construction
product leaving the factory gate, and it will be separately declared for the
product and for any accompanying packaging, as required from the *PCR Part A.*
The Carbon content of Cardboard and Paper is assumed to 0.46 kg C. Overall,
there is an amount of 9 weight-% Carbon in the product leaving the factory gate
and has to be considered

Information on describing the biogenic Carbon Content at factory gate

Name	Value	Unit
Biogenic carbon content in accompanying packaging	0.74	kg C

Note: 1 kg of biogenic carbon is equivalent to 44/12 kg of CO2

The following technical scenario information is required for the declared modules and optional for non-declared modules. Modules for which no information is declared can be deleted; additional information can also be listed if necessary.

The following technical information is a basis for the declared modules or can be used for developing specific scenarios in the context of a building assessment if modules are not declared (MND).

A5 is not declared including the disposal of the packaging material on the construction site, the amounts of packaging materials included in the LCA calculations must be declared as technical scenario information for Module A5.

Transport from the gate to the site (A4)

Name	Value	Unit
Litres of fuel	0,0332	l/100km
Transport distance	2003	km
Capacity utilisation (including empty runs)	85	%
Gross density of products transported	445	kg/m^3
Wastage during distribution	0,02	%

Installation into the building (A5)

Name	Value	Unit
Packaging waste for incineration (LDPE film)	0,031	kg
Packaging waste for incineration (Paper/Cardboard)	1,95	kg

An
estimated RSL of 10 years can be used to facilitate building calculations. This
is an EU consensus-based estimation, referenced in Appendix 7: Lot 11 –
Circulators in Buildings, prepared by AEA Energy & Environment for the
European Commission in the context of the Eco Design Directive.

Reference service life

Name	Value	Unit
Life Span according to the manufacturer	10	a

Operational energy use (B6)

Name	Value	Unit
Electricity consumption Group 1	545	kWh/a
Electricity consumption Group 2	775	kWh/a
Average power input, Group 1	0,109	kW
Average power input, Group 2	0,155	kW
Running hours (all groups)	5.000	h/a

End of life (C1-C4)

Name	Value	Unit
Collected as mixed construction waste	21,23	kg
Transportation distance (C2)	500	km
Aluminium for recycling	2,79	kg
Steel for recycling	12,1	kg
Copper for recycling	0,51	kg
Stainless steel for recycling	0,84	kg
Plastics for incineration w/energy	1,38	kg
Electronics for incineration w/energy	0,81	kg
Landfilling	2,8	kg

Reuse, recovery and/or recycling potentials (D), relevant scenario information

Name	Value	Unit
A5, incineration w/energy recov. (LDPE foil)	4,37	MJ
A5, incineration w/energy recov. (Paper/Cardboard)	7,91	MJ
C3, steel for recycling (net amounts)	-1,72	kg
C3, stainless steel for recycling (net amounts)	0,52	kg
C3, aluminium for recycling (net amounts)	-0,383	kg
C3, copper for recycling (net amounts)	0,221	kg
C3, plastics for incineration, w/ energy recov.	1,38	kg
C3, electronics for incineration, w/ energy recov.	0,81	kg

LCA: Results

Characterization model: *EN 15804* - 2012+A2 - 2019, PEF. By Decision no. 20170712-n of the IBU SVR, the modules B3, B4, B5 are marked as MNR (module not relevant) as default. The LCA results in module B6 are given on a period of one year, according to *PCR Part B*. To obtain the results from module B6 over the entire life cycle, the LCA results of module B6 must be multiplied by the estimated RSL of 10 years. The indicator results for module B6 are declared for Group 1. B6 indicator results for other groups can be derived by multiplying the B6 indicator results with the following factors:

Group 2: 1,422

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; ND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

Product stage			Construction process stage		Use stage							End of life stage				Benefits and loads beyond the system boundaries
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
X	X	X	X	X	MND	MND	MNR	MNR	MNR	X	MND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1PCS of MAGNA3 65-40/60 (Cast Iron)

Parameter	Unit	A1	A2	A3	A4	A5	B6	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq	1.05E+02	1.41E+00	8.1E-01	1.45E+00	2.86E+00	2.2E+02	0	5.9E-01	6.57E+00	1.39E-01	4.59E-01
GWP-fossil	kg CO_2 eq	1.05E+02	1.4E+00	4.05E+00	1.44E+00	1.53E-01	2.19E+02	0	5.87E-01	6.56E+00	1.43E-01	4.65E-01
GWP-biogenic	kg CO_2 eq	4.64E-01	-1.9E-03	-3.28E+00	-2.94E-03	2.7E+00	7.31E-01	0	-9.89E-04	6.35E-03	-4.3E-03	-3.62E-03
GWP-luluc	kg CO_2 eq	1.8E-01	1.01E-02	3.66E-02	1.14E-02	9.69E-05	3.18E-01	0	4.77E-03	3.16E-03	1.25E-04	-2.74E-03
ODP	kg CFC11 eq	9.52E-08	2.45E-16	4.07E-09	1.99E-11	5.23E-16	4.83E-12	0	1.08E-16	4.76E-14	3.21E-16	-7.63E-13
AP	mol H^+ eq	5.54E-01	1.07E-02	1.7E-02	8.38E-03	8.22E-04	4.84E-01	0	3.47E-03	5.5E-03	4.43E-04	-9.34E-03
EP-freshwater	kg P eq	1.63E-03	3.85E-06	6.44E-05	4.63E-06	1.2E-07	5.86E-04	0	1.8E-06	8.37E-06	1.56E-05	-4.24E-06
EP-marine	kg N eq	7.15E-02	3.71E-03	3.3E-03	4E-03	3E-04	1.08E-01	0	1.67E-03	1.33E-03	1.02E-04	-1.03E-05
EP-terrestrial	mol N eq	7.51E-01	4.11E-02	3.3E-02	4.43E-02	3.73E-03	1.13E+00	0	1.85E-02	1.49E-02	1.12E-03	3.31E-04
POCP	kg NMVOC eq	2.22E-01	8.55E-03	9.46E-03	7.61E-03	7.83E-04	2.95E-01	0	3.17E-03	3.64E-03	3.29E-04	-1.65E-05
ADPE	kg Sb eq	5.58E-03	1.05E-07	5.96E-05	1.24E-06	8.71E-09	6.35E-05	0	4.77E-08	6.27E-07	9.65E-09	-6.17E-04
ADPF	MJ	1.43E+03	1.86E+01	5.62E+01	1.94E+01	9.85E-01	3.86E+03	0	7.86E+00	3.88E+01	2.05E+00	-1.44E+01
WDP	m^3 world eq deprived	2.59E+01	1.25E-02	2.36E-01	2.02E-02	3.52E-01	4.78E+01	0	5.75E-03	9.18E-01	-1.58E-03	-4.25E-01

GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential)

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1PCS of MAGNA3 65-40/60 (Cast Iron)

Parameter	Unit	A1	A2	A3	A4	A5	B6	C1	C2	C3	C4	D
PERE	MJ	3.97E+02	9.73E-01	5.11E+01	1.21E+00	1.7E-01	1.71E+03	0	4.55E-01	1.68E+01	1.44E-01	3.69E+00
PERM	MJ	0	0	0	0	0	0	0	0	0	0	0
PERT	MJ	3.97E+02	9.73E-01	5.11E+01	1.21E+00	1.7E-01	1.71E+03	0	4.55E-01	1.68E+01	1.44E-01	3.69E+00
PENRE	MJ	1.43E+03	1.87E+01	5.62E+01	1.94E+01	9.86E-01	3.86E+03	0	7.89E+00	3.88E+01	2.05E+00	-1.41E+01
PENRM	MJ	0	0	0	0	0	0	0	0	0	0	0
PENRT	MJ	1.43E+03	1.87E+01	5.62E+01	1.94E+01	9.86E-01	3.86E+03	0	7.89E+00	3.88E+01	2.05E+00	-1.41E+01
SM	kg	1.79E+01	0	2.31E-01	3.62E-03	0	0	0	0	0	0	0
RSF	MJ	1.46E-23	0	0	2.91E-27	0	0	0	0	0	0	0

NRSF	MJ	1.71E-22	0	0	3.42E-26	0	0	0	0	0	0	0
FW	m^3	8.11E-01	1.14E-03	2.57E-02	1.48E-03	8.29E-03	1.98E+00	0	5.3E-04	2.99E-02	2.6E-05	2.57E-02

PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2:
1PCS of MAGNA3 65-40/60 (Cast Iron)

Parameter	Unit	A1	A2	A3	A4	A5	B6	C1	C2	C3	C4	D
HWD	kg	3.3E-04	7.76E-07	1.22E-04	9.59E-07	5.11E-09	1.6E-06	0	3.65E-07	1.96E-08	8.21E-09	-3.25E-04
NHWD	kg	4.12E+00	2.85E-03	2.91E-01	4.09E-03	9.43E-02	2.74E+00	0	1.25E-03	6.3E-01	2.35E+00	2.35E+00
RWD	kg	6.2E-02	3.3E-05	1.55E-03	5.25E-05	4.74E-05	5.85E-01	0	1.46E-05	5.75E-03	2.45E-05	-1.8E-03
CRU	kg	0	0	0	0	0	0	0	0	0	0	0
MFR	kg	0	0	0	0	0	0	0	0	1.63E+01	0	0
MER	kg	0	0	0	0	0	0	0	0	0	0	0
EEE	MJ	0	0	0	0	4.37E+00	0	0	0	7.4E+00	0	0
EET	MJ	0	0	0	0	7.91E+00	0	0	0	1.33E+01	0	0

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

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional:
1PCS of MAGNA3 65-40/60 (Cast Iron)

Parameter	Unit	A1	A2	A3	A4	A5	B6	C1	C2	C3	C4	D
PM	Disease incidence	6.83E-06	1.27E-07	2.37E-07	4.98E-08	4.65E-09	4.06E-06	0	2.03E-08	4.65E-08	4.52E-09	-2.53E-07
IR	kBq U235 eq	6.81E+00	4.86E-03	2.44E-01	7.34E-03	7.3E-03	9.6E+01	0	2.15E-03	9.42E-01	3.48E-03	-1.54E-01
ETP-fw	CTUe	8.38E+02	1.38E+01	1.82E+01	1.42E+01	4.97E-01	1.65E+03	0	5.88E+00	1.69E+01	1.44E+00	-5.41E+00
HTP-c	CTUh	1.62E-06	2.84E-10	6.46E-07	7.48E-10	2.44E-11	4.56E-08	0	1.22E-10	5.13E-10	8.27E-11	-6.64E-08
HTP-nc	CTUh	2.45E-06	1.55E-08	5.68E-08	1.72E-08	1.15E-09	1.68E-06	0	6.98E-09	2.07E-08	7.21E-09	4.97E-10
SQP	SQP	4.09E+02	5.87E+00	9.71E+01	6.7E+00	2.68E-01	1.23E+03	0	2.76E+00	1.22E+01	1.48E-01	-1.61E+01

PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); SQP = Potential soil quality index

Disclaimer
1 – for the indicator 'Potential Human exposure efficiency relative to U235'. 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 or radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – for the indicators 'abiotic depletion potential for non-fossil resources', 'abiotic depletion potential for fossil resources', 'water (user) deprivation potential, deprivation-weighted water consumption', 'potential comparative toxic unit for ecosystems', 'potential comparative toxic unit for humans – cancerogenic', 'Potential comparative toxic unit for humans - not cancerogenic', 'potential soil quality index'. The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high as there is limited experience with the indicator.

Disclaimer 3: *JRC Technical Reports, Version 2, 2018* Page 6, for the indicator "EP-freshwater". This indicator has been calculated as 'kg P eq' as required in the characterization model EUTREND model, Struijs et al.,

2009b, as implemented in ReCiPe; This EPD was created using a software tool.

References

Standards

Machinery Directive

DIRECTIVE 2006/42/EC OF THE EUROPEAN

PARLIAMENT AND OF THE COUNCIL of 17 May

2006 on machinery

Radio Equipment Directive

DIRECTIVE 2014/53/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of

radio equipment

Electromagnetic Compatibility (EMC) Directive

DIRECTIVE 2014/30/EU OF THE EUROPEAN

PARLIAMENT AND OF THE COUNCIL of 26 February

2014 on the harmonistion of the laws of the Member

States relating to electromagnetic compatibility

Ecodesign Directive

DIRECTIVE 2009/125/EC OF THE EUROPEAN

PARLIAMENT AND OF THE COUNCIL of 21 October

2009 establishing a framework for the setting of

ecodesign requirements for energy-related products

EC 641/2009

COMMISSION REGULATION (EC) No 641/2009 of 22 July 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for glandless standalone circulators and glandless circulators integrated in

products

substances

EC 622/2012

COMMISSION
REGULATION (EU) No 622/2012 of 11 July 2012 amending Regulation (EC) No
641/2009 with regard to ecodesign requirements for glandless standalone
circulators and glandless circulators integrated in products

DIRECTIVE
2011/65/EU

DIRECTIVE
2011/65/EU OF THE EUROPEAN

PARLIAMENT AND
OF THE COUNCIL of 8 June 2011

on the
restriction of the use of certain hazardous

substances in
electrical and electronic equipment

DIRECTIVE
2015/863/EU

DIRECTIVE
2015/863/EU of 31 March 2015 amending

Annex II to
Directive 2011/65/EU of the European

Parliament and
of the Council as regards the list of

restricted

ETSI EN 301
489-1

ETSI EN 301
489-1 V2.2.0, Electromagnetic Compatibility (EMC) standard for radio equipment
and services; Part 1: Common technical requirements

ETSI EN 301
489-17

ETSI EN 301
489-17 V3.2.0, Electromagnetic Compatibility (EMC) standard for radio equipment
and services; Part 17: Specific conditions for Broadband Data Transmission
Systems

ETSI EN 300 328
V2.1.1

ETSI EN 300 328
V2.1.1, Wideband transmission systems; Data transmission equipment operating in
the 2,4 GHz ISM band and using wide band modulation techniques

EN 809

EN 809:1998-10
+ A1:2009, Pumps and pump units for

liquids -
Common safety requirements

EN 55014-1

EN
55014-1:2017, Electromagnetic compatibility – Requirements for household
appliances, electric tools and similar apparatus – Part 1: Emission

EN 55014-2

EN
55014-2:2015, Electromagnetic compatibility –

Requirements
for household appliances, electric tools

and similar
apparatus – Part 2: Immunity – Product

family standard
(CISPR 14-2:2015)

EN 50581:2012

EN 50581:2012,
Technical documentation for the

assessment of
electrical and electronic products with

respect to the
restriction of hazardous substances

EN 60335-1

EN
60335-1:2012/A11:2014/A13:2017, Household

and similar
electrical appliances – Safety – Part 1:General requirements

EN 60335-2-51

EN
60335-2-51:2003-03 + A1:2008 + A2:2012, Household and similar electrical
appliances – Safety –Part 2-51: Particular requirements for stationary
circulation pumps for heating and service water installations

EN 61000-3-2

EN
61000-3-2:2014/2019, Electromagnetic compatibility (EMC) – Part 3-2: Limits –
Limits for harmonic current emissions (equipment input current =16 A per phase)

EN 61000-3-3

EN
61000-3-3:2013-08/ A1:2019, Electromagnetic compatibility (EMC) – Part 3-3:

Limits – Limitation of voltage changes, voltage fluctuations and flicker in public
low voltage supply systems, for equipment with

rated current
<= 16 A per phase and not subject to conditional connection

EN 61000-6-2

EN
61000-6-2:2008/2019, Electromagnetic compatibility (EMC) – Part 6-2: Generic
standards –Immunity for industrial environments

EN 16297-1

EN
16297-1:2012-10, Pumps – Rotodynamic pumps –Glandless circulators – Part 1:
General requirements and procedures for testing and calculation of energy
efficiency index (EEI)

EN 16297-2

EN 16297-2:2012-10,
Pumps – Rotodynamic pumps –Glandless circulators – Part 2: Calculation of
energy efficiency index (EEI) for standalone circulators

EN 16297-3

EN
16297-3:2012, Pumps – Rotodynamic pumps –Glandless circulators – Part 3: Energy
efficiency index (EEI) for circulators integrated in products

ISO 14001

EN ISO
14001:2015-09, Environmental management systems - Requirements with guidance
for use

ISO 14025

DIN EN /ISO
14025:2011-10, Environmental labels and declarations — Type III environmental
declarations — Principles and procedures

EN 15804

EN
15804:2012-04+A1 2013, Sustainability of construction works — Environmental
Product Declarations — Core rules for the product category of construction
products

PCR Part A

Institut Bauen
und Umwelt e.V., Berlin (pub.): Product Category Rules for Building-Related
Products and Services, Product Category Rules for Construction Products from
the range of Environmental Product Declarations of Institut Bauen und Umwelt
(IBU), Part A: Calculation Rules for the Life Cycle Assessment and Requirements
on the Project Report, Version 1.7 (2021)

PCR
Part B

Institut Bauen
und Umwelt e.V., Berlin (pub.): Product Category Rules for Building-Related
Products and Services, Product Category Rules for Construction Products from
the range of Environmental Product Declarations of Institut Bauen und Umwelt
(IBU), Part B: Requirements on the EPD for Pumps for liquids and liquids with
solids, Version 1.0 (2018)

Further references

CPR

REGULATION (EU)
No 305/2011 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 9 March 2011
laying down harmonised conditions for the marketing of construction products
and repealing Council Directive 89/106/EEC

CML 2001

Impact
assessment characterization factors Institute of Environmental Sciences, Leiden
University, Netherlands

ECHA candidate list

Candidate List
of substances of very high concern (SVHCs) for authorisation, European
Chemicals Agency (ECHA), Helsinki, Finland

Ecoinvent

Ecoinvent v3.5

GaBi ts

GaBi ts 9.2.1.68
(database schema 8007)

REACH

Regulation (EC)
No 1907/2006 of the European Parliament and of the Council of 18 December 2006

concerning the Registration, Evaluation, Authorisation and Restriction of
Chemicals (REACH) (Status: 27.06.2018)

Advisory Board
(formerly SVA)

Decision no.
20170712-n

SVR

The literature referred to in the Environmental Product Declaration must be listed in full.Standards already fully quoted in the EPD do not need to be listed here again.
The current version of PCR Part A and PCR Part B of the PCR document on which they are based must be referenced.

Publisher

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ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A2*

Owner of the Declaration	Grundfos Holding A/S
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-GRU-20240014-CBA1-EN
Issue date	21.03.2024
Valid to	20.03.2029

MAGNA3 65-40/60 (Stainless Steel)

Grundfos Holding A/S

Institut Bauen und Umwelt e.V.

ECO PLATFORM EPD VERIFIED

www.ibu-epd.com | https://epd-online.com

General Information

Grundfos Holding A/S

Programme holder

IBU – Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

Declaration number

EPD-GRU-20240014-CBA1-EN

This declaration is based on the product category rules:

Pumps for liquids and liquids with solids, 01.08.2021
(PCR checked and approved by the SVR)

Issue date

21.03.2024

Valid to

20.03.2029

Dipl.-Ing. Hans Peters
(Chairman of Institut Bauen und Umwelt e.V.)

Florian Pronold
(Managing Director Institut Bauen und Umwelt e.V.)

MAGNA3 65-40/60 (Stainless Steel)

Owner of the declaration

Grundfos Holding A/S
Poul Due Jensens Vej 7
8850 Bjerringbro
Denmark

Declared product / declared unit

1 PCS. of MAGNA3 65-40/60 (Stainless Steel)

Scope:

The declaration applies to 1 piece of MAGNA3 (Stainless Steel) pump.

The product is produced in Wahlstedt, Germany, and the life cycle assessment is based on data collected at the production site.

Production has been modeled using annual production data from 2021.

The declaration covers two different types of the MAGNA3 65- product (40/60).

The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

The EPD was created according to the specifications of EN 15804+A2. In the following, the standard will be simplified as *EN 15804*.

Verification

The standard EN 15804 serves as the core PCR
Independent verification of the declaration and data according to ISO 14025:2011
☐ internally ☒ externally

Mrs Kim Allbury,
(Independent verifier)

Product

Product description/Product definition
The Grundfos MAGNA3 circulator pumps are designed for circulating liquids in heating systems, air conditioning and cooling systems and domestic hot water systems. However, the pump range can also be used in ground source heat pump systems and solar heating systems.

The MAGNA3 pump is a centrifugal pump powered by an electrical motor. It has a high-performance neodymium magnet rotor which increases motor efficiency and an insulation shell to reduce heat loss from the cast iron pump housing with threaded connections.

The declaration covers two types of the MAGNA3 pump. They are grouped as shown below. The group reference in the technical data and scenarios refers also to these.

GROUP 1 - MAGNA3 65-40

GROUP 2 - MAGNA3 65-60

These are all the same physical products and 100 % identical in terms of design, dimensions and materials as well as supply chain and manufacturing processes, i.e., all cradle to gate processes (A1-A3).

The products are also identical in terms of packaging, distribution, reference service life and end-of-life treatment.

The only thing that differentiates the products from each other is the software which controls how the pump operates in the system in which it is installed, making them fit for different applications. Hence, all life cycle modules are identical, except use stage module B6, which will change, as the applied scenarios for electricity consumption changes. For the placing on the market in the European Union/European Free Trade Association (EU/EFTA) (with the exception of Switzerland) the following legal provisions apply:

Machinery Directive (2006/42/EC)

Standard used: *EN 809:1998 + A1:2009.*

Radio Equipment Directive (2014/53/EU)

Standards used:
EN 60335-1:2012/AC:2014 + A11:2014, EN 60335-2-51:2003 + A1:2008 + A2:2012, EN 62233:2008.

EN 55014-1:2006

A1:2009 + A2:2011, EN 55014-1:2017, EN 61000-6-2:2005, EN 61000-3-2:2014, EN 61000-3-3:2013, ETSI EN 301 489-1 V2.2.0, ETSI EN 301 489-17 V3.2.0. ETSI EN 300 328 V2.1.1

Electromagnetic Compatibility (EMC) Directive (2014/30/EU)

Standards used:
EN 55014-1:2017, EN 55014-2:2015,

EN 61000-3-2:2014/2019, EN 61000-6-2:2008/2019,

EN 61000-3-3:2013 A1:2019

RoHS Directive 2011/65/EU and 2015/863//EU

Standard: *EN 50581:2012.*

Ecodesign Directive (2009/125/EC)

Commission Regulation (EC) No: 641/2009 and

Commission Regulation (EU) 622/2012

Standards used:
EN 16297-1:2012, EN 16297-2:2012, EN 16297-3:2012.

The CE marking takes into account the proof of conformity with the respective harmonized norms based on the legal provisions above.

MAGNA3 pumps are not harmonized in accordance with the *CPR.*

Application
For the application and use the respective national provisions apply.

The pump is designed for circulating liquids in the following systems:

· heating systems

· domestic hot-water systems

· air-conditioning and cooling systems

· ground-source heat-pump systems

· solar-heating systems

The pump is suitable for thin, clean, non-aggressive and non-explosive liquids, not containing solid particles or fibres that may attack the pump mechanically or chemically. In heating systems, the water must meet the requirements of accepted standards on water quality in heating systems. The pumps are also suitable for domestic hot-water systems.

Technical Data
The performance data of the product according to the harmonised norms, based on the harmonisation provisions above apply. The relevant technical specifications according to the *PCR Part B* are given in the table below. Characteristics that are the same for all two product groups are only given once. Others are given individually for all groups.

Constructional data

Name	Value	Unit
Frequency	50	Hz
Voltage	230	V
Pumped liquid (e.g. water)	Clean Water	-
Energy Efficiency Index Gr.1	0,18	
Energy Efficiency Index Gr.2	0,17	
Flow range Gr. 1 (max)	23,0	m^3/h
Flow range Gr. 2 (max)	32,0	m^3/h
Head max. Gr.1	4	m
Head max. Gr. 2	6	m
Power input Gr. 1 Average (from load profile describing use)	0,109	m
Power input Gr. 2 Average (from load profile describing use)	0,155	m
Nominal capacity Gr.1	0,19	kW
Nominal capacity Gr.2	0,342	kW

Performance data of the product according to the harmonised standards, based on provisions for harmonisation.

Base materials/Ancillary materials

Base materials / Ancillary materials

Name	Value	Unit
Aluminium	13	%
Ceramics	0,29	%
Copper	2,43	%
Electronics	0,22	%
Magnet Nd	1,04	%
Paper	0,48	%
PCB	3,57	%
Plastics	0,31	%
Plastics, foam	1,17	%
Plastics GF	4,93	%
Rubber	0,16	%
Stainless steel	59,97	%
Steel	4,85	%
Cardboard	7,64	%
Plastic film	0,07	%
TOTAL	100	%

REACH

This product/article/at least one partial article contains substances listed in the *ECHA candidate list* (date:10.06.2022) exceeding 0.1 percentage by mass: **no**

The Wahlstedt production has been assessed and certified as meeting the requirements in *ISO 14001, ISO 50001, ISO 45001 and ISO 9001.*

Reference service life

No use stage scenario which refers to the lifetime of the product is declared. However, to facilitate building calculations, an estimated RSL of 10 years can be used. This is an EU consensus-based estimation, referenced on page 37 in Appendix 7: *Lot 11 – Circulators in Buildings*, prepared by AEA Energy & Environment for the European Commission in the context of the Eco Design Directive:

There is no definitive information on the average circulator life available, there is consensus within the industry that it is at least 12 years. However, this is complicated by many factors, including many being scrapped prematurely when e.g. the boiler they are connected to is replaced.

From the estimated stock (140Mpa) and annual sales (14Mpa), the average lifetime of the circulator is taken as 10 years for the purposes of this study.

The RSL of the declared product is not directly influencing the results in this study, as no declared use stage scenario is dependent on the RSL; The use stage sub-module B6 is declared per year as required by the *PCR Part B.*

LCA: Calculation rules

Declared Unit

The declared
unit is 1 piece (pcs.) of MAGNA3 (Stainless Steel) pump.

Declared unit

Name	Value	Unit
Declared unit	1	pce.
Mass reference	24.1	kg/pce
Conversion factor [Mass/Declared Unit]	24.1	

System boundary

This EPD is Cradle-To-Grave. The system boundaries of the EPD follow the modular approach in *EN 15804*. By decision no. 20170712-n of the *SVR*, the modules B3, B4 and B5 are by default declared as "MNR" (module not relevant).

The product stage (A1-A3) comprises raw material extraction and processing, transport processes as well as the manufacturing process. The final production and assembly of the MAGNA3 pump takes place at a Grundfos manufacturing site in Germany. However, the full supply-chain leading to the finished product at the gate is rather complex and includes a large amount of raw materials, components and semi-finished parts which comes from both external suppliers as well as other Grundfos production facilities.

The product stage is included in the study, and according to *EN 15804* the system boundary with nature is set to include those processes that provide the material and energy inputs into the system and the following manufacturing, transport up to the factory gate as well as the processing any waste arising from those processes.

Wastes and losses are included in the modules where they occur according to the polluter pays principle and the modular

approach of *EN 15804.*

The product includes:

· A1 Extraction and processing of raw materials;

· A1 Reuse of products or materials from a previous product system;

· A1 Processing of secondary materials;

· A1 Generation of electricity, steam and heat from primary energy resources, also including their extraction, refining and transport;

· A1 Energy recovery and other recovery processes from secondary fuels;

· A2 Transportation up to the factory gate and internal transport;

· A3 Production of ancillary materials or pre products;

· A3 Manufacturing of products and coproducts;

· A3 Manufacturing of packaging;

· A1-A3 processing up to the end-of-waste state or disposal of final residues.

For secondary material inputs, the system boundary to the previous system (providing the secondary material) is set where outputs reach the end-of-waste state. The recycling of secondary material into new raw materials is included in the system boundary of this study. Waste materials from production processes that are recycled without any modification of the material's inherent characteristics are modelled as closed-loop within A1-A3. This is done up to the input mass flow that was used during production.

Waste for incineration arising in the product stage is accounted for in the module where the waste is produced. The environmental loads from the incineration process are declared in the module where it occurs and the electricity and heat which is produced from the incineration are considered as closed-loop within A1-A3, as described in *PCR Part A,* 5.5.1. The input of biogenic carbon from the production of packaging material is inventoried in A3. As required by *PCR Part A*, the corresponding end-of-life module of the packaging material, A5, is also declared and the emissions of biogenic carbon are inventoried.

The construction process stage (A4-A5) includes:

· A4: Transportation from factory gate to the distribution center:

· Consumption of electricity, thermal energy and water at the distribution center;

· Transportation from distribution center to construction site;

· Wastage during distribution.

· A5: Installation process;

· Transport of packaging waste to treatment site;

· Waste treatment of packaging.

The packaging material does not reach the end of waste state but is incinerated as waste.

According to European statistics, the average R1 value of incineration plants is > 0.6. Therefore, it is assumed that packaging material is treated thermally in an incineration plant with R1 > 0.6. The loads from the combustion process of packaging are declared in module A5 and the resulting energy benefits in module D, as required by the *PCR Part A*, 5.5.2.

Use stage (B1-B7):

The use stage, related to the building fabric includes:

· B1, use or application of the installed product;

· B2, maintenance.

The use stage related to the operation of the building includes:

· B6, operational energy use;

· B7, operational water use.

In this study, all use stage modules are assessed, though B1, B2 and B7 are assessed to be zero. By decision no. 20170712-n of the *SVR*, the modules B3, B4 and B5 are by default declared as "MNR" (module not relevant).

The modules include the provision and transport of all materials, products and related energy and water use, as well as waste processing up to the end-of-waste state or disposal of final residues during the use stage. They also include all impacts and aspects related to the losses during the use stage (i.e. production, transport, and waste processing and disposal of the lost products and materials).

Generally, the geographical coverage of the datasets used matches the actual processes taking place. Meaning, that when modelling taking place in Grundfos Bjerringbro, the Danish electricity grid mix is used in the model and thermal energy from natural gas. These are generally of very high quality with very good technological, temporal and geographical representativeness.

Contributions to operational energy use during the use stage (B6) come from the electricity consumption of the product. The annual electricity consumption is calculated by multiplying the average power input, which is based on a defined load profile, with the annual running hours. For use stage (B6) European Average electricity grid mix has been used. These values are declared in the scenarios section.

The End-of-Life stage (C1-C4) includes all activities from when the product reaches the end of its service life and no longer provides any functionality and until all materials and components are processed for reuse/recycling or disposed of.

According to *EN 15804* and the *PCR Part A,* the end-of-life stage includes:

· C1 deconstruction of the product from the building, including initial on-site sorting of the materials;

· C2 transportation of the discarded product to a recycling site and transportation of waste to final disposal;

· C3 waste processing, collection of waste fractions from the deconstruction and waste processing of material flows intended for reuse, recycling and energy recovery;

· C4 waste disposal including physical pretreatment and management of the disposal site.

At the end of life, the MAGNA3 pump is manually disassembled from the piping system in which it has been installed. The definition of the applied end-of-life scenario in this EPD follows the requirements in the *PCR Part A*, 6.2 regarding complex products, with a combination of recycling, thermal waste treatment and landfilling. 100 % of the material is considered in the end of life scenario as required by the *PCR*. An overall collection rate of 90 % has been assumed.

Materials from which energy is recovered in an incineration process with an R1-value above 0.60 are in this study included with the environmental burdens from the incineration process inventoried in C3, the recovered energy is declared as exported energy in C3

and the energy benefits are declared in D. This procedure is according to the *PCR Part A*, 5.5.6. C3 includes the mechanical separation of the product followed by a series of sorting steps. Metal fractions are recycled and plastics, cardboard and electronics are assumed incinerated with energy recovery. The residual fractions are landfilled and declared in C4.

The specific amounts are shown in the scenarios section.

Beyond system boundary (D): According to *EN 15804* module D includes the reuse, recovery and/or recycling potentials, expressed as net impacts and benefits. Any declared benefits and loads from net

flows leaving the product system that have not been allocated as co-products and that have passed the end-of-waste state are included in module D.

Contributions to module D comes from waste incineration processes in A5 and C3 as well as material recycling in C3. The specific fractions and net flows are shown in the scenarios section.

Geographic Representativeness

Land or region, in which the declared product system is manufactured, used or handled at the end of the product´s lifespan: Europe

Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to *EN 15804* and the building context, respectively the product-specific characteristics of performance, are taken into account. Software and databases used: *LCA for Experts 10.7.1.28*
Schema 8007
Sphera and Ecoinvent databases

LCA: Scenarios and additional technical information

Characteristic product properties of biogenic carbon

The biogenic carbon content quantifies the amount of biogenic carbon in a construction product leaving the factory gate, and it will be separately declared for the product and for any accompanying packaging, as required from the *PCR Part A*. The Carbon content of Cardboard and Paper is assumed to 0.46 kg C. It means 46% of the paper and carbdoard is assumed to be biogenic carbon content. Overall, there is an amount of weight-% Carbon in the product leaving the factory gate and has to be considered

Information on describing the biogenic Carbon Content at factory gate

Name	Value	Unit
Biogenic carbon content in accompanying packaging	0.9	kg C

Note: 1 kg of biogenic carbon is equivalent to 44/12 kg of CO2

Transport from the gate to the site (A4)

Name	Value	Unit
Litres of fuel	0,0332	l/100km
Transport distance	2003	km
Capacity utilisation (including empty runs)	85	%
Gross density of products transported	445	kg/m^3
Wastage during distribution	0,02	%

Installation into the building (A5)

Name	Value	Unit
Packaging waste for incineration (LDPE film)	0,016	kg
Packaging waste for incineration (Paper/Cardboard)	1,955	kg

An estimated RSL of 10 years can be used to facilitate building calculations. This is an EU consensus-based estimation, referenced in Appendix 7: Lot 11 – *Circulators in Buildings*, prepared by *AEA Energy & Environment* for the European Commission in the context of the *Eco Design Directive*.

Reference service life

Name	Value	Unit
Life Span according to the manufacturer	10	a

Operational energy use (B6)

Name	Value	Unit
Electricity consumption Group 1	545	kWh/a
Electricity consumption Group 2	775	kWh/a
Average power input, Group 1	0,109	kW
Average power input, Group 2	0,155	kW
Running hours (all groups)	5.000	h/a

End of life (C1-C4)

Name	Value	Unit
Collected as mixed construction waste	22,125	kg
Transportation distance (C2)	500	km
Aluminium for recycling	2,74	kg
Steel for recycling	1,03	kg
Copper for recycling	0,52	kg
Stainless steel for recycling	12,75	kg
Plastics for incineration w/energy	1,40	kg
Electronics for incineration w/energy	0,80	kg
Landfilling	2,89	kg

Reuse, recovery and/or recycling potentials (D), relevant scenario information

Name	Value	Unit
A5, incineration w/energy recov. thermal energy	8,9	MJ
A5, incineration w/energy recov. electric energy)	4,92	MJ
C3, steel for recycling (net amounts)	-0,93	kg
C3, stainless steel for recycling (net amounts)	3,92	kg
C3, aluminium for recycling (net amounts)	-0,433	kg
C3, copper for recycling (net amounts)	0,221	kg
C3, incineration w/energy recov. thermal energy	13,4	MJ
C3, incineration w/energy recov. electric energy	7,45	MJ

LCA: Results

Characterization model: *EN 15804* - 2012+A2 - 2019, PEF. By Decision no. 20170712-n of the IBU SVR, the modules B3, B4, B5 are marked as MNR (module not relevant) as default. The LCA results in module B6 are given on a period of one year, according to *PCR Part B*. To obtain the results from module B6 over the entire life cycle, the LCA results of module B6 must be multiplied by the estimated RSL of 10 years. The indicator results for module B6 are declared for Group 1. B6 indicator results for other groups can be derived by multiplying the B6 indicator results with the following factors:

Group 2: 1,422

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

Product stage			Construction process stage		Use stage							End of life stage				Benefits and loads beyond the system boundaries
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
X	X	X	X	X	X	X	MNR	MNR	MNR	X	X	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1PCS of MAGNA3 65-40/60

Parameter	Unit	A1	A2	A3	A4	A5	B1	B2	B6	B7	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq	1.17E+02	6.06E+00	6.92E-01	1.85E+00	3.17E+00	0	0	1.77E+02	0	0	7.6E-01	6.25E+00	1.42E-01	-1.13E+01
GWP-fossil	kg CO_2 eq	1.17E+02	6.06E+00	3.91E+00	1.86E+00	4.69E-01	0	0	1.76E+02	0	0	7.64E-01	6.24E+00	1.44E-01	-1.13E+01
GWP-biogenic	kg CO_2 eq	-1.7E-02	-9.06E-03	-3.25E +00	-2.73E-02	2.7E+00	0	0	1.53E+00	0	0	-1.13E-02	1.54E-02	-1.78E-03	-3.31E-02
GWP-luluc	kg CO_2 eq	7.29E-02	8.8E-03	3.04E-02	1.68E-02	9.56E-05	0	0	1.91E-02	0	0	7.09E-03	2.27E-04	1.3E-04	-2.44E-03
ODP	kg CFC11 eq	4.74E-08	4.73E-13	4.06E-09	1.07E-11	4.18E-13	0	0	3.24E-09	0	0	9.97E-14	3.34E-11	2.4E-13	-2.61E-11
AP	mol H^+ eq	8.51E-01	1.82E-01	1.94E-02	1.11E-02	8.61E-04	0	0	3.76E-01	0	0	4.6E-03	4.61E-03	4.44E-04	-1.08E-01
EP-freshwater	kg P eq	1.52E-03	4.6E-06	6.86E-05	6.98E-06	1.56E-07	0	0	6.56E-04	0	0	2.8E-06	9.46E-06	1.66E-05	-1.52E-05
EP-marine	kg N eq	9.23E-02	4.33E-02	4.06E-03	5.34E-03	3.15E-04	0	0	8.98E-02	0	0	2.24E-03	1.2E-03	1.06E-04	-1.26E-02
EP-terrestrial	mol N eq	9.93E-01	4.75E-01	4.07E-02	5.92E-02	3.96E-03	0	0	9.39E-01	0	0	2.49E-02	1.34E-02	1.16E-03	-1.36E-01
POCP	kg NMVOC eq	2.93E-01	1.23E-01	1.14E-02	1.02E-02	8.19E-04	0	0	2.4E-01	0	0	4.25E-03	3.2E-03	3.34E-04	-4.04E-02
ADPE	kg Sb eq	8.86E-03	1.09E-07	6.05E-05	1.9E-06	4.31E-09	0	0	2.72E-05	0	0	5.08E-08	2.79E-07	3.87E-09	-1.22E-03
ADPF	MJ	1.64E+03	7.54E+01	5.8E+01	2.54E+01	1.16E+00	0	0	3.7E+03	0	0	1.04E+01	3.89E+01	2.15E+00	-1.34E+02
WDP	m^3 world eq deprived	3.91E+01	1.99E-02	3.94E-02	3.11E-02	3.81E-01	0	0	3.92E+01	0	0	9.25E-03	8.52E-01	-2E-03	-7.15E-01

GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential)

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1PCS of MAGNA3 65-40/60

Parameter	Unit	A1	A2	A3	A4	A5	B1	B2	B6	B7	C1	C2	C3	C4	D
PERE	MJ	4.28E+02	1.21E+00	5.58E+01	1.97E+00	2.62E-01	0	0	2.21E+03	0	0	7.59E-01	2.27E+01	1.94E-01	2.42E+00
PERM	MJ	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PERT	MJ	4.28E+02	1.21E+00	5.58E+01	1.97E+00	2.62E-01	0	0	2.21E+03	0	0	7.59E-01	2.27E+01	1.94E-01	2.42E+00
PENRE	MJ	1.64E+03	7.56E+01	5.8E+01	2.55E+01	1.16E+00	0	0	3.7E+03	0	0	1.05E+01	3.89E+01	2.15E+00	-1.34E +02
PENRM	MJ	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PENRT	MJ	1.64E+03	7.56E+01	5.8E+01	2.55E+01	1.16E+00	0	0	3.7E+03	0	0	1.05E+01	3.89E+01	2.15E+00	-1.34E +02
SM	kg	1.45E+01	0	2.31E-01	2.94E-03	0	0	0	0	0	0	0	0	0	0
RSF	MJ	1.46E-23	0	0	2.91E-27	0	0	0	0	0	0	0	0	0	0
NRSF	MJ	1.71E-22	0	0	3.42E-26	0	0	0	0	0	0	0	0	0	0
FW	m^3	1.16E+00	1.38E-03	2.32E-02	2.26E-03	8.99E-03	0	0	1.79E+00	0	0	8.32E-04	2.88E-02	2.25E-05	2.19E-02

PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels;

NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1PCS of MAGNA3 65-40/60

Parameter	Unit	A1	A2	A3	A4	A5	B1	B2	B6	B7	C1	C2	C3	C4	D
HWD	kg	7.01E-06	2.37E-10	1.21E-04	2.57E-08	2.94E-11	0	0	4.35E-07	0	0	3.24E-11	4.42E-09	1.8E-10	-2.44E-03
NHWD	kg	9.22E+00	7.69E-03	3.75E-01	5.94E-03	1.23E-01	0	0	2.71E+00	0	0	1.6E-03	6.46E-01	2.49E+00	2.02E+00
RWD	kg	5.6E-02	9.78E-05	1.78E-03	6.33E-05	5.29E-05	0	0	5.88E-01	0	0	1.96E-05	6.03E-03	2.53E-05	-2.62E-03
CRU	kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MFR	kg	0	0	0	0	0	0	0	0	0	0	0	1.7E+01	0	0
MER	kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
EEE	MJ	0	0	0	0	4.92E+00	0	0	0	0	0	0	7.45E+00	0	0
EET	MJ	0	0	0	0	8.9E+00	0	0	0	0	0	0	1.34E+01	0	0

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

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: 1PCS of MAGNA3 65-40/60

Parameter	Unit	A1	A2	A3	A4	A5	B1	B2	B6	B7	C1	C2	C3	C4	D
PM	Disease incidence	1.07E-05	3.15E-06	2.88E-07	7.2E-08	5.08E-09	0	0	3.16E-06	0	0	2.92E-08	3.91E-08	4.51E-09	-2.69E-06
IR	kBq U235 eq	7.52E+00	1.41E-02	2.85E-01	9.35E-03	8.26E-03	0	0	9.79E+01	0	0	2.92E-03	1E+00	3.74E-03	-2.26E-01
ETP-fw	CTUe	8.32E+02	5.34E+01	1.98E+01	1.79E+01	5.59E-01	0	0	1.03E+03	0	0	7.47E+00	1.12E+01	1.35E+00	-1.65E+01
HTP-c	CTUh	2.38E-05	9.92E-10	6.46E-07	5.26E-09	3.05E-11	0	0	5.44E-08	0	0	1.52E-10	6.24E-10	8.68E-11	-5.35E-07
HTP-nc	CTUh	1.76E-06	3.4E-08	4.24E-08	1.64E-08	1.14E-09	0	0	8.68E-07	0	0	6.75E-09	1.25E-08	7.41E-09	-7.13E-08
SQP	SQP	3.81E+02	5.56E+00	1.06E+02	1.05E+01	3.41E-01	0	0	1.45E+03	0	0	4.36E+00	1.51E+01	1.92E-01	-1.75E+01

PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); SQP = Potential soil quality index

Disclaimer 1 – for the indicator 'Potential Human exposure efficiency relative to U235'.
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 or radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – for the indicators 'abiotic depletion potential for non-fossil resources', 'abiotic depletion potential for fossil resources', 'water (user) deprivation potential, deprivation-weighted water consumption', 'potential comparative toxic unit for ecosystems', 'potential comparative toxic unit for humans – cancerogenic', 'Potential comparative toxic unit for humans - not cancerogenic', 'potential soil quality index'. The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high as there is limited experience with the indicator.

Disclaimer 3: *JRC Technical Reports, Version 2, 2018* Page 6, for the indicator "EP-freshwater". This indicator has been calculated as 'kg P eq' as required in the characterization model EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe; This EPD was created using a software tool.

References

Standards

Machinery Directive

DIRECTIVE 2006/42/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 May 2006 on machinery

Radio Equipment Directive

DIRECTIVE 2014/53/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment

Electromagnetic Compatibility (EMC) Directive

DIRECTIVE 2014/30/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 26 February 2014 on the harmonistion of the laws of the Member States relating to electromagnetic compatibility

Ecodesign Directive

DIRECTIVE 2009/125/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products

EC 641/2009

COMMISSION REGULATION (EC) No 641/2009 of 22 July 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for glandless standalone circulators and glandless circulators integrated in

products

EC 622/2012

COMMISSION REGULATION (EU) No 622/2012 of 11 July 2012 amending Regulation (EC) No 641/2009 with regard to ecodesign requirements for glandless standalone circulators and glandless circulators integrated in products

DIRECTIVE 2011/65/EU

DIRECTIVE 2011/65/EU OF THE EUROPEAN

PARLIAMENT AND OF THE COUNCIL of 8 June 2011

on the restriction of the use of certain hazardous

substances in electrical and electronic equipment

DIRECTIVE 2015/863/EU

DIRECTIVE 2015/863/EU of 31 March 2015 amending

Annex II to Directive 2011/65/EU of the European

Parliament and of the Council as regards the list of

restricted substances

ETSI EN 301 489-1

ETSI EN 301 489-1 V2.2.0, Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements

ETSI EN 301 489-17

ETSI EN 301 489-17 V3.2.0, Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for Broadband Data Transmission Systems

ETSI EN 300 328 V2.1.1

ETSI EN 300 328 V2.1.1, Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques

EN 809

EN 809:1998-10 + A1:2009, Pumps and pump units for

liquids - Common safety requirements

EN 55014-1

EN 55014-1:2017, Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission

EN 55014-2

EN 55014-2:2015, Electromagnetic compatibility –

Requirements for household appliances, electric tools

and similar apparatus – Part 2: Immunity – Product

family standard (CISPR 14-2:2015)

EN 50581:2012

EN 50581:2012, Technical documentation for the

assessment of electrical and electronic products with

respect to the restriction of hazardous substances

EN 60335-1

EN 60335-1:2012/A11:2014/A13:2017, Household

and similar electrical appliances – Safety – Part 1:General requirements

EN 60335-2-51

EN 60335-2-51:2003-03 + A1:2008 + A2:2012, Household and similar electrical appliances – Safety –Part 2-51: Particular requirements for stationary circulation pumps for heating and service water installations

EN 61000-3-2

EN 61000-3-2:2014/2019, Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current =16 A per phase)

EN 61000-3-3

EN 61000-3-3:2013-08/ A1:2019, Electromagnetic compatibility (EMC) – Part 3-3:
Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low voltage supply systems, for equipment with

rated current <= 16 A per phase and not subject to conditional connection

EN 61000-6-2

EN 61000-6-2:2008/2019, Electromagnetic compatibility (EMC) – Part 6-2: Generic standards –Immunity for industrial environments

EN 16297-1

EN 16297-1:2012-10, Pumps – Rotodynamic pumps – Glandless circulators – Part 1:
General requirements and procedures for testing and calculation of energy efficiency index (EEI)

EN 16297-2

EN 16297-2:2012-10, Pumps – Rotodynamic pumps – Glandless circulators – Part 2: Calculation of energy efficiency index (EEI) for standalone circulators

EN 16297-3

EN 16297-3:2012, Pumps – Rotodynamic pumps –Glandless circulators – Part 3: Energy efficiency index (EEI) for circulators integrated in products

ISO 14001

EN ISO 14001:2015-09, Environmental management systems - Requirements with guidance for use

ISO 14025

DIN EN /ISO 14025:2011-10, Environmental labels and declarations — Type III environmental declarations — Principles and procedures

EN 15804

EN 15804:2012-04+A1 2013, Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

PCR Part A

Institut Bauen und Umwelt e.V., Berlin (pub.): Product Category Rules for Building-Related Products and Services, Product Category Rules for Construction Products from the range of Environmental Product Declarations of Institut Bauen und Umwelt (IBU), Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report, Version 1.3.

PCR Part B

Institut Bauen und Umwelt e.V., Berlin (pub.): Product Category Rules for Building-Related Products and Services, Product Category Rules for Construction Products from the range of Environmental Product Declarations of Institut Bauen und Umwelt (IBU), Part B: Requirements on the EPD for Pumps for liquids and liquids with solids, Version 1.0 (2018)

Further references

CPR

REGULATION (EU) No 305/2011 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC

CML 2001

Impact assessment characterization factors Institute of Environmental Sciences, Leiden University, Netherlands

ECHA candidate list

Candidate List of substances of very high concern (SVHCs) for authorisation, European Chemicals Agency (ECHA), Helsinki, Finland **EUTREND model**
Struijs et al., 2009b

AEA Energy & Environment
Circulators in Buildings

Ecoinvent

Ecoinvent v3.9.1

LCA for Experts

10.7.1.28 Schema 8007 **REACH**

Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) (Status: 27.06.2018)

SVR

Advisory Board (formerly SVA)

Decision no.
20170712-n
The literature referred to in the Environmental Product Declaration must be listed in full.Standards already fully quoted in the EPD do not need to be listed here again.
The current version of PCR Part A and PCR Part B of the PCR document on which they are based must be referenced.

Publisher

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ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A2*

Owner of the Declaration	Grundfos Holding A/S
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-GRU-20230079-CBC1-EN
Issue date	21/11/2023
Valid to	20/11/2028

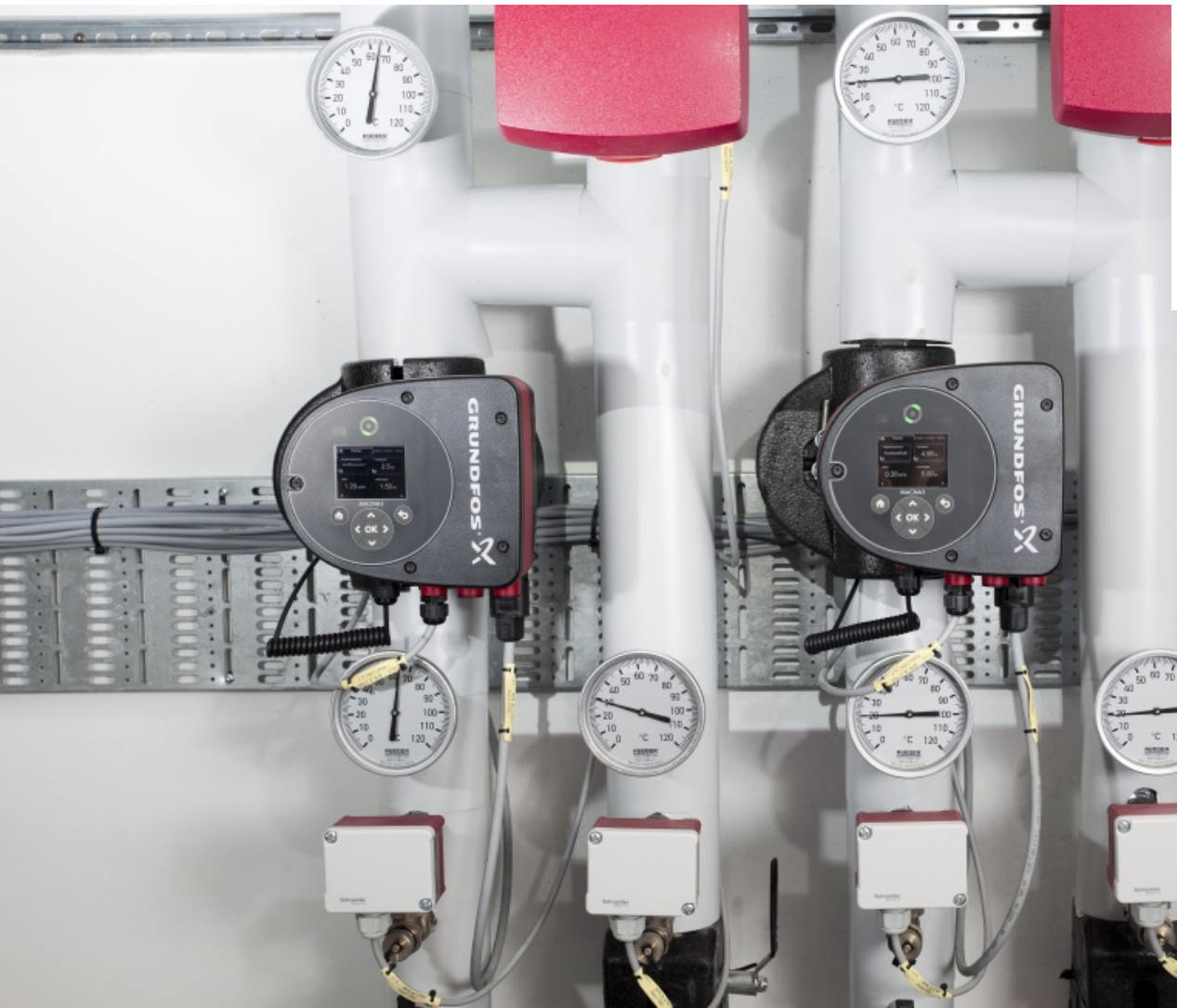
MAGNA3 65-80/100/120 (Cast Iron)

Grundfos Holding A/S

Institut Bauen und Umwelt e.V.

ECO PLATFORM EPD VERIFIED

www.ibu-epd.com | https://epd-online.com



General Information

Grundfos Holding A/S

Programme holder

IBU – Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

Declaration number

EPD-GRU-20230079-CBC1-EN

This declaration is based on the product category rules:

Pumps for liquids and liquids with solids, 01/08/2021
(PCR checked and approved by the SVR)

Issue date

21/11/2023

Valid to

20/11/2028

Dipl.-Ing. Hans Peters
(Chairman of Institut Bauen und Umwelt e.V.)

Florian Pronold
(Managing Director Institut Bauen und Umwelt e.V.)

MAGNA3 65-80/100/120 (Cast Iron)

Owner of the declaration

Grundfos Holding A/S
Poul Due Jensens Vej 7
8850 Bjerringbro
Denmark

Declared product / declared unit

1 PCS. of MAGNA3 65-80/100/120 (Cast Iron)

Scope:

The declaration applies to 1 piece of MAGNA3 (Cast Iron) pump.

The product is produced in Wahlstedt, Germany, and the life cycle assessment is based on data collected at the production site.

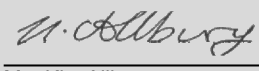
Production has been modeled using annual production data from 2021.

The declaration covers three different types of the MAGNA3 65- product (80/100/120).
The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

The EPD was created according to the specifications of EN 15804+A2. In the following, the standard will be simplified as *EN 15804*.

Verification

The standard EN 15804 serves as the core PCR
Independent verification of the declaration and data according to ISO 14025:2011
☐ internally ☒ externally



Mrs Kim Allbury,
(Independent verifier)

Product

Product description/Product definition

The Grundfos MAGNA3 circulator pumps are designed for circulating liquids in heating systems, air conditioning and cooling systems and domestic hot water systems. However, the pump range can also be used in ground source heat pump systems and solar heating systems.

The MAGNA3 pump is a centrifugal pump powered by an electrical motor. It has a high-performance neodymium magnet rotor which increases motor efficiency and an insulation shell to reduce heat loss from the cast iron pump housing with threaded connections.

The declaration covers three types of the MAGNA3 pump. They are grouped as shown below. The group reference in the technical data and scenarios refers also to these.

GROUP 1 - MAGNA3 65-80

GROUP 2 - MAGNA3 65-100
GROUP 3 - MAGNA3 65-120

These are all the same physical products and 100 % identical in terms of design, dimensions and materials as well as supply chain and manufacturing processes, i.e., all cradle to gate processes (A1-A3).

The products are also identical in terms of packaging, distribution, reference service life and end-of-life treatment.

The only thing that differentiates the products from each other is the software which controls how the pump operates in the system in which it is installed, making them fit for different applications. Hence, all life cycle modules are identical, except use stage module B6, which will change, as the applied scenarios for electricity consumption changes. For the placing on the market in the European Union/European Free Trade Association (EU/EFTA) (with the exception of Switzerland) the following legal provisions as well as the corresponding harmonised norms based on these provisions apply:

Machinery Directive (2006/42/EC)

Standard used: *EN 809:1998 + A1:2009.*

Radio Equipment Directive (2014/53/EU)

Standards used:
EN 60335-1:2012/AC:2014 + A11:2014, EN 60335-2-51:2003 + A1:2008 + A2:2012, EN 62233:2008.

EN 55014-1:2006 + A1:2009 + A2:2011, EN 55014-1:2017, EN 61000-6-2:2005, EN 61000-3-2:2014, EN 61000-3-3:2013, ETSI EN 301 489-1 V2.2.0, ETSI EN 301 489-17 V3.2.0. ETSI EN 300 328 V2.1.1

Electromagnetic Compatibility (EMC) Directive (2014/30/EU)

Standards used: *EN 55014-1:2017, EN 55014-2:2015,*

EN 61000-3-2:2014/2019, EN 61000-6-2:2008/2019,

EN 61000-3-3:2013 A1:2019

RoHS Directive 2011/65/EU and 2015/863//EU

Standard: *EN 50581:2012.*

Ecodesign Directive (2009/125/EC)

Commission Regulation (EC) No: 641/2009 and

Commission Regulation (EU) 622/2012

Standards used: *EN 16297-1:2012, EN 16297-2:2012, EN 16297-3:2012.*

The CE-marking takes into account the proof of conformity with the respective harmonized norms based on the legal provisions above.

MAGNA3 pumps are not harmonized in accordance with the *CPR.*

Application

For the application and use the respective national provisions apply.

The pump is designed for circulating liquids in the following systems:

. heating systems

. domestic hot-water systems

. air-conditioning and cooling systems

. ground-source heat-pump systems

. solar-heating systems

The pump is suitable for thin, clean, non-aggressive and non-explosive liquids, not containing solid particles or fibres that may attack the pump mechanically or chemically. In heating systems, the water must meet the requirements of accepted standards on water quality in heating systems. The pumps are also suitable for domestic hot-water systems

Technical Data

The performance data of the product according to the harmonized norms, based on the harmonization provisions above apply.

The relevant technical specifications according to the *PCR Part B* are given

in
the table below.

Characteristics
that are the same for all product groups are only given once.
Others are given
individually for all three groups.

Constructional data

Name	Value	Unit
Frequency	50	Hz
Voltage	230	V
Energy Efficiency Index Gr.1	0,18	
Energy Efficiency Index Gr.2	0,17	
Energy Efficiency Index Gr.3	0,17	
Flow range Gr. 1 (max)	37,5	m^3/h
Flow range Gr. 2 (max)	40,0	m^3/h
Flow range Gr. 3 (max)	42,50	m^3/h
Head max. Gr.1	8	m
Head max. Gr.2	10	m
Head max. Gr.3	12	m
Power input Gr. 1 Average (from load profile describing use)	0,197	kW
Power input Gr. 2 Average (from load profile describing use)	0,249	kW
Power input Gr. 3 Average (from load profile describing use)	0,320	kW
Nominal capacity Gr.1	0,461	kW
Nominal capacity Gr. 2	0,599	kW
Nominal capacity Gr.3	0,75	kW

Performance
data of the product according to the

harmonized
standards, based on provisions for harmonization.

Base materials/Ancillary materials

Name	Value	Unit
Aluminium	13	%
Cast iron	53	%
Ceramics	0,3	%
Copper	3	%
Electronics	0,2	%
Magnet Nd	1	%
Paper	0,5	%
PCB	4	%
Plastics	0,3	%
Plastics, foam	1	%
Plastics GF	5	%
Rubber	0,2	%
Stainless steel	4	%
Steel	8	%
Cardboard	8	%
Plastic film	0,1	%
TOTAL	100	%

REACH

This product/article/at
least one partial article contains

substances
listed in the *ECHA candidate list* (date:

10.06.2022)
exceeding 0.1 percentage by mass: **no**

The Wahlstedt
production has been assessed and certified as meeting the requirements in *ISO 14001,*
ISO 50001, ISO 45001 and ISO 9001.

Reference service life

No use stage
scenario which refers to the lifetime of the product is declared. However, to
facilitate building calculations, an estimated RSL of 10 years can be used.
This is an EU consensus-based estimation, referenced on page 37 in Appendix 7: *Lot*
11 – Circulators in Buildings, prepared by AEA Energy & Environment for
the European Commission in the context of the Eco Design Directive:

There is no
definitive information on the average circulator life available, there is consensus
within the industry that it is at least 12 years. However, this is complicated by
many factors, including many being scrapped prematurely when e.g. the
boiler they are connected to is replaced.

From the
estimated stock (140Mpa) and annual sales (14Mpa), the average lifetime of
the circulator is taken as 10 years for the purposes of this study.

B6 is declared per year as required by the *PCR Part B.*

The RSL of the
declared product is not directly influencing the results in this study, as no
declared use stage scenario is dependent on the RSL; The use stage sub-module

LCA: Calculation rules

Declared Unit

The declared
unit is 1 piece (pcs.) of MAGNA3 (Cast Iron) pump.

Declared unit

Name	Value	Unit
Declared unit	1	pce.
Mass reference	23.9	kg/pce
Conversion factor [Mass/Declared Unit]	23.9	

For IBU core EPDs (where clause 3.6 is part of the EPD): for average EPDs, an estimate of the robustness of the LCA values must be made, e.g. concerning the variability of the production process, geographical representativeness and the influence of background data and preliminary products compared to the environmental impacts caused by the actual production.

System boundary

This EPD is
Cradle-To-Grave. The system boundaries

of the EPD
follow the modular approach in *EN 15804*. By decision no. 20170712-n of
the *SVR*, the modules B3, B4 and B5 are by default declared as
"MNR" (module not relevant).

The product
stage (A1-A3) comprises raw
material extraction and processing, transport processes as well as the
manufacturing process. The final production and assembly of the MAGNA3 pump
takes place at a Grundfos manufacturing site in Germany. However, the full
supply-chain leading to the finished product at the gate is rather complex and
includes a large amount of raw materials, components and semi-finished parts
which comes from both external suppliers as well as other Grundfos production
facilities.

The product
stage is included in the study, and according to *EN 15804* the system
boundary with nature is set to include those processes that provide the
material and energy inputs into the system and the following manufacturing,
transport up to the factory gate as well as the processing any waste arising
from those processes.

Wastes and
losses are included in the modules where they occur according to the polluter
pays principle and the modular approach of *EN 15804.*

The
product includes:

.
A1 Extraction and processing of raw materials;

.
A1 Reuse of products or materials from a previous product system;

.
A1 Processing of secondary materials;

.
A1 Generation of electricity, steam and heat from primary energy resources,
also including their extraction, refining and transport;

.
A1 Energy recovery and other recovery processes from secondary fuels;

.
A2 Transportation up to the factory gate and internal transport;

.
A3 Production of ancillary materials or pre products;

.
A3 Manufacturing of products and coproducts;

.
A3 Manufacturing of packaging;

.
A1-A3 processing up to the end-of-waste state or disposal of final residues.

For secondary
material inputs, the system boundary to the previous system (providing the
secondary material) is set where outputs reach the end-of-waste state. The
recycling of secondary material into new raw materials is included in the
system boundary of this study. Waste

materials from
production processes that are recycled without any modification of the material's
inherent characteristics are modelled as closed-loop within A1-A3. This is done
up to the input mass flow that was used during production.

Waste for
incineration arising in the product stage is accounted for in the module where
the waste is produced. The environmental loads from the incineration process
are declared in the module where it occurs and the electricity and heat which
is produced from the incineration are considered as closed-loop within A1-A3, as
described in *PCR Part A,* 5.5.1. The input of biogenic carbon from the
production of packaging material is inventoried in A3. As required by *PCR*
Part A, the corresponding end-of-life module of the packaging material, A5, is also declared and the emissions of biogenic carbon are
inventoried.

The
construction process stage (A4-A5) includes:

A4:

.
Transportation from factory gate to distribution center:

.
Consumption of electricity, thermal energy and water at distribution center;

.
Transportation from distribution center to construction site;

.
Wastage during distribution.

A5:

.
Installation process;

.
Transport of packaging waste to treatment site;

.
Waste treatment of packaging.

The packaging
material does not reach the end of waste state but is incinerated as waste.
According to European statistics, the average R1 value of

incineration plants
is > 0.6. Therefore, it is assumed

that packaging
material is treated thermally in an incineration plant with R1 > 0.6. The
loads from the combustion process of packaging are declared in module A5 and
the resulting energy benefits in module

D, as required
by the *PCR Part A*, 5.5.2.

Use stage
(B1-B7):

The use stage,
related to the building fabric includes:

.
B1, use or application of the installed product;

.
B2, maintenance.

The use stage
related to the operation of the building

includes:

.
B6, operational energy use;

.
B7, operational water use.

In this study,
all use stage modules are assessed, though B1, B2 and B7 are assessed to be
zero. By decision no. 20170712-n of the *SVR*, the modules B3,

B4 and B5
are by default declared as "MNR" (module

not relevant).
The modules include the provision and transport of all materials, products and
related energy and water use, as well as waste processing up to the
end-of-waste state or disposal of final residues during the use stage. They
also include all impacts and

aspects related
to the losses during the use stage (i.e. production, transport, and waste
processing and disposal of the lost products and materials).

Generally, the
geographical coverage of the datasets used matches the actual processes taking
place. Meaning, that when modelling taking place in Grundfos Bjerringbro,
the Danish electricity grid mix is used in the model and thermal energy
from natural gas. These are generally of very high quality with very good
technological, temporal and geographical representativeness.

Contributions
to operational energy use during the use stage (B6) come from the electricity
consumption of the product. The annual electricity consumption is calculated by
multiplying the average power input, which is based on a defined load profile,
with the annual running hours. For use stage (B6) European Average
electricity grid mix has been used. These values are declared in the scenarios
section.

The End-of-Life
stage (C1-C4) includes all
activities from when the product reaches the end of its service life and no
longer provides any functionality and until all materials and components are
processed for

An
overall collection rate of 90 % has been assumed.

reuse/recycling
or disposed of.

Materials from
which energy is recovered in an incineration process with an R1-value above 0.60
are in this study included with the environmental burdens from the incineration
process inventoried in C3, the recovered energy is declared as exported energy
in C3

According to *EN 15804* and the *PCR Part A,* the end-of-life stage includes:

.
C1 deconstruction of the product from the

and the energy
benefits are declared in D. This procedure is according to the *PCR Part A*,
5.5.6. C3 includes the mechanical separation of the product followed by a
series of sorting steps. Metal fractions are recycled and plastics, cardboard
and electronics are assumed incinerated with energy recovery. The residual
fractions are landfilled and declared in C4.

.
building, including initial on-site sorting of the

.
materials;

.
C2 transportation of the discarded product to a recycling site and
transportation of waste to final disposal;

The specific
amounts are shown in the scenarios section.

.
C3 waste processing, collection of waste fractions from the deconstruction and
waste processing of material flows intended for reuse, recycling and energy
recovery;

Beyond system boundary (D): According to *EN 15804* module D includes the reuse, recovery and/or recycling potentials,
expressed as net impacts and benefits. Any declared benefits and loads from net

.
C4 waste disposal including physical pretreatment and management of the
disposal site.

flows leaving
the product system that have not been allocated as co-products and that have
passed the end-of-waste state are included in module D.

At the end of life,
the MAGNA3 pump is manually disassembled from the piping system in which it has
been installed. The definition of the applied end-of-life scenario in this EPD
follows the requirements in the

Contributions
to module D comes from waste incineration processes in A5 and C3 as well as
material recycling in C3. The specific fractions and net flows are shown in the
scenarios section.

PCR Part A, 6.2 regarding complex products, with a combination
of recycling, thermal waste treatment and landfilling. 100 % of the material is
considered in the end of life scenario as required by the *PCR*.

Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to *EN 15804* and the building context, respectively the product-specific characteristics of performance, are taken into account. Software and databases used: *GaBi ts*

Basically, a
comparison or an evaluation of EPD data is only possible if all the data sets
to be compared were created according to *EN 15804* and the building context, respectively the product-specific
characteristics of performance, are taken into account.

9.2.1.68
(database schema 8007) *Ecoinvent v3.5.*.

Geographic Representativeness

Land or region, in which the declared product system is manufactured, used or handled at the end of the product´s lifespan: Germany

Comparability

LCA: Scenarios and additional technical information

Characteristic product properties of biogenic carbon

The biogenic
carbon content quantifies the amount of biogenic carbon in a construction
product leaving the factory gate, and it will be separately declared for the
product and for any accompanying packaging, as required from the *PCR Part A.*
The Carbon content of Cardboard and Paper is assumed to 0.46 kg C. Overall,
there is an amount of 9 weight-% Carbon in the product leaving the factory gate
and has to be considered

Information on describing the biogenic Carbon Content at factory gate

Name	Value	Unit
Biogenic carbon content in accompanying packaging	0.74	kg C

Note: 1 kg of biogenic carbon is equivalent to 44/12 kg of CO2

The following technical scenario information is required for the declared modules and optional for non-declared modules. Modules for which no information is declared can be deleted; additional information can also be listed if necessary.

The following technical information is a basis for the declared modules or can be used for developing specific scenarios in the context of a building assessment if modules are not declared (MND).

A5 is not declared including the disposal of the packaging material on the construction site, the amounts of packaging materials included in the LCA calculations must be declared as technical scenario information for Module A5.

Transport from the gate to the site (A4)

Name	Value	Unit
Litres of fuel	0,0332	l/100km
Transport distance	2003	km
Capacity utilisation (including empty runs)	85	%
Gross density of products transported	460	kg/m^3
Wastage during distribution	0,02	%

Installation into the building (A5)

Name	Value	Unit
Packaging waste for incineration (LDPE film)	0,031	kg
Packaging waste for incineration (Paper/Cardboard)	1,95	kg

An
estimated RSL of 10 years can be used to facilitate building calculations. This
is an EU consensus-based estimation, referenced in Appendix 7: Lot 11 –
Circulators in Buildings, prepared by AEA Energy & Environment for the
European Commission in the context of the Eco Design Directive.

Reference service life

Name	Value	Unit
Life Span according to the manufacturer	10	a

Operational energy use (B6)

Name	Value	Unit
Electricity consumption Group 1	985	kWh/a
Electricity consumption Group 2	1245	kWh/a
Electricity consumption Group 3	1600	kWh/a
Average power input, Group 1	0,197	kW
Average power input, Group 2	0,249	kW
Average power input, Group 3	0,32	kW
Running hours (all groups)	5.000	h/a

End of life (C1-C4)

Name	Value	Unit
Collected as mixed construction waste	21,94	kg
Transportation distance (C2)	500	km
Aluminium for recycling	2,79	kg
Steel for recycling	12,7	kg
Copper for recycling	0,60	kg
Stainless steel for recycling	0,84	kg
Paper/Cardboard for for incineration w/energy recovery	1,95	kg
Plastics for incineration w/energy	1,39	kg
Electronics for incineration w/energy	0,81	kg
Landfilling	2,81	kg

Reuse, recovery and/or recycling potentials (D), relevant scenario information

Name	Value	Unit
A5, incineration w/energy recov. (LDPE foil)	4,37	MJ
A5, incineration w/energy recov. (Paper/Cardboard)	7,91	MJ
C3, steel for recycling (net amounts)	-1,28	kg
C3, stainless steel for recycling (net amounts)	0,52	kg
C3, aluminium for recycling (net amounts)	-0,383	kg
C3, copper for recycling (net amounts)	0,258	kg
C3, plastics for incineration, w/ energy recov.	1,39	kg
C3, electronics for incineration, w/ energy recov.	0,81	kg

LCA: Results

Characterization model: *EN 15804* - 2012+A2 - 2019, PEF. By Decision no. 20170712-n of the IBU SVR, the modules B3, B4, B5 are marked as MNR (module not relevant) as default. The LCA results in module B6 are given on a period of one year, according to *PCR Part B*. To obtain the results from module B6 over the entire life cycle, the LCA results of module B6 must be multiplied by the estimated RSL of 10 years. The indicator results for module B6 are declared for Group 1. B6 indicator results for other groups can be derived by multiplying the B6 indicator results with the following factors:

Group 2 PN6/10: 1,265

Group 3 PN6/10: 1,626
Group 2 PN16: 1,29
Group 3 PN16: 1,55

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; ND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

Product stage			Construction process stage		Use stage							End of life stage				Benefits and loads beyond the system boundaries
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	MND	MND	MNR	MNR	MNR	X	MND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1PCS of MAGNA3 65-80/100/120 (Cast Iron)

Parameter	Unit	A1	A2	A3	A4	A5	B6	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq	1.07E+02	1.46E+00	8.1E-01	1.49E+00	2.86E+00	3.98E+02	0	6.11E-01	6.65E+00	1.43E-01	-3.4E-01
GWP-fossil	kg CO_2 eq	1.06E+02	1.45E+00	4.05E+00	1.48E+00	1.53E-01	3.97E+02	0	6.07E-01	6.64E+00	1.47E-01	-3.34E-01
GWP-biogenic	kg CO_2 eq	4.63E-01	-1.98E-03	-3.28E+00	-3.02E-03	2.7E+00	1.32E+00	0	-1.02E-03	6.57E-03	-4.43E-03	-2.68E-03
GWP-luluc	kg CO_2 eq	1.82E-01	1.05E-02	3.66E-02	1.18E-02	9.69E-05	5.75E-01	0	4.93E-03	3.27E-03	1.29E-04	-3.03E-03
ODP	kg CFC11 eq	9.52E-08	2.53E-16	4.07E-09	1.99E-11	5.23E-16	8.72E-12	0	1.12E-16	4.92E-14	3.31E-16	-7.6E-13
AP	mol H^+ eq	5.65E-01	1.08E-02	1.7E-02	8.64E-03	8.22E-04	8.75E-01	0	3.58E-03	5.67E-03	4.57E-04	-1.35E-02
EP-freshwater	kg P eq	1.63E-03	3.99E-06	6.44E-05	4.77E-06	1.2E-07	1.06E-03	0	1.86E-06	8.65E-06	1.61E-05	-4.47E-06
EP-marine	kg N eq	7.27E-02	3.76E-03	3.3E-03	4.12E-03	3E-04	1.94E-01	0	1.73E-03	1.37E-03	1.37E-03	-5.12E-04
EP-terrestrial	mol N eq	7.64E-01	4.16E-02	3.3E-02	4.56E-02	3.73E-03	2.04E+00	0	1.91E-02	1.53E-02	1.16E-03	-5.09E-03
POCP	kg NMVOC eq	2.26E-01	8.64E-03	9.46E-03	7.85E-03	7.83E-04	5.33E-01	0	3.28E-03	3.74E-03	3.39E-04	-1.74E-03
ADPE	kg Sb eq	5.89E-03	1.09E-07	5.96E-05	1.31E-06	8.71E-09	1.15E-04	0	4.93E-08	6.48E-07	9.95E-09	-7.2E-04
ADPF	MJ	1.45E+03	1.92E+01	5.62E+01	2E+01	9.85E-01	6.97E+03	0	8.13E+00	4.01E+01	2.11E+00	-2.05E+01
WDP	m^3 world eq deprived	2.61E+01	1.29E-02	2.36E-01	2.07E-02	3.52E-01	8.64E+01	0	5.94E-03	9.34E-01	-1.63E-03	-4.92E-01

GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential)

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1PCS of MAGNA3 65-80/100/120 (Cast Iron)

Parameter	Unit	A1	A2	A3	A4	A5	B6	C1	C2	C3	C4	D
PERE	MJ	3.99E+02	1.01E+00	5.11E+01	1.25E+00	1.7E-01	3.09E+03	0	4.7E-01	1.74E+01	1.48E-01	4.06E+00
PERM	MJ	0	0	0	0	-2.58E+01	0	0	0	-1.82E+00	0	0

PERT	MJ	3.99E+02	1.01E+00	5.11E+01	1.25E+00	1.7E-01	3.09E+03	0	4.7E-01	1.74E+01	1.48E-01	4.06E+00
PENRE	MJ	1.45E+03	1.93E+01	5.62E+01	2E+01	9.86E-01	6.97E+03	0	8.16E+00	4.01E+01	2.11E+00	-2.04E+01
PENRM	MJ	0	0	0	0	-6.9E-01	0	0	0	-2.39E+00	0	0
PENRT	MJ	1.45E+03	1.93E+01	5.62E+01	2E+01	9.86E-01	6.97E+03	0	8.16E+00	4.01E+01	2.11E+00	-2.04E+01
SM	kg	1.8E+01	0	2.31E-01	3.65E-03	0	0	0	0	0	0	0
RSF	MJ	1.46E-23	0	0	2.91E-27	0	0	0	0	0	0	0
NRSF	MJ	1.71E-22	0	0	3.42E-26	0	0	0	0	0	0	0
FW	m^3	8.16E-01	1.18E-03	2.57E-02	1.52E-03	8.29E-03	3.57E+00	0	5.48E-04	3.05E-02	2.68E-05	2.39E-02

PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2:
1PCS of MAGNA3 65-80/100/120 (Cast Iron)

Parameter	Unit	A1	A2	A3	A4	A5	B6	C1	C2	C3	C4	D
HWD	kg	3.3E-04	8.05E-07	1.22E-04	9.86E-07	5.11E-09	2.89E-06	0	3.78E-07	2.01E-08	8.46E-09	-3.25E-04
NHWD	kg	4.29E+00	2.95E-03	2.91E-01	4.23E-03	9.43E-02	4.95E+00	0	1.29E-03	6.44E-01	2.42E+00	1.53E+00
RWD	kg	6.21E-02	3.41E-05	1.55E-03	5.38E-05	4.74E-05	1.06E+00	0	1.5E-05	5.94E-03	2.53E-05	-1.71E-03
CRU	kg	0	0	0	0	0	0	0	0	0	0	0
MFR	kg	0	0	0	0	0	0	0	0	1.69E+01	0	0
MER	kg	0	0	0	0	0	0	0	0	0	0	0
EEE	MJ	0	0	0	0	4.37E+00	0	0	0	7.41E+00	0	0
EET	MJ	0	0	0	0	7.91E+00	0	0	0	1.34E+01	0	0

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

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional:
1PCS of MAGNA3 65-80/100/120 (Cast Iron)

Parameter	Unit	A1	A2	A3	A4	A5	B6	C1	C2	C3	C4	D
PM	Disease incidence	6.93E-06	1.28E-07	2.37E-07	5.13E-08	4.65E-09	7.34E-06	0	2.1E-08	4.79E-08	4.66E-09	-2.96E-07
IR	kBq U235 eq	6.82E+00	5.03E-03	2.44E-01	7.53E-03	7.3E-03	1.74E+02	0	2.22E-03	9.74E-01	3.59E-03	-1.46E-01
ETP-fw	CTUe	8.45E+02	1.43E+01	1.82E+01	1.46E+01	4.97E-01	2.98E+03	0	6.09E+00	1.75E+01	1.49E+00	-7.65E+00
HTP-c	CTUh	1.62E-06	2.93E-10	6.46E-07	7.58E-10	2.44E-11	8.24E-08	0	1.26E-10	5.29E-10	8.53E-11	-6.76E-08
HTP-nc	CTUh	2.5E-06	1.6E-08	5.68E-08	1.77E-08	1.15E-09	3.03E-06	0	7.22E-09	2.13E-08	7.44E-09	-5.99E-09
SQP	SQP	4.14E+02	6.09E+00	9.71E+01	6.91E+00	2.68E-01	2.22E+03	0	2.85E+00	1.26E+01	1.53E-01	-1.71E+01

PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); SQP = Potential soil quality index

Disclaimer
1 – for the indicator 'Potential Human exposure efficiency relative to U235'. 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 or radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – for the indicators 'abiotic depletion potential for non-fossil resources', 'abiotic depletion potential for fossil resources', 'water (user) deprivation potential, deprivation-weighted water consumption', 'potential comparative toxic unit for ecosystems', 'potential comparative toxic unit for humans – cancerogenic', 'Potential comparative toxic unit for humans - not cancerogenic', 'potential soil quality index'. The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high as there is limited experience with the indicator.

Disclaimer 3: *JRC Technical Reports, Version 2, 2018* Page 6, for the indicator "EP-freshwater". This indicator has been calculated as 'kg P eq' as required in the characterization model EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe;

References

Standards

Machinery Directive

DIRECTIVE 2006/42/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 May 2006 on machinery

Radio Equipment Directive

DIRECTIVE 2014/53/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment

Electromagnetic Compatibility (EMC) Directive

DIRECTIVE 2014/30/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 26 February 2014 on the harmonistion of the laws of the Member States relating to electromagnetic compatibility

Ecodesign Directive

DIRECTIVE 2009/125/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products

EC 641/2009

COMMISSION REGULATION (EC) No 641/2009 of 22 July 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for glandless standalone circulators and

glandless circulators integrated in

products

EC 622/2012

COMMISSION
REGULATION (EU) No 622/2012 of 11 July 2012 amending Regulation (EC) No
641/2009 with regard to ecodesign requirements for glandless standalone
circulators and glandless circulators integrated in products

DIRECTIVE 2011/65/EU

DIRECTIVE
2011/65/EU OF THE EUROPEAN

PARLIAMENT AND
OF THE COUNCIL of 8 June 2011

on the
restriction of the use of certain hazardous

substances in
electrical and electronic equipment

DIRECTIVE 2015/863/EU

DIRECTIVE
2015/863/EU of 31 March 2015 amending

Annex II to

Directive 2011/65/EU of the European

Parliament and
of the Council as regards the list of

restricted
substances

ETSI EN 301 489-1

ETSI EN 301
489-1 V2.2.0, Electromagnetic Compatibility (EMC) standard for radio equipment
and services; Part 1: Common technical requirements

ETSI EN 301 489-17

ETSI EN 301
489-17 V3.2.0, Electromagnetic Compatibility (EMC) standard for radio equipment
and services; Part 17: Specific conditions for Broadband Data Transmission
Systems

ETSI EN 300 328 V2.1.1

ETSI EN 300 328
V2.1.1, Wideband transmission systems; Data transmission equipment operating in
the 2,4 GHz ISM band and using wide band modulation techniques

EN 809

EN 809:1998-10
+ A1:2009, Pumps and pump units for

liquids -
Common safety requirements

EN 55014-1

EN
55014-1:2017, Electromagnetic compatibility – Requirements for household
appliances, electric tools and similar apparatus – Part 1: Emission

EN 55014-2

EN
55014-2:2015, Electromagnetic compatibility –

Requirements
for household appliances, electric tools

and similar
apparatus – Part 2: Immunity – Product

family standard
(CISPR 14-2:2015)

EN 50581:2012

EN 50581:2012,
Technical documentation for the

assessment of
electrical and electronic products with

respect to the
restriction of hazardous substances

EN 60335-1

EN
60335-1:2012/A11:2014/A13:2017, Household

and similar
electrical appliances – Safety – Part 1:General requirements

EN 60335-2-51

EN
60335-2-51:2003-03 + A1:2008 + A2:2012, Household and similar electrical
appliances – Safety –Part 2-51: Particular requirements for stationary
circulation pumps for heating and service water installations

EN 61000-3-2

EN
61000-3-2:2014/2019, Electromagnetic compatibility (EMC) – Part 3-2: Limits –
Limits for harmonic current emissions (equipment input current =16 A per phase)

EN 61000-3-3

EN
61000-3-3:2013-08/ A1:2019, Electromagnetic compatibility (EMC) – Part 3-3:
Limits – Limitation of voltage changes, voltage fluctuations and flicker in public
low voltage supply systems, for equipment with

rated current
<= 16 A per phase and not subject to conditional connection

EN 61000-6-2

EN
61000-6-2:2008/2019, Electromagnetic compatibility (EMC) – Part 6-2: Generic
standards –Immunity for industrial environments

EN 16297-1

EN
16297-1:2012-10, Pumps – Rotodynamic pumps –Glandless circulators – Part 1:
General requirements and procedures for testing and calculation of energy
efficiency index (EEI)

EN 16297-2

EN 16297-2:2012-10,
Pumps – Rotodynamic pumps –Glandless circulators – Part 2: Calculation of
energy efficiency index (EEI) for standalone circulators

EN 16297-3

EN
16297-3:2012, Pumps – Rotodynamic pumps –Glandless circulators – Part 3: Energy
efficiency index (EEI) for circulators integrated in products

ISO 14001

EN ISO
14001:2015-09, Environmental management systems - Requirements with guidance
for use

ISO 14025

DIN EN /ISO
14025:2011-10, Environmental labels and declarations — Type III environmental
declarations — Principles and procedures

EN 15804

EN
15804:2012-04+A1 2013, Sustainability of construction works — Environmental
Product Declarations — Core rules for the product category of construction
products

CPR

REGULATION (EU)
No 305/2011 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 9 March 2011
laying down harmonised conditions for the marketing of construction products
and repealing Council Directive 89/106/EEC

PCR Part A

Institut Bauen
und Umwelt e.V., Berlin (pub.): Product Category Rules for Building-Related
Products and Services, Product Category Rules for Construction Products from
the range of Environmental Product Declarations of Institut Bauen und Umwelt
(IBU), Part A: Calculation Rules for the Life Cycle Assessment and Requirements
on the Project Report, Version 1.7 (2021)

CML 2001

Impact
assessment characterization factors Institute of Environmental Sciences, Leiden
University, Netherlands

PCR Part B

Institut Bauen
und Umwelt e.V., Berlin (pub.): Product Category Rules for Building-Related
Products and Services, Product Category Rules for Construction Products from
the range of Environmental Product Declarations of Institut Bauen und Umwelt
(IBU), Part B: Requirements on the EPD for Pumps for liquids and liquids with
solids, Version 1.0 (2018)

ECHA candidate list

Candidate List
of substances of very high concern (SVHCs) for authorisation, European
Chemicals Agency (ECHA), Helsinki, Finland

Ecoinvent

Ecoinvent v3.5

GaBi ts

GaBi ts 9.2.1.68
(database schema 8007)

Further references

REACH

Regulation (EC)
No 1907/2006 of the European Parliament and of the Council of 18 December 2006
concerning the Registration, Evaluation, Authorisation and Restriction of
Chemicals (REACH) (Status: 27.06.2018)

SVR

Advisory Board
(formerly SVA)

Decision no.
20170712-n

The literature referred to in the Environmental Product Declaration must be listed in full.Standards already fully quoted in the EPD do not need to be listed here again.
The current version of PCR Part A and PCR Part B of the PCR document on which they are based must be referenced.

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ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A2*

Owner of the Declaration	Grundfos Holding A/S
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-GRU-20240017-CBA1-EN
Issue date	21/03/2024
Valid to	20/03/2029

MAGNA3 65-80/100/120 (Stainless Steel)

Grundfos Holding A/S

Institut Bauen und Umwelt e.V.

ECO PLATFORM EPD VERIFIED

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General Information

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Declaration number

EPD-GRU-20240017-CBA1-EN

This declaration is based on the product category rules:

Pumps for liquids and liquids with solids, 01/08/2021
(PCR checked and approved by the SVR)

Issue date

21/03/2024

Valid to

20/03/2029

Dipl.-Ing. Hans Peters
(Chairman of Institut Bauen und Umwelt e.V.)

Florian Pronold
(Managing Director Institut Bauen und Umwelt e.V.)

MAGNA3 65-80/100/120 (Stainless Steel)

Owner of the declaration

Grundfos Holding A/S
Poul Due Jensens Vej 7
8850 Bjerringbro
Denmark

Declared product / declared unit

1 PCS. of MAGNA3 65-80/100/120 (Stainless Steel)

Scope:

The declaration applies to 1 piece of MAGNA3 (Stainless Steel) pump.

The product is produced in Wahlstedt, Germany, and the life cycle assessment is based on data collected at the production site.

Production has been modeled using annual production data from 2021.

The declaration covers three different types of the MAGNA3 65- product (80/100/120).
The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

The EPD was created according to the specifications of EN 15804+A2. In the following, the standard will be simplified as *EN 15804*.

Verification

The standard EN 15804 serves as the core PCR
Independent verification of the declaration and data according to ISO 14025:2011
☐ internally ☒ externally

Mrs Kim Allbury,
(Independent verifier)

Product

Product description/Product definition
The Grundfos MAGNA3 circulator pumps are designed for circulating liquids in heating systems, air conditioning and cooling systems and domestic hot water systems. However, the pump range can also be used in ground source heat pump systems and solar heating systems.

The MAGNA3 pump is a centrifugal pump powered by an electrical motor. It has a high-performance neodymium magnet rotor which increases motor efficiency and an insulation shell to reduce heat loss from the cast iron pump housing with threaded connections.

The declaration covers three types of the MAGNA3 pump. They are grouped as shown below. The group reference in the technical data and scenarios refers also to these.

GROUP 1 - MAGNA3 65-80

GROUP 2 - MAGNA3 65-100 GROUP 3 - MAGNA3 65-120

These are all the same physical products and 100 % identical in terms of design, dimensions and materials as well as supply chain and manufacturing processes, i.e., all cradle to gate processes (A1-A3).

The products are also identical in terms of packaging, distribution, reference service life and end-of-life treatment.

The only thing that differentiates the products from each other is the software which controls how the pump operates in the system in which it is installed, making them fit for different applications. Hence, all life cycle modules are identical, except use stage module B6, which will change, as the applied scenarios for electricity consumption changes. For the placing on the market in the European Union/European Free Trade Association (EU/EFTA) (with the exception of Switzerland) the following legal provisions as well as the corresponding harmonised norms based on these provisions apply:
Machinery Directive (2006/42/EC)

Standard used: *EN 809:1998 + A1:2009.*

Radio Equipment Directive (2014/53/EU)

Standards used:
EN 60335-1:2012/AC:2014 + A11:2014, EN 60335-2-51:2003 + A1:2008 + A2:2012, EN 62233:2008.

EN 55014-1:2006 + A1:2009 + A2:2011, EN 55014-1:2017, EN 61000-6-2:2005, EN 61000-3-2:2014, EN 61000-3-3:2013, ETSI EN 301 489-1 V2.2.0, ETSI EN 301 489-17 V3.2.0. ETSI EN 300 328 V2.1.1

Electromagnetic Compatibility (EMC) Directive (2014/30/EU)

Standards used: *EN 55014-1:2017, EN 55014-2:2015,*

EN 61000-3-2:2014/2019, EN 61000-6-2:2008/2019,

EN 61000-3-3:2013 A1:2019

RoHS Directive 2011/65/EU and 2015/863//EU

Standard: *EN 50581:2012.*

Ecodesign Directive (2009/125/EC)

Commission Regulation (EC) No: 641/2009 and

Commission Regulation (EU) 622/2012

Standards used:
EN 16297-1:2012, EN 16297-2:2012, EN 16297-3:2012.

The CE-marking takes into account the proof of conformity with the respective harmonized norms based on the legal provisions above.

MAGNA3 pumps are not harmonized in accordance with the *CPR.*

Application
For the application and use the respective national provisions apply.

The pump is designed for circulating liquids in the

following systems:

· heating systems

· domestic hot-water systems

· air-conditioning and cooling systems

· ground-source heat-pump systems

· solar-heating systems

The pump is suitable for thin, clean, non-aggressive and non-explosive liquids, not containing solid particles or fibres that may attack the pump mechanically or chemically. In heating systems, the water must meet the requirements of accepted standards on water quality in heating systems. The pumps are also suitable for domestic hot-water systems

Technical Data
The performance data of the product according to the harmonized norms, based on the harmonization provisions above apply.

The relevant technical specifications according to the *PCR Part B* are given in the table below.

Characteristics that are the same for all product groups are only given once. Others are given individually for all three groups.

Constructional data

Name	Value	Unit
Frequency	50	Hz
Voltage	230	V
Energy Efficiency Index Gr.1	0,18	
Energy Efficiency Index Gr.2	0,17	
Energy Efficiency Index Gr.3	0,17	
Flow range Gr. 1 (max)	37,5	m^3/h
Flow range Gr. 2 (max)	40,0	m^3/h
Flow range Gr. 3 (max)	42,50	m^3/h
Head max. Gr.1	8	m
Head max. Gr.2	10	m
Head max. Gr.3	12	m
Power input Gr. 1 Average (from load profile describing use)	0,197	kW
Power input Gr. 2 Average (from load profile describing use)	0,249	kW
Power input Gr. 3 Average (from load profile describing use)	0,320	kW
Nominal capacity Gr.1	0,461	kW
Nominal capacity Gr. 2	0,599	kW
Nominal capacity Gr.3	0,75	kW

Performance data of the product according to the harmonised standards, based on provisions for harmonisation.

Base materials/Ancillary materials

Name	Value	Unit
Aluminium	13	%
Ceramics	0,28	%
Copper	2,75	%
Electronics	0,21	%
Magnet Nd	1,01	%
Paper	0,46	%
PCB	3,46	%
Plastics	0,31	%
Plastics, foam	1,14	%
Plastics GF	4,78	%
Rubber	0,16	%
Stainless steel	58,26	%
Steel	7,22	%
Cardboard	8	%
Plastic film	0,1	%
TOTAL	100	%

REACH

This product/article/at least one partial article contains substances listed in the *ECHA candidate list* (date:

10.06.2022) exceeding 0.1 percentage by mass: **no**

The Wahlstedt production has been assessed and certified as meeting the requirements in *ISO 14001, ISO 50001, ISO 45001 and ISO 9001.*

Reference service life

No use stage scenario which refers to the lifetime of the product is declared. However, to facilitate building calculations, an estimated RSL of 10 years can be used.
This is an EU consensus-based estimation, referenced on page 37 in Appendix 7: *Lot 11 – Circulators in Buildings*, prepared by *AEA Energy & Environment* for the European Commission in the context of the *Eco Design Directive*:

There is no definitive information on the average circulator life available, there is consensus within the industry that it is at least 12 years. However, this is complicated by many factors, including many being scrapped prematurely when e.g. the boiler they are connected to is replaced.

From the estimated stock (140Mpa) and annual sales (14Mpa), the average lifetime of the circulator is taken as 10 years for the purposes of this study.

The RSL of the declared product is not directly influencing the results in this study, as no declared use stage scenario is dependent on the RSL; The use stage sub-module B6 is declared per year as required by the *PCR Part B.*

LCA: Calculation rules

Declared Unit

The declared
unit is 1 piece (pcs.) of MAGNA3 (Stainless Steel) pump.

Declared unit

Name	Value	Unit
Declared unit	1	pce.
Mass reference	24.85	kg/pce
Conversion factor [Mass/Declared Unit]	24.85	

System boundary

This EPD is Cradle-To-Grave. The system boundaries

of the EPD follow the modular approach in *EN 15804*. By decision no. 20170712-n of the *SVR*, the modules B3, B4 and B5 are by default declared as "MNR" (module not relevant).

The product stage (A1-A3) comprises raw material extraction and processing, transport processes as well as the manufacturing process. The final production and assembly of the MAGNA3 pump takes place at a Grundfos manufacturing site in Germany. However, the full supply-chain leading to the finished product at the gate is rather complex and includes a large amount of raw materials, components and semi-finished parts which comes from both external suppliers as well as other Grundfos production facilities.

The product stage is included in the study, and according to *EN 15804* the system boundary with nature is set to include those processes that provide the material and energy inputs into the system and the following manufacturing, transport up to the factory gate as well as the processing any waste arising from those processes.

Wastes and losses are included in the modules where they occur according to the polluter pays principle and the modular approach of *EN 15804.*

The product includes:

· A1 Extraction and processing of raw materials;

· A1 Reuse of products or materials from a previous product system;

· A1 Processing of secondary materials;

· A1 Generation of electricity, steam and heat from primary energy resources, also including their extraction, refining and transport;

· A1 Energy recovery and other recovery processes from secondary fuels;

· A2 Transportation up to the factory gate and internal transport;

· A3 Production of ancillary materials or pre products;

· A3 Manufacturing of products and coproducts;

· A3 Manufacturing of packaging;

· A1-A3 processing up to the end-of-waste state or disposal of final residues.

For secondary material inputs, the system boundary to the previous system (providing the secondary material) is set where outputs reach the end-of-waste state. The recycling of secondary material into new raw materials is included in the system boundary of this study. Waste materials from production processes that are recycled without any modification of the material's inherent characteristics are modelled as closed-loop within A1-A3. This is done up to the input mass flow that was used during production.

Waste for incineration arising in the product stage is accounted for in the module where the waste is produced. The environmental loads from the incineration process are declared in the module where it occurs and the electricity and heat which is produced from the incineration are considered as closed-loop within A1-A3, as described in *PCR Part A,* 5.5.1. The input of biogenic carbon from the production of packaging material is inventoried in A3. As required by *PCR Part A*, the corresponding end-of-life module of the packaging material, A5, is also declared and the emissions of biogenic carbon are inventoried.

The construction process stage (A4-A5) includes:

A4:

· Transportation from factory gate to the distribution center:

· Consumption of electricity, thermal energy and water at the distribution center;

· Transportation from distribution center to construction site;

· Wastage during distribution.

A5:

· Installation process;

· Transport of packaging waste to treatment site;

· Waste treatment of packaging.

The packaging material does not reach the end of waste state but is incinerated as waste.
According to European statistics, the average R1 value of incineration plants is > 0.6. Therefore, it is assumed that packaging material is treated thermally in an incineration plant with R1 > 0.6. The loads from the combustion process of packaging are declared in module A5 and the resulting energy benefits in module

D, as required by the *PCR Part A*, 5.5.2.

Use stage (B1-B7):

The use stage, related to the building fabric includes:

· B1, use or application of the installed product;

· B2, maintenance.

The use stage related to the operation of the building

includes:

· B6, operational energy use;

· B7, operational water use.

In this study, all use stage modules are assessed, though B1, B2 and B7 are assessed to be zero. By decision no. 20170712-n of the *SVR*, the modules B3, B4 and B5 are by default declared as "MNR" (module not relevant).
The modules include the provision and transport of all materials, products and related energy and water use, as well as waste processing up to the end-of-waste state or disposal of final residues during the use stage. They also include all impacts and aspects related to the losses during the use stage (i.e. production, transport, and waste processing and disposal of the lost products and materials).

Generally, the geographical coverage of the datasets used matches the actual processes taking place. Meaning, that when modelling taking place in Grundfos Bjerringbro, the Danish electricity grid mix is used in the model and thermal energy from natural gas. These are generally of very high quality with very good technological, temporal and geographical representativeness.

Contributions to operational energy use during the use stage (B6) come from the electricity consumption of the product. The annual electricity consumption is calculated by multiplying the average power input, which is based on a defined load profile, with the annual running hours. For use stage (B6) European Average electricity grid mix has been used. These values are declared in the scenarios section.

The End-of-Life stage (C1-C4) includes all activities from when the product reaches the end of its service life and no longer provides any functionality and until all materials and components are processed for reuse/recycling or disposed of.

According to *EN 15804* and the *PCR Part A,* the end-of-life stage includes:

· C1 deconstruction of the product from the

· building, including initial on-site sorting of the

· materials;

· C2 transportation of the discarded product to a recycling site and transportation of waste to final disposal;

· C3 waste processing, collection of waste fractions from the deconstruction and waste processing of material flows intended for reuse, recycling and energy recovery;

· C4 waste disposal including physical pretreatment and management of the disposal site.

At the end of life, the MAGNA3 pump is manually disassembled from the piping system in which it has been installed. The definition of the applied end-of-life scenario in this EPD follows the requirements in the

PCR Part A, 6.2 regarding complex products, with a combination of recycling, thermal waste treatment and landfilling. 100 % of the material is considered in the end of life scenario as required by the *PCR*. An overall collection rate of 90 % has been assumed.

Materials from which energy is recovered in an incineration process with an R1-value above 0.60 are in this study included with the environmental burdens from the incineration process inventoried in C3, the recovered energy is declared as exported energy in C3 and the energy benefits are declared in D. This procedure is according to the *PCR Part A*, 5.5.6. C3 includes the mechanical separation of the product followed by a series of sorting steps. Metal fractions are recycled and plastics, cardboard and electronics are assumed incinerated with energy recovery. The residual fractions are landfilled and declared in C4.

The specific amounts are shown in the scenarios section.

Beyond system boundary (D): According to *EN 15804* module D includes the reuse, recovery and/or recycling potentials, expressed as net impacts and benefits. Any declared benefits and loads from net

flows leaving the product system that have not been allocated as co-products and that have passed the end-of-waste state are included in module D.

Contributions to module D comes from waste incineration processes in A5 and C3 as well as material recycling in C3. The specific fractions and net flows are shown in the scenarios section.

Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to *EN 15804* and the building context, respectively the product-specific characteristics of performance, are taken into account.

Geographic Representativeness

Land or region, in which the declared product system is manufactured, used or handled at the end of the product´s lifespan: Germany

Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to *EN 15804* and the building context, respectively the product-specific characteristics of performance, are taken into account. Software and databases used: *LCA for Experts 10.7.1.28*
Schema 8007
Sphera and Ecoinvent databases

LCA: Scenarios and additional technical information

Characteristic product properties of biogenic carbon

The biogenic carbon content quantifies the amount of biogenic carbon in a construction product leaving the factory gate, and it will be separately declared for the product and for any accompanying packaging, as required from the *PCR Part A*. The Carbon content of Cardboard and Paper is assumed to 0.46 kg in 1 kg of material. This means that 46% biogenic carbon content is assumed Overall, there is an amount of weight-% Carbon in the product leaving the factory gate and has to be considered

Information on describing the biogenic Carbon Content at factory gate

Name	Value	Unit
Biogenic carbon content in accompanying packaging	0.9	kg C

Note: 1 kg of biogenic carbon is equivalent to 44/12 kg of CO2

Transport from the gate to the site (A4)

Name	Value	Unit
Litres of fuel	0,0332	l/100km
Transport distance	2003	km
Capacity utilisation (including empty runs)	85	%
Gross density of products transported	460	kg/m^3
Wastage during distribution	0,02	%

Installation into the building (A5)

Name	Value	Unit
Packaging waste for incineration (LDPE film)	0,02	kg
Packaging waste for incineration (Paper/Cardboard)	1,955	kg

An estimated RSL of 10 years can be used to facilitate building calculations. This is an EU consensus-based estimation, referenced in Appendix 7: Lot 11 – Circulators in Buildings, prepared by AEA Energy & Environment for the European Commission in the context of the Eco Design Directive.

Reference service life

Name	Value	Unit
Life Span according to the manufacturer	10	a

Operational energy use (B6)

Name	Value	Unit
Electricity consumption Group 1	985	kWh/a
Electricity consumption Group 2	1245	kWh/a
Electricity consumption Group 3	1600	kWh/a
Average power input, Group 1	0,197	kW
Average power input, Group 2	0,249	kW
Average power input, Group 3	0,32	kW
Running hours (all groups)	5.000	h/a

End of life (C1-C4)

Name	Value	Unit
Collected as mixed construction waste	22,871	kg
Transportation distance (C2)	500	km
Aluminium for recycling	2,74	kg
Steel for recycling	1,58	kg
Copper for recycling	0,60	kg
Stainless steel for recycling	12,76	kg
Plastics for incineration w/energy	1,40	kg
Electronics for incineration w/energy	0,80	kg
Landfilling	2,81	kg

Reuse, recovery and/or recycling potentials (D), relevant scenario information

Name	Value	Unit
A5, incineration w/energy recov. thermal energy	8,89	MJ
A5, incineration w/energy recov. electric energy	4,91	MJ
C3, steel for recycling (net amounts)	-0,469	kg
C3, stainless steel for recycling (net amounts)	3,93	kg
C3, aluminium for recycling (net amounts)	-0,436	kg
C3, copper for recycling (net amounts)	0,258	kg
C3, incineration w/energy recov. thermal energy	13,4	MJ
C3, incineration w/energy recov. electric energy	7,45	MJ

LCA: Results

Characterization model: *EN 15804* - 2012+A2 - 2019, PEF. By Decision no. 20170712-n of the IBU SVR, the modules B3, B4, B5 are marked as MNR (module not relevant) as default. The LCA results in module B6 are given on a period of one year, according to *PCR Part B*. To obtain the results from module B6 over the entire life cycle, the LCA results of module B6 must be multiplied by the estimated RSL of 10 years. The indicator results for module B6 are declared for Group 1. B6 indicator results for other groups can be derived by multiplying the B6 indicator results with the following factors:

GROUP 1 - MAGNA3 65-80: 1,00
GROUP 2 - MAGNA3 65-100: 1,265
GROUP 3 - MAGNA3 65-120: 1,626

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

Product stage			Construction process stage		Use stage							End of life stage				Benefits and loads beyond the system boundaries
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
X	X	X	X	X	X	X	MNR	MNR	MNR	X	X	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1PCS of MAGNA3 65-80/100/120

Parameter	Unit	A1	A2	A3	A4	A5	B1	B2	B6	B7	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq	1.19E+02	6.12E+00	6.92E-01	1.9E+00	3.17E+00	0	0	3.21E+02	0	0	7.85E-01	6.32E+00	1.46E-01	-1.21E+01
GWP-fossil	kg CO_2 eq	1.18E+02	6.12E+00	3.91E+00	1.91E+00	4.68E-01	0	0	3.18E+02	0	0	7.89E-01	6.3E+00	1.48E-01	-1.21E+01
GWP-biogenic	kg CO_2 eq	-1.82E-02	-9.84E-03	-3.25E +00	-2.81E-02	2.7E+00	0	0	2.76E+00	0	0	-1.17E-02	1.59E-02	-1.83E-03	-3.14E-02
GWP-luluc	kg CO_2 eq	7.48E-02	9.29E-03	3.04E-02	1.73E-02	9.55E-05	0	0	3.45E-02	0	0	7.33E-03	2.34E-04	1.34E-04	-3.16E-03
ODP	kg CFC11 eq	4.74E-08	4.8E-13	4.06E-09	1.07E-11	4.18E-13	0	0	5.86E-09	0	0	1.03E-13	3.45E-11	2.47E-13	-2.44E-11
AP	mol H^+ eq	8.61E-01	1.82E-01	1.94E-02	1.14E-02	8.6E-04	0	0	6.79E-01	0	0	4.75E-03	4.74E-03	4.57E-04	-1.12E-01
EP-freshwater	kg P eq	1.52E-03	4.79E-06	6.86E-05	7.18E-06	1.56E-07	0	0	1.19E-03	0	0	2.89E-06	9.76E-06	1.7E-05	-1.55E-05
EP-marine	kg N eq	9.35E-02	4.34E-02	4.06E-03	5.5E-03	3.15E-04	0	0	1.62E-01	0	0	2.31E-03	1.23E-03	1.09E-04	-1.31E-02
EP-terrestrial	mol N eq	1.01E+00	4.76E-01	4.07E-02	6.1E-02	3.95E-03	0	0	1.7E+00	0	0	2.57E-02	1.38E-02	1.2E-03	-1.41E-01
POCP	kg NMVOC eq	2.97E-01	1.23E-01	1.14E-02	1.05E-02	8.18E-04	0	0	4.33E-01	0	0	4.39E-03	3.29E-03	3.44E-04	-4.21E-02
ADPE	kg Sb eq	9.16E-03	1.13E-07	6.05E-05	1.97E-06	4.3E-09	0	0	4.91E-05	0	0	5.24E-08	2.88E-07	3.98E-09	-1.32E-03
ADPF	MJ	1.66E+03	7.61E+01	5.8E+01	2.62E+01	1.16E+00	0	0	6.69E+03	0	0	1.08E+01	4.01E+01	2.21E+00	-1.4E+02
WDP	m^3 world eq deprived	3.94E+01	2.05E-02	3.94E-02	3.19E-02	3.81E-01	0	0	7.08E+01	0	0	9.56E-03	8.66E-01	-2.06E-03	-8E-01

GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential)

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1PCS of MAGNA3 65-80/100/120

Parameter	Unit	A1	A2	A3	A4	A5	B1	B2	B6	B7	C1	C2	C3	C4	D
PERE	MJ	4.3E+02	1.26E+00	5.58E+01	2.03E+00	2.61E-01	0	0	4E+03	0	0	7.84E-01	2.35E+01	1.99E-01	3.04E+00
PERM	MJ	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PERT	MJ	1.26E+00	5.58E+01	2.03E+00	2.61E-01	0	0	0	4E+03	0	0	7.84E-01	2.35E+01	1.99E-01	3.04E+00
PENRE	MJ	1.66E+03	7.63E+01	5.8E+01	2.62E+01	1.16E+00	0	0	6.69E+03	0	0	1.08E+01	4.02E+01	2.22E+00	-1.4E+02
PENRM	MJ	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PENRT	MJ	1.66E+03	7.63E+01	5.8E+01	2.62E+01	1.16E+00	0	0	6.69E+03	0	0	1.08E+01	4.02E+01	2.22E+00	-1.4E+02
SM	kg	1.46E+01	0	2.31E-01	2.97E-03	0	0	0	0	0	0	0	0	0	0
RSF	MJ	1.46E-23	0	0	2.91E-27	0	0	0	0	0	0	0	0	0	0
NRSF	MJ	1.71E-22	0	0	3.42E-26	0	0	0	0	0	0	0	0	0	0
FW	m^3	1.17E+00	1.44E-03	2.32E-02	2.32E-03	8.98E-03	0	0	3.23E+00	0	0	8.59E-04	2.94E-02	2.31E-05	2.05E-02

PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels;

NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1PCS of MAGNA3 65-80/100/120

Parameter	Unit	A1	A2	A3	A4	A5	B1	B2	B6	B7	C1	C2	C3	C4	D
HWD	kg	7.01E-06	2.4E-10	1.21E-04	2.57E-08	2.94E-11	0	0	7.86E-07	0	0	3.35E-11	4.56E-09	1.85E-10	-2.44E-03
NHWD	kg	9.4E+00	7.8E-03	3.75E-01	6.09E-03	1.23E-01	0	0	4.9E+00	0	0	1.65E-03	6.6E-01	2.56E+00	2.1E+00
RWD	kg	5.61E-02	9.91E-05	1.78E-03	6.49E-05	5.29E-05	0	0	1.06E+00	0	0	2.02E-05	6.23E-03	2.6E-05	-2.52E-03
CRU	kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MFR	kg	0	0	0	0	0	0	0	0	0	0	0	1.77E+01	0	0
MER	kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
EEE	MJ	0	0	0	0	4.91E+00	0	0	0	0	0	0	7.45E+00	0	0
EET	MJ	0	0	0	0	8.89E+00	0	0	0	0	0	0	1.34E+01	0	0

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

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: 1PCS of MAGNA3 65-80/100/120

Parameter	Unit	A1	A2	A3	A4	A5	B1	B2	B6	B7	C1	C2	C3	C4	D
PM	Disease incidence	1.08E-05	3.15E-06	2.88E-07	7.41E-08	5.08E-09	0	0	5.71E-06	0	0	3.01E-08	3.01E-08	4.64E-09	-2.74E-06
IR	kBq U235 eq	7.53E+00	1.43E-02	2.85E-01	9.58E-03	8.25E-03	0	0	1.77E+02	0	0	3.02E-03	3.02E-03	3.85E-03	-2.13E-01
ETP-fw	CTUe	8.38E+02	5.39E+01	1.98E+01	1.84E+01	5.58E-01	0	0	1.86E+03	0	0	7.72E+00	7.72E+00	1.39E+00	-1.82E+01
HTP-c	CTUh	2.38E-05	1E-09	6.46E-07	5.27E-09	3.05E-11	0	0	9.84E-08	0	0	1.57E-10	1.57E-10	8.93E-11	-5.37E-07
HTP-nc	CTUh	1.79E-06	3.45E-08	4.24E-08	1.69E-08	1.14E-09	0	0	1.57E-06	0	0	6.97E-09	6.97E-09	7.63E-09	-7.24E-08
SQP	SQP	3.87E+02	5.86E+00	1.06E+02	1.08E+01	3.41E-01	0	0	2.62E+03	0	0	4.5E+00	4.5E+00	1.98E-01	-1.85E+01

PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); SQP = Potential soil quality index

Disclaimer 1 – for the indicator 'Potential Human exposure efficiency relative to U235'.
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 or radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – for the indicators 'abiotic depletion potential for non-fossil resources', 'abiotic depletion potential for fossil resources', 'water (user) deprivation potential, deprivation-weighted water consumption', 'potential comparative toxic unit for ecosystems', 'potential comparative toxic unit for humans – cancerogenic', 'Potential comparative toxic unit for humans - not cancerogenic', 'potential soil quality index'. The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high as there is limited experience with the indicator.

Disclaimer 3: *JRC Technical Reports, Version 2, 2018* Page 6, for the indicator "EP-freshwater". This indicator has been calculated as 'kg P eq' as required in the characterization model EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe; This EPD was created using a software tool.

References

Standards

Machinery Directive

DIRECTIVE 2006/42/EC OF THE EUROPEAN

PARLIAMENT AND OF THE COUNCIL of 17 May

2006 on machinery

Radio Equipment Directive

DIRECTIVE 2014/53/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of

radio equipment

Electromagnetic Compatibility (EMC) Directive

DIRECTIVE 2014/30/EU OF THE EUROPEAN

PARLIAMENT AND OF THE COUNCIL of 26 February

2014 on the harmonistion of the laws of the Member

States relating to electromagnetic compatibility

Ecodesign Directive

DIRECTIVE 2009/125/EC OF THE EUROPEAN

PARLIAMENT AND OF THE COUNCIL of 21 October

2009 establishing a framework for the setting of

ecodesign requirements for energy-related products

EC 641/2009

COMMISSION REGULATION (EC) No 641/2009 of 22 July 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for glandless standalone circulators and glandless circulators integrated in

products

EC 622/2012

COMMISSION REGULATION (EU) No 622/2012 of 11 July 2012 amending Regulation (EC) No 641/2009 with regard to ecodesign requirements for glandless standalone circulators and glandless circulators integrated in products

DIRECTIVE 2011/65/EU

DIRECTIVE 2011/65/EU OF THE EUROPEAN

PARLIAMENT AND OF THE COUNCIL of 8 June 2011

on the restriction of the use of certain hazardous

substances in electrical and electronic equipment

DIRECTIVE 2015/863/EU

DIRECTIVE 2015/863/EU of 31 March 2015 amending

Annex II to Directive 2011/65/EU of the European

Parliament and of the Council as regards the list of

restricted substances

ETSI EN 301 489-1

ETSI EN 301 489-1 V2.2.0, Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements

ETSI EN 301 489-17

ETSI EN 301 489-17 V3.2.0, Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for Broadband Data Transmission Systems

ETSI EN 300 328 V2.1.1

ETSI EN 300 328 V2.1.1, Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques

EN 809

EN 809:1998-10 + A1:2009, Pumps and pump units for

liquids - Common safety requirements

EN 55014-1

EN 55014-1:2017, Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission

EN 55014-2

EN 55014-2:2015, Electromagnetic compatibility –

Requirements for household appliances, electric tools

and similar apparatus – Part 2: Immunity – Product

family standard (CISPR 14-2:2015)

EN 50581:2012

EN 50581:2012, Technical documentation for the

assessment of electrical and electronic products with

respect to the restriction of hazardous substances

EN 60335-1

EN 60335-1:2012/A11:2014/A13:2017, Household

and similar electrical appliances – Safety – Part 1:General requirements

EN 60335-2-51

EN 60335-2-51:2003-03 + A1:2008 + A2:2012, Household and similar electrical appliances – Safety –Part 2-51: Particular requirements for stationary circulation pumps for heating and service water installations

EN 61000-3-2

EN 61000-3-2:2014/2019, Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current =16 A per phase)

EN 61000-3-3

EN 61000-3-3:2013-08/ A1:2019, Electromagnetic compatibility (EMC) – Part 3-3:
Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low voltage supply systems, for equipment with

rated current <= 16 A per phase and not subject to conditional connection

EN 61000-6-2

EN 61000-6-2:2008/2019, Electromagnetic compatibility (EMC) – Part 6-2: Generic standards –Immunity for industrial environments

EN 16297-1

EN 16297-1:2012-10, Pumps – Rotodynamic pumps – Glandless circulators – Part 1:
General requirements and procedures for testing and calculation of energy efficiency index (EEI)

EN 16297-2

EN 16297-2:2012-10, Pumps – Rotodynamic pumps – Glandless circulators – Part 2: Calculation of energy efficiency index (EEI) for standalone circulators

EN 16297-3

EN 16297-3:2012, Pumps – Rotodynamic pumps –Glandless circulators – Part 3: Energy efficiency index (EEI) for circulators integrated in products

ISO 14001

EN ISO 14001:2015-09, Environmental management systems - Requirements with guidance for use

ISO 14025

DIN EN /ISO 14025:2011-10, Environmental labels and declarations — Type III environmental declarations — Principles and procedures

EN 15804

EN 15804:2012-04+A1 2013, Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

PCR Part A

Institut Bauen und Umwelt e.V., Berlin (pub.): Product Category Rules for Building-Related Products and Services, Product Category Rules for Construction Products from the range of Environmental Product Declarations of Institut Bauen und Umwelt (IBU), Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report, Version 1.3.

PCR Part B

Institut Bauen und Umwelt e.V., Berlin (pub.): Product Category Rules for Building-Related Products and Services, Product Category Rules for Construction Products from the range of Environmental Product Declarations of Institut Bauen und Umwelt (IBU), Part B: Requirements on the EPD for Pumps for liquids and liquids with solids, Version 1.0 (2018)

Further references

CPR

REGULATION (EU) No 305/2011 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC

CML 2001

Impact assessment characterization factors Institute of Environmental Sciences, Leiden University, Netherlands

ECHA candidate list

Candidate List of substances of very high concern (SVHCs) for authorisation, European Chemicals Agency (ECHA), Helsinki, Finland

EUTREND model

Struijs et al., 2009b

AEA Energy & Environment

Circulators in Buildings

Ecoinvent

Ecoinvent v3.9.1

LCA for Experts

LCA for Experts 10.7.1.28Schema 8007

REACH
Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) (Status: 27.06.2018)

SVR

Advisory Board (formerly SVA)

Decision no.
20170712-n

Publisher

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ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A2*

Owner of the Declaration	Grundfos Holding A/S
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-GRU-20230080-CBC1-EN
Issue date	21/11/2023
Valid to	20/11/2028

MAGNA3 80-100/120 (Cast Iron)

Grundfos Holding A/S

Institut Bauen und Umwelt e.V.

ECO PLATFORM EPD VERIFIED

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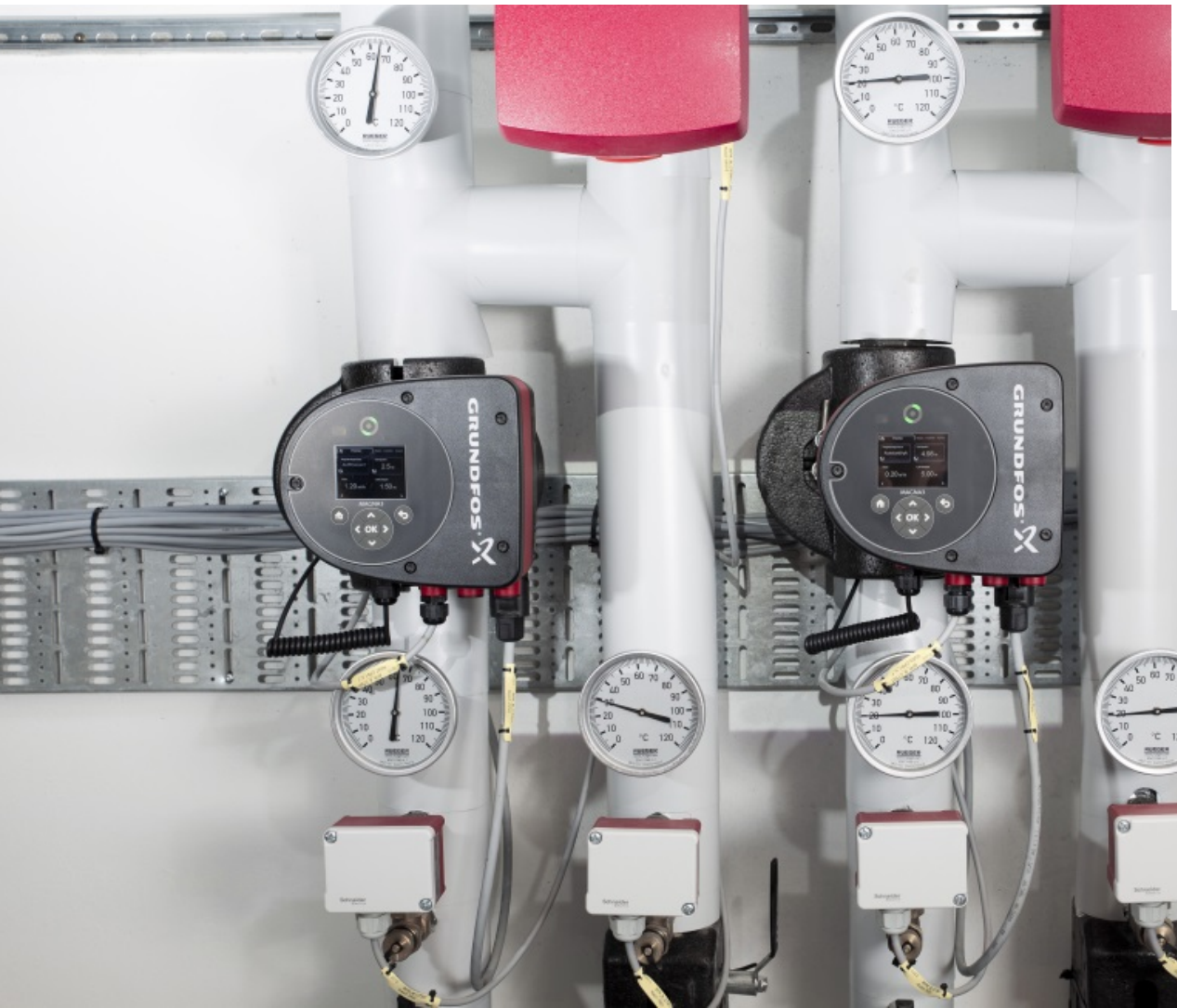

General Information

Grundfos Holding A/S

Programme holder

IBU – Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

Declaration number

EPD-GRU-20230080-CBC1-EN

This declaration is based on the product category rules:

Pumps for liquids and liquids with solids, 01/08/2021
(PCR checked and approved by the SVR)

Issue date

21/11/2023

Valid to

20/11/2028

Dipl.-Ing. Hans Peters
(Chairman of Institut Bauen und Umwelt e.V.)

Florian Pronold
(Managing Director Institut Bauen und Umwelt e.V.)

MAGNA3 80-100/120 (Cast Iron)

Owner of the declaration

Grundfos Holding A/S
Poul Due Jensens Vej 7
8850 Bjerringbro
Denmark

Declared product / declared unit

1 PCS. of MAGNA3 80-100/120 (Cast Iron)

Scope:

The declaration applies to 1 piece of MAGNA3 (Cast Iron) pump.

The product is produced in Wahlstedt, Germany, and the life cycle assessment is based on data collected at the production site.

Production has been modeled using annual production data from 2021.

The declaration covers two different types of the MAGNA3 80- product (100/120).

The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

The EPD was created according to the specifications of EN 15804+A2. In the following, the standard will be simplified as *EN 15804*.

Verification

The standard EN 15804 serves as the core PCR
Independent verification of the declaration and data according to ISO 14025:2011
☐ internally ☒ externally

Mrs Kim Allbury,
(Independent verifier)

Product

Product description/Product definition

The Grundfos MAGNA3 circulator pumps are designed for circulating liquids in heating systems, air conditioning and cooling systems and domestic hot water systems. However, the pump range can also be used in ground source heat pump systems and solar heating systems.

The MAGNA3 pump is a centrifugal pump powered by an electrical motor. It has a high-performance neodymium magnet rotor which increases motor efficiency and an insulation shell to reduce heat loss from the cast iron pump housing with threaded connections.

The declaration covers two types of the MAGNA3 pump. They are grouped as shown below. The group reference in the technical data and scenarios refers also to these.

GROUP 1 - MAGNA3 80-100

GROUP 2 - MAGNA3 80-120

These are all the same physical products and 100 % identical in terms of design, dimensions and materials as well as supply chain and manufacturing processes, i.e., all cradle to gate processes (A1-A3).

The products are also identical in terms of packaging, distribution, reference service life and end-of-life treatment.

The only thing that differentiates the products from each other is the software which controls how the pump operates in the system in which it is installed, making them fit for different applications. Hence, all life cycle modules are identical, except use stage module B6, which will change, as the applied scenarios for electricity consumption changes. For the placing on the market in the European Union/European Free Trade Association (EU/EFTA) (with the exception of Switzerland) the following
legal provisions apply:

Machinery
Directive (2006/42/EC)

Standard used: *EN 809:1998 + A1:2009.*

Radio Equipment
Directive (2014/53/EU)

Standards used:
EN 60335-1:2012/AC:2014 + A11:2014, EN 60335-2-51:2003 + A1:2008 + A2:2012,
EN 62233:2008.

EN 55014-1:2006
+ A1:2009 + A2:2011, EN 55014-1:2017, EN 61000-6-2:2005, EN 61000-3-2:2014, EN
61000-3-3:2013, ETSI EN 301 489-1 V2.2.0, ETSI EN 301 489-17 V3.2.0. ETSI EN 300 328 V2.1.1

Electromagnetic
Compatibility (EMC) Directive (2014/30/EU)

Standards used: *EN 55014-1:2017, EN 55014-2:2015,*

EN
61000-3-2:2014/2019, EN 61000-6-2:2008/2019,

EN 61000-3-3:2013
A1:2019

RoHS Directive
2011/65/EU and 2015/863//EU

Standard: *EN 50581:2012.*

Ecodesign
Directive (2009/125/EC)

Commission
Regulation (EC) No: 641/2009 and

Commission Regulation
(EU) 622/2012

Standards used:
EN 16297-1:2012, EN 16297-2:2012, EN 16297-3:2012.

The CE marking takes into account the proof of conformity with the respective harmonized norms based on the legal provisions above.

MAGNA3 pumps
are not harmonized in accordance with the *CPR*.

Application
For the application and use the respective national

provisions apply.

The pump is designed for circulating liquids in the

following systems:

· heating systems

· domestic hot-water systems

· air-conditioning and cooling systems

· ground-source heat-pump systems

· solar-heating systems

The pump is suitable for thin, clean, non-aggressive and non-explosive liquids, not containing solid particles or fibres that may attack the pump mechanically or chemically. In heating systems, the water must meet the requirements of accepted standards on water quality in heating systems. The pumps are also suitable for domestic hot-water systems.

Technical Data
The performance
data of the product according to the harmonized norms, based on the
harmonization provisions above apply.

The relevant
technical specifications according to the *PCR Part B* are given in
the table below.

Characteristics
that are the same for all product groups are only given once. Others are
given individually for all two groups.

Constructional data

Name	Value	Unit
Frequency	50	Hz
Voltage	230	V
Pumped liquid (e.g. water)	Clean Water	-
Energy Efficiency Index Gr.1	0,17	
Energy Efficiency Index Gr.2	0,17	
Flow range Gr. 1 (max)	61,0	m3/h
Flow range Gr. 2 (max)	61,0	m3/h
Head max. Gr.1	10	m
Head max. Gr. 2	12	m
Power input Gr. 1 Average (from load profile describing use)	0,413	kW
Power input Gr. 2 Average (from load profile describing use)	0,52	kW
Nominal capacity Gr.1	1,02	kW
Nominal capacity Gr.2	1,271	kW

Performance
data of the product according to the

harmonized
standards, based on provisions for harmonization.

Base materials/Ancillary materials

Base materials / Ancillary materials

Name	Value	Unit
Aluminium	12	%
Cast iron	55	%
Ceramics	0,2	%
Copper	4	%
Electronics	0,2	%
Magnet Nd	1	%
Paper	0,4	%
PCB	3	%
Plastics	0,3	%
Plastics, foam	1	%
Plastics GF	4	%
Rubber	0,1	%
Stainless steel	4	%
Steel	9	%
Cardboard	7	%
Plastic film	0,1	%
TOTAL	100	%

REACH

This product/article/at
least one partial article contains

substances
listed in the *ECHA candidate list* (date:

10.06.2022)
exceeding 0.1 percentage by mass: **no**

The Wahlstedt
production has been assessed and certified as meeting the requirements in *ISO 14001,*
ISO 50001, ISO 45001 and ISO 9001.

Reference service life

No use stage
scenario which refers to the lifetime of the product is declared. However, to
facilitate building calculations, an estimated RSL of 10 years can be used.
This is an EU consensus-based estimation, referenced on page 37 in Appendix 7: *Lot*
11 – Circulators in Buildings, prepared by AEA Energy & Environment for
the European Commission in the context of the Eco Design Directive:

There is no
definitive information on the average circulator life available, there is consensus
within the industry that it is at least 12 years. However, this is complicated by
many factors, including many being scrapped prematurely when e.g. the
boiler they are connected to is replaced.

From the
estimated stock (140Mpa) and annual sales (14Mpa), the average lifetime of
the circulator is taken as 10 years for the purposes of this study.

The RSL of the
declared product is not directly influencing the results in this study, as no
declared use stage scenario is dependent on the RSL; The use stage sub-module
B6 is declared per year as required by the *PCR Part B.*

LCA: Calculation rules

Declared Unit

The declared
unit is 1 piece (pcs.) of MAGNA3 (Cast Iron) pump.

Declared unit

Name	Value	Unit
Declared unit	1	pce.
Mass reference	34.4	kg/pce
Conversion factor [Mass/Declared Unit]	34.4	

For IBU core EPDs (where clause 3.6 is part of the EPD): for average EPDs, an estimate of the robustness of the LCA values must be made, e.g. concerning the variability of the production process, geographical representativeness and the influence of background data and preliminary products compared to the environmental impacts caused by the actual production.

System boundary

This EPD is
Cradle-To-Grave. The system boundaries

of the EPD
follow the modular approach in *EN 15804*. By decision no. 20170712-n of
the *SVR*, the modules B3, B4 and B5 are by default declared as
"MNR" (module not relevant).

The product
stage (A1-A3) comprises raw

material extraction and processing, transport processes as well as the
manufacturing process. The final production and assembly of the MAGNA3 pump
takes place at a Grundfos manufacturing site in Germany. However, the full
supply-chain leading to the finished product at the gate is rather complex and
includes a large amount of raw materials, components and semi-finished parts
which come from both external suppliers as well as other Grundfos production
facilities.

The product
stage is included in the study, and according to *EN 15804* the system
boundary with nature is set to include those processes that provide the
material and energy inputs into the system and the following manufacturing,
transport up to the factory gate as well as the processing any waste arising
from those processes.

Wastes and
losses are included in the modules where they occur according to the polluter
pays principle and the modular approach of *EN 15804.*

The
product includes:

.
A1 Extraction and processing of raw materials;

.
A1 Reuse of products or materials from a previous product system;

.
A1 Processing of secondary materials;

.
A1 Generation of electricity, steam and heat from primary energy resources,
also including their extraction, refining and transport;

.
A1 Energy recovery and other recovery processes from secondary fuels;

.
A2 Transportation up to the factory gate and internal transport;

.
A3 Production of ancillary materials or pre products;

.
A3 Manufacturing of products and coproducts;

.
A3 Manufacturing of packaging;

.
A1-A3 processing up to the end-of-waste state or disposal of final residues.

For secondary
material inputs, the system boundary to the previous system (providing the
secondary material) is set where outputs reach the end-of-waste state. The
recycling of secondary material into new raw materials is included in the
system boundary of this study. Waste

materials from
production processes that are recycled without any modification of the material's
inherent characteristics are modelled as closed-loop within A1-A3. This is done
up to the input mass flow that was used during production.

Waste for
incineration arising in the product stage is accounted for in the module where
the waste is produced. The environmental loads from the incineration process
are declared in the module where it occurs and the electricity and heat which
is produced from the incineration are considered as closed-loop

within A1-A3, as described in *PCR Part A,* 5.5.1. The input of biogenic carbon from the production of packaging material is inventoried in A3. As required by *PCR Part A*, the corresponding end-of-life module of the packaging material, A5, is also declared and the emissions of biogenic carbon are inventoried.

The construction process stage (A4-A5) includes:

A4:

.
Transportation from factory gate to distribution center:

.
Consumption of electricity, thermal energy and water at distribution center;

.
Transportation from distribution center to construction site;

.
Wastage during distribution.

A5:

.
Installation process;

.
Transport of packaging waste to treatment site;

.
Waste treatment of packaging.

The packaging material does not reach the end of waste state but is incinerated as waste. According to European statistics, the average R1 value of incineration plants is > 0.6. Therefore, it is assumed that packaging material is treated thermally in an incineration plant with R1 > 0.6. The loads from the combustion process of packaging are declared in module A5 and the resulting energy benefits in module D, as required by the *PCR Part A*, 5.5.2.

Use stage (B1-B7):

The use stage, related to the building fabric includes:

.
B1, use or application of the installed product;

.
B2, maintenance.

The use stage related to the operation of the building includes:

.
B6, operational energy use;

.
B7, operational water use.

In this study, all use stage modules are assessed, though B1, B2 and B7 are assessed to be zero. By decision no. 20170712-n of the *SVR*, the modules B3, B4 and B5

are by default declared as "MNR" (module not relevant).
The modules include the provision and transport of all materials, products and related energy and water use, as well as waste processing up to the end-of-waste state or disposal of final residues during the use stage. They also include all impacts and aspects related to the losses during the use stage (i.e. production, transport, and waste processing and disposal of the lost products and materials).

Generally, the geographical coverage of the datasets used matches the actual processes taking place. Meaning, that when modelling taking place in Grundfos Bjerringbro, the Danish electricity grid mix is used in the model and thermal energy from natural gas. These are generally of very high quality with very good technological, temporal and geographical representativeness.

Contributions to operational energy use during the use stage (B6) come from the electricity consumption of the product. The annual electricity consumption is calculated by multiplying the average power input, which is based on a defined load profile, with the annual running hours. For use stage (B6) European Average electricity grid mix has been used. These values are declared in the scenarios section.

The End-of-Life stage (C1-C4) includes all activities from when the product reaches the end of its service life and no longer provides any functionality and until all materials and components are processed for reuse/recycling or disposed of.

According to *EN 15804* and the *PCR Part A,* the end-of-life stage includes:

. C1 deconstruction of the product from the building, including initial on-site sorting of the materials;

. C2 transportation of the discarded product to a recycling site and transportation of waste to final disposal;

. C3 waste processing, collection of waste fractions from the deconstruction and waste processing of material flows intended for reuse, recycling and energy recovery;

. C4 waste disposal including physical pretreatment and management of the disposal site.

At the end of life, the MAGNA3 pump is manually disassembled from the piping system in which it has been installed. The definition of the applied end-of-life scenario in this EPD follows the requirements in the *PCR Part A*, 6.2 regarding complex products, with a combination of recycling, thermal waste treatment and landfilling. 100 % of the material is considered in the end of life scenario as required by the *PCR*. An

overall collection rate of 90 % has been assumed.

Materials from
which energy is recovered in an incineration process with an R1-value above 0.60
are in this study included with the environmental burdens from the incineration
process inventoried in C3, the recovered energy is declared as exported energy
in C3

and the energy
benefits are declared in D. This procedure is according to the *PCR Part A*,
5.5.6. C3 includes the mechanical separation of the product followed by a
series of sorting steps. Metal fractions are recycled and plastics, cardboard
and electronics are assumed incinerated with energy recovery. The residual
fractions are landfilled and declared in C4.

The specific
amounts are shown in the scenarios section.

Beyond system boundary (D): According to *EN 15804* module D includes the reuse, recovery and/or recycling potentials,
expressed as net impacts and benefits. Any declared benefits and loads from net
flows leaving
the product system that have not been allocated as co-products and that have
passed the end-of-waste state are included in module D.

Contributions
to module D comes from waste incineration processes in A5 and C3 as well as
material recycling in C3. The specific fractions and net flows are shown in the
scenarios section.

Geographic Representativeness
Land or region, in which the declared product system is manufactured, used or handled at the end of the product´s lifespan: Europe

Comparability
Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to *EN 15804* and the building context, respectively the product-specific characteristics of performance, are taken into account. Software
and databases used: *GaBi ts*

9.2.1.68
(database schema 8007) *Ecoinvent v3.5.*.

LCA: Scenarios and additional technical information

Characteristic product properties of biogenic carbon
The biogenic carbon content quantifies the amount of biogenic carbon in a construction product leaving the factory gate, and it will be separately declared for the product and for any accompanying packaging, as required from the *PCR Part A.* The Carbon content of Cardboard and Paper is assumed to 0.46 kg
C. Overall, there is an amount of 9 weight-% Carbon in the product leaving the factory gate and has to be considered

Information on describing the biogenic Carbon Content at factury gate

Name	Value	Unit
Biogenic carbon content in accompanying packaging	0.74	kg C

Note: 1 kg of biogenic carbon is equivalent to 44/12 kg of CO2

The following technical scenario information is required for the declared modules and optional for non-declared modules. Modules for which no information is declared can be deleted; additional information can also be listed if necessary.

The following technical information is a basis for the declared modules or can be used for developing specific scenarios in the context of a building assessment if modules are not declared (MND).

A5 is not declared including the disposal of the packaging material on the construction site, the amounts of packaging materials included in the LCA calculations must be declared as technical scenario information for Module A5.

Transport from the gate to the site (A4)

Name	Value	Unit
Litres of fuel	0,0332	l/100km
Transport distance	2003	km
Capacity utilisation (including empty runs)	85	%
Gross density of products transported	716	kg/m^3
Wastage during distribution	0,02	%

Installation into the building (A5)

Name	Value	Unit
Packaging waste for incineration (LDPE film)	0,031	kg
Packaging waste for incineration (Paper/Cardboard)	2,35	kg

An estimated
RSL of 10 years can be used to facilitate building calculations. This is an EU
consensus-based estimation, referenced in Appendix 7: Lot 11 – Circulators in
Buildings, prepared by AEA Energy & Environment for the European Commission
in the context of the Eco Design Directive.

Reference service life

Name	Value	Unit
Life Span according to the manufacturer	10	a

Operational energy use (B6)

Name	Value	Unit
Electricity consumption Group 1	2065	kWh/a
Electricity consumption Group 2	2600	kWh/a
Average power input, Group 1	0,413	kW
Average power input, Group 2	0,520	kW
Running hours (all groups)	5.000	h/a

End of life (C1-C4)

Name	Value	Unit
Collected as mixed construction waste	29,95	kg
Transportation distance (C2)	500	km
Aluminium for recycling	3,43	kg
Steel for recycling	18,3	kg
Copper for recycling	1,05	kg
Stainless steel for recycling	1,06	kg
Plastics for incineration w/energy	1,5	kg
Electronics for incineration w/energy	0,81	kg
Landfilling	3,8	kg

Reuse, recovery and/or recycling potentials (D), relevant scenario information

Name	Value	Unit
A5, incineration w/energy recov. (LDPE foil)	5,21	MJ
A5, incineration w/energy recov. (Paper/Cardboard)	9,46	MJ
C3, steel for recycling (net amounts)	-1,49	kg
C3, stainless steel for recycling (net amounts)	0,5	kg
C3, aluminium for recycling (net amounts)	-0,469	kg
C3, copper for recycling (net amounts)	0,451	kg
C3, plastics for incineration, w/ energy recov.	1,51	kg
C3, electronics for incineration, w/ energy recov.	0,81	kg

LCA: Results

Characterization model: *EN 15804* - 2012+A2 - 2019, PEF. By Decision no. 20170712-n of the IBU SVR, the modules B3, B4, B5 are marked as MNR (module not relevant) as default. The LCA results in module B6 are given on a period of one year, according to *PCR Part B*. To obtain the results from module B6 over the entire life cycle, the LCA results of module B6 must be multiplied by the estimated RSL of 10 years. The indicator results for module B6 are declared for Group 1. B6 indicator results for other groups can be derived by multiplying the B6 indicator results with the following factors:
Group 2: 1,259

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; ND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

Product stage			Construction process stage		Use stage							End of life stage				Benefits and loads beyond the system boundaries
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	MND	MND	MNR	MNR	MNR	X	MND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1PCS of MAGNA3 80-100/120 (Cast Iron)

Parameter	Unit	A1	A2	A3	A4	A5	B6	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq	1.28E+02	1.87E+00	4.99E-01	2.02E+00	3.42E+00	8.35E+02	0	8.34E-01	7.79E+00	1.9E-01	-1.87E-01
GWP-fossil	kg CO_2 eq	1.27E+02	1.86E+00	4.45E+00	2E+00	1.68E-01	8.31E+02	0	8.28E-01	7.77E+00	1.96E-01	-1.83E-01
GWP-biogenic	kg CO_2 eq	6.66E-01	-2.67E-03	-3.99E+00	-3.98E-03	3.25E+00	2.77E+00	0	-1.4E-03	9E-03	-5.9E-03	2.81E-04
GWP-luluc	kg CO_2 eq	2.4E-01	1.39E-02	3.93E-02	1.59E-02	1.16E-04	1.2E+00	0	6.74E-03	4.45E-03	1.72E-04	-4.52E-03
ODP	kg CFC11 eq	9.98E-08	3.29E-16	4.07E-09	2.08E-11	6.25E-16	1.83E-11	0	1.53E-16	6.7E-14	4.4E-16	-9.29E-13
AP	mol H^+ eq	6.3E-01	1.25E-02	1.81E-02	1.16E-02	9.86E-04	1.84E+00	0	4.89E-03	7.5E-03	6.08E-04	-2.08E-02
EP-freshwater	kg P eq	1.69E-03	5.25E-06	7.38E-05	6.34E-06	1.43E-07	2.22E-03	0	2.53E-06	1.18E-05	2.14E-05	-5.14E-06
EP-marine	kg N eq	8.28E-02	4.53E-03	3.68E-03	5.57E-03	3.6E-04	4.08E-01	0	2.36E-03	1.78E-03	1.4E-04	-4.77E-04
EP-terrestrial	mol N eq	8.71E-01	5.01E-02	3.68E-02	6.17E-02	4.47E-03	4.28E+00	0	2.61E-02	1.96E-02	1.54E-03	-4.56E-03
POCP	kg NMVOC eq	2.6E-01	1.01E-02	1.04E-02	1.06E-02	9.4E-04	1.12E+00	0	4.48E-03	4.86E-03	4.52E-04	-1.93E-03
ADPE	kg Sb eq	7.51E-03	1.42E-07	6.09E-05	1.68E-06	1.04E-08	2.41E-04	0	6.73E-08	8.82E-07	1.32E-08	-1.26E-03
ADPF	MJ	1.71E+03	2.47E+01	6.15E+01	2.69E+01	1.18E+00	1.46E+04	0	1.11E+01	5.45E+01	2.81E+00	-2.03E+01
WDP	m^3 world eq deprived	2.79E+01	1.7E-02	3.41E-01	2.65E-02	4.21E-01	1.81E+02	0	8.11E-03	1.14E+00	-2.16E-03	-8.43E-01

GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential)

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1PCS of MAGNA3 80-100/120 (Cast Iron)

Parameter	Unit	A1	A2	A3	A4	A5	B6	C1	C2	C3	C4	D
PERE	MJ	4.89E+02	1.33E+00	6.04E+01	1.67E+00	2.03E-01	6.48E+03	0	6.42E-01	2.37E+01	1.97E-01	5.44E+00
PERM	MJ	0	0	0	0	0	0	0	0	0	0	0
PERT	MJ	4.89E+02	1.33E+00	6.04E+01	1.67E+00	2.03E-01	6.48E+03	0	6.42E-01	2.37E+01	1.97E-01	5.44E+00
PENRE	MJ	1.71E+03	2.48E+01	6.15E+01	2.7E+01	1.18E+00	1.46E+04	0	1.11E+01	5.45E+01	2.81E+00	-2.01E+01
PENRM	MJ	0	0	0	0	0	0	0	0	0	0	0
PENRT	MJ	1.71E+03	2.48E+01	6.15E+01	2.7E+01	1.18E+00	1.46E+04	0	1.11E+01	5.45E+01	2.81E+00	-2.01E+01
SM	kg	2.48E+01	0	2.38E-01	5.02E-03	0	0	0	0	0	0	0
RSF	MJ	1.46E-23	0	0	2.91E-27	0	0	0	0	0	0	0
NRSF	MJ	1.71E-22	0	0	3.42E-26	0	0	0	0	0	0	0
FW	m^3	8.98E-01	1.55E-03	3.09E-02	2.02E-03	9.93E-03	7.49E+00	0	7.48E-04	3.84E-02	3.57E-05	2.61E-02

PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1PCS of MAGNA3 80-100/120 (Cast Iron)

Parameter	Unit	A1	A2	A3	A4	A5	B6	C1	C2	C3	C4	D
HWD	kg	4.67E-04	1.06E-06	1.22E-04	1.33E-06	6.11E-09	6.05E-06	0	5.15E-07	2.65E-08	1.13E-08	-3.12E-04
NHWD	kg	5.35E+00	3.83E-03	3.07E-01	5.61E-03	1.12E-01	1.04E+01	0	1.77E-03	8E-01	3.22E+00	2.14E+00
RWD	kg	7.58E-02	4.44E-05	1.69E-03	7.1E-05	5.67E-05	2.22E+00	0	2.05E-05	8.1E-03	3.36E-05	-1.65E-03
CRU	kg	0	0	0	0	0	0	0	0	0	0	0
MFR	kg	0	0	0	0	0	0	0	0	2.38E+01	0	0
MER	kg	0	0	0	0	0	0	0	0	0	0	0
EEE	MJ	0	0	0	0	5.21E+00	0	0	0	0	0	0
EET	MJ	0	0	0	0	9.46E+00	0	0	0	1.43E+01	0	0

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

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: 1PCS of MAGNA3 80-100/120 (Cast Iron)

Parameter	Unit	A1	A2	A3	A4	A5	B6	C1	C2	C3	C4	D
PM	Disease incidence	7.9E-06	1.38E-07	2.51E-07	6.91E-08	5.56E-09	1.54E-05	0	2.86E-08	6.33E-08	6.2E-09	-3.32E-07
IR	kBq U235 eq	8.3E+00	6.54E-03	2.67E-01	9.97E-03	8.74E-03	3.64E+02	0	3.03E-03	1.33E+00	4.78E-03	-1.11E-01
ETP-fw	CTUe	9.4E+02	1.84E+01	1.95E+01	1.97E+01	5.93E-01	6.25E+03	0	8.31E+00	2.36E+01	1.98E+00	-1.17E+01
HTP-c	CTUh	1.66E-06	3.79E-10	6.61E-07	8.74E-10	2.91E-11	1.73E-07	0	1.72E-10	7.03E-10	1.13E-10	-6.42E-08
HTP-nc	CTUh	2.8E-06	2.07E-08	6.13E-08	2.38E-08	1.36E-09	6.36E-06	0	9.86E-09	2.79E-08	9.89E-09	-9.39E-09
SQP	SQP	5.11E+02	8.02E+00	1.17E+02	9.32E+00	3.2E-01	4.65E+03	0	3.9E+00	1.72E+01	2.03E-01	-2.51E+01

PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); SQP = Potential soil quality index

Disclaimer
1 – for the indicator 'Potential Human exposure Efficiency relative to U235'. 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 or radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – for the indicators 'abiotic depletion potential for non-fossil resources', 'abiotic depletion potential for fossil resources', 'water (user) deprivation potential, deprivation-weighted water consumption', 'potential comparative toxic unit for ecosystems', 'potential comparative toxic unit for humans – cancerogenic', 'Potential comparative toxic unit for humans - not cancerogenic', 'potential soil quality index'. The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high as there is limited experience with the indicator.

Disclaimer 3: *JRC Technical Reports, Version 2, 2018* Page 6, for the indicator "EP-freshwater". This indicator has been calculated as 'kg P eq' as required in the characterization model EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe; This EPD was created using a software tool.

References

Standards

Machinery Directive

DIRECTIVE
2006/42/EC OF THE EUROPEAN

PARLIAMENT AND
OF THE COUNCIL of 17 May

2006 on
machinery

Radio Equipment Directive

DIRECTIVE
2014/53/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 April 2014 on
the harmonisation of the laws of the Member States relating to the making
available on the market of

radio equipment

Electromagnetic Compatibility (EMC) Directive

DIRECTIVE
2014/30/EU OF THE EUROPEAN

PARLIAMENT AND
OF THE COUNCIL of 26 February

2014 on the
harmonization of the laws of the Member

States relating
to electromagnetic compatibility

Ecodesign Directive

DIRECTIVE
2009/125/EC OF THE EUROPEAN

PARLIAMENT AND
OF THE COUNCIL of 21 October

2009
establishing a framework for the setting of

eco-design
requirements for energy-related products

EC 641/2009

COMMISSION
REGULATION (EC) No 641/2009 of 22 July 2009 implementing Directive 2005/32/EC
of the European Parliament and of the Council with regard to eco-design
requirements for glandless standalone circulators and glandless circulators
integrated in

products

EC 622/2012

COMMISSION
REGULATION (EU) No 622/2012 of 11 July 2012 amending Regulation (EC) No
641/2009 with regard to eco-design requirements for glandless standalone
circulators and glandless circulators integrated in products

and services; Part 1: Common technical requirements

DIRECTIVE 2011/65/EU

DIRECTIVE 2011/65/EU OF THE EUROPEAN

PARLIAMENT AND OF THE COUNCIL of 8 June 2011

on the restriction of the use of certain hazardous

substances in electrical and electronic equipment

DIRECTIVE 2015/863/EU

DIRECTIVE 2015/863/EU of 31 March 2015 amending

Annex II to Directive 2011/65/EU of the European

Parliament and of the Council as regards the list of

restricted substances

ETSI EN 301 489-1

ETSI EN 301 489-1 V2.2.0, Electromagnetic Compatibility (EMC) standard for radio equipment

ETSI EN 301 489-17

ETSI EN 301 489-17 V3.2.0, Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for Broadband Data Transmission Systems

ETSI EN 300 328 V2.1.1

ETSI EN 300 328 V2.1.1, Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques

EN 809

EN 809:1998-10 + A1:2009, Pumps and pump units for

liquids - Common safety requirements

EN 55014-1

EN
55014-1:2017, Electromagnetic compatibility – Requirements for household
appliances, electric tools and similar apparatus – Part 1: Emission

EN 55014-2

EN
55014-2:2015, Electromagnetic compatibility –

Requirements
for household appliances, electric tools

and similar
apparatus – Part 2: Immunity – Product

family standard
(CISPR 14-2:2015)

EN 50581:2012

EN 50581:2012,
Technical documentation for the

assessment of
electrical and electronic products with

respect to the
restriction of hazardous substances

EN 60335-1

EN
60335-1:2012/A11:2014/A13:2017, Household

and similar
electrical appliances – Safety – Part 1:General requirements

EN 60335-2-51

EN 60335-2-51:2003-03
+ A1:2008 + A2:2012, Household and similar electrical appliances – Safety –Part
2-51: Particular requirements for stationary circulation pumps for heating and
service water installations

EN 61000-3-2

EN
61000-3-2:2014/2019, Electromagnetic compatibility (EMC) – Part 3-2: Limits –
Limits for harmonic current emissions (equipment input current =16 A per phase)

EN 61000-3-3

EN
61000-3-3:2013-08/ A1:2019, Electromagnetic compatibility (EMC) – Part 3-3:
Limits – Limitation of voltage changes, voltage fluctuations and flicker in
public low voltage supply systems, for equipment with

rated current
<= 16 A per phase and not subject to conditional connection

EN 61000-6-2

EN
61000-6-2:2008/2019, Electromagnetic compatibility (EMC) – Part 6-2: Generic
standards –Immunity for industrial environments

EN 16297-1

EN
16297-1:2012-10, Pumps – Rotodynamic pumps –Glandless circulators – Part 1:
General requirements and procedures for testing and calculation of energy
efficiency index (EEI)

EN 16297-2

EN
16297-2:2012-10, Pumps – Rotodynamic pumps –Glandless circulators – Part 2:
Calculation of energy efficiency index (EEI) for standalone circulators

EN 16297-3

EN
16297-3:2012, Pumps – Rotodynamic pumps –Glandless circulators – Part 3: Energy
efficiency index (EEI) for circulators integrated in products

ISO 14001

EN ISO
14001:2015-09, Environmental management systems - Requirements with guidance
for use

ISO 14025

DIN EN /ISO
14025:2011-10, Environmental labels and declarations — Type III environmental
declarations — Principles and procedures

EN 15804

EN
15804:2012-04+A1 2013, Sustainability of construction works — Environmental
Product Declarations — Core rules for the product category of construction
products

PCR Part A

Institut Bauen
und Umwelt e.V., Berlin (pub.): Product Category Rules for Building-Related
Products and Services, Product Category Rules for Construction Products from
the range of Environmental Product Declarations of Institut Bauen und Umwelt
(IBU), Part A: Calculation Rules for the Life Cycle Assessment and Requirements
on the Project Report, Version 1.7 (2021)

PCR
Part B

Institut Bauen
und Umwelt e.V., Berlin (pub.): Product Category Rules for Building-Related
Products and Services, Product Category Rules for Construction Products from
the range of Environmental Product Declarations of Institut Bauen und Umwelt
(IBU), Part B: Requirements on the EPD for Pumps for liquids and liquids with
solids, Version 1.0 (2018)

Further references

CPR

REGULATION (EU)
No 305/2011 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 9 March 2011
laying down harmonised conditions for the marketing of construction products
and repealing Council Directive 89/106/EEC

CML 2001

Impact
assessment characterization factors Institute of Environmental Sciences, Leiden
University, Netherlands

ECHA candidate list

Candidate List
of substances of very high concern (SVHCs) for authorization, European
Chemicals Agency (ECHA), Helsinki, Finland

Ecoinvent

Ecoinvent v3.5

GaBi ts

GaBi ts 9.2.1.68
(database schema 8007)

REACH

Regulation (EC)
No 1907/2006 of the European Parliament and of the Council of 18 December 2006
concerning the Registration, Evaluation, Authorization and Restriction of
Chemicals (REACH) (Status: 27.06.2018)

SVR

Advisory Board

(formerly SVA)

Decision no.
20170712-n

The literature referred to in the
Environmental Product Declaration must be listed in full.

Standards
already fully quoted in the EPD do not need to be listed here

again.

The current
version of PCR Part A and PCR Part B of the PCR document
on which they are
based must be referenced

.

The literature referred to in the Environmental Product Declaration must be listed in full.Standards already fully quoted in the EPD do not need to be listed here again.
The current version of PCR Part A and PCR Part B of the PCR document on which they are based must be referenced.

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ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A2*

Owner of the Declaration	Grundfos Holding A/S
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-GRU-20230081-CBC1-EN
Issue date	21/11/2023
Valid to	20/11/2028

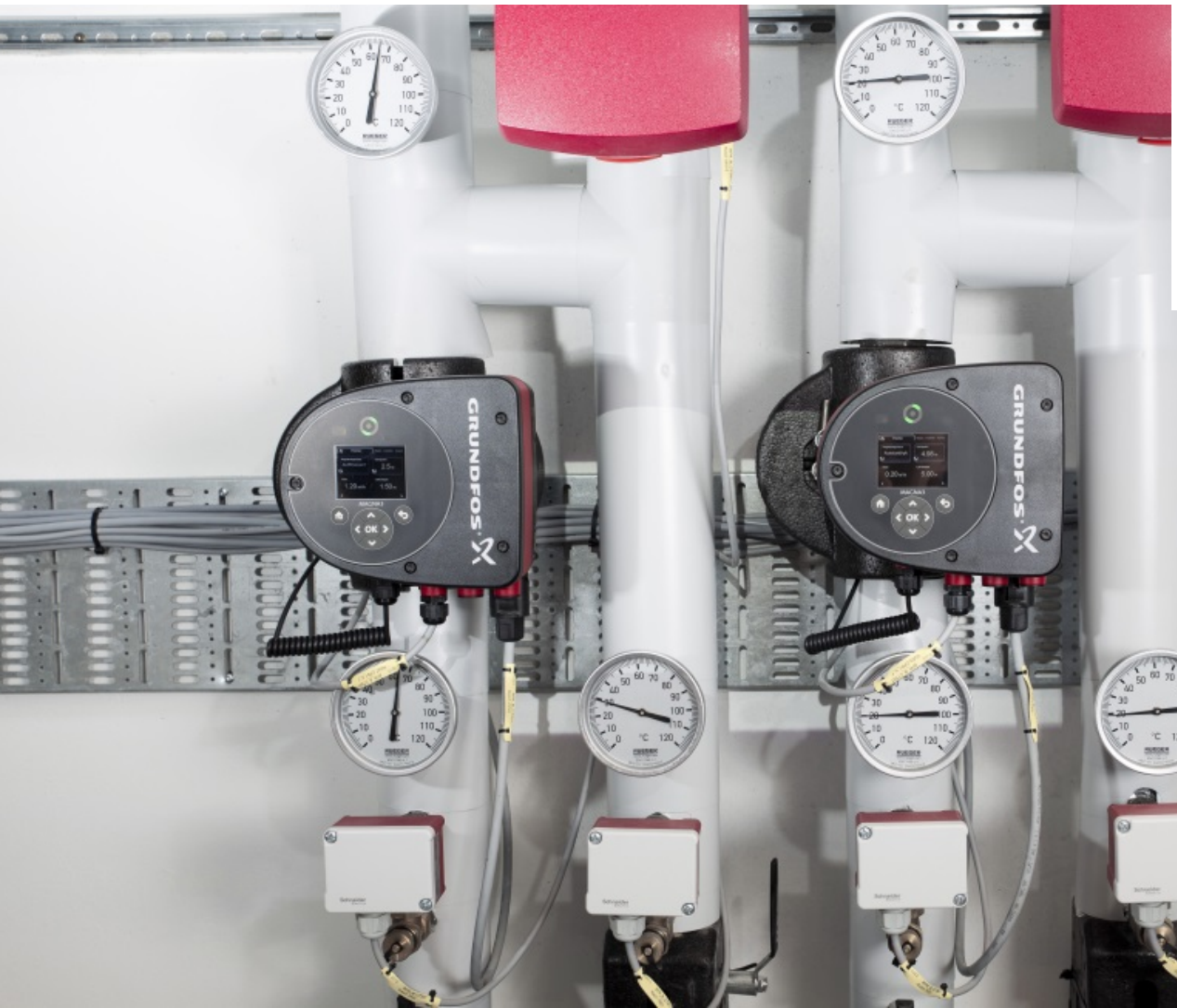
MAGNA3 80-40/60/80 (Cast Iron)

Grundfos Holding A/S

Institut Bauen und Umwelt e.V.

ECO PLATFORM EPD VERIFIED

www.ibu-epd.com | https://epd-online.com



General Information

Grundfos Holding A/S

Programme holder

IBU – Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

Declaration number

EPD-GRU-20230081-CBC1-EN

This declaration is based on the product category rules:

Pumps for liquids and liquids with solids, 01/08/2021
(PCR checked and approved by the SVR)

Issue date

21/11/2023

Valid to

20/11/2028

Dipl.-Ing. Hans Peters
(Chairman of Institut Bauen und Umwelt e.V.)

Florian Pronold
(Managing Director Institut Bauen und Umwelt e.V.)

MAGNA3 80-40/60/80 (Cast Iron)

Owner of the declaration

Grundfos Holding A/S
Poul Due Jensens Vej 7
8850 Bjerringbro
Denmark

Declared product / declared unit

1 PCS. of MAGNA3 80-40/60/80 (Cast Iron)

Scope:

The declaration applies to 1 piece of MAGNA3 (Cast Iron) pump.

The product is produced in Wahlstedt, Germany, and the life cycle assessment is based on data collected at the production site.

Production has been modeled using annual production data from 2021.

The declaration covers three different types of the MAGNA3 80- product (40/60/80).

The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

The EPD was created according to the specifications of EN 15804+A2. In the following, the standard will be simplified as *EN 15804*.

Verification

The standard EN 15804 serves as the core PCR
Independent verification of the declaration and data according to ISO 14025:2011
☐ internally ☒ externally

Mrs Kim Allbury,
(Independent verifier)

Product

Product description/Product definition

The Grundfos MAGNA3 circulator pumps are designed for circulating liquids in heating systems, air conditioning and cooling systems and domestic hot water systems. However, the pump range can also be used in ground source heat pump systems and solar heating systems.

The MAGNA3 pump is a centrifugal pump powered by an electrical motor. It has a high-performance neodymium magnet rotor which increases motor efficiency and an insulation shell to reduce heat loss from the cast iron pump housing with threaded connections.

The declaration covers three types of the MAGNA3 pump. They are grouped as shown below. The group reference in the technical data and scenarios refers also to these.

GROUP 1 - MAGNA3 80-40

GROUP 2 - MAGNA3 80-60

GROUP 3 - MAGNA3 80-80

These are all the same physical products and 100 % identical in terms of design, dimensions and materials as well as supply chain and manufacturing processes, i.e., all cradle to gate processes (A1-A3).

The products are also identical in terms of packaging, distribution, reference service life and end-of-life treatment.

The only thing that differentiates the products from each other is the software which controls how the pump operates in the system in which it is installed, making them fit for different applications. Hence, all life cycle modules are identical, except use stage module B6, which will change, as the applied scenarios for electricity consumption changes. For the placing on the market in the European Union/European Free Trade Association (EU/EFTA) (with the exception of Switzerland) the following
legal provisions apply:

Machinery
Directive (2006/42/EC)

Standard used: *EN 809:1998 + A1:2009.*

Radio Equipment
Directive (2014/53/EU)

Standards used:
EN 60335-1:2012/AC:2014 + A11:2014, EN 60335-2-51:2003 + A1:2008 + A2:2012,
EN 62233:2008.

EN 55014-1:2006
+ A1:2009 + A2:2011, EN 55014-1:2017, EN 61000-6-2:2005, EN 61000-3-2:2014, EN
61000-3-3:2013, ETSI EN 301 489-1 V2.2.0, ETSI EN 301 489-17 V3.2.0. ETSI EN 300 328 V2.1.1

Electromagnetic
Compatibility (EMC) Directive (2014/30/EU)

Standards used: *EN 55014-1:2017, EN 55014-2:2015,*

EN
61000-3-2:2014/2019, EN 61000-6-2:2008/2019,

EN 61000-3-3:2013
A1:2019

RoHS Directive
2011/65/EU and 2015/863//EU

Standard: *EN 50581:2012.*

Ecodesign

Directive (2009/125/EC)

Commission
Regulation (EC) No: 641/2009 and

Commission Regulation
(EU) 622/2012

Standards used:
EN 16297-1:2012, EN 16297-2:2012, EN 16297-3:2012.

The CE marking takes into account the proof of conformity with the respective harmonized norms based on the legal provisions above.

MAGNA3 pumps
are not harmonized in accordance with the *CPR*.

Application
For the application and use the respective national

provisions apply.

The pump is designed for circulating liquids in the

following systems:

· heating systems

· domestic hot-water systems

· air-conditioning and cooling systems

· ground-source heat-pump systems

· solar-heating systems

The pump is suitable for thin, clean, non-aggressive and non-explosive liquids, not containing solid particles or fibres that may attack the pump mechanically or chemically. In heating systems, the water must meet the requirements of accepted standards on water quality in heating systems. The pumps are also suitable for domestic hot-water systems.

Technical Data
The performance data of the product according to the harmonized norms, based on the harmonization provisions above apply.
The relevant technical specifications according to the *PCR Part B* are given in the table below. Characteristics that are the same for all product groups are only given once. Others are given individually for all three groups.

Constructional data

Name	Value	Unit
Frequency	50	Hz
Voltage	230	V
Pumped liquid (e.g. water)	Clean Water	-
Energy Efficiency Index	0,17	
Energy Efficiency Index	0,17	
Energy Efficiency Index	0,17	
Flow range Gr. 1 (max)	35,0	m3/h
Flow range Gr. 2 (max)	48,0	m3/h
Flow range Gr. 3 (max)	55,0	m3/h
Head max. Gr.1	4	m
Head max. Gr.2	6	m
Head max. Gr.3	8	m
Power input Gr. 1 Average (from load profile describing use)	0,211	kW
Power input Gr. 2 Average (from load profile describing use)	0,211	kW
Power input Gr. 3 Average (from load profile describing use)	0,303	kW
Nominal capacity Gr.1	0,321	kW
Nominal capacity Gr. 2	0,52	kW
Nominal capacity Gr.3	0,707	kW

Performance
data of the product according to the harmonised standards, based on provisions for harmonization.

Base materials/Ancillary materials

Base materials / Ancillary materials

Name	Value	Unit
Aluminium	11	%
Cast iron	60	%
Ceramics	0,2	%
Copper	2	%
Electronics	0,2	%
Magnet Nd	1	%
Paper	0,4	%
PCB	3	%
Plastics	0,3	%
Plastics, foam	1	%
Plastics GF	4	%
Rubber	0,1	%
Stainless steel	4	%
Steel	6	%
Cardboard	7	%
Plastic film	0,1%	%
TOTAL	100	%

REACH

This product/article/at
least one partial article contains

substances
listed in the *ECHA candidate list* (date:

10.06.2022)
exceeding 0.1 percentage by mass: **no**

within the industry that it is at least 12 years. However, this is complicated by many factors, including many being scrapped prematurely when e.g. the boiler they are connected to is replaced.

The Wahlstedt production has been assessed and certified as meeting the requirements in *ISO 14001, ISO 50001, ISO 45001 and ISO 9001.*

From the estimated stock (140Mpa) and annual sales (14Mpa), the average lifetime of the circulator is taken as 10 years for the purposes of this study.

Reference service life

No use stage scenario which refers to the lifetime of the product is declared. However, to facilitate building calculations, an estimated RSL of 10 years can be used.
This is an EU consensus-based estimation, referenced on page 37 in Appendix 7: *Lot 11 – Circulators in Buildings*, prepared by AEA Energy & Environment for the European Commission in the context of the Eco Design Directive:

The RSL of the declared product is not directly influencing the results in this study, as no declared use stage scenario is dependent on the RSL; The use stage sub-module B6 is declared per year as required by the *PCR Part B.*

There is no definitive information on the average circulator life available, there is consensus

LCA: Calculation rules

Declared Unit

The declared unit is 1 piece (pcs.) of MAGNA3 (Cast Iron) pump.

Declared unit

Name	Value	Unit
Declared unit	1	pce.
Mass reference	29.91	kg/pce
Conversion factor [Mass/Declared Unit]	29.91	

For IBU core EPDs (where clause 3.6 is part of the EPD): for average EPDs, an estimate of the robustness of the LCA values must be made, e.g. concerning the variability of the production process, geographical representativeness and the influence of background data and preliminary products compared to the environmental impacts caused by the actual production.

System boundary

This EPD is Cradle-To-Grave. The system boundaries of the EPD follow the modular approach in *EN 15804*. By decision no. 20170712-n of the *SVR*, the modules B3, B4 and B5 are by default declared as "MNR" (module not relevant).

The product stage (A1-A3) comprises raw material extraction and processing, transport processes as well as the manufacturing process. The final production and assembly of the MAGNA3 pump takes place at a Grundfos manufacturing site in Germany. However, the full supply-chain leading to the finished product at the gate is rather complex and includes a large amount of raw materials, components and semi-finished parts which come from both external suppliers as well as other Grundfos production facilities.

The product stage is included in the study, and according to *EN 15804* the system boundary with nature is set to include those processes that provide the material and energy inputs into the system and the following manufacturing, transport up to the factory gate as well as the processing any waste arising from those processes.

Wastes and losses are included in the modules where they occur according to the polluter pays principle and the modular approach of *EN 15804.*

The product includes:

. A1 Extraction and processing of raw materials;

. A1 Reuse of products or materials from a previous product system;

. A1 Processing of secondary materials;

. A1 Generation of electricity, steam and heat from primary energy resources, also including their extraction, refining and transport;

. A1 Energy recovery and other recovery processes from secondary fuels;

. A2 Transportation up to the factory gate and internal transport;

. A3 Production of ancillary materials or pre products;

. A3 Manufacturing of products and coproducts;

. A3 Manufacturing of packaging;

. A1-A3 processing up to the end-of-waste state or disposal of final residues.

For secondary material inputs, the system boundary to the previous system (providing the secondary material) is set where outputs reach the end-of-waste state. The recycling of secondary material into new raw materials is included in the system boundary of this study. Waste materials from production processes that are recycled without any modification of the material's inherent characteristics are modelled as closed-loop within A1-A3. This is done up to the input mass flow that was used during production.

Waste for incineration arising in the product stage is accounted for in the module where the waste is produced. The environmental loads from the incineration process are declared in the module where it occurs and the electricity and heat which is produced from the incineration are considered as closed-loop within A1-A3, as described in *PCR Part A,* 5.5.1. The input of biogenic carbon from the production of packaging material is inventoried in A3. As required by *PCR Part A*, the corresponding end-of-life module of the packaging material, A5, is also declared and the emissions of biogenic carbon are inventoried.

The construction process stage (A4-A5) includes:

A4:

.
Transportation from factory gate to distribution center:

.
Consumption of electricity, thermal energy and water at distribution center;

.
Transportation from distribution center to construction site;

.
Wastage during distribution.

A5:

.
Installation process;

.
Transport of packaging waste to treatment site;

.
Waste treatment of packaging.

The packaging
material does not reach the end of waste state but is incinerated as waste.
According to European statistics, the average R1 value of incineration plants
is > 0.6. Therefore, it is assumed

that packaging
material is treated thermally in an incineration plant with R1 > 0.6. The
loads from the combustion process of packaging are declared in module A5 and
the resulting energy benefits in module

D, as required
by the *PCR Part A*, 5.5.2.

Use stage
(B1-B7):

The use stage,
related to the building fabric includes:

.
B1, use or application of the installed product;

.
B2, maintenance.

The use stage
related to the operation of the building

includes:

.
B6, operational energy use;

.
B7, operational water use.

In this study,
all use stage modules are assessed, though B1, B2 and B7 are assessed to be
zero. By decision no. 20170712-n of the *SVR*, the modules B3, B4 and B5
are by default declared as "MNR" (module

not relevant).
The modules include the provision and transport of all materials, products and
related energy and water use, as well as waste processing up to the
end-of-waste state or disposal of final residues during the use stage. They
also include all impacts and

aspects related
to the losses during the use stage (i.e. production, transport, and waste
processing and disposal of the lost products and materials).

Generally, the
geographical coverage of the datasets used matches the actual processes taking
place. Meaning, that when modelling taking place in Grundfos Bjerringbro,
the Danish electricity grid mix is used in the model and thermal energy
from natural gas. These are generally of very high quality with very good
technological, temporal and geographical representativeness.

Contributions
to operational energy use during the use stage (B6) come from the electricity
consumption of the product. The annual electricity consumption is calculated by
multiplying the average power input, which is based on a defined load profile,
with the annual running hours. For use stage (B6) European Average
electricity grid mix has been used. These values are declared in the scenarios
section.

**The End-of-Life
stage (C1-C4)** includes all
activities from when the product reaches the end of its service life and no
longer provides any functionality and until all materials and components are
processed for

reuse/recycling
or disposed of.

According to *EN
15804* and the *PCR Part A,* the end-of-life stage
includes:

.
C1 deconstruction of the product from the
building, including initial on-site sorting of the

.
materials;

.
C2 transportation of the discarded product to a recycling site and
transportation of waste to final disposal;

.
C3 waste processing, collection of waste fractions from the deconstruction and
waste processing of material flows intended for reuse, recycling and energy
recovery;

.
C4 waste disposal including physical pretreatment and management of the
disposal site.

At the end of life,
the MAGNA3 pump is manually disassembled from the piping system in which it has
been installed. The definition of the applied end-of-life scenario in this EPD
follows the requirements in the

PCR Part A, 6.2 regarding complex products, with a combination
of recycling, thermal waste treatment and landfilling. 100 % of the material is
considered in the end of life scenario as required by the *PCR*. An
overall collection rate of 90 % has been assumed.

Materials from
which energy is recovered in an incineration process with an R1-value above 0.60
are in this study included with the environmental burdens from the incineration
process inventoried in C3, the recovered energy is declared as exported energy
in C3

and the energy
benefits are declared in D. This procedure is according to the *PCR Part A*,
5.5.6. C3 includes the mechanical separation of the product followed by a
series of sorting steps. Metal fractions are recycled and plastics, cardboard
and electronics are assumed incinerated with energy recovery. The residual
fractions are landfilled and declared in C4.

The specific
amounts are shown in the scenarios section.

Beyond system boundary (D): According to *EN 15804* module D includes the reuse, recovery and/or recycling potentials,
expressed as net impacts and benefits. Any declared benefits and loads from net

flows leaving
the product system that have not been allocated as co-products and that have
passed the end-of-waste state are included in module D.

Contributions
to module D comes from waste incineration processes in A5 and C3 as well as
material recycling in C3. The specific fractions and net flows are shown in the
scenarios section.

Geographic Representativeness
Land or region, in which the declared product system is manufactured, used or handled at the end of the product´s lifespan: Europe

Comparability
Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to *EN 15804* and the building context, respectively the product-specific characteristics of performance, are taken into account. Software and databases used: *GaBi ts*

9.2.1.68
(database schema 8007) *Ecoinvent v3.5.*.

LCA: Scenarios and additional technical information

Characteristic product properties of biogenic carbon
The biogenic carbon content quantifies the amount of biogenic carbon in a construction product leaving the factory gate, and it will be separately declared for the product and for any accompanying packaging, as required from the *PCR Part A*. The Carbon content of Cardboard and Paper is assumed to 0.46 kg
C. Overall, there is an amount of 9 weight-% Carbon in the product leaving the factory gate and has to be considered

Information on describing the biogenic Carbon Content at factory gate

Name	Value	Unit
Biogenic carbon content in accompanying packaging	0.74	kg C

Note: 1 kg of biogenic carbon is equivalent to 44/12 kg of CO2

The following technical scenario information is required for the declared modules and optional for non-declared modules. Modules for which no information is declared can be deleted; additional information can also be listed if necessary.

The following technical information is a basis for the declared modules or can be used for developing specific scenarios in the context of a building assessment if modules are not declared (MND).

A5 is not declared including the disposal of the packaging material on the construction site, the amounts of packaging materials included in the LCA calculations must be declared as technical scenario information for Module A5.

Transport from the gate to the site (A4)

Name	Value	Unit
Litres of fuel	0,0332	l/100km
Transport distance	2003	km
Capacity utilisation (including empty runs)	85	%
Gross density of products transported	575	kg/m^3
Wastage during distribution	0,02	%

Installation into the building (A5)

Name	Value	Unit
Packaging waste for incineration (LDPE film)	0,031	kg
Packaging waste for incineration (Paper/Cardboard)	2,35	kg

An estimated
RSL of 10 years can be used to facilitate building calculations.

This is an EU
consensus-based estimation, referenced in Appendix 7: Lot 11 – Circulators in
Buildings, prepared by AEA Energy & Environment for the European Commission
in the context of the Eco Design Directive.

Reference service life

Name	Value	Unit
Life Span according to the manufacturer	10	a

Operational energy use (B6)

Name	Value	Unit
Electricity consumption, Group 1	1055	kWh/a
Electricity consumption, Group 2	1055	kWh/a
Electricity consumption, Group 3	1515	kWh/a
Average power input, Group 1	0,211	kW
Average power input, Group 2	0,211	kW
Average power input, Group 3	0,303	kW
Running hours (all groups)	5.000	h/a

End of life (C1-C4)

Name	Value	Unit
Collected as mixed construction waste	29,79	kg
Transportation distance (C2)	500	km
Aluminium for recycling	2,84	kg
Steel for recycling	17,3	kg
Copper for recycling	0,603	kg
Stainless steel for recycling	0,97	kg
Plastics for incineration w/energy	1,51	kg
Electronics for incineration w/energy	0,81	kg
Landfilling	5,757	kg

Reuse, recovery and/or recycling potentials (D), relevant scenario information

Name	Value	Unit
A5, incineration w/energy recov. (LDPE foil)	5,21	MJ
A5, incineration w/energy recov. (Paper/Cardboard)	9,46	MJ
C3, steel for recycling (net amounts)	-2,23	kg
C3, stainless steel for recycling (net amounts)	0,407	kg
C3, aluminium for recycling (net amounts)	-0,39	kg
C3, copper for recycling (net amounts)	0,258	kg
C3, plastics for incineration, w/ energy recov.	1,51	kg
C3, electronics for incineration, w/ energy recov.	0,81	kg

LCA: Results

Characterization
model: *EN 15804* - 2012+A2 - 2019, PEF. By Decision no. 20170712-n of the IBU SVR, the modules B3, B4, B5 are marked as MNR (module not relevant) as default. The LCA results in module B6 are given on a period of one year, according to *PCR Part B*. To obtain the results from module B6 over the entire life cycle, the LCA results of module B6 must be multiplied by the estimated RSL of 10 years. The indicator results for module B6 are declared for Group 1. B6 indicator results for other groups can be derived by multiplying the B6 indicator results with the following factors:

Group 2: 1,43

Group 3: 1,43

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; ND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

Product stage			Construction process stage		Use stage							End of life stage				Benefits and loads beyond the system boundaries
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	MND	MND	MNR	MNR	MNR	X	MND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1PCS of MAGNA3 80-40/60/80 (Cast Iron)

Parameter	Unit	A1	A2	A3	A4	A5	B6	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq	1.22E+02	1.76E+00	4.61E-01	1.87E+00	3.42E+00	4.27E+02	0	7.67E-01	7.58E+00	1.76E-01	1.23E+00
GWP-fossil	kg CO_2 eq	1.21E+02	1.75E+00	4.41E+00	1.86E+00	1.68E-01	4.25E+02	0	7.62E-01	7.57E+00	1.81E-01	1.24E+00
GWP-biogenic	kg CO_2 eq	6.74E-01	-2.48E-03	-3.99E+00	-3.73E-03	3.25E+00	1.42E+00	0	-1.29E-03	8.28E-03	-5.46E-03	-3.54E-03
GWP-luluc	kg CO_2 eq	2.33E-01	1.29E-02	3.93E-02	1.47E-02	1.16E-04	6.15E-01	0	6.2E-03	4.1E-03	1.59E-04	-3.21E-03
ODP	kg CFC11 eq	9.98E-08	3.08E-16	4.07E-09	2.08E-11	6.25E-16	9.34E-12	0	1.41E-16	6.17E-14	4.08E-16	-7.83E-13
AP	mol H^+ eq	5.82E-01	1.22E-02	1.8E-02	1.08E-02	9.86E-04	9.38E-01	0	4.5E-03	6.97E-03	5.63E-04	-6.39E-03
EP-freshwater	kg P eq	1.68E-03	4.9E-06	7.37E-05	5.89E-06	1.43E-07	1.13E-03	0	2.33E-06	1.08E-05	1.98E-05	-4.33E-06
EP-marine	kg N eq	7.89E-02	4.4E-03	3.66E-03	5.16E-03	3.6E-04	2.08E-01	0	2.17E-03	1.66E-03	1.3E-04	6.66E-04
EP-terrestrial	mol N eq	8.29E-01	4.87E-02	3.65E-02	5.71E-02	4.47E-03	2.19E+00	0	2.41E-02	1.84E-02	1.43E-03	7.68E-03
POCP	kg NMVOC eq	2.46E-01	9.89E-03	1.04E-02	9.81E-03	9.4E-04	5.71E-01	0	4.12E-03	4.54E-03	4.18E-04	2.18E-03
ADPE	kg Sb eq	5.87E-03	1.33E-07	6.02E-05	1.33E-06	1.04E-08	1.23E-04	0	6.19E-08	8.12E-07	1.23E-08	-7.2E-04
ADPF	MJ	1.65E+03	2.32E+01	6.1E+01	2.49E+01	1.18E+00	7.47E+03	0	1.02E+01	5.02E+01	2.6E+00	-1.09E+01
WDP	m^3 world eq deprived	2.65E+01	1.59E-02	3.35E-01	2.47E-02	4.21E-01	9.26E+01	0	7.47E-03	1.09E+00	-2E-03	-5.32E-01

GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential)

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1PCS of MAGNA3 80-40/60/80 (Cast Iron)

Parameter	Unit	A1	A2	A3	A4	A5	B6	C1	C2	C3	C4	D
PERE	MJ	4.81E+02	1.24E+00	6.01E+01	1.56E+00	2.03E-01	3.31E+03	0	5.91E-01	2.18E+01	1.82E-01	1.83E+00
PERM	MJ	0	0	0	0	0	0	0	0	0	0	0
PERT	MJ	4.81E+02	1.24E+00	6.01E+01	1.56E+00	2.03E-01	3.31E+03	0	5.91E-01	2.18E+01	1.82E-01	1.83E+00
PENRE	MJ	1.65E+03	2.33E+01	6.1E+01	2.5E+01	1.18E+00	7.47E+03	0	1.03E+01	5.02E+01	2.6E+00	-1.06E+01

PENRM	MJ	0	0	0	0	0	0	0	0	0	0	0
PENRT	MJ	1.65E+03	2.33E+01	6.1E+01	2.5E+01	1.18E+00	7.47E+03	0	1.03E+01	5.02E+01	2.6E+00	-1.06E+01
SM	kg	2.35E+01	0	2.34E-01	4.75E-03	0	0	0	0	0	0	0
RSF	MJ	1.46E-23	0	0	2.91E-27	0	0	0	0	0	0	0
NRSF	MJ	1.71E-22	0	0	3.42E-26	0	0	0	0	0	0	0
FW	m^3	8.66E-01	1.45E-03	3.06E-02	1.88E-03	9.93E-03	3.83E+00	0	6.88E-04	3.63E-02	3.31E-05	2.45E-02

PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1PCS of MAGNA3 80-40/60/80 (Cast Iron)

Parameter	Unit	A1	A2	A3	A4	A5	B6	C1	C2	C3	C4	D
HWD	kg	4.67E-04	9.91E-07	1.22E-04	1.24E-06	6.11E-09	3.09E-06	0	4.74E-07	2.46E-08	1.04E-08	-2.54E-04
NHWD	kg	4.4E+00	3.59E-03	3.04E-01	5.09E-03	1.12E-01	5.3E+00	0	1.63E-03	7.54E-01	2.98E+00	1.55E+00
RWD	kg	7.51E-02	4.16E-05	1.68E-03	6.67E-05	5.67E-05	1.13E+00	0	1.89E-05	7.45E-03	3.11E-05	-2.26E-03
CRU	kg	0	0	0	0	0	0	0	0	0	0	0
MFR	kg	0	0	0	0	0	0	0	0	2.17E+01	0	0
MER	kg	0	0	0	0	0	0	0	0	0	0	0
EEE	MJ	0	0	0	0	5.214581634	0	0	0	7.983556048	0	0
EET	MJ	0	0	0	0	9.46E+00	0	0	0	1.44E+01	0	0

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

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: 1PCS of MAGNA3 80-40/60/80 (Cast Iron)

Parameter	Unit	A1	A2	A3	A4	A5	B6	C1	C2	C3	C4	D
PM	Disease incidence	7.44E-06	1.36E-07	2.49E-07	6.4E-08	5.56E-09	7.86E-06	0	2.63E-08	5.88E-08	5.74E-09	-1.63E-07
IR	kBq U235 eq	8.21E+00	6.12E-03	2.64E-01	9.34E-03	8.74E-03	1.86E+02	0	2.79E-03	1.22E+00	4.42E-03	-2.23E-01
ETP-fw	CTUe	9.11E+02	1.73E+01	1.93E+01	1.83E+01	5.93E-01	3.19E+03	0	7.64E+00	2.18E+01	1.83E+00	-5.45E+00
HTP-c	CTUh	1.3E-06	3.55E-10	6.52E-07	7.71E-10	2.91E-11	8.82E-08	0	1.58E-10	6.52E-10	1.05E-10	-4.95E-08
HTP-nc	CTUh	2.62E-06	1.95E-08	6.09E-08	2.21E-08	1.36E-09	3.25E-06	0	9.07E-09	2.6E-08	9.16E-09	6.15E-09
SQP	SQP	4.85E+02	7.49E+00	1.16E+02	8.64E+00	3.2E-01	2.38E+03	0	3.59E+00	1.58E+01	1.88E-01	-1.89E+01

PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); SQP = Potential soil quality index

Disclaimer
1 – for the indicator 'Potential Human exposure efficiency relative to U235'. 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 or radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – for the indicators 'abiotic depletion potential for non-fossil resources', 'abiotic depletion potential for fossil resources', 'water (user) deprivation potential, deprivation-weighted water consumption', 'potential comparative toxic unit for ecosystems', 'potential comparative toxic unit for humans – cancerogenic', 'Potential comparative toxic unit for humans - not cancerogenic', 'potential soil quality index'. The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high as there is limited experience with the indicator.

Disclaimer 3: *JRC*

Technical Reports, Version 2, 2018 Page 6, for the indicator "EP-freshwater". This indicator has been calculated as 'kg P eq' as required in the characterization model EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe; This EPD was created using a software tool.

References

Standards

Machinery Directive

DIRECTIVE 2006/42/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 May 2006 on machinery

Radio Equipment Directive

DIRECTIVE 2014/53/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 April 2014 on the harmonization of the laws of the Member States relating to the making available on the market of radio equipment

Electromagnetic Compatibility (EMC) Directive

DIRECTIVE 2014/30/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 26 February 2014 on the harmonization of the laws of the Member States relating to electromagnetic compatibility

Ecodesign Directive

DIRECTIVE 2009/125/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 21 October 2009 establishing a framework for the setting of eco-design requirements for energy-related products

EC 641/2009

COMMISSION REGULATION (EC) No 641/2009 of 22 July 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to eco-design requirements for glandless standalone circulators and glandless circulators integrated in

products

Parliament and
of the Council as regards the list of

restricted
substances

EC 622/2012

COMMISSION
REGULATION (EU) No 622/2012 of 11 July 2012 amending Regulation (EC) No
641/2009 with regard to eco-design requirements for glandless standalone
circulators and glandless circulators integrated in products

ETSI EN 301
489-1

ETSI EN 301
489-1 V2.2.0, Electromagnetic Compatibility (EMC) standard for radio equipment
and services; Part 1: Common technical requirements

DIRECTIVE
2011/65/EU

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PARLIAMENT AND
OF THE COUNCIL of 8 June 2011

on the
restriction of the use of certain hazardous

substances in
electrical and electronic equipment

ETSI EN 301
489-17

ETSI EN 301
489-17 V3.2.0, Electromagnetic Compatibility (EMC) standard for radio equipment
and services; Part 17: Specific conditions for Broadband Data Transmission
Systems

DIRECTIVE
2015/863/EU

DIRECTIVE
2015/863/EU of 31 March 2015 amending

Annex II to
Directive 2011/65/EU of the European

ETSI EN 300 328
V2.1.1

ETSI EN 300 328
V2.1.1, Wideband transmission systems; Data transmission equipment operating in
the 2,4 GHz ISM band and using wide band modulation techniques

Technical documentation for the

assessment of
electrical and electronic products with

respect to the
restriction of hazardous substances

EN 809

EN 809:1998-10
+ A1:2009, Pumps and pump units for

liquids -
Common safety requirements

EN 55014-1

EN
55014-1:2017, Electromagnetic compatibility – Requirements for household
appliances, electric tools and similar apparatus – Part 1: Emission

EN 55014-2

EN
55014-2:2015, Electromagnetic compatibility –

Requirements
for household appliances, electric tools

and similar
apparatus – Part 2: Immunity – Product

family standard
(CISPR 14-2:2015)

EN 50581:2012

EN 50581:2012,

EN 60335-1

EN
60335-1:2012/A11:2014/A13:2017, Household

and similar
electrical appliances – Safety – Part 1:General requirements

EN 60335-2-51

EN 60335-2-51:2003-03
+ A1:2008 + A2:2012, Household and similar electrical appliances – Safety –Part
2-51: Particular requirements for stationary circulation pumps for heating and
service water installations

EN 61000-3-2

EN
61000-3-2:2014/2019, Electromagnetic compatibility (EMC) – Part 3-2: Limits –
Limits for harmonic current emissions (equipment input current =16 A per phase)

EN 61000-3-3

EN
61000-3-3:2013-08/ A1:2019, Electromagnetic compatibility (EMC) – Part 3-3:
Limits – Limitation of voltage changes, voltage fluctuations and flicker in
public low voltage supply systems, for equipment with

rated current
<= 16 A per phase and not subject to conditional connection

EN 61000-6-2

EN
61000-6-2:2008/2019, Electromagnetic compatibility (EMC) – Part 6-2: Generic
standards –Immunity for industrial environments

EN 16297-1

EN
16297-1:2012-10, Pumps – Rotodynamic pumps –Glandless circulators – Part 1:
General requirements and procedures for testing and calculation of energy
efficiency index (EEI)

EN 16297-2

EN
16297-2:2012-10, Pumps – Rotodynamic pumps –Glandless circulators – Part 2:
Calculation of energy efficiency index (EEI) for standalone circulators

EN 16297-3

EN
16297-3:2012, Pumps – Rotodynamic pumps –Glandless circulators – Part 3: Energy
efficiency index (EEI) for circulators integrated in products

ISO 14001

EN ISO
14001:2015-09, Environmental management systems - Requirements with guidance
for use

ISO 14025

DIN EN /ISO
14025:2011-10, Environmental labels and declarations — Type III environmental
declarations — Principles and procedures

EN 15804

EN
15804:2012-04+A1 2013, Sustainability of construction works — Environmental
Product Declarations — Core rules for the product category of construction
products

PCR Part A

Institut Bauen
und Umwelt e.V., Berlin (pub.): Product Category Rules for Building-Related
Products and Services, Product Category Rules for Construction Products from
the range of Environmental Product Declarations of Institut Bauen und Umwelt
(IBU), Part A: Calculation Rules for the Life Cycle Assessment and Requirements
on the Project Report, Version 1.7 (2021)

PCR Part B

Institut Bauen
und Umwelt e.V., Berlin (pub.): Product Category Rules for Building-Related
Products and Services, Product Category Rules for Construction Products from
the range of Environmental Product Declarations of Institut Bauen und Umwelt
(IBU), Part B: Requirements on the EPD for Pumps for liquids and liquids with
solids, Version 1.0 (2018)

Further references

CPR

REGULATION (EU)
No 305/2011 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 9 March 2011
laying down harmonised conditions for the marketing of construction products
and repealing Council Directive 89/106/EEC

CML 2001

Impact
assessment characterization factors Institute of Environmental Sciences, Leiden
University, Netherlands

ECHA candidate list

Candidate List
of substances of very high concern (SVHCs) for authorization, European
Chemicals Agency (ECHA), Helsinki, Finland

Ecoinvent

Ecoinvent v3.5

GaBi ts

GaBi ts 9.2.1.68
(database schema 8007)

REACH

Regulation (EC)
No 1907/2006 of the European Parliament and of the Council of 18 December 2006
concerning the Registration, Evaluation, Authorization and Restriction of
Chemicals (REACH) (Status: 27.06.2018)

SVR

Advisory Board
(formerly SVA)

Decision no.
20170712-n

The literature referred to in the
Environmental Product Declaration must be listed in full.

Standards
already fully quoted in the EPD do not need to be listed here again.

The current
version of PCR Part A and PCR Part B of the PCR document on which they are
based must be referenced

.

The literature referred to in the Environmental Product Declaration must be listed in full.Standards already fully quoted in the EPD do not need to be listed here again.
The current version of PCR Part A and PCR Part B of the PCR document on which they are based must be referenced.

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ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A2*

Owner of the Declaration	Grundfos Holding A/S
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-GRU-20230074-CBC1-EN
Issue date	22/11/2023
Valid to	21/11/2028

MAGNA3 100-40/60 (Cast Iron)

Grundfos Holding A/S

Institut Bauen und Umwelt e.V.

ECO PLATFORM EPD VERIFIED

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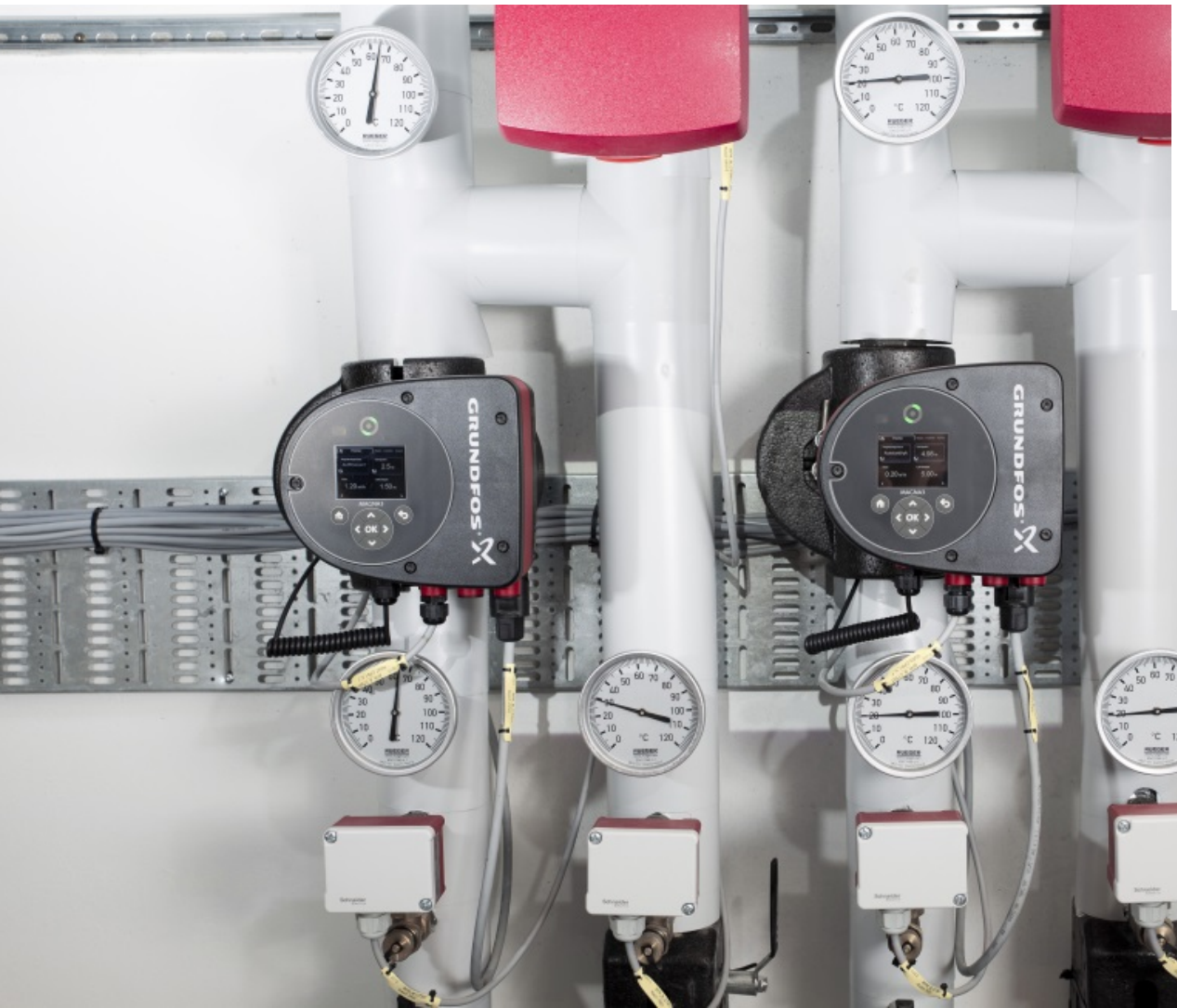

General Information

Grundfos Holding A/S

Programme holder

IBU – Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

Declaration number

EPD-GRU-20230074-CBC1-EN

This declaration is based on the product category rules:

Pumps for liquids and liquids with solids, 01/08/2021
(PCR checked and approved by the SVR)

Issue date

22/11/2023

Valid to

21/11/2028

Dipl.-Ing. Hans Peters
(Chairman of Institut Bauen und Umwelt e.V.)

Florian Pronold
(Managing Director Institut Bauen und Umwelt e.V.)

MAGNA3 100-40/60 (Cast Iron)

Owner of the declaration

Grundfos Holding A/S
Poul Due Jensens Vej 7
8850 Bjerringbro
Denmark

Declared product / declared unit

1 PCS. of MAGNA3 100-40/60 (Cast Iron)

Scope:

The declaration applies to 1 piece of MAGNA3 (Cast Iron) pump.

The product is produced in Wahlstedt, Germany, and the life cycle assessment is based on data collected at the production site.

Production has been modeled using annual production data from 2021.

The declaration covers two different types of the MAGNA3 100- product (40/60).

The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

The EPD was created according to the specifications of EN 15804+A2. In the following, the standard will be simplified as *EN 15804*.

Verification

The standard EN 15804 serves as the core PCR
Independent verification of the declaration and data according to ISO 14025:2011
☐ internally ☒ externally

Mrs Kim Allbury,
(Independent verifier)

Product

Product description/Product definition
The Grundfos MAGNA3 circulator pumps are designed for circulating liquids in heating systems, air conditioning and cooling systems and domestic hot water systems. However, the pump range can also be used in ground source heat pump systems and solar heating systems.

The MAGNA3 pump is a centrifugal pump powered by an electrical motor. It has a high-performance neodymium magnet rotor which increases motor efficiency and an insulation shell to reduce heat loss from the cast iron pump housing with threaded connections.

The declaration covers two types of the MAGNA3 pump. They are grouped as shown below. The group reference in the technical data and scenarios refers also to these.

GROUP 1 - MAGNA3 100-40
GROUP 2 - MAGNA3 100-60

These are all the same physical products and 100 % identical in terms of design, dimensions and materials as well as supply chain and manufacturing processes, i.e., all cradle to gate processes (A1-A3).

The products are also identical in terms of packaging, distribution, reference service life and end-of-life treatment.

The only thing that differentiates the products from each other is the software which controls how the pump operates in the system in which it is installed, making them fit for different applications. Hence, all life cycle modules are identical, except use stage module B6, which will change, as the applied scenarios for electricity consumption changes. For the placing on the market in the European Union/European Free Trade Association (EU/EFTA) (with the exception of Switzerland) the following legal provisions apply:

Machinery Directive (2006/42/EC)

Standard used: *EN 809:1998 + A1:2009.*

Radio Equipment Directive (2014/53/EU)

Standards used:
EN 60335-1:2012/AC:2014 + A11:2014, EN 60335-2-51:2003 + A1:2008 + A2:2012, EN 62233:2008.

EN 55014-1:2006 + A1:2009 + A2:2011, EN 55014-1:2017, EN 61000-6-2:2005, EN 61000-3-2:2014, EN 61000-3-3:2013, ETSI EN 301 489-1 V2.2.0, ETSI EN 301 489-17 V3.2.0. ETSI EN 300 328 V2.1.1

Electromagnetic Compatibility (EMC) Directive (2014/30/EU)

Standards used:
EN 55014-1:2017, EN 55014-2:2015,

EN 61000-3-2:2014/2019, EN 61000-6-2:2008/2019,

EN 61000-3-3:2013 A1:2019

RoHS Directive 2011/65/EU and 2015/863//EU

Standard: *EN 50581:2012.*

Ecodesign Directive (2009/125/EC)

Commission Regulation (EC) No: 641/2009 and

Commission Regulation (EU) 622/2012

Standards used:
EN 16297-1:2012, EN 16297-2:2012, EN 16297-3:2012.

The CE marking takes into account the proof of conformity with the respective harmonized norms based on the legal provisions above.

MAGNA3 pumps are not harmonized in accordance with the *CPR.*

Application
For the application and use the respective national provisions apply.

The pump is designed for circulating liquids in the following systems:

· heating systems
· domestic hot-water systems
· air-conditioning and cooling systems
· ground-source heat-pump systems
· solar-heating systems

The pump is suitable for thin, clean, non-aggressive and non-explosive liquids, not containing solid particles or fibres that may attack the pump mechanically or chemically. In heating systems, the water must meet the requirements of accepted standards on water quality in heating systems. The pumps are also suitable for domestic hot-water systems.

Technical Data
The performance data of the product according to the harmonized norms, based on the harmonization provisions above apply.
The relevant technical specifications according to the *PCR Part B* are given in the table below.
Characteristics that are the same for all product groups are only given once. Others are given individually for all two groups.

Constructional data

Name	Value	Unit
Frequency	50	Hz
Voltage	230	V
Pumped liquid (e.g. water)	Clean Water	-
Energy Efficiency Index	0,17	
Energy Efficiency Index	0,17	
Flow range Gr. 1 (max)	50,0	m3/h
Flow range Gr. 2 (max)	53,0	m3/h
Head max. Gr.1	4	m3/h
Head max. Gr. 2	6	m
Power input Gr. 1 Average (from load profile describing use)	0,204	kW
Power input Gr. 2 Average (from load profile describing use)	0,257	kW
Nominal capacity Gr.1	0,452	kW
Nominal capacity Gr.2	0,65	kW

Performance data of the product according to the harmonized standards, based on provisions for harmonization.

Base materials/Ancillary materials

Base materials / Ancillary materials

Name	Value	Unit
Aluminium	9	%
Cast iron	61	%
Ceramics	0,2	%
Copper	3	%
Electronics	0,2	%
Magnet Nd	1	%
Paper	0,3	%
PCB	2	%
Plastics	0,2	%
Plastics, foam	1	%
Plastics GF	3	%
Rubber	0,1	%
Stainless steel	3	%
Steel	8	%
Cardboard	7	%
Plastic film	0,1	%
TOTAL	100	%

REACH
This product/article/at least one partial article contains substances listed in the *ECHA candidate list* (date: 10.06.2022) exceeding 0.1 percentage by mass: **no**

The Wahlstedt production has been assessed and certified as meeting the requirements in *ISO 14001, ISO 50001, ISO 45001 and ISO 9001.*

Reference service life
No use stage scenario which refers to the lifetime of the product is declared. However, to facilitate building calculations, an estimated RSL of 10 years can be used.
This is an EU consensus-based estimation, referenced on page 37 in Appendix 7: *Lot 11 – Circulators in Buildings*, prepared by AEA Energy & Environment for the European Commission in the context of the Eco Design Directive:

There is no definitive information on the average circulator life available, there is consensus within the industry that it is at least 12 years. However, this is complicated by many factors, including many being scrapped prematurely when e.g. the boiler they are connected to is replaced.
From the estimated stock (140Mpa) and annual sales (14Mpa), the average lifetime of the circulator is taken as 10 years for the purposes of this study.
The RSL of the declared product is not directly influencing the results in this study, as no declared use stage scenario is dependent on the RSL; The use stage sub-module B6 is declared per year as required by the *PCR Part B.*

LCA: Calculation rules

Declared Unit
The declared unit is 1 piece (pcs.) of MAGNA3 (Cast Iron) pump.

Declared unit

Name	Value	Unit
Declared unit	1	pce.
Mass reference	36.6	kg/pce
Conversion factor [Mass/Declared Unit]	36.6	

For IBU core EPDs (where clause 3.6 is part of the EPD): for average EPDs, an estimate of the robustness of the LCA values must be made, e.g. concerning the variability of the production process, geographical representativeness and the influence of background data and preliminary products compared to the environmental impacts caused by the actual production.

System boundary
System boundary
This EPD is Cradle-To-Grave. The system boundaries of the EPD follow the modular approach in *EN 15804*. By decision no. 20170712-n of the *SVR*, the modules B3, B4 and B5 are by default declared as "MNR" (module not relevant).

The product stage (A1-A3) comprises raw material extraction and processing, transport processes, as well as the manufacturing process. The final production and assembly of the MAGNA3 pump take place at a Grundfos manufacturing site in Germany. However, the full supply chain leading to the finished product at the gate is rather complex and includes a large amount of raw materials, components, and semi-finished parts which come from both external suppliers and other Grundfos production facilities.

The product stage is included in the study, and according to *EN 15804* the system boundary with nature is set to include those processes that provide the material and energy inputs into the system and the following manufacturing, transport up to the factory gate, as well as the processing of any waste arising from those processes.
Wastes and losses are included in the modules where they occur according to the polluter pays principle and the modular approach of *EN 15804.*

The product includes:

· A1 Extraction and processing of raw materials;
· A1 Reuse of products or materials from a previous product system;
· A1 Processing of secondary materials;
· A1 Generation of electricity, steam and heat from primary energy resources, also including their extraction, refining and transport;
· A1 Energy recovery and other recovery processes from secondary fuels;
· A2 Transportation up to the factory gate and internal transport;
· A3 Production of ancillary materials or pre products;
· A3 Manufacturing of products and coproducts;
· A3 Manufacturing of packaging;
· A1-A3 processing up to the end-of-waste state or disposal of final residues.

For secondary material inputs, the system boundary to the previous system (providing the secondary material) is set where outputs reach the end-of-waste state. The recycling of secondary material into new raw materials is included in the system boundary of this study. Waste materials from production processes that are recycled without any modification of the material's inherent characteristics are modelled as closed loop within A1-A3. This is done up to the input mass flow that was used during production.
Waste for incineration arising in the product stage is accounted for in the module where the waste is produced. The environmental loads from the incineration process are declared in the module where it occurs and the electricity and heat which is produced from the incineration are considered as closed-loop within A1-A3, as described in *PCR Part A,* 5.5.1. The input of biogenic carbon from the production of packaging material is inventoried in A3. As required by *PCR Part A*, the corresponding end-of-life module of the packaging material, A5, is also declared and the emissions of biogenic carbon are inventoried.

The construction process stage (A4-A5) includes:

A4:

· Transportation from factory gate to distribution center:
· Consumption of electricity, thermal energy and water at distribution center;
· Transportation from distribution center to construction site;
· Wastage during distribution.

A5:

· Installation process;
· Transport of packaging waste to treatment site;
· Waste treatment of packaging.

The packaging material does not reach the end of waste state but is incinerated as waste.
According to European statistics, the average R1 value of incineration plants is > 0.6. Therefore, it is assumed

that packaging material is treated thermally in an incineration plant with R1 > 0.6. The loads from the combustion process of packaging are declared in module A5 and the resulting energy benefits in module D, as required by the *PCR Part A*, 5.5.2.

Use stage (B1-B7):

The use stage, related to the building fabric includes:

· B1, use or application of the installed product;
· B2, maintenance.

The use stage related to the operation of the building includes:

· B6, operational energy use;
· B7, operational water use.

In this study, all use stage modules are assessed, though B1, B2 and B7 are assessed to be zero. By decision no. 20170712-n of the *SVR*, the modules B3, B4 and B5 are by default declared as "MNR" (module

not relevant).
The modules include the provision and transport of all materials, products and related energy and water use, as well as waste processing up to the end-of-waste state or disposal of final residues during the use stage. They also include all impacts and aspects related to the losses during the use stage (i.e. production, transport, and waste processing and disposal of the lost products and materials).

Generally, the geographical coverage of the datasets used matches the actual processes taking place. Meaning, that when modelling taking place in Grundfos Bjerringbro, the Danish electricity grid mix is used in the model and thermal energy from natural gas. These are generally of very high quality with very good technological, temporal and geographical representativeness.

Contributions to operational energy use during the use stage (B6) come from the electricity consumption of the product. The annual electricity consumption is calculated by multiplying the average power input, which is based on a defined load profile, with the annual running hours. For use stage (B6) European Average electricity grid mix has been used. These values are declared in the scenarios section.

The End-of-Life stage (C1-C4) includes all activities from when the product reaches the end of its service life and no longer provides any functionality and until all materials and components are processed for reuse/recycling or disposed of.

According to *EN 15804* and the *PCR Part A,* the end-of-life stage includes:

· C1 deconstruction of the product from the building, including initial on-site sorting of the materials;
· C2 transportation of the discarded product to a recycling site and transportation of waste to final disposal;
· C3 waste processing, collection of waste fractions from the deconstruction and waste processing of material flows intended for reuse, recycling and energy recovery;
· C4 waste disposal including physical pretreatment and management of the disposal site.

At the end of life, the MAGNA3 pump is manually disassembled from the piping system in which it has been installed. The definition of the applied end-of-life scenario in this EPD follows the requirements in the

PCR Part A, 6.2 regarding complex products, with a combination of recycling, thermal waste treatment and landfilling. 100 % of the material is considered in the end of life scenario as required by the *PCR*. An overall collection rate of 90 % has been assumed.

Materials from which energy is recovered in an incineration process with an R1-value above 0.60 are in this study included with the environmental burdens from the incineration process inventoried in C3, the recovered energy is declared as exported energy in C3

and the energy benefits are declared in D. This procedure is according to the *PCR Part A*, 5.5.6. C3 includes the mechanical separation of the product followed by a series of sorting steps. Metal fractions are recycled and plastics, cardboard and electronics are assumed incinerated with energy recovery. The residual fractions are landfilled and declared in C4.
The specific amounts are shown in the scenarios section.

Beyond system boundary (D): According to *EN 15804* module D includes the reuse, recovery and/or recycling potentials, expressed as net impacts and benefits. Any declared benefits and loads from net flows leaving the product system that have not been allocated as co-products and that have passed the end-of-waste state are included in module D.

Contributions to module D comes from waste incineration processes in A5 and C3 as well as material recycling in C3. The specific fractions and net flows are shown in the scenarios section.

Geographic Representativeness

Land or region, in which the declared product system is manufactured, used or handled at the end of the product´s lifespan: Europe

Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to *EN 15804* and the building context, respectively the product-specific characteristics of performance, are taken into account. Software and databases used: *GaBi ts* 9.2.1.68 (database schema 8007) *Ecoinvent v3.5.*.

LCA: Scenarios and additional technical information

Characteristic product properties of biogenic carbon

The biogenic carbon content quantifies the amount of biogenic carbon in a construction product leaving the factory gate, and it will be separately declared for the product and for any accompanying packaging, as required from the *PCR Part A*. The Carbon content of Cardboard and Paper is assumed to 0.46 kg C. Overall, there is an amount of 9 weight-% Carbon in the product leaving the factory gate and has to be considered.

Information on describing the biogenic Carbon Content at factory gate

Name	Value	Unit
Biogenic carbon content in accompanying packaging	0.74	kg C

Note: 1 kg of biogenic carbon is equivalent to 44/12 kg of CO2

The following technical scenario information is required for the declared modules and optional for non-declared modules. Modules for which no information is declared can be deleted; additional information can also be listed if necessary.

The following technical information is a basis for the declared modules or can be used for developing specific scenarios in the context of a building assessment if modules are not declared (MND).

A5 is not declared including the disposal of the packaging material on the construction site, the amounts of packaging materials included in the LCA calculations must be declared as technical scenario information for Module A5.

Transport from the gate to the site (A4)

Name	Value	Unit
Litres of fuel	0,052	l/100km
Transport distance	2003	km
Capacity utilisation (including empty runs)	85	%
Gross density of products transported	704	kg/m^3
Wastage during distribution	0,02	%

Installation into the building (A5)

Name	Value	Unit
Packaging waste for incineration (LDPE film)	0,031	kg
Packaging waste for incineration (Paper/Cardboard)	2,81	kg

An estimated RSL of 10
years can be used to facilitate building calculations. This is an EU
consensus-based estimation, referenced in Appendix 7: Lot 11 – Circulators in
Buildings, prepared by AEA Energy & Environment for the European Commission
in the context of the Eco Design Directive

Reference service life

Name	Value	Unit
Life Span according to the manufacturer	10	a

Operational energy use (B6)

Name	Value	Unit
Electricity consumption Group 1	1020	kWh/a
Electricity consumption Group 2	1285	kWh/a
Average power input, Group 1	0,204	kW
Average power input, Group 2	0,257	kW
Running hours (all groups)	5.000	h/a

End of life (C1-C4)

Name	Value	Unit
Collected as mixed construction waste	33,8	kg
Transportation distance (C2)	500	km
Aluminium for recycling	2,84	kg
Steel for recycling	22,2	kg
Copper for recycling	1,05	kg
Stainless steel for recycling	1,09	kg
Plastics for incineration w/energy	1,58	kg
Electronics for incineration w/energy	0,81	kg
Landfilling	4,23	kg

Reuse, recovery and/or recycling potentials (D), relevant scenario information

Name	Value	Unit
A5, incineration w/energy recov. (LDPE foil)	6,19	MJ
A5, incineration w/energy recov. (Paper/Cardboard)	11,2	MJ
C3, steel for recycling (net amounts)	-2,21	kg
C3, stainless steel for recycling (net amounts)	0,49	kg
C3, aluminium for recycling (net amounts)	-0,39	kg
C3, copper for recycling (net amounts)	0,451	kg
C3, plastics for incineration, w/ energy recov.	1,58	kg
C3, electronics for incineration, w/ energy recov.	0,81	kg

LCA: Results

Characterization model: *EN 15804* - 2012+A2 - 2019, PEF. By Decision no. 20170712-n of the IBU SVR, the modules B3, B4, B5 are marked as MNR (module not relevant) as default. The LCA results in module B6 are given on a period of one year, according to *PCR Part B*. To obtain the results from module B6 over the entire life cycle, the LCA results of module B6 must be multiplied by the estimated RSL of 10 years. The indicator results for module B6 are declared for Group 1. B6 indicator results for other groups can be derived by multiplying the B6 indicator results with the following factors:

Group 2: 1,259

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; ND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

Product stage			Construction process stage		Use stage							End of life stage				Benefits and loads beyond the system boundaries
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	MND	MND	MNR	MNR	MNR	X	MND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1PCS of MAGNA3 100-40/60 (Cast Iron)

Parameter	Unit	A1	A2	A3	A4	A5	B6	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq	1.41E+02	2.12E+00	8.21E-02	2.28E+00	4.06E+00	4.13E+02	0	9.41E-01	8.39E+00	2.13E-01	1.49E-02
GWP-fossil	kg CO_2 eq	1.4E+02	2.1E+00	4.84E+00	2.27E+00	1.86E-01	4.11E+02	0	9.35E-01	8.37E+00	2.19E-01	2.23E-02
GWP-biogenic	kg CO_2 eq	8.37E-01	-3.08E-03	-4.8E+00	-4.55E-03	3.88E+00	1.37E+00	0	-1.58E-03	1.02E-02	-6.61E-03	-2.45E-03
GWP-luluc	kg CO_2 eq	2.82E-01	1.58E-02	4.23E-02	1.8E-02	1.38E-04	5.95E-01	0	7.6E-03	5.01E-03	1.93E-04	-4.96E-03
ODP	kg CFC11 eq	1.04E-07	3.73E-16	4.08E-09	2.15E-11	7.41E-16	9.03E-12	0	1.72E-16	7.55E-14	4.93E-16	-7.88E-13
AP	mol H^+ eq	6.48E-01	1.36E-02	1.91E-02	1.32E-02	1.17E-03	9.06E-01	0	5.52E-03	8.39E-03	6.81E-04	-2.13E-02
EP-freshwater	kg P eq	1.73E-03	5.99E-06	8.45E-05	7.15E-06	1.7E-07	1.1E-03	0	2.86E-06	1.33E-05	2.39E-05	-5.59E-06
EP-marine	kg N eq	8.84E-02	5.06E-03	4.09E-03	6.31E-03	4.29E-04	2.01E-01	0	2.66E-03	1.98E-03	1.57E-04	-3.25E-04
EP-terrestrial	mol N eq	9.3E-01	5.61E-02	4.07E-02	6.99E-02	5.33E-03	2.12E+00	0	2.95E-02	2.18E-02	1.72E-03	-2.93E-03
POCP	kg NMVOC eq	2.77E-01	1.12E-02	1.14E-02	1.2E-02	1.12E-03	5.52E-01	0	5.06E-03	5.41E-03	5.05E-04	-1.29E-03
ADPE	kg Sb eq	7.51E-03	1.62E-07	6.1E-05	1.7E-06	1.24E-08	1.19E-04	0	7.6E-08	9.95E-07	1.48E-08	-1.26E-03
ADPF	MJ	1.88E+03	2.8E+01	6.68E+01	3.05E+01	1.4E+00	7.22E+03	0	1.25E+01	6.14E+01	3.14E+00	-2.49E+01
WDP	m^3 world eq deprived	2.84E+01	1.93E-02	4.55E-01	2.94E-02	5.01E-01	8.95E+01	0	9.16E-03	1.24E+00	-2.42E-03	-9.93E-01

GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential)

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1PCS of MAGNA3 100-40/60 (Cast Iron)

Parameter	Unit	A1	A2	A3	A4	A5	B6	C1	C2	C3	C4	D
PERE	MJ	5.58E+02	1.51E+00	7.07E+01	1.9E+00	2.41E-01	3.2E+03	0	7.25E-01	2.67E+01	2.21E-01	-2.9E-01
PERM	MJ	0	0	0	0	0	0	0	0	0	0	0
PERT	MJ	5.58E+02	1.51E+00	7.07E+01	1.9E+00	2.41E-01	3.2E+03	0	7.25E-01	2.67E+01	2.21E-01	-2.9E-01
PENRE	MJ	1.88E+03	2.81E+01	6.68E+01	3.06E+01	1.4E+00	7.22E+03	0	1.26E+01	6.14E+01	3.15E+00	-2.47E+01
PENRM	MJ	0	0	0	0	0	0	0	0	0	0	0
PENRT	MJ	1.88E+03	2.81E+01	6.68E+01	3.06E+01	1.4E+00	7.22E+03	0	1.26E+01	6.14E+01	3.15E+00	-2.47E+01
SM	kg	2.88E+01	0	2.38E-01	5.8E-03	0	0	0	0	0	0	0
RSF	MJ	1.46E-23	0	0	2.91E-27	0	0	0	0	0	0	0
NRSF	MJ	1.71E-22	0	0	3.42E-26	0	0	0	0	0	0	0
FW	m^3	9.43E-01	1.77E-03	3.65E-02	2.27E-03	1.18E-02	3.7E+00	0	8.44E-04	4.23E-02	4E-05	1.61E-02

PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1PCS of MAGNA3 100-40/60 (Cast Iron)

Parameter	Unit	A1	A2	A3	A4	A5	B6	C1	C2	C3	C4	D
HWD	kg	5.79E-04	1.21E-06	1.22E-04	1.22E-04	1.51E-06	2.99E-06	0	5.82E-07	2.96E-08	1.26E-08	-3.09E-04
NHWD	kg	5.5E+00	4.34E-03	3.2E-01	6.24E-03	1.32E-01	5.12E+00	0	1.99E-03	8.75E-01	3.6E+00	1.96E+00
RWD	kg	8.67E-02	5.04E-05	1.83E-03	8.06E-05	6.75E-05	1.1E+00	0	2.32E-05	9.13E-03	3.77E-05	-2.66E-03
CRU	kg	0	0	0	0	0	0	0	0	0	0	0
MFR	kg	0	0	0	0	0	0	0	0	2.72E+01	0	0
MER	kg	0	0	0	0	0	0	0	0	0	0	0
EEE	MJ	0	0	0	0	6.19E+00	0	0	0	8.26E+00	0	0
EET	MJ	0	0	0	0	1.12E+01	0	0	0	1.49E+01	0	0

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

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: 1PCS of MAGNA3 100-40/60 (Cast Iron)

Parameter	Unit	A1	A2	A3	A4	A5	B6	C1	C2	C3	C4	D
PM	Disease incidence	8.38E-06	1.44E-07	2.64E-07	7.82E-08	6.61E-09	7.6E-06	0	3.23E-08	7.07E-08	6.94E-09	-3.26E-07
IR	kBq U235 eq	9.48E+00	7.42E-03	2.89E-01	1.13E-02	1.04E-02	1.8E+02	0	3.42E-03	1.5E+00	5.35E-03	-2.87E-01
ETP-fw	CTUe	9.96E+02	2.08E+01	2.06E+01	2.24E+01	7.04E-01	3.09E+03	0	9.38E+00	2.66E+01	2.22E+00	-1.4E+01
HTP-c	CTUh	1.67E-06	4.29E-10	6.61E-07	9.32E-10	3.45E-11	8.53E-08	0	1.94E-10	7.87E-10	1.27E-10	-6.23E-08
HTP-nc	CTUh	2.91E-06	2.36E-08	6.59E-08	2.7E-08	1.59E-09	3.14E-06	0	1.11E-08	3.12E-08	1.11E-08	-1.2E-08
SQP	SQP	5.7E+02	9.16E+00	1.39E+02	1.06E+01	3.81E-01	2.3E+03	0	4.4E+00	1.94E+01	2.27E-01	-2.69E+01

PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); SQP = Potential soil quality index

Disclaimer 1 – for the indicator 'Potential Human exposure efficiency relative to U235'.
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, or radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, radon and some construction materials is also not measured by this indicator.

Disclaimer 2 – for the indicators 'abiotic depletion potential for non-fossil resources', 'abiotic depletion potential for fossil resources', 'water (user) deprivation potential, deprivation-weighted water consumption', 'potential comparative toxic unit for ecosystems', 'potential comparative toxic unit for humans – cancerogenic', 'Potential comparative toxic unit for humans - not cancerogenic', 'potential soil quality index'. The results of this environmental impact indicator shall be used with care, as the uncertainties on these results are high or as there is limited experience with the indicator.

Disclaimer 3: *JRC Technical Reports, Version 2, 2018* Page 6, for the indicator "EP-freshwater". This indicator has been calculated as 'kg P eq' as required in the characterization model EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe; This EPD was created using a software tool.

References

Standards

Machinery Directive

DIRECTIVE 2006/42/EC OF THE EUROPEAN

PARLIAMENT AND OF THE COUNCIL of 17 May

2006 on machinery

Radio Equipment Directive

DIRECTIVE 2014/53/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 April 2014 on the harmonization of the laws of the Member States relating to the making available on the market of radio equipment

Electromagnetic Compatibility (EMC) Directive

DIRECTIVE 2014/30/EU OF THE EUROPEAN

PARLIAMENT AND OF THE COUNCIL of 26 February

2014 on the harmonization of the laws of the Member

States relating to electromagnetic compatibility

Ecodesign Directive

DIRECTIVE 2009/125/EC OF THE EUROPEAN

PARLIAMENT AND OF THE COUNCIL of 21 October

2009 establishing a framework for the setting of

eco-design requirements for energy-related products

EC 641/2009

COMMISSION REGULATION (EC) No 641/2009 of 22 July 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to eco-design requirements for glandless standalone circulators and glandless circulators integrated in products

EC 622/2012

COMMISSION REGULATION (EU) No 622/2012 of 11 July 2012 amending Regulation (EC) No 641/2009 with regard to eco-design requirements for glandless standalone circulators

and glandless circulators integrated in products

DIRECTIVE 2011/65/EU

DIRECTIVE 2011/65/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment

DIRECTIVE 2015/863/EU

DIRECTIVE 2015/863/EU of 31 March 2015 amending Annex II to Directive 2011/65/EU of the European Parliament and of the Council as regards the list of restricted substances

ETSI EN 301 489-1

ETSI EN 301 489-1 V2.2.0, Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements

ETSI EN 301 489-17

ETSI EN 301 489-17 V3.2.0, Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for Broadband Data Transmission Systems

ETSI EN 300 328 V2.1.1

ETSI EN 300 328 V2.1.1, Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques

EN 809

EN 809:1998-10 + A1:2009, Pumps and pump units for liquids - Common safety requirements

EN 55014-1

EN 55014-1:2017, Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission

EN 55014-2

EN 55014-2:2015, Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 2: Immunity – Product family standard (CISPR 14-2:2015)

EN 50581:2012

EN 50581:2012, Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

EN 60335-1

EN 60335-1:2012/A11:2014/A13:2017, Household and similar electrical appliances – Safety – Part 1: General requirements

EN 60335-2-51

EN 60335-2-51:2003-03 + A1:2008 + A2:2012, Household and similar electrical appliances – Safety –Part 2-51: Particular requirements for stationary circulation pumps for heating and service water installations

EN 61000-3-2

EN 61000-3-2:2014/2019, Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current =16 A per phase)

EN 61000-3-3

EN 61000-3-3:2013-08/ A1:2019, Electromagnetic compatibility (EMC) – Part 3-3:
Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low voltage supply systems, for equipment with rated current <= 16 A per phase and not subject to conditional connection

EN 61000-6-2

EN 61000-6-2:2008/2019, Electromagnetic compatibility (EMC) – Part 6-2: Generic standards –Immunity for industrial environments

EN 16297-1

EN 16297-1:2012-10, Pumps – Rotodynamic pumps – Glandless circulators – Part 1:
General requirements and procedures for testing and calculation of energy efficiency index (EEI)

EN 16297-2

EN 16297-2:2012-10, Pumps – Rotodynamic pumps – Glandless circulators – Part 2: Calculation of energy efficiency index (EEI) for standalone circulators

EN 16297-3

EN 16297-3:2012, Pumps – Rotodynamic pumps –Glandless circulators – Part 3: Energy efficiency index (EEI) for circulators integrated in products

ISO 14001

EN ISO 14001:2015-09, Environmental management systems - Requirements with guidance for use

ISO 14025

DIN EN /ISO 14025:2011-10, Environmental labels and declarations — Type III environmental declarations — Principles and procedures

EN 15804

EN 15804:2012-04+A1 2013, Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

PCR Part A

Institut Bauen und Umwelt e.V., Berlin (pub.): Product Category Rules for Building-Related Products and Services, Product Category Rules for Construction Products from the range of Environmental Product Declarations of Institut Bauen und Umwelt (IBU), Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report, Version 1.7 (2021)

PCR Part B

Institut Bauen und Umwelt e.V., Berlin (pub.): Product Category Rules for Building-Related Products and Services, Product Category Rules for Construction Products from the range of Environmental Product Declarations of Institut Bauen und Umwelt (IBU), Part B: Requirements on the EPD for Pumps for liquids and liquids with solids, Version 1.0 (2018)

Further references

CPR
REGULATION (EU) No 305/2011 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 9 March 2011 laying down harmonized conditions for the marketing of construction products and repealing Council Directive 89/106/EEC

CML 2001
Impact assessment characterization factors Institute of Environmental Sciences, Leiden University, Netherlands
ECHA candidate list
Candidate List of substances of very high concern (SVHCs) for authorization, European Chemicals Agency (ECHA), Helsinki, Finland

Ecoinvent
Ecoinvent v3.5

GaBi ts
GaBi ts 9.2.1.68 (database schema 8007)

REACH

Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) (Status: 27.06.2018)

SVR
Advisory Board (formerly SVA) Decision no. 20170712-n

The literature referred to in the Environmental Product Declaration must be listed in full.

Standards already fully quoted in the EPD do not need to be listed here again.

The current version of PCR Part A and PCR Part B of the PCR document on which they are based must be referenced. The literature referred to in the Environmental Product Declaration must be listed in full.

Standards already fully quoted in the EPD do not need to be listed here again.

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The current version of PCR Part A and PCR Part B of the PCR document on which they are based must be referenced.

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ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A2*

Owner of the Declaration	Grundfos Holding A/S
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-GRU-20230075-CBC1-EN
Issue date	21.11.2023
Valid to	20.11.2028

MAGNA3 100-80/100/120 (Cast Iron)

Grundfos Holding A/S

Institut Bauen und Umwelt e.V.

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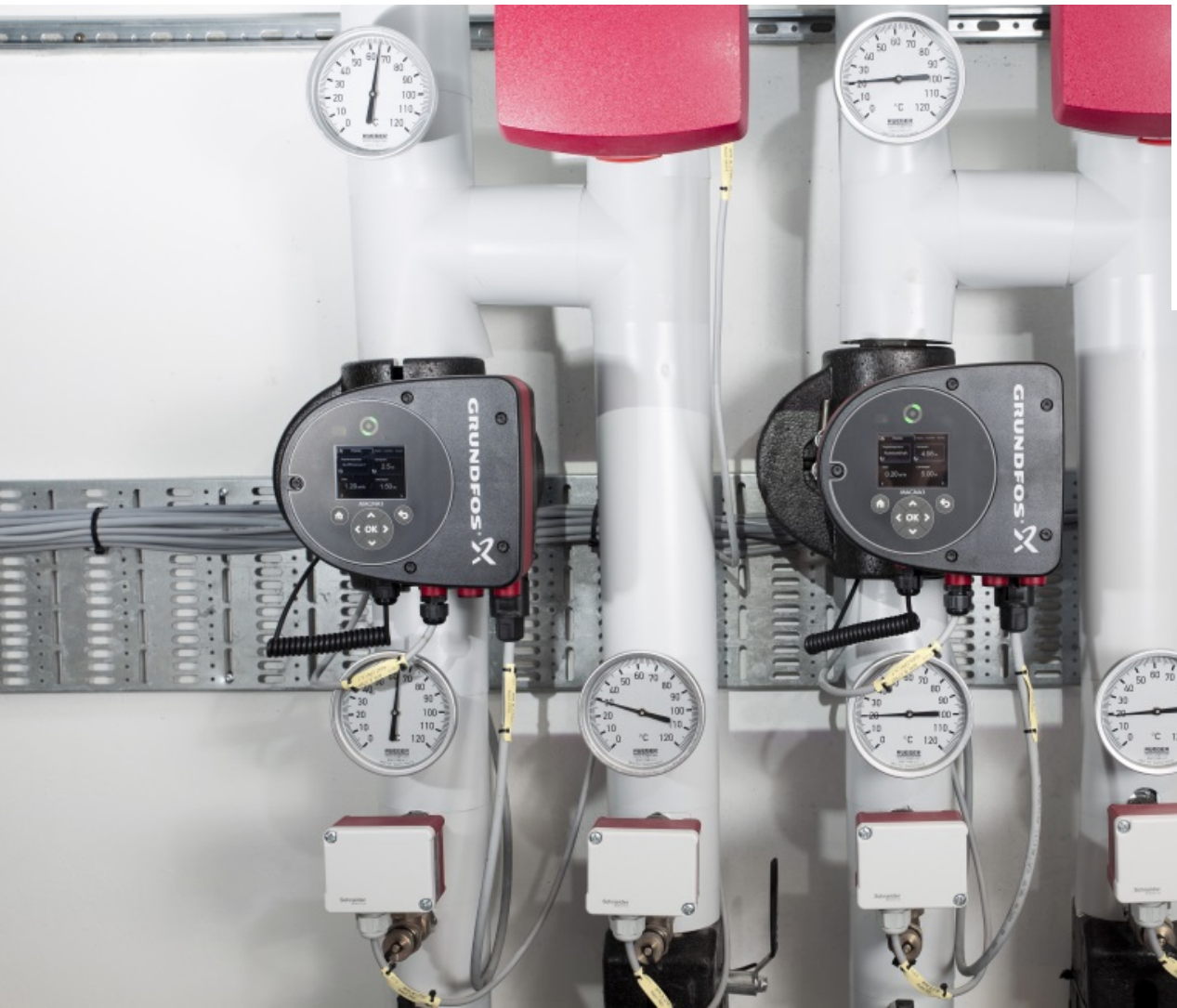

General Information

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IBU – Institut Bauen und Umwelt e.V.
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Declaration number

EPD-GRU-20230075-CBC1-EN

This declaration is based on the product category rules:

Pumps for liquids and liquids with solids, 01.08.2021
(PCR checked and approved by the SVR)

Issue date

21.11.2023

Valid to

20.11.2028

Dipl.-Ing. Hans Peters
(Chairman of Institut Bauen und Umwelt e.V.)

Florian Pronold
(Managing Director Institut Bauen und Umwelt e.V.)

MAGNA3 100-80/100/120 (Cast Iron)

Owner of the declaration

Grundfos Holding A/S
Poul Due Jensens Vej 7
8850 Bjerringbro
Denmark

Declared product / declared unit

1 PCS. of MAGNA3 100-80/100/120 (Cast Iron)

Scope:

The declaration applies to 1 piece of MAGNA3 (Cast Iron) pump.
The product is produced in Wahlstedt, Germany, and the life cycle assessment is based on data collected at the production site.

Production has been modeled using annual production data from 2021.
The declaration covers three different types of the MAGNA3 100- product (80/100/120).
The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

The EPD was created according to the specifications of EN 15804+A2. In the following, the standard will be simplified as *EN 15804*.

Verification

The standard EN 15804 serves as the core PCR
Independent verification of the declaration and data according to ISO 14025:2011
☐ internally ☒ externally

Mrs Kim Allbury,
(Independent verifier)

Product

Product description/Product definition
The Grundfos MAGNA3 circulator pumps are designed for circulating liquids in heating systems, air conditioning and cooling systems and domestic hot water systems. However, the pump range can also be used in ground source heat pump systems and solar heating systems.

The MAGNA3 pump is a centrifugal pump powered by an electrical motor. It has a high-performance neodymium magnet rotor which increases motor efficiency and an insulation shell to reduce heat loss from the cast iron pump housing with threaded connections.
The declaration covers three types of the MAGNA3 pump. They are grouped as shown below. The group reference in the technical data and scenarios refers also to these.

GROUP 1 - MAGNA3 100-80
GROUP 2 - MAGNA3 100-100 GROUP 3 - MAGNA 3 100-120

These are all the same physical products and 100 % identical in terms of design, dimensions and materials as well as supply chain and manufacturing processes, i.e., all cradle to gate processes (A1-A3).

The products are also identical in terms of packaging, distribution, reference service life and end-of-life treatment.

The only thing that differentiates the products from each other is the software which controls how the pump operates in the system in which it is installed, making them fit for different applications. Hence, all life cycle modules are identical, except use stage module B6, which will change, as the applied scenarios for electricity consumption changes. For the placing on the market in the European Union/European Free Trade Association (EU/EFTA) (with the exception of Switzerland) the following legal provisions apply:

Machinery Directive (2006/42/EC)
Standard used: *EN 809:1998 + A1:2009.*

Radio Equipment Directive (2014/53/EU)
Standards used:
EN 60335-1:2012/AC:2014 + A11:2014, EN 60335-2-51:2003 + A1:2008 + A2:2012, EN 62233:2008.

EN 55014-1:2006 + A1:2009 + A2:2011, EN 55014-1:2017, EN 61000-6-2:2005, EN 61000-3-2:2014, EN 61000-3-3:2013, ETSI EN 301 489-1 V2.2.0, ETSI EN 301 489-17 V3.2.0. ETSI EN 300 328 V2.1.1

Electromagnetic Compatibility (EMC) Directive (2014/30/EU)
Standards used:
EN 55014-1:2017, EN 55014-2:2015,

EN 61000-3-2:2014/2019, EN 61000-6-2:2008/2019,

EN 61000-3-3:2013 A1:2019

RoHS Directive 2011/65/EU and 2015/863//EU
Standard: *EN 50581:2012.*

Ecodesign Directive (2009/125/EC)
Commission Regulation (EC) No: 641/2009 and Commission Regulation (EU) 622/2012
Standards used:
EN 16297-1:2012, EN 16297-2:2012, EN 16297-3:2012.

The CE marking takes into account the proof of conformity with the respective harmonized norms based on the legal provisions above.

MAGNA3 pumps are not harmonized in accordance with the *CPR.*

Application
For the application and use the respective national provisions apply.

The pump is designed for circulating liquids in the following systems:

· heating systems
· domestic hot-water systems
· air-conditioning and cooling systems
· ground-source heat-pump systems
· solar-heating systems

The pump is suitable for thin, clean, non-aggressive and non-explosive liquids, not containing solid particles or fibres that may attack the pump mechanically or chemically. In heating systems, the water must meet the requirements of accepted standards on water quality in heating systems. The pumps are also suitable for domestic hot-water systems

Technical Data
The performance data of the product according to the harmonized norms, based on the harmonization provisions above apply.
The relevant technical specifications according to the *PCR Part B* are given in the table below.
Characteristics that are the same for all product groups are only given once. Others are given individually for all three groups.

Constructional data

Name	Value	Unit
Frequency	50	Hz
Voltage	230	V
Pumped liquid (e.g. water)	Clean Water	-
Energy Efficiency Index Gr.1	0,17	
Energy Efficiency Index Gr.2	0,17	
Energy Efficiency Index Gr.3	0,17	
Flow range Gr. 1 (max)	60,0	m3/h
Flow range Gr. 2 (max)	66,0	m3/h
Flow range Gr. 3 (max)	71,0	m3/h
Head max. Gr.1	8	m
Head max. Gr.2	10	m
Head max. Gr.3	12	m
Power input Gr. 1 Average (from load profile describing use)	0,404	kW
Power input Gr. 2 Average (from load profile describing use)	0,558	kW
Power input Gr. 3 Average (from load profile describing use)	0,636	kW
Nominal capacity Gr.1	0,95	kW
Nominal capacity Gr. 2	1,21	kW
Nominal capacity Gr.3	1,54	kW

Performance data of the product according to the harmonized standards, based on provisions for harmonization.

Base materials/Ancillary materials

Base materials / Ancillary materials

Name	Value	Unit
Aluminium	10	%
Cast iron	60	%
Ceramics	0,2	%
Copper	3	%
Electronics	0,2	%
Magnet Nd	1	%
Paper	0,3	%
PCB	2	%
Plastics	0,2	%
Plastics, foam	1	%
Plastics GF	3	%
Rubber	0,1	%
Stainless steel	3	%
Steel	8	%
Cardboard	7	%
Plastic film	0,04	%
TOTAL	100	%

REACH
This product/article/at least one partial article contains substances listed in the *ECHA candidate list* (date: 10.06.2022) exceeding 0.1 percentage by mass: **no**

The Wahlstedt production has been assessed and certified as meeting the requirements in *ISO 14001, ISO 50001, ISO 45001 and ISO 9001*

Reference service life
No use stage scenario which refers to the lifetime of the product is declared. However, to facilitate building calculations, an estimated RSL of 10 years can be used.
This is an EU consensus-based estimation, referenced on page 37 in Appendix 7: *Lot 11 – Circulators in Buildings*, prepared by AEA Energy & Environment for the European Commission in the context of the Eco Design Directive:

There is no definitive information on the average circulator life available, there is consensus within the industry that it is at least 12 years. However, this is complicated by many factors, including many being scrapped prematurely when e.g. the boiler they are connected to is replaced.

From the estimated stock (140Mpa) and annual sales (14Mpa), the average lifetime of the circulator is taken as 10 years for the purposes of this study.

The RSL of the declared product is not directly influencing the results in this study, as no declared use stage scenario is dependent on the RSL; The use stage sub-module B6 is declared per year as required by the *PCR Part B.*

LCA: Calculation rules

Declared Unit
The declared unit is 1 piece (pcs.) of MAGNA3 (Cast Iron) pump.

Name	Value	Unit
Declared unit	1	pce.
Mass reference	37.23	kg/pce
Conversion factor [Mass/Declared Unit]	37.23	

For IBU core EPDs (where clause 3.6 is part of the EPD): for average EPDs, an estimate of the robustness of the LCA values must be made, e.g. concerning the variability of the production process, geographical representativeness and the influence of background data and preliminary products compared to the environmental impacts caused by the actual production.

System boundary
This EPD is Cradle-To-Grave. The system boundaries of the EPD follow the modular approach in *EN 15804*. By decision no. 20170712-n of the *SVR*, the modules B3, B4 and B5 are by default declared as "MNR" (module not relevant).

The product stage (A1-A3) comprises raw material extraction and processing, transport processes as well as the manufacturing process. The final production and assembly of the MAGNA3 pump takes place at a Grundfos manufacturing site in Germany. However, the full supply-chain leading to the finished product at the gate is rather complex and includes a large amount of raw materials, components and semi-finished parts which comes from both external suppliers as well as other Grundfos production facilities.

The product stage is included in the study, and according to *EN 15804* the system boundary with nature is set to include those processes that provide the material and energy inputs into the system and the following manufacturing, transport up to the factory gate as well as the processing any waste arising from those processes.
Wastes and losses are included in the modules where they occur according to the polluter pays principle and the modular approach of *EN 15804.*

The product includes:

· A1 Extraction and processing of raw materials;
· A1 Reuse of products or materials from a previous product system;
· A1 Processing of secondary materials;
· A1 Generation of electricity, steam and heat from primary energy resources, also including their extraction, refining and transport;
· A1 Energy recovery and other recovery processes from secondary fuels;
· A2 Transportation up to the factory gate and internal transport;
· A3 Production of ancillary materials or pre products;
· A3 Manufacturing of products and coproducts;
· A3 Manufacturing of packaging;
· A1-A3 processing up to the end-of-waste state or disposal of final residues.

For secondary material inputs, the system boundary to the previous system (providing the secondary material) is set where outputs reach the end-of-waste state. The recycling of secondary material into new raw materials is included in the system boundary of this study. Waste materials from production processes that is recycled without any modification of the material inherent characteristics are modelled as closed loop within A1-A3. This is done up to the input mass flow that was used during production.

Waste for incineration arising in the product stage is accounted

for in the module where the waste is produced. The environmental loads from the incineration process are declared in the module where it occurs and the electricity and heat which is produced from the incineration are considered as closed-loop within A1-A3, as described in *PCR Part A,* 5.5.1. The input of biogenic carbon from the production of packaging material is inventoried in A3. As required by *PCR Part A*, the corresponding end-of-life module of the packaging material, A5, is also declared and the emissions of biogenic carbon are inventoried.

The construction process stage (A4-A5) includes:

A4:

· Transportation from factory gate to distribution center:
· Consumption of electricity, thermal energy and water at distribution center;
· Transportation from distribution center to construction site;
· Wastage during distribution.

A5:

· Installation process;
· Transport of packaging waste to treatment site;
· Waste treatment of packaging.

The packaging material does not reach the end of waste state but is incinerated as waste.
According to European statistics, the average R1 value of incineration plants is > 0.6. Therefore, it is assumed

that packaging material is treated thermally in an incineration plant with R1 > 0.6. The loads from the combustion process of packaging are declared in module A5 and the resulting energy benefits in module D, as required by the *PCR Part A*, 5.5.2.

Use stage (B1-B7):

The use stage, related to the building fabric includes:

· B1, use or application of the installed product;
· B2, maintenance.

The use stage related to the operation of the building includes:

· B6, operational energy use;
· B7, operational water use.

In this study, all use stage modules are assessed, though B1, B2 and B7 are assessed to be zero. By decision no. 20170712-n of the *SVR*, the modules B3, B4 and B5 are by default declared as "MNR" (module not relevant).
The modules include the provision and transport of all materials, products and related energy and water use, as well as waste processing up to the end-of-waste state or disposal of final residues during the use stage. They also include all impacts and aspects related to the losses during the use stage (i.e. production, transport, and waste processing and disposal of the lost products and materials).

Generally, the geographical coverage of the datasets used matches the actual processes taking place. Meaning, that when modelling taking place in Grundfos Bjerringbro, the Danish electricity grid mix is used in the model and thermal energy from natural gas. These are generally of very high quality with very good technological, temporal and geographical representativeness.

Contributions to operational energy use during the use stage (B6) come from the electricity consumption of the product. The annual electricity consumption is calculated by multiplying the average power input, which is based on a defined load profile, with the annual running hours. For use stage (B6) European Average electricity grid mix has been used. These values are declared in the scenarios section.

The End-of-Life stage (C1-C4) includes all activities from when the product reaches the end of its service life and no longer provides any functionality and until all materials and components are processed for reuse/recycling or disposed of.

According to *EN 15804* and the *PCR Part A,* the end-of-life stage includes:

· C1 deconstruction of the product from the building, including initial on-site sorting of the materials;
· C2 transportation of the discarded product to a recycling site and transportation of waste to final disposal;
· C3 waste processing, collection of waste fractions from the deconstruction and waste processing of material flows intended for reuse, recycling and energy recovery;

· C4 waste disposal including physical pretreatment and management of the disposal site.

At the end of life, the MAGNA3 pump is manually disassembled from the piping system in which it has been installed. The definition of the applied end-of-life scenario in this EPD follows the requirements in the

PCR Part A, 6.2 regarding complex products, with a combination of recycling, thermal waste treatment and landfilling. 100 % of the material is considered in the end-of-life scenario as required by the *PCR*. An overall collection rate of 90 % has been assumed.

Materials from which energy is recovered in an incineration process with an R1-value above 0.60 are in this study included with the environmental burdens from the incineration process inventoried in C3, the recovered energy is declared as exported energy in C3 and the energy benefits are declared in D. This procedure is according to the *PCR Part A*, 5.5.6. C3 includes the mechanical separation of the product followed by a series of sorting steps. Metal fractions are recycled and plastics, cardboard and electronics are assumed incinerated with energy recovery. The residual fractions are landfilled and declared in C4.

The specific amounts are shown in the scenarios section.

Beyond system boundary (D): According to *EN 15804* module D includes the reuse, recovery and/or recycling potentials, expressed as net impacts and benefits. Any declared benefits and loads from net flows leaving the product system that have not been allocated as co-products and that have passed the end-of-waste state are included in module D.

Contributions to module D comes from waste incineration processes in A5 and C3 as well as material recycling in C3. The specific fractions and net flows are shown in the scenarios section.

Geographic Representativeness
Land or region, in which the declared product system is manufactured, used or handled at the end of the product´s lifespan: Europe

Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to *EN 15804* and the building context, respectively the product-specific characteristics of performance, are taken into account. Software and databases used: *GaBi ts*

9.2.1.68 (database schema 8007) *Ecoinvent v3.5.*.

LCA: Scenarios and additional technical information

Characteristic product properties of biogenic carbon

The biogenic carbon content quantifies the amount of biogenic carbon in a construction product leaving the factory gate, and it will be separately declared for the product and for any accompanying packaging, as required from the *PCR Part A*. The Carbon content of Cardboard and Paper is assumed to 0.46 kg C. Overall, there is an amount of 9 weight-% Carbon in the product leaving the factory gate and has to be considered.

Information on describing the biogenic Carbon Content at factory gate

Name	Value	Unit
Biogenic carbon content in accompanying packaging	0.74	kg C

Note: 1 kg of biogenic carbon is equivalent to 44/12 kg of CO2

The following technical scenario information is required for the declared modules and optional for non-declared modules. Modules for which no information is declared can be deleted; additional information can also be listed if necessary.

The following technical information is a basis for the declared modules or can be used for developing specific scenarios in the context of a building assessment if modules are not declared (MND).

A5 is not declared including the disposal of the packaging material on the construction site, the amounts of packaging materials included in the LCA calculations must be declared as technical scenario information for Module A5.

Transport from the gate to the site (A4)

Name	Value	Unit
Litres of fuel	0,052	l/100km
Transport distance	2003	km
Capacity utilisation (including empty runs)	85	%
Gross density of products transported	716	kg/m^3
Wastage during distribution	0,02	%

Installation into the building (A5)

Name	Value	Unit
Packaging waste for incineration (LDPE film)	0,031	kg
Packaging waste for incineration (Paper/Cardboard)	2,81	kg

An
estimated RSL of 10 years can be used to facilitate building calculations. This
is an EU consensus-based estimation, referenced in Appendix 7: Lot 11 –
Circulators in Buildings, prepared by AEA Energy & Environment for the
European Commission in the context of the Eco Design Directive.

Operational energy use (B6)

Name	Value	Unit
Electricity consumption	2020	kWh/a
Electricity consumption	2790	kWh/a
Electricity consumption	3180	kWh/a
Average power input,	0,404	kW
Average power input,	0,558	kW
Average power input,	0,636	kW
Running hours (all groups)	5.000	h/a

End of life (C1-C4)

Name	Value	Unit
Collected as mixed construction waste	34,42	kg
Transportation distance (C2)	500	km
Aluminium for recycling	3,43	kg
Steel for recycling	22,2	kg
Copper for recycling	1,05	kg
Stainless steel for recycling	1,04	kg
Plastics for incineration w/energy	1,58	kg
Electronics for incineration w/energy	0,81	kg
Landfilling	4,31	kg

Reuse, recovery and/or recycling potentials (D), relevant scenario information

Name	Value	Unit
A5, incineration w/energy recov. (LDPE foil)	6,19	MJ
A5, incineration w/energy recov. (Paper/Cardboard)	11,2	MJ
C3, steel for recycling (net amounts)	-2,2	kg
C3, stainless steel for recycling (net amounts)	0,49	kg
C3, aluminium for recycling (net amounts)	-0,46	kg
C3, copper for recycling (net amounts)	0,451	kg
C3, plastics for incineration, w/ energy recov.	1,58	kg
C3, electronics for incineration, w/ energy recov.	0,81	kg

LCA: Results

Characterization model: *EN 15804* - 2012+A2 - 2019, PEF. By Decision no. 20170712-n of the IBU SVR, the modules B3, B4, B5 are marked as MNR (module not relevant) as default. The LCA results in module B6 are given on a period of one year, according to *PCR Part B*. To obtain the results from module B6 over the entire life cycle, the LCA results of module B6 must be multiplied by the estimated RSL of 10 years. The indicator results for module B6 are declared for Group 1. B6 indicator results for other groups can be derived by multiplying the B6 indicator results with the following factors:

Group 2: 1,38 Group 3: 1,57

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; ND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

Product stage			Construction process stage		Use stage							End of life stage				Benefits and loads beyond the system boundaries
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	MND	MND	MNR	MNR	MNR	X	MND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1PCS of MAGNA3 100-80/100/120 (Cast Iron)

Parameter	Unit	A1	A2	A3	A4	A5	B6	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq	1.41E+02	2.13E+00	8.21E-02	2.32E+00	4.06E+00	8.17E+02	0	9.58E-01	8.45E+00	2.17E-01	6.39E-01
GWP-fossil	kg CO_2 eq	1.4E+02	2.11E+00	4.84E+00	2.31E+00	1.86E-01	8.13E+02	0	9.52E-01	8.44E+00	2.23E-01	6.45E-01
GWP-biogenic	kg CO_2 eq	8.37E-01	-3.1E-03	-4.8E+00	-4.61E-03	3.88E+00	2.71E+00	0	-1.61E-03	1.04E-02	-6.72E-03	-1.2E-03
GWP-luluc	kg CO_2 eq	2.82E-01	1.59E-02	4.23E-02	1.83E-02	1.38E-04	1.18E+00	0	7.74E-03	5.1E-03	1.96E-04	-4.73E-03
ODP	kg CFC11 eq	1.04E-07	3.76E-16	4.08E-09	2.15E-11	7.41E-16	1.79E-11	0	1.76E-16	7.69E-14	5.02E-16	-9.38E-13
AP	mol H^+ eq	6.48E-01	1.36E-02	1.91E-02	1.34E-02	1.17E-03	1.8E+00	0	5.63E-03	8.53E-03	6.93E-04	-1.8E-02
EP-freshwater	kg P eq	1.73E-03	6.03E-06	8.45E-05	7.26E-06	1.7E-07	2.17E-03	0	2.91E-06	1.35E-05	2.43E-05	-5.35E-06
EP-marine	kg N eq	8.84E-02	5.07E-03	4.09E-03	6.42E-03	4.29E-04	3.99E-01	0	2.71E-03	2.01E-03	1.6E-04	7.86E-05
EP-terrestrial	mol N eq	9.3E-01	5.62E-02	4.07E-02	7.1E-02	5.33E-03	4.19E+00	0	3.01E-02	2.21E-02	1.75E-03	1.48E-03
POCP	kg NMVOC eq	2.77E-01	1.12E-02	1.14E-02	1.22E-02	1.12E-03	1.09E+00	0	5.15E-03	5.49E-03	5.14E-04	-2.66E-05
ADPE	kg Sb eq	7.51E-03	1.63E-07	6.1E-05	1.7E-06	1.24E-08	2.35E-04	0	7.74E-08	1.01E-06	1.51E-08	-1.26E-03
ADPF	MJ	1.88E+03	2.81E+01	6.68E+01	3.1E+01	1.4E+00	1.43E+04	0	1.28E+01	6.25E+01	3.2E+00	-1.71E+01
WDP	m^3 world eq deprived	2.83E+01	1.95E-02	4.57E-01	2.98E-02	5.01E-01	1.77E+02	0	9.33E-03	1.25E+00	-2.46E-03	-8.96E-01

GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential)

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1PCS of MAGNA3 100-80/100/120 (Cast Iron)

Parameter	Unit	A1	A2	A3	A4	A5	B6	C1	C2	C3	C4	D
PERE	MJ	5.58E+02	1.52E+00	7.07E+01	1.93E+00	2.41E-01	6.34E+03	0	7.38E-01	2.72E+01	2.24E-01	3.34E+00
PERM	MJ	0	0	0	0	0	0	0	0	0	0	0
PERT	MJ	5.58E+02	1.52E+00	7.07E+01	1.93E+00	2.41E-01	6.34E+03	0	7.38E-01	2.72E+01	2.24E-01	3.34E+00
PENRE	MJ	1.88E+03	2.82E+01	6.68E+01	3.11E+01	1.4E+00	1.43E+04	0	1.28E+01	6.25E+01	3.2E+00	-1.69E+01
PENRM	MJ	0	0	0	0	0	0	0	0	0	0	0
PENRT	MJ	1.88E+03	2.82E+01	6.68E+01	3.11E+01	1.4E+00	1.43E+04	0	1.28E+01	6.25E+01	3.2E+00	-1.69E+01
SM	kg	2.94E+01	0	2.38E-01	5.94E-03	0	0	0	0	0	0	0
RSF	MJ	1.46E-23	0	0	2.91E-27	0	0	0	0	0	0	0
NRSF	MJ	1.71E-22	0	0	3.42E-26	0	0	0	0	0	0	0
FW	m^3	9.43E-01	1.78E-03	3.65E-02	2.31E-03	1.18E-02	7.33E+00	0	8.6E-04	4.29E-02	4.07E-05	2.55E-02

PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1PCS of MAGNA3 100-80/100/120 (Cast Iron)

Parameter	Unit	A1	A2	A3	A4	A5	B6	C1	C2	C3	C4	D
HWD	kg	5.79E-04	1.22E-06	1.22E-04	1.54E-06	7.27E-09	5.92E-06	0	5.93E-07	3.01E-08	1.28E-08	-3.09E-04
NHWD	kg	5.5E+00	4.37E-03	3.2E-01	6.32E-03	1.32E-01	1.01E+01	0	2.03E-03	8.87E-01	3.66E+00	2.15E+00
RWD	kg	8.66E-02	5.06E-05	1.83E-03	8.16E-05	6.75E-05	2.17E+00	0	2.36E-05	9.3E-03	3.83E-05	-2.19E-03
CRU	kg	0	0	0	0	0	0	0	0	0	0	0
MFR	kg	0	0	0	0	0	0	0	0	2.77E+01	0	0
MER	kg	0	0	0	0	0	0	0	0	0	0	0
EEE	MJ	0	0	0	0	6.19E+00	0	0	0	8.26E+00	0	0
EET	MJ	0	0	0	0	1.12E+01	0	0	0	1.49E+01	0	0

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

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: 1PCS of MAGNA3 100-80/100/120 (Cast Iron)

Parameter	Unit	A1	A2	A3	A4	A5	B6	C1	C2	C3	C4	D
PM	Disease incidence	8.37E-06	1.44E-07	2.64E-07	7.95E-08	6.61E-09	1.51E-05	0	3.29E-08	7.19E-08	7.06E-09	-2.92E-07
IR	kBq U235 eq	9.47E+00	7.46E-03	2.89E-01	1.15E-02	1.04E-02	3.56E+02	0	3.48E-03	1.52E+00	5.44E-03	-1.89E-01
ETP-fw	CTUe	9.96E+02	2.1E+01	2.06E+01	2.27E+01	7.04E-01	6.12E+03	0	9.55E+00	2.71E+01	2.25E+00	-1.12E+01
HTP-c	CTUh	1.64E-06	4.31E-10	6.61E-07	9.35E-10	3.45E-11	1.69E-07	0	1.98E-10	8E-10	1.29E-10	-6.18E-08
HTP-nc	CTUh	2.91E-06	2.37E-08	6.59E-08	2.74E-08	1.59E-09	6.22E-06	0	1.13E-08	3.17E-08	1.13E-08	-4.34E-09
SQP	SQP	5.7E+02	9.22E+00	1.39E+02	1.07E+01	3.81E-01	4.55E+03	0	4.48E+00	1.97E+01	2.31E-01	-2.66E+01

PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); SQP = Potential soil quality index

Disclaimer 1 – for the indicator 'Potential Human exposure efficiency relative to U235'.
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 or radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – for the indicators 'abiotic depletion potential for non-fossil resources', 'abiotic depletion potential for fossil resources', 'water (user) deprivation potential, deprivation-weighted water consumption', 'potential comparative toxic unit for ecosystems', 'potential comparative toxic unit for humans – cancerogenic', 'Potential comparative toxic unit for humans - not cancerogenic', 'potential soil quality index'. The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high as there is limited experience with the indicator.

Disclaimer 3: *JRC Technical Reports, Version 2, 2018* Page 6, for the indicator "EP-freshwater". This indicator has been calculated as 'kg P eq' as required in the characterization model EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe; This EPD was created using a software tool.

References

Standards

EN 15804

EN 15804:2012+A1 2013, Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products.

EN 15804

EN 15804:2012+A2:2019+AC:2021, Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products.

ISO 14025

EN ISO 14025:2011, Environmental labels and declarations — Type III environmental declarations — Principles and procedures.

Further References

Title of the software/database

Title of the software/database. Addition to the title, version. Place: Publisher, Date of publication [Access on access date].

IBU 2021

Institut Bauen und Umwelt e.V.: General Instructions for the EPD programme of Institut Bauen und Umwelt e.V., Version 2.0, Berlin: Institut Bauen und Umwelt e.V., 2021
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Standards

Machinery Directive
DIRECTIVE 2006/42/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 May
2006 on machinery

Radio Equipment Directive
DIRECTIVE 2014/53/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment

Electromagnetic Compatibility (EMC) Directive

DIRECTIVE 2014/30/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 26 February 2014 on the harmonistion of the laws of the Member States relating to electromagnetic compatibility

Ecodesign Directive

DIRECTIVE 2009/125/EC OF THE EUROPEAN PARLIAMENT

AND OF THE COUNCIL of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products

EC 641/2009
COMMISSION REGULATION (EC) No 641/2009 of 22 July 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for glandless standalone circulators and glandless circulators integrated in products

EC 622/2012
COMMISSION REGULATION (EU) No 622/2012 of 11 July 2012 amending Regulation (EC) No 641/2009 with regard to ecodesign requirements for glandless standalone circulators and glandless circulators integrated in products

DIRECTIVE 2011/65/EU
DIRECTIVE 2011/65/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment

DIRECTIVE 2015/863/EU
DIRECTIVE 2015/863/EU of 31 March 2015 amending Annex II to Directive 2011/65/EU of the European Parliament and of the Council as regards the list of restricted substances

ETSI EN 301 489-1
ETSI EN 301 489-1 V2.2.0, Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements

ETSI EN 301 489-17
ETSI EN 301 489-17 V3.2.0, Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for Broadband Data Transmission Systems

ETSI EN 300 328 V2.1.1
ETSI EN 300 328 V2.1.1, Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques

EN 809
EN 809:1998-10 + A1:2009, Pumps and pump units for liquids - Common safety requirements

EN 55014-1
EN 55014-1:2017, Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission

EN 55014-2
EN 55014-2:2015, Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 2: Immunity – Product family standard (CISPR 14-2:2015)

EN 50581:2012
EN 50581:2012, Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

EN 60335-1
EN 60335-1:2012/A11:2014/A13:2017, Household and similar electrical appliances – Safety – Part 1:General requirements

EN 60335-2-51
EN 60335-2-51:2003-03 + A1:2008 + A2:2012, Household and similar electrical appliances – Safety –Part 2-51: Particular requirements for stationary circulation pumps for heating and service water installations

EN 61000-3-2
EN 61000-3-2:2014/2019, Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current =16 A per phase)

EN 61000-3-3
EN 61000-3-3:2013-08/ A1:2019, Electromagnetic compatibility (EMC) – Part 3-3:
Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low voltage supply systems, for equipment with rated current <= 16 A per phase and not subject to conditional connection

EN 61000-6-2
EN 61000-6-2:2008/2019, Electromagnetic compatibility (EMC) – Part 6-2: Generic standards –Immunity for industrial environments

EN 16297-1
EN 16297-1:2012-10, Pumps – Rotodynamic pumps – Glandless circulators – Part 1:
General requirements and procedures for testing and calculation of energy efficiency index (EEI)

EN 16297-2
EN 16297-2:2012-10, Pumps – Rotodynamic pumps – Glandless circulators – Part 2: Calculation of energy efficiency index (EEI) for standalone circulators

EN 16297-3
EN 16297-3:2012, Pumps – Rotodynamic pumps –Glandless circulators – Part 3: Energy efficiency index (EEI) for circulators integrated in products

ISO 14001
EN ISO 14001:2015-09, Environmental management systems - Requirements with guidance for use

ISO 14025
DIN EN /ISO 14025:2011-10, Environmental labels and declarations — Type III environmental declarations — Principles and procedures

EN 15804
EN 15804:2012-04+A1 2013, Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

PCR Part A
Institut Bauen und Umwelt e.V., Berlin (pub.): Product Category Rules for Building-Related Products and Services, Product Category Rules for Construction Products from the range of Environmental Product Declarations of Institut Bauen und Umwelt (IBU), Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report, Version 1.7 (2021)

PCR Part B
Institut Bauen und Umwelt e.V., Berlin (pub.): Product Category Rules for Building-Related Products and Services, Product Category Rules for Construction Products from the range of Environmental Product Declarations of Institut Bauen und Umwelt (IBU), Part B: Requirements on the EPD for Pumps for liquids and liquids with solids, Version 1.0 (2018)

Further references

CPR
REGULATION (EU) No 305/2011 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC

CML 2001
Impact assessment characterization factors Institute of Environmental Sciences, Leiden University, Netherlands

ECHA candidate list
Candidate List of substances of very high concern (SVHCs) for authorisation, European Chemicals Agency (ECHA), Helsinki, Finland

Ecoinvent
Ecoinvent v3.5

GaBi ts
GaBi ts 9.2.1.68 (database schema 8007)

REACH
Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) (Status: 27.06.2018)

SVR
Advisory Board (formerly SVA)
Decision no. 20170712-n

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ENVIRONMENTAL-PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A1*

Owner of the Declaration	Grundfos Holding A/S
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-GRU-20180144-CCC2-EN
Issue date	20.11.2018
Valid to	19.05.2024

MAGNA3 25-40/60/80/100/120 (Cast Iron)

Grundfos Holding A/S

Institut Bauen und Umwelt e.V.

ECO PLATFORM EPD VERIFIED

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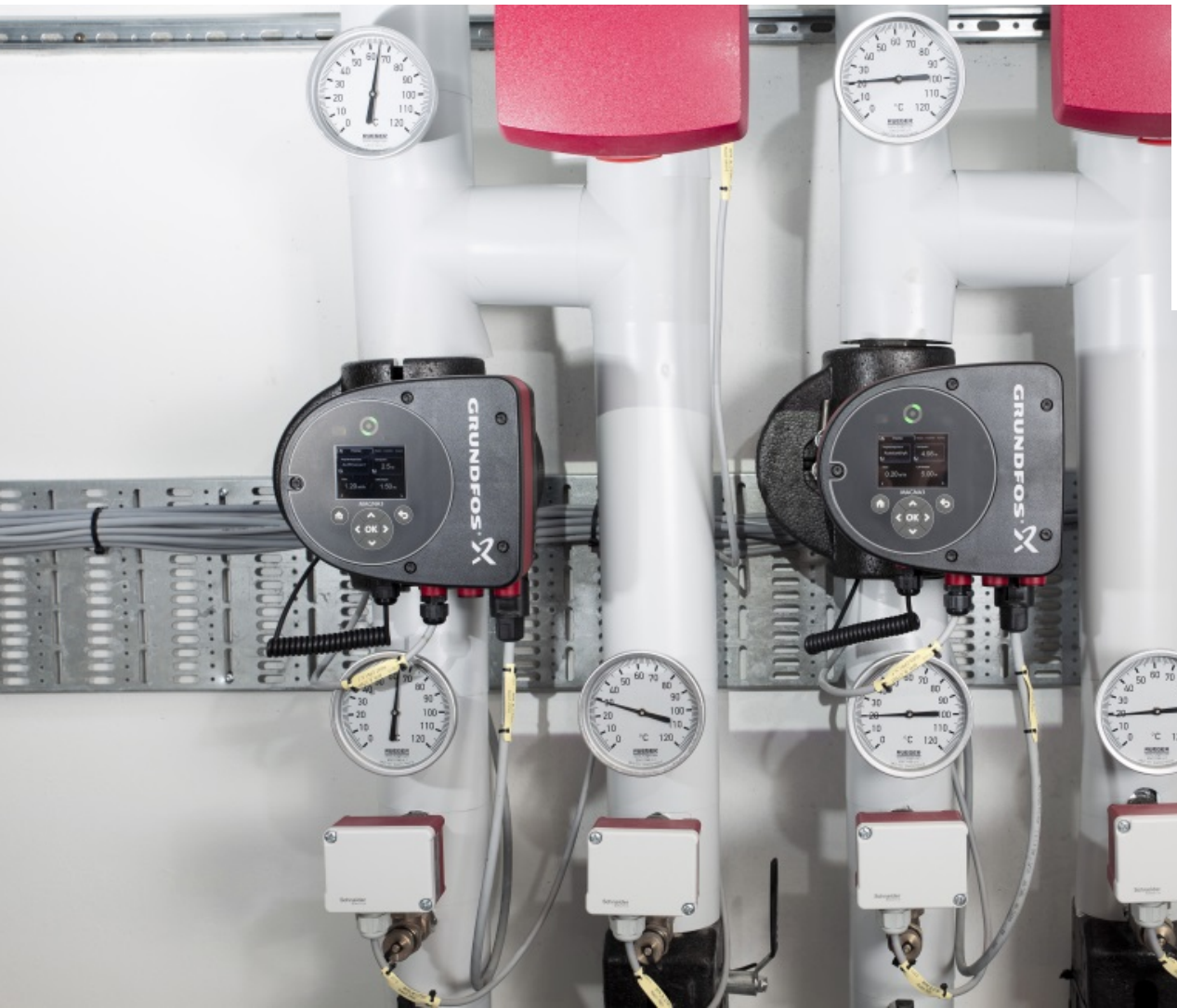

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Declaration number

EPD-GRU-20180144-CCC2-EN

This declaration is based on the product category rules:

Pumps for liquids and liquids with solids, 01.08.2021
(PCR checked and approved by the SVR)

Issue date

20.11.2018

Valid to

19.05.2024

Dipl.-Ing Hans Peters
(chairman of Institut Bauen und Umwelt e.V.)

Florian Pronold
(Managing Director Institut Bauen und Umwelt e.V.)

MAGNA3 25-40/60/80/100/120 (Cast Iron)

Owner of the declaration

Grundfos Holding A/S
Poul Due Jensens Vej 7
8850 Bjerringbro
Denmark

Declared product / declared unit

1 PCS. of MAGNA3 25-40/60/80/100/120 (Cast Iron)

Scope:

The declared product is 1 piece of MAGNA3 25-40/60/80/100/120 (Cast Iron) pump. The product is produced in Wahlstedt, Germany, and the life cycle assessment is based on data collected at the production site. The declaration covers five different types of the MAGNA3 25- product (40/60/80/100/120). All life cycle sub-modules are identical for all five types, except module B6. The indicator results for module B6 in the results tables are declared for MAGNA3 25-40. B6 indicator results for 60, 80, 100 or 120 can be derived by multiplying the B6 indicator results with the factors given in the section LCA: Results.
The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

The EPD was created according to the specifications of EN 15804+A1. In the following, the standard will be simplified as *EN 15804 bezeichnet*.

Verification

The standard EN 15804 serves as the core PCR
Independent verification of the declaration and data according to ISO 14025:2011
☐ internally ☒ externally

Angela Schindler,
(Independent verifier)

Product

Product description/Product definition

The Grundfos MAGNA3 circulator pumps are designed for circulating liquids in heating systems, air-conditioning and cooling systems and domestic hot-water systems. However, the pump range can also be used in ground source heat pump systems and solar-heating systems.

The MAGNA3 pump is a centrifugal pump powered by an electrical motor. It has a high-performance neodymium magnet rotor which increases motor efficiency and an insulation shell to reduce heat loss from the cast iron pump housing with threaded connections.

This EPD covers five types of the MAGNA3 pump. These are all the same physical products and 100 % identical in terms of design, dimensions and materials as well as supply chain and manufacturing processes, i.e. all cradle to gate processes (A1-A3). The products are also identical in terms of packaging, distribution, reference service life and end-of-life treatment. The only thing that differentiates the products from each other is the software which controls how the pump operates in the system in which it is installed, making them fit for different applications. Hence, all life cycle modules are identical, except use stage module B6, which will change, as the applied scenarios for electricity consumption changes.

Each type covers 4 different product numbers: PN10 (Int.), PN10 (Germany), PN16 (Int.), PN16 (Germany). They are grouped as shown below. The group reference in the technical data and scenarios refers also to these.

GROUP 1 - MAGNA3 25-40 180 PN10/16:
97924244, 97924623, 97924249, 97924628

GROUP 2 - MAGNA3 25-60 180 PN10/16:
97924245, 97924624, 97924250, 97924629

GROUP 3 - MAGNA3 25-80 180 PN10/16:
97924246, 97924625, 97924251, 97924630

GROUP 4 - MAGNA3 25-100 180 PN10/16:
97924247, 97924626, 97924252, 97924631

GROUP 5 - MAGNA3 25-120 180 PN10/16:
97924248, 97924627, 97924253, 97924632 For the placing on the market in the EU/EFTA (with the exception of Switzerland) the following legal provisions as well as the corresponding harmonised norms based on these provisions apply:

Machinery Directive (2006/42/EC)
Standard used: EN 809:1998 + A1:2009.

Radio Equipment Directive (2014/53/EU)
Standards used: EN 60335-1:2012/AC:2014 + A11:2014, EN 60335-2-51:2003 + A1:2008 + A2:2012, EN 62233:2008. EN 55014-1:2006 + A1:2009 + A2:2011, EN 55014-1:2017, EN 61000-6-2:2005, EN 61000-3-2:2014, EN 61000-3-3:2013, ETSI EN 301 489-1 V2.2.0, ETSI EN 301 489-17 V3.2.0. ETSI EN 300 328 V2.1.1

Ecodesign Directive (2009/125/EC)
Commission Regulation (EC) No: 641/2009 and Commission Regulation (EU) 622/2012.
Standards used: EN 16297-1:2012, EN 16297-2:2012.

The CE-marking takes into account the proof of conformity with the respective harmonized norms based on
the legal provisions above.

MAGNA3 pumps are not covered by a harmonized standard under the /Regulation EU No. 305/2011/ (CPR).

Application

For
the application and use the respective national provisions apply. The pump is designed for circulating liquids in the following systems:

- heating systems
- domestic hot-water systems
- air-conditioning and cooling systems
- ground-source heat-pump systems
- solar-heating systems

The pump is suitable for thin, clean, non-aggressive and non-explosive liquids, not containing solid particles or fibres that may attack the pump mechanically or chemically. In heating systems, the water must meet the requirements of accepted standards on water quality in heating systems, for example the German standard VDI 2035. The pumps are also suitable for domestic hot-water systems.

Technical Data

The
performance data of the product according to the harmonised norms, based on the
harmonisation provisions above apply.

The relevant technical specifications according to the PCR Part B is given in the table below. Characteristics that are the same for all five product groups are only given once. Others are given individually for all five groups.
Note:
Electrical pumps usually falls under the scope of several internal market
directives and regulations, such as the Machinery directive, Ecodesign
Directive, Radio Equipment Directive etc. The relevant technical data given in
the EPD will vary depending on the type of product and areas of application,
and the table below should be adjusted accordingly.

Name	Value	Unit
Frequency	50	Hz
Voltage	230	V
Pumped liquid (e.g. water)	Clean water	-
Energy Efficiency Index	0,18	
Flow range, Gr. 1 (max)	6,1	m3/h
Flow range, Gr. 2 (max)	7,5	m3/h
Flow range, Gr. 3 (max)	8,5	m3/h
Flow range, Gr. 4 (max)	9,4	m3/h
Flow range, Gr. 5 (max)	9,7	m3/h
Head max., Gr. 1	4	m
Head max., Gr. 2	6	m
Head max., Gr. 3	8	m
Head max., Gr. 4	10	m
Head max., Gr. 5	12	m
Power input, Gr. 1 Average (from load profile describing use)	0,0238	kW
Power input, Gr. 2 Average (from load profile describing use)	0,0363	kW
Power input, Gr. 3 Average (from load profile describing use)	0,0498	kW
Power input, Gr. 4 Average (from load profile describing use)	0,0643	kW
Power input, Gr. 5 Average (from load profile describing use)	0,0739	kW
Nominal capacity, Gr. 1	0,05	kW
Nominal capacity, Gr. 2	0,084	kW
Nominal capacity, Gr. 3	0,116	kW
Nominal capacity, Gr. 4	0,153	kW
Nominal capacity, Gr. 5	0,185	kW

Please select one of the following options and delete the header of the selected [alternative]:

[Alternative 1a: Product according to the CPR, based on a hEN]:

- Performance data of the product in accordance with the declaration of performance with respect to its essential characteristics according to *EN xyz:date, title*.
- Voluntary data: *source, date, title* (not part of CE-marking).

[Alternative 1b: Product according to the CPR, based on an ETA]:

- Performance data of the product in accordance with the declaration of performance with respect to its essential characteristics according to *ETA no. xyz, date, title*.
- Voluntary data: *source, date, title* (not part of CE-marking).

[Alternative 2a: Product not harmonised in accordance with the CPR but in accordance with other provisions for harmonisation of the EU]:

Performance data of the product according to the harmonised standards, based on provisions for harmonization.

Voluntary data: *source, date, title* (not part of CE-marking).

[Alternative 2b: Product harmonized as well in accordance with the CPR as with other legal provisions of the EU]:

- Performance data of the product in accordance with the declaration of performance with respect to its essential characteristics according to *EN xyz: date, title* or *ETA no. xyz, date, title* respectively.
- Performance data of the product, based on the harmonised standards, in accordance with the other provisions for harmonization.
- Voluntary data: *source, date, title* (not part of CE-marking)

[Alternative 3: Product for which no legal provisions for harmonisation of the EU exist]:

Performance data of the product with respect to its characteristics in accordance with the relevant technical provision (no CE-marking).

Base materials/Ancillary materials

Name	Value	Unit
Aluminium	5,4	%
Cardboard	6,4	%
Cast iron	36	%
Ceramics	0,8	%
Copper	3,2	%
Electronics	6,1	%
Magnet	1,9	%
Paper	3,0	%
Plastic film	0,2	%
Plastics	15,6	%
Rubber	0,6	%
Stainless steel	6,5	%
Steel	6,6	%
Wood pallet	7,7	%
TOTAL	100	%

REACH
The product does not contain substances listed in the Candidate List of Substances of Very High Concern for Authorisation (15.01.2018) exceeding 0.1 percentage by mass.

ISO 14001
The Wahlstedt production has been assessed and certified as meeting the requirements in ISO 14001:2015 (Certificate DE11/81829052.07)

Environment and health during use

Reference service life
No use stage scenario which refers to the lifetime of the product is declared. However, to facilitate building calculations, an estimated RSL of 10 years can be used. This is an EU consensus-based estimation, referenced on page 37 in Appendix 7: Lot 11 – Circulators in Buildings, prepared by AEA Energy & Environment for the European Commission in the context of the Eco Design Directive:

There is no definitive information on average circulator life available, there is consensus within industry that it is at least 12 years. However, this is complicated by many factors, including many being scrapped prematurely when e.g. the boiler they are connected to is replaced.

From the estimated stock (140Mpa) and annual sales (14Mpa), the average lifetime of the circulator is taken as being 10 years for the purposes of this study.

The RSL of the declared product is not directly influencing the results in this study, as no declared use stage scenario is dependent on the RSL; The use stage sub-module B6 is

declared per year as required by the PCR Part B.

LCA: Calculation rules

Declared Unit
The declared unit is 1 piece (pce) of product.

Name	Value	Unit
Declared unit	1	pce.
Mass reference	6,41	kg/pce
Conversion factor to 1 kg	0,156	-

For IBU core EPDs (where clause 3.6 is part of the EPD): for average EPDs, an estimate of the robustness of the LCA values must be made, e.g. concerning variability of the production process, geographical representativeness and the influence of background data and preliminary products compared to the environmental impacts caused by actual production.

System boundary
This EPD is Cradle-To-Grave.

The system boundaries of the EPD follow the modular approach in EN 15804.

By decision no. 20170712-n of the SVR, the modules B3, B4 and B5 are by default declared as "MNR" (module not relevant).

The product stage (A1-A3) comprises raw material extraction and processing, transport processes as well as the manufacturing process. The product stage is included in the study, and according to EN 15804 the system boundary with nature is set to include those processes that provide the material and energy inputs into the system and the following manufacturing, transport up to the factory gate as well as the processing of any waste arising from those processes.

Wastes and losses are included in the modules where they occur according to the polluter pays principle and the modular approach of EN 15804.

The product stage includes:

- A1 Extraction and processing of raw materials
- A1 Reuse of products or materials from a previous product system
- A1 Processing of secondary materials
- A1 Generation of electricity, steam and heat from primary energy resources, also including their extraction, refining and transport
- A1 Energy recovery and other recovery processes from secondary fuels
- A2 Transportation up to the factory gate and internal transport
- A3 Production of ancillary materials or pre-products
- A3 Manufacturing of products and co-products
- A3 Manufacturing of packaging
- A1-A3 processing up to the end-of-waste state or disposal of final residues

For secondary material inputs, the system boundary to the previous system (providing the secondary material) is set where outputs reach the end-of-waste state. The recycling of secondary material into new raw materials is included in the system boundary of this study.

Waste materials from production processes that is recycled without any modification of the material-inherent characteristics are modelled as closed loop within A1-A3. This is done up to the input mass flow that was used during production.

Waste for incineration arising in the product stage is accounted for in the module where the waste is produced. The environmental loads from the incineration process are declared in the module where it occurs and the electricity and heat which is produced from the incineration is considered as closed-loop within A1-A3, as described in PCR Part A, 5.5.1.

Input of biogenic carbon from the production of packaging material is inventoried in A3. As required by PCR Part A, the corresponding end-of-life module of the packaging material, A5, is also declared and the emissions of biogenic carbon inventoried.

The construction process stage (A4-A5) includes:

A4:

- Transportation from factory gate to distribution center
- Consumption of electricity, thermal energy and water at distribution center
- Transportation from distribution center to construction site
- Wastage during distribution

A5:

- Installation process
- Transport of packaging waste to treatment site
- Waste treatment of packaging

The packaging material does not reach the end of waste state but is incinerated as waste. According to European statistics, the average R1 value of incineration plants is > 0.6. Therefore, it is assumed that packaging material are treated thermally in an incineration plant with R1 > 0.6. The loads from the combustion process of packaging are declared in module A5 and the resulting energy benefits in module D, as required by the PCR Part A, 5.5.2.

Use stage (B1-B7):
The use stage, related to the building fabric includes:

- B1, use or application of the installed product
- B2, maintenance

The use stage related to the operation of the building includes:

- B6, operational energy use
- B7, operational water use

In this study, all use stage modules are assessed, though B1, B2 and B7 are assessed to be zero. By decision no. 20170712-n of the SVR, the modules B3, B4 and B5 are by default declared as "MNR" (module not relevant). The modules include the provision and transport of all materials, products and related energy and water use, as well as waste processing up to the end-of-waste state or disposal of final residues during the use stage. They also include all impacts and aspects related to the losses during the use stage (i.e. production, transport, and waste processing and disposal of the lost products and materials).

Contributions to operational energy use during the use stage (B6) comes from the electricity consumption of the product. The annual electricity consumption is calculated by multiplying the average power input, which is based on a defined load profile, with the annual running hours. These values are declared in the scenarios section.

The End-of-Life stage (C1-C4) includes all activities from when the product reaches the end of its service life and no longer provides any functionality and until all materials and components are processed for reuse/recycling or disposed of.

According to EN 15804 and the PCR Part A, the end of life stage includes:

- C1 deconstruction of the product from the building, including initial on-site sorting of the materials
- C2 transportation of the discarded product to a recycling site and transportation of waste to final disposal
- C3 waste processing, collection of waste fractions from the deconstruction and waste processing of material flows intended for reuse, recycling and energy recovery
- C4 waste disposal including physical pre-treatment and management of the disposal site

At end of life, the MAGNA3 pump is manually disassembled from the piping system in which it has been installed. The definition of the applied end-of-life scenario in this EPD follows the requirements in the PCR Part A, 6.2 regarding complex products, with a combination of recycling, thermal waste treatment and landfilling. 100 % of the material is considered in the end of life scenario as required by the PCR. An overall collection rate of 90 % have been assumed. Materials from which energy is recovered in an incineration process with a R1-value above 0.60 are in this study included with the environmental burdens from the incineration process inventoried in C3, the recovered energy is declared as exported energy in C3 and the energy benefits is declared in D. This procedure is according to the PCR Part A, 5.5.6.

C3 includes the mechanical separation of the product followed by a series of sorting steps. Metal fractions are recycled and plastics, paper (manuals) and electronics are assumed incinerated with energy recovery. The residual fractions are landfilled and declared in C4. The specific amounts are shown in the scenarios section.

Beyond system boundary (D): According to EN 15804 module D includes the reuse, recovery and/or recycling potentials, expressed as net impacts and benefits. Any declared benefits and loads from net flows leaving the product system that have not been allocated as co-products and that have passed the end-of-waste state are included in module D.

Contributions to module D comes from waste incineration processes in A5 and C3 as well as material recycling in C3. The specific fractions and net flows are shown in the scenarios section.

Geographic Representativeness

Land or region, in which the declared product system is manufactured, used or handled at the end of the product´s lifespan: Europe

Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to *EN 15804* and the building context, respectively the product-specific characteristics of performance, are taken into account.

LCA: Scenarios and additional technical information

The following technical information forms the basis for the declared gate-to-grave modules and can be used for developing specific scenarios in the context of a building assessment.

Transport from the gate to the site (A4)

Name	Value	Unit
Litres of fuel	0,0129	l/100km
Transport distance	2003	km
Capacity utilisation (including empty runs)	85	%
Gross density of products transported	428	kg/m^3
Wastage during distribution	0,01	%

Assembly (A5)

Name	Value	Unit
Packaging waste for incineration (PE-film)	0,0093	kg
Packaging waste for incineration (Wood pallet)	0,49	kg
Packaging waste for incineration (Cardboard)	0,411	kg

An estimated RSL of 10 years can be used to facilitate building calculations. This is an EU consensus-based estimation, referenced in Appendix 7: Lot 11 – Circulators in Buildings, prepared by AEA Energy & Environment for the European Commission in the context of the Eco Design Directive.

Reference service life

Name	Value	Unit
Life Span according to the manufacturer	10	a

Operational energy use (B6)

Name	Value	Unit
Electricity consumption, Group 1	119	kWh/a
Electricity consumption, Group 2	181,5	kWh/a
Electricity consumption, Group 3	249	kWh/a
Electricity consumption, Group 4	321,5	kWh/a
Electricity consumption, Group 5	369,5	kWh/a
Average power input, Group 1	0,0238	kW
Average power input, Group 2	0,0363	kW
Average power input, Group 3	0,0498	kW
Average power input, Group 4	0,0643	kW
Average power input, Group 5	0,0739	kW
Running hours (all groups)	5000	h/a

End of life (C1-C4)

Name	Value	Unit
Collected as mixed construction waste	5,5	kg
Transportation distance (C2)	500	km
Aluminium for recycling	0,3	kg
Steel for recycling	2,42	kg
Copper for recycling	0,19	kg
Stainless steel for recycling	0,36	kg
Paper for incineration w/energy recovery	0,17	kg
Plastics for incineration w/energy recovery	0,93	kg
Electronics for incineration w/energy recovery	0,35	kg
Landfilling	0,79	kg

Reuse, recovery and/or recycling potentials (D), relevant scenario information

The values in the table are flow amounts which contributes to module D.

Name	Value	Unit
A5, incineration w/energy recov. (PE-foil)	0,0093	kg
A5, incineration w/energy recov. (Wood pallet)	0,49	kg
A5, incineration w/energy recov. (Cardboard)	0,411	kg
C3, steel for recycling (net amounts)	-0,158	kg
C3, stainless steel for recycling (net amounts)	0,224	kg
C3, aluminium for recycling (net amounts)	-0,047	kg
C3, copper for recycling (net amounts)	0,061	kg
C3, paper for incineration, w/ energy recov.	0,17	kg
C3, plastics for incineration, w/ energy recov.	0,93	kg
C3, electronics for incineration, w/ energy recov.	0,35	kg

LCA: Results

Characterization model: CML 2001 – Apr. 2013. By Decision no. 20170712-n of the IBU SVR, the modules B3, B4, B5 are marked as MNR (module not relevant) as default. The LCA results in B6 refers to a period of one year, as required by the PCR Part B. To quantify B6 over the total life cycle, the LCA results of module B6 is multiplied by 10 (estimated service life).The indicator results for module B6 are declared for MAGNA3 25-40. B6 indicator results for 60/80/100/120 can be derived by multiplying the B6 indicator results with the following factors:

MAGNA3 25-40: **1,00**
MAGNA3 25-60: **1,53**
MAGNA3 25-80: **2,09**
MAGNA3 25-100: **2,70**
MAGNA3 25-120: **3,11**

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED; MNR = MODULE NOT RELEVANT)

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
X	X	X	X	X	X	X	MNR	MNR	MNR	X	X	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A1: 1 PCS of MAGNA3 25-40 (Cast Iron)

Parameter	Unit	A1-A3	A4	A5	B1	B2	B6	B7	C1	C2	C3	C4	D
GWP	kg CO_2 eq	5.13E+01	7.72E-01	1.51E+00	0	0	4.94E+01	0	0	1.41E-01	3.33E+00	1.26E-02	-1.8E+00
ODP	kg CFC11 eq	7.17E-08	7.2E-12	3.44E-14	0	0	2.2E-10	0	0	5.91E-15	1.28E-12	2.85E-15	-7.08E-09
AP	kg SO_2 eq	4.72E-01	3.19E-03	2.33E-04	0	0	1.4E-01	0	0	5.83E-04	1.11E-03	7.46E-05	-8.84E-03
EP	kg PO_4^3 eq	2.52E-02	8.01E-04	4.72E-05	0	0	1.31E-02	0	0	1.48E-04	1.45E-04	1.03E-05	-4.45E-04
POCP	kg Ethen eq	2.45E-02	-1.28E-03	5.98E-06	0	0	8.78E-03	0	0	-2.39E-04	7.5E-05	5.8E-06	-5.39E-04
ADPE	kg Sb eq	3.01E-03	3.7E-07	2.13E-08	0	0	2.62E-05	0	0	1.26E-08	2.06E-07	4.84E-09	-2.06E-04
ADPF	MJ	6.53E+02	1.06E+01	3.85E-01	0	0	5.26E+02	0	0	1.93E+00	3.46E+00	1.63E-01	-2.35E+01

GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A1: 1 PCS of MAGNA3 25-40 (Cast Iron)

Parameter	Unit	A1-A3	A4	A5	B1	B2	B6	B7	C1	C2	C3	C4	D
PERE	MJ	1.5E+02	5.76E-01	1.52E+01	0	0	3.39E+02	0	0	1.01E-01	4.38E+00	2.09E-02	-3.45E+00
PERM	MJ	1.79E+01	0	-1.52E+01	0	0	0	0	0	0	-2.39E+00	0	0
PERT	MJ	1.68E+02	5.76E-01	6.28E-02	0	0	3.39E+02	0	0	1.01E-01	1.99E+00	2.09E-02	-3.45E+00
PENRE	MJ	6.89E+02	1.06E+01	8.4E-01	0	0	9.02E+02	0	0	1.94E+00	3.11E+01	1.69E-01	-2.87E+01
PENRM	MJ	3.12E+01	0	-4E-01	0	0	0	0	0	0	-2.54E+01	0	0
PENRT	MJ	7.2E+02	1.06E+01	4.45E-01	0	0	9.02E+02	0	0	1.94E+00	5.66E+00	1.69E-01	-2.87E+01
SM	kg	3.18E+00	3.18E-04	0	0	0	0	0	0	0	0	0	0
RSF	MJ	0	0	0	0	0	0	0	0	0	0	0	0
NRSF	MJ	0	0	0	0	0	0	0	0	0	0	0	0
FW	m^3	8.55E-01	1.11E-03	3.93E-03	0	0	4.62E-01	0	0	1.87E-04	9.69E-03	3.23E-05	-6.63E-03

PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A1: 1 PCS of MAGNA3 25-40 (Cast Iron)

Parameter	Unit	A1-A3	A4	A5	B1	B2	B6	B7	C1	C2	C3	C4	D
HWD	kg	9.64E-05	5.6E-07	4.32E-09	0	0	4.23E-07	0	0	1.02E-07	4.01E-09	2.91E-09	-2.18E-08

NHWD	kg	3.05E+00	1.23E-03	1.67E-02	0	0	6.35E-01	0	0	1.56E-04	9.89E-02	7.93E-01	2.33E-01
RWD	kg	2.58E-02	2.71E-05	2.39E-05	0	0	1.49E-01	0	0	4.06E-06	8.74E-04	2.44E-06	-2.03E-03
CRU	kg	0	0	0	0	0	0	0	0	0	0	0	0
MFR	kg	0	0	0	0	0	0	0	0	0	3.26E+00	0	0
MER	kg	0	0	0	0	0	0	0	0	0	0	0	0
EEE	MJ	0	0	2.23E+00	0	0	0	0	0	0	5.03E+00	0	0
EET	MJ	0	0	4.01E+00	0	0	0	0	0	0	9.05E+00	0	0

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

Note: The use of secondary material (SM) in A4 comes from product wastage during distribution.

References

Standards

EN 15804

EN 15804:2012+A1 2013, Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products.

EN 15804

EN 15804:2012+A2:2019+AC:2021, Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products.

ISO 14025

EN ISO 14025:2011, Environmental labels and declarations — Type III environmental declarations — Principles and procedures.

Further References

Title of the software/database

Title of the software/database. Addition to the title, version. Place: Publisher, Date of publication [Access on access date].

IBU 2021

Institut Bauen und Umwelt e.V.: General Instructions for the EPD programme of Institut Bauen und Umwelt e.V., Version 2.0, Berlin: Institut Bauen und Umwelt e.V., 2021 www.ibu-epd.com

/IBU 2018/
Product Category Rules for Building-Related Products and Services, Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report, Version 1.7

/IBU 2018/
PCR Guidance-Text for Building-Related Products and Services, Part B: Requirements on the EPD for Pumps for liquids and liquids with solids, Version 1.0

/Machinery Directive/
DIRECTIVE 2006/42/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 May 2006 on machinery

/EN 809/
EN 809:1998-10 + A1:2009 Pumps and pump units for liquids - Common safety requirements

/Radio Equipment Directive/
DIRECTIVE 2014/53/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment

/EN 60335-1/
EN 60335-1:2012-01/AC:2014 + A11:2014 Household and similar electrical appliances - Safety - Part 1: General requirements

/EN 60335-2-51/
EN 60335-2-51:2003-03 + A1:2008 + A2:2012 Household and similar electrical appliances – Safety – Part 2-51: Particular requirements for stationary circulation pumps for heating and service water installations

/EN 62233/
EN 62233:2008-04 Measurement methods for electromagnetic fields of household appliances and similar apparatus with regard to human exposure

/EN 55014-1/
EN 55014-1:2017-04 Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission

/EN 61000-6-2/
EN 61000-6-2:2005-08 Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity for industrial environments

/EN 61000-3-2/
EN 61000-3-2:2014-08 Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current = 16 A per phase)

/61000-3-3:2013/
61000-3-3:2013-08 Electromagnetic compatibility (EMC) – Part 3-3: Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current <= 16 A per phase and not subject to conditional connection

/ETSI EN 301 489-1/
ETSI EN 301 489-1 V2.2.0 ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements

/ETSI EN 301 489-17/
ETSI EN 301 489-17 V3.2.0 ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for Broadband Data Transmission Systems

/ETSI EN 300 328 V2.1.1/
ETSI EN 300 328 V2.1.1 Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques

/Ecodesign Directive/
DIRECTIVE 2009/125/EC OF THE EUROPEAN PARLIAMENT

AND OF THE COUNCIL of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products

/EC 641/2009/
COMMISSION REGULATION (EC) No 641/2009 of 22 July 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for glandless standalone circulators and glandless circulators integrated in products

/EC 622/2012/
COMMISSION REGULATION (EU) No 622/2012 of 11 July 2012 amending Regulation (EC) No 641/2009 with regard to ecodesign requirements for glandless standalone circulators and glandless circulators integrated in products

/EN 16297-1/
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/EN 16297-2/
EN 16297-2:2012-10 Pumps – Rotodynamic pumps – Glandless circulators – Part 2: Calculation of energy efficiency index (EEI) for standalone circulators

/VDI 2035/
VDI 2035:2005-12 "Vermeidung von Schäden in Warmwasser-Heizungsanlagen"

/ISO 14001/
EN ISO 14001:2015-09 Environmental management systems - Requirements with guidance for use

/CPR/
REGULATION (EU) No 305/2011 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC

/GaBi/
GaBi ts 8.7.0.18 (database schema 8007)

/Ecoinvent/
Ecoinvent v3.4

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ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A2*

Owner of the Declaration	Grundfos Holding A/S
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-GRU-20230077-CBC1-EN
Issue date	21.11.2023
Valid to	20.11.2028

MAGNA3 40-80/100 (Cast Iron)

Grundfos Holding A/S

Institut Bauen und Umwelt e.V.

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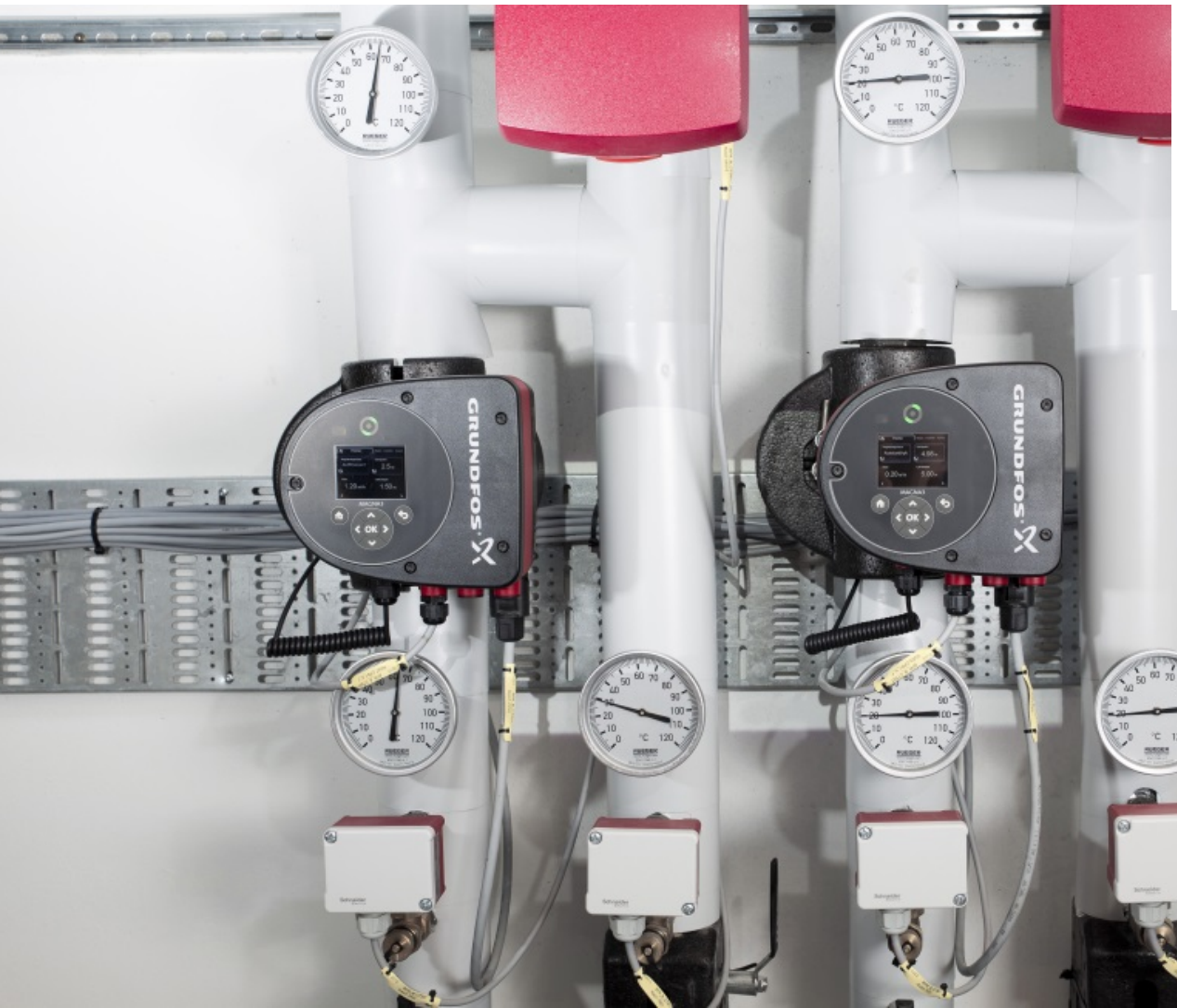

General Information

Grundfos Holding A/S

Programme holder

IBU – Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

Declaration number

EPD-GRU-20230077-CBC1-EN

This declaration is based on the product category rules:

Pumps for liquids and liquids with solids, 01.08.2021
(PCR checked and approved by the SVR)

Issue date

21.11.2023

Valid to

20.11.2028

Dipl.-Ing. Hans Peters
(Chairman of Institut Bauen und Umwelt e.V.)

Florian Pronold
(Managing Director Institut Bauen und Umwelt e.V.)

MAGNA3 40-80/100 (Cast Iron)

Owner of the declaration

Grundfos Holding A/S
Poul Due Jensens Vej 7
8850 Bjerringbro
Denmark

Declared product / declared unit

1 PCS. of MAGNA3 40-80/100 (Cast iron)

Scope:

The declaration applies to 1 piece of MAGNA3 (Cast Iron) pump. The product is produced in Wahlstedt, Germany, and the life cycle assessment is based on data collected at the production site.

Production has been modeled using annual production data from 2021.

The declaration covers two different types of the MAGNA3 40- product (80/100).
The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

The EPD was created according to the specifications of EN 15804+A2. In the following, the standard will be simplified as *EN 15804*.

Verification

The standard EN 15804 serves as the core PCR
Independent verification of the declaration and data according to ISO 14025:2011
☐ internally ☒ externally

Mrs Kim Allbury,
(Independent verifier)

Product

Product description/Product definition

The Grundfos MAGNA3 circulator pumps are designed for circulating liquids in heating systems, air conditioning and cooling systems and domestic hot water systems. However, the pump range can also be used in ground source heat pump systems and solar heating systems.

The MAGNA3 pump is a centrifugal pump powered by an electrical motor. It has a high-performance neodymium magnet rotor which increases motor efficiency and an insulation shell to reduce heat loss from the cast iron pump housing with threaded connections.

The declaration covers two types of the MAGNA3 pump. They are grouped as shown below. The group reference in the technical data and scenarios refers also to these.
GROUP 1 - MAGNA3 40-80

GROUP 2 - MAGNA3 40-100

These are all the same physical products and 100 % identical in terms of design, dimensions and materials as well as supply chain and manufacturing processes, i.e., all cradle to gate processes (A1-A3).

The products are also identical in terms of packaging, distribution, reference service life and end-of-life treatment.

The only thing that differentiates the products from each other is the software which controls how the pump operates in the system in which it is installed, making them fit for different applications.
Hence, all life cycle modules are identical, except use stage module B6, which will change, as the applied scenarios for electricity consumption changes. For the placing on the market in the European Union/European Free Trade Association (EU/EFTA) (with the exception of Switzerland) the following legal provisions apply:

Machinery Directive (2006/42/EC)

Standard used: *EN 809:1998 + A1:2009.*

Radio Equipment Directive (2014/53/EU)

Standards used:
EN 60335-1:2012/AC:2014 + A11:2014, EN 60335-2-51:2003 + A1:2008 + A2:2012, EN 62233:2008.

EN 55014-1:2006 + A1:2009 + A2:2011, EN 55014-1:2017, EN 61000-6-2:2005, EN 61000-3-2:2014, EN 61000-3-3:2013, ETSI EN 301 489-1 V2.2.0, ETSI EN 301 489-17 V3.2.0. ETSI EN 300 328 V2.1.1

Electromagnetic Compatibility (EMC) Directive (2014/30/EU)

Standards used:
EN 55014-1:2017, EN 55014-2:2015,

EN
61000-3-2:2014/2019, EN 61000-6-2:2008/2019,

EN
61000-3-3:2013 A1:2019

RoHS Directive
2011/65/EU and 2015/863//EU

Standard: *EN*
50581:2012.

Ecodesign
Directive (2009/125/EC)

Commission
Regulation (EC) No: 641/2009 and

Commission
Regulation (EU) 622/2012

Standards used:
EN 16297-1:2012, EN 16297-2:2012, EN 16297-3:2012.

The CE marking takes
into account the proof of conformity with the respective harmonized norms based
on the legal provisions above.
MAGNA3 pumps are not harmonized in accordance with the *CPR.*

Application
For the
application and use the respective national
provisions
apply.

The pump is
designed for circulating liquids in the

following
systems:

.
heating systems

.
domestic hot-water systems

.
air-conditioning and cooling systems

.
ground-source heat-pump systems

.
solar-heating systems

The pump is
suitable for thin, clean, non-aggressive and non-explosive liquids, not
containing solid particles or fibres that may attack the pump mechanically or
chemically. In heating systems, the water must meet the requirements of
accepted standards on water quality in
heating systems. The pumps are also suitable for domestic hot-water systems.

Technical Data
The performance
data of the product according to the harmonized norms, based on the
harmonization provisions above apply.

The relevant
technical specifications according to the *PCR Part B are* given in
the table below.

Characteristics
that are the same for all product groups are only given once. Others are given
individually for all two groups.

Constructional data

Name	Value	Unit
Frequency	50	Hz
Voltage	230	V
Pumped liquid (e.g. water)	Clean Water	-
Energy Efficiency Index Gr.1	0,19	
Energy Efficiency Index Gr.2	0,18	
Flow range Gr. 1 (max)	18,5	m^3/h
Flow range Gr. 2 (max)	21,0	m^3/h
Head max. Gr.1	8	m
Head max. Gr.2	10	m
Power input Gr. 1 Average (from load profile describing use)	0,117	kW
Power input Gr. 2 Average (from load profile describing use)	0,163	kW
Nominal capacity Gr.1	0,267	kW
Nominal capacity Gr.2	0,359	kW

Performance
data of the product according to the harmonized standards, based on provisions for harmonization.

Base materials/Ancillary materials

Base materials / Ancillary materials

Name	Value	Unit
Aluminium	17	%
Cast iron	45	%
Ceramics	0,4	%
Copper	3	%
Electronics	0,3	%
Magnet Nd	1	%
Paper	1	%
PCB	5	%
Plastics	0,4	%
Plastics, foam	1	%
Plastics GF	6	%
Rubber	0,2	%
Stainless steel	6	%
Steel	6	%
Cardboard	9	%
Plastic film	0,1	%
TOTAL	100	%

REACH
This product/article/at least one partial article contains

substances listed in the *ECHA candidate list* (date: 10.06.2022) exceeding 0.1 percentage by mass: **no**

The Wahlstedt production has been assessed and certified as meeting the requirements in *ISO 14001, ISO 50001, ISO 45001 and ISO 9001.*

Reference service life
No use stage scenario which refers to the lifetime of the product is declared. However, to facilitate building calculations, an estimated RSL of 10 years can be used.
This is an EU consensus-based estimation, referenced on page 37 in Appendix 7: *Lot 11 – Circulators in Buildings*, prepared by AEA Energy & Environment for the European Commission in the context of the Eco Design Directive:

There is no definitive information on the average circulator life available, there is consensus within the industry that it is at least 12 years. However, this is complicated by many factors, including many being scrapped prematurely when e.g. the boiler they are connected to is replaced.

From the estimated stock (140Mpa) and annual sales (14Mpa), the average lifetime of the circulator is taken as 10 years for the purposes of this study.

The RSL of the declared product is not directly influencing the results in this study, as no declared use stage scenario is dependent on the RSL; The use stage sub-module B6 is declared per year as required by the *PCR Part B.*

LCA: Calculation rules

Declared Unit
The declared unit is 1 piece (pcs.) of MAGNA3 (Cast iron) pump.

Declared unit

Name	Value	Unit
Declared unit	1	pce.
Mass reference	18.74	kg/pce
Conversion factor [Mass/Declared Unit]	18.74	

For IBU core EPDs (where clause 3.6 is part of the EPD): for average EPDs, an estimate of the robustness of the LCA values must be made, e.g. concerning the variability of the production process, geographical representativeness and the influence of background data and preliminary products compared to the environmental impacts caused by the actual production.

System boundary
This EPD is Cradle-To-Grave. The system boundaries

of the EPD follow the modular approach in *EN 15804*.
By decision no. 20170712-n of the *SVR*, the modules B3, B4 and B5 are by
default declared as "MNR" (module not relevant).

The product stage (A1-A3)
comprises raw material extraction and processing, transport processes as well
as the manufacturing process. The final production and assembly of the MAGNA3
pump takes place at a Grundfos manufacturing site in Germany. However, the full
supply-chain leading to the finished product at the gate is rather complex and
includes a large amount of raw materials, components and semi-finished parts
which comes from both external suppliers as well as other Grundfos production
facilities

The product stage is included in the study, and
according to *EN 15804* the system boundary with nature is set to include
those

processes that provide the material and energy inputs
into the system and the following manufacturing, transport up to the factory
gate as well as the processing any waste arising from those processes.

Wastes and losses are included in the modules where
they occur according to the polluter pays principle and the modular approach of
EN 15804.

The product includes:

· A1
Extraction and processing of raw materials;

· A1 Reuse
of products or materials from a previous product system;

· A1
Processing of secondary materials;

· A1
Generation of electricity, steam and heat from primary energy resources, also
including their extraction, refining and transport;

· A1 Energy
recovery and other recovery processes from secondary fuels;

· A2
Transportation up to the factory gate and internal transport;

· A3
Production of ancillary materials or pre products;

· A3 Manufacturing
of products and coproducts;

· A3

Manufacturing of packaging;

· A1-A3
processing up to the end-of-waste state or disposal of final residues.

For secondary material inputs, the system boundary to the previous system (providing the secondary material) is set where outputs
reach the end-of-waste state. The recycling of secondary material into new raw
materials is included in the system boundary of this study. Waste

materials from production processes that are recycled without any modification of the material's inherent characteristics are modelled
as closed-loop within A1-A3. This is done up to the input mass flow that was
used during production.

Waste for incineration arising in the product stage is accounted for in the module where the waste is produced. The environmental
loads from the incineration process are declared in the module where it occurs
and the electricity and heat which are produced from the incineration is
considered as closed-loop within A1-A3, as described in *PCR Part A,*
5.5.1. The input of biogenic carbon from the production of packaging material is
inventoried in A3. As required by *PCR Part A*, the corresponding
end-of-life module of the packaging material, A5, is also declared and the
emissions of biogenic carbon are inventoried.

The construction process stage (A4-A5) includes:

A4:

.
Transportation from factory gate to distribution center:

.

Consumption of electricity, thermal energy and water at distribution center;

.
Transportation from distribution center to construction site;

· Wastage
during distribution.

A5:

.
Installation process;

· Transport
of packaging waste to treatment site;

· Waste
treatment of packaging.

The packaging material does not reach the end of waste state but is incinerated as waste. According to European statistics, the
average R1 value of incineration plants is > 0.6. Therefore, it is assumed

that packaging material is treated thermally in an incineration plant with R1 > 0.6. The loads from the combustion process of
packaging are declared in module A5 and the resulting energy benefits in module

D, as required by the *PCR Part A*, 5.5.2.

Use stage (B1-B7):

The use stage, related to the building fabric includes:

· B1, use or
application of the installed product;

· B2,
maintenance.

The use stage related to the operation of the building

includes:

· B6,
operational energy use;

· B7,
operational water use.

In this study, all use stage modules are assessed, though B1, B2 and B7 are assessed to be zero. By decision no. 20170712-n of the *SVR*, the modules B3, B4 and B5 are by default declared as "MNR" (module

not relevant). The modules include the provision and transport of all materials, products and related energy and water use, as well as waste processing up to the end-of-waste state or disposal of final residues during the use stage. They also include all impacts and

aspects related to the losses during the use stage (i.e. production, transport, and waste processing and disposal of the lost products and materials).

Generally, the geographical coverage of the datasets used matches the actual processes taking place. Meaning, that when modelling taking place in Grundfos Bjerringbro, the Danish electricity grid mix is used in the model and thermal energy from natural gas. These are generally of very high quality with very good technological, temporal and geographical representativeness.

Contributions to operational energy use during the use stage (B6) come from the electricity consumption of the product. The annual electricity consumption is calculated by multiplying the average power input, which is based on a defined load profile, with the annual running hours.
For use stage (B6) European Average electricity grid mix has been used. These values are declared in the scenarios section.

The End-of-Life stage (C1-C4)
includes all activities from when the product reaches the end of its service life and no longer provides any functionality and until all materials and components are processed for

reuse/recycling or disposed of.

According to *EN 15804* and the *PCR Part A,* the end-of-life stage includes:

· C1
deconstruction of the product from the

· building,
including initial on-site sorting of the

· materials;

· C2
transportation of the discarded product to a recycling site and transportation of waste to final disposal;

· C3 waste
processing, collection of waste fractions from the deconstruction and waste processing of material flows intended for reuse, recycling and energy recovery;

· C4 waste
disposal including physical pretreatment and management of the disposal site.

At the end of life, the MAGNA3 pump is manually disassembled from the piping system in which it has been installed. The
definition of the applied end-of-life scenario in this EPD follows the
requirements in the

PCR Part A, 6.2 regarding complex products,
with a combination of recycling, thermal waste treatment and landfilling. 100 %
of the material is considered in the end of life scenario as required by the *PCR*.
An overall collection rate of 90 % has been assumed.

Materials from which energy is recovered in an incineration process with an R1-value above 0.60 are in this study included with
the environmental burdens from the incineration process inventoried in C3, the
recovered energy is declared as exported energy in C3

and the energy benefits are declared in D. This procedure is according to the *PCR Part A*, 5.5.6. C3 includes the
mechanical separation of the product followed by a series of sorting steps.
Metal fractions are recycled and plastics, cardboard and electronics are
assumed incinerated with energy recovery. The residual fractions are landfilled
and declared in C4.

The specific amounts are shown in the scenarios

section.

Beyond system boundary (D):
According to *EN 15804* module D includes the reuse, recovery and/or
recycling potentials, expressed as net impacts and benefits. Any declared
benefits and loads from net

flows leaving the product system that have not been allocated as co-products and that have passed the end-of-waste state are
included in module D.

Contributions to module D comes from waste incineration processes in A5 and C3 as well as material recycling in C3. The
specific fractions and net flows are shown in the scenarios section.

Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to *EN*
15804 and the building context, respectively the product-specific
characteristics of performance, are taken into account.

Geographic Representativeness
Land or region, in which the declared product system is manufactured, used or handled at the end of the product´s lifespan: Europe

Comparability
Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to *EN 15804* and the building context, respectively the product-specific characteristics of performance, are taken into account. Software and
databases used: *GaBi ts*

9.2.1.68
(database schema 8007) *Ecoinvent v3.5.*.

LCA: Scenarios and additional technical information

Characteristic product properties of biogenic carbon

The biogenic
carbon content quantifies the amount of biogenic carbon in a construction
product leaving the factory gate, and it will be separately declared for the
product and for any accompanying packaging, as required from the *PCR Part A.*
The Carbon content of Cardboard and Paper is assumed to 0.46 kg C. Overall,
there is an amount of 9 weight-% Carbon in the product leaving the factory gate
and has to be considered

Information on describing the biogenic Carbon Content at factory gate

Name	Value	Unit
Biogenic carbon content in accompanying packaging	0.74	kg C

Note: 1 kg of biogenic carbon is equivalent to 44/12 kg of CO2

The following technical scenario information is required for the declared modules and optional for non-declared modules. Modules for which no information is declared can be deleted; additional information can also be listed if necessary.

The following technical information is a basis for the declared modules or can be used for developing specific scenarios in the context of a building assessment if modules are not declared (MND).

A5 is not declared including the disposal of the packaging material on the construction site, the amounts of packaging materials included in the LCA calculations must be declared as technical scenario information for Module A5.

Transport from the gate to the site (A4)

Name	Value	Unit
Litres of fuel	0,0332	l/100km
Transport distance	2003	km
Capacity utilisation (including empty runs)	85	%
Gross density of products transported	360	kg/m^3
Wastage during distribution	0,02	%

Installation into the building (A5)

Name	Value	Unit
Packaging waste for incineration (LDPE film)	0,031	kg
Packaging waste for incineration (Paper/Cardboard)	1,72	kg

An estimated
RSL of 10 years can be used to facilitate building calculations. This is an EU
consensus-based estimation, referenced in Appendix 7: Lot 11 – Circulators in
Buildings, prepared by AEA Energy & Environment for the European Commission
in the context of the Eco Design Directive.

Reference service life

Name	Value	Unit
Life Span according to the manufacturer	10	a

Operational energy use (B6)

Name	Value	Unit
Electricity consumption, Group 1	585	kWh/a
Electricity consumption, Group 2	815	kWh/a
Average power input, Group 1	0,117	kW
Average power input, Group 2	0,163	kW
Running hours (all groups)	5.000	h/a

End of life (C1-C4)

Name	Value	Unit
Collected as mixed construction waste	17,03	kg
Transportation distance (C2)	500	km
Aluminium for recycling	2,8	kg
Steel for recycling	8,44	kg
Copper for recycling	0,51	kg
Stainless steel for recycling	0,91	kg
Plastics for incineration w/energy	0,031	kg
Electronics for incineration w/energy	0,81	kg
Landfilling	2,28	kg

Reuse, recovery and/or recycling potentials (D), relevant scenario information

Name	Value	Unit
A5, incineration w/energy recov. (LDPE foil)	3,85	MJ
A5, incineration w/energy recov. (Paper/Cardboard)	6,99	MJ
C3, steel for recycling (net amounts)	-1,2	kg
C3, stainless steel for recycling (net amounts)	0,52	kg
C3, aluminium for recycling (net amounts)	-0,383	kg
C3, copper for recycling (net amounts)	0,221	kg
C3, plastics for incineration, w/ energy recov.	1,28	kg
C3, electronics for incineration, w/ energy recov.	0,814	kg

LCA: Results

Characterization model: *EN 15804* - 2012+A2 - 2019, PEF. By Decision no. 20170712-n of the IBU SVR, the modules B3, B4, B5 are marked as MNR (module not relevant) as default. The LCA results in module B6 are given on a period of one year, according to *PCR Part B*. To obtain the results from module B6 over the entire life cycle, the LCA results of module B6 must be multiplied by the estimated RSL of 10 years. The indicator results for module B6 are declared for Group 1. B6 indicator results for other groups can be derived by multiplying the B6 indicator results with the following factors:

Group 2: 1,39

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

Product stage			Construction process stage		Use stage							End of life stage				Benefits and loads beyond the system boundaries
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
X	X	X	X	X	MND	MND	MNR	MNR	MNR	X	MND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1PCS of MAGNA3 40-80/100 (Cast Iron)

Parameter	Unit	A1	A2	A3	A4	A5	B6	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq	9.29E+01	1.17E+00	9.34E-01	1.17E+00	2.52E+00	2.37E+02	0	4.73E-01	5.85E+00	1.14E-01	-4.63E-01
GWP-fossil	kg CO_2 eq	9.25E+01	1.17E+00	3.75E+00	1.17E+00	1.44E-01	2.35E+02	0	4.7E-01	5.84E+00	1.17E-01	-4.58E-01
GWP-biogenic	kg CO_2 eq	3E-01	-1.5E-03	-2.85E+00	-2.43E-03	2.37E+00	7.85E-01	0	-7.93E-04	5.08E-03	-3.53E-03	-2.31E-03
GWP-luluc	kg CO_2 eq	1.4E-01	8.23E-03	3.5E-02	9.22E-03	8.56E-05	3.41E-01	0	3.83E-03	2.54E-03	1.03E-04	-2.58E-03
ODP	kg CFC11 eq	9.16E-08	2.01E-16	4.06E-09	1.91E-11	4.62E-16	5.18E-12	0	8.67E-17	3.83E-14	2.64E-16	-7.55E-13
AP	mol H^+ eq	5.4E-01	9.62E-03	1.41E-02	6.79E-03	7.23E-04	5.2E-01	0	2.78E-03	4.53E-03	3.64E-04	-1.23E-02
EP-freshwater	kg P eq	1.58E-03	3.13E-06	5.85E-05	3.8E-06	1.06E-07	6.29E-04	0	1.44E-06	6.74E-06	1.28E-05	-4.13E-06
EP-marine	kg N eq	6.64E-02	3.2E-03	2.97E-03	3.23E-03	2.64E-04	1.15E-01	0	1.34E-03	1.11E-03	8.4E-05	-6.03E-04
EP-terrestrial	mol N eq	6.97E-01	3.54E-02	2.98E-02	3.58E-02	3.28E-03	1.21E+00	0	1.48E-02	1.26E-02	9.22E-04	-6.11E-03
POCP	kg NMVOC eq	2.05E-01	7.56E-03	8.49E-03	6.16E-03	6.89E-04	3.16E-01	0	2.54E-03	3.04E-03	2.7E-04	-2.03E-03
ADPE	kg Sb eq	5.58E-03	8.61E-08	5.22E-05	1.22E-06	7.69E-09	6.82E-05	0	3.82E-08	5.04E-07	7.93E-09	-6.17E-04
ADPF	MJ	1.26E+03	1.54E+01	5.23E+01	1.57E+01	8.69E-01	4.14E+03	0	6.31E+00	3.13E+01	1.68E+00	-1.9E+01
WDP	m^3 world eq deprived	2.54E+01	1.02E-02	1.62E-01	1.72E-02	3.1E-01	5.13E+01	0	4.61E-03	8.01E-01	-1.3E-03	-3.8E-01

GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential)

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1PCS of MAGNA3 40-80/100 (Cast Iron)

Parameter	Unit	A1	A2	A3	A4	A5	B6	C1	C2	C3	C4	D
PERE	MJ	3.32E+02	7.9E-01	4.56E+01	9.82E-01	1.5E-01	1.83E+03	0	3.65E-01	1.35E+01	1.18E-01	5.52E+00
PERM	MJ	0	0	0	0	0	0	0	0	0	0	ND
PERT	MJ	3.32E+02	7.9E-01	4.56E+01	9.82E-01	1.5E-01	1.83E+03	0	3.65E-01	1.35E+01	1.18E-01	5.52E+00
PENRE	MJ	1.26E+03	1.55E+01	5.23E+01	1.57E+01	8.7E-01	4.14E+03	0	6.33E+00	3.13E+01	1.68E+00	-1.88E+01
PENRM	MJ	0	0	0	0	0	0	0	0	0	0	0
PENRT	MJ	1.26E+03	1.55E+01	5.23E+01	1.57E+01	8.7E-01	4.14E+03	0	6.33E+00	3.13E+01	1.68E+00	-1.88E+01
SM	kg	1.35E+01	0	2.31E-01	2.74E-03	0	0	0	0	0	0	0
RSF	MJ	1.46E-23	0	0	2.91E-27	0	0	0	0	0	0	0

NRSF	MJ	1.71E-22	0	0	3.42E-26	0	0	0	0	0	0	0
FW	m^3	7.68E-01	9.25E-04	2.24E-02	1.22E-03	7.3E-03	2.12E+00	0	4.25E-04	2.55E-02	2.14E-05	2.59E-02

PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2:
1PCS of MAGNA3 40-80/100 (Cast Iron)

Parameter	Unit	A1	A2	A3	A4	A5	B6	C1	C2	C3	C4	D
HWD	kg	2.23E-04	6.3E-07	1.22E-04	7.71E-07	4.51E-09	1.71E-06	0	2.93E-07	1.62E-08	6.74E-09	-3.27E-04
NHWD	kg	4E+00	2.35E-03	2.71E-01	3.45E-03	8.38E-02	2.94E+00	0	1E-03	5.49E-01	1.93E+00	1.45E+00
RWD	kg	5.17E-02	2.35E-03	2.71E-01	3.45E-03	8.38E-02	2.94E+00	0	1E-03	5.49E-01	1.93E+00	1.45E+00
CRU	kg	0	0	0	0	0	0	0	0	0	0	0
MFR	kg	0	0	0	0	0	0	0	0	1.27E+01	0	0
MER	kg	0	0	0	0	0	0	0	0	0	0	0
EEE	MJ	0	0	0	0	3.85E+00	0	0	0	6.93E+00	0	0
EET	MJ	0	0	0	0	6.99E+00	0	0	0	1.25E+01	0	0

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

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional:
1PCS of MAGNA3 40-80/100 (Cast Iron)

Parameter	Unit	A1	A2	A3	A4	A5	B6	C1	C2	C3	C4	D
PM	Disease incidence	6.4E-06	1.21E-07	2.1E-07	4.05E-08	4.1E-09	4.36E-06	0	1.63E-08	3.84E-08	3.71E-09	-2.95E-07
IR	kBq U235 eq	5.69E+00	4E-03	2.3E-01	5.98E-03	6.43E-03	1.03E+02	0	1.72E-03	7.57E-01	2.86E-03	-9.13E-02
ETP-fw	CTUe	7.84E+02	1.15E+01	1.73E+01	1.15E+01	4.39E-01	1.77E+03	0	4.72E+00	1.37E+01	1.18E+00	-6.22E+00
HTP-c	CTUh	1.66E-06	2.35E-10	6.46E-07	6.99E-10	2.16E-11	4.89E-08	0	9.77E-11	4.21E-10	6.79E-11	-6.88E-08
HTP-nc	CTUh	2.35E-06	1.27E-08	5.21E-08	1.4E-08	1.02E-09	1.8E-06	0	5.6E-09	1.72E-08	5.92E-09	-5.1E-09
SQP	SQP	3.53E+02	4.76E+00	8.54E+01	5.42E+00	2.36E-01	1.32E+03	0	2.21E+00	9.86E+00	1.22E-01	-1.48E+01

PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); SQP = Potential soil quality index

Disclaimer
1 – for the indicator 'Potential Human exposure efficiency relative to U235'. 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 or radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – for the indicators 'abiotic depletion potential for non-fossil resources', 'abiotic depletion potential for fossil resources', 'water (user) deprivation potential, deprivation-weighted water consumption', 'potential comparative toxic unit for ecosystems', 'potential comparative toxic unit for humans – cancerogenic', 'Potential comparative toxic unit for humans - not cancerogenic', 'potential soil quality index'. The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high as there is limited experience with the indicator.

Disclaimer 3: *JRC Technical Reports, Version 2, 2018* Page 6, for the indicator "EP-freshwater". This indicator has been calculated as 'kg P eq' as required in the characterization model EUTREND model, Struijs et al.,

2009b, as implemented in ReCiPe; This EPD was created using a software tool.

References

Standards

Machinery Directive

DIRECTIVE 2006/42/EC OF THE EUROPEAN

PARLIAMENT AND OF THE COUNCIL of 17 May

2006 on machinery

Radio Equipment Directive

DIRECTIVE 2014/53/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of

radio equipment

Electromagnetic Compatibility (EMC) Directive

DIRECTIVE 2014/30/EU OF THE EUROPEAN

PARLIAMENT AND OF THE COUNCIL of 26 February

2014 on the harmonistion of the laws of the Member

States relating to electromagnetic compatibility

Ecodesign Directive

DIRECTIVE 2009/125/EC OF THE EUROPEAN

PARLIAMENT AND OF THE COUNCIL of 21 October

2009 establishing a framework for the setting of

ecodesign requirements for energy-related products

EC 641/2009

COMMISSION REGULATION (EC) No 641/2009 of 22 July 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for glandless standalone circulators and glandless circulators integrated in

products

substances

EC 622/2012

COMMISSION
REGULATION (EU) No 622/2012 of 11 July 2012 amending Regulation (EC) No
641/2009 with regard to ecodesign requirements for glandless standalone
circulators and glandless circulators integrated in products

DIRECTIVE
2011/65/EU

DIRECTIVE
2011/65/EU OF THE EUROPEAN

PARLIAMENT AND
OF THE COUNCIL of 8 June 2011

on the
restriction of the use of certain hazardous

substances in
electrical and electronic equipment

DIRECTIVE
2015/863/EU

DIRECTIVE
2015/863/EU of 31 March 2015 amending

Annex II to
Directive 2011/65/EU of the European

Parliament and
of the Council as regards the list of

restricted

ETSI EN 301
489-1

ETSI EN 301
489-1 V2.2.0, Electromagnetic Compatibility (EMC) standard for radio equipment
and services; Part 1: Common technical requirements

ETSI EN 301
489-17

ETSI EN 301
489-17 V3.2.0, Electromagnetic Compatibility (EMC) standard for radio equipment
and services; Part 17: Specific conditions for Broadband Data Transmission
Systems

ETSI EN 300 328
V2.1.1

ETSI EN 300 328
V2.1.1, Wideband transmission systems; Data transmission equipment operating in
the 2,4 GHz ISM band and using wide band modulation techniques

EN 809

EN 809:1998-10
+ A1:2009, Pumps and pump units for

liquids -
Common safety requirements

EN 55014-1

EN
55014-1:2017, Electromagnetic compatibility – Requirements for household
appliances, electric tools and similar apparatus – Part 1: Emission

EN 55014-2

EN
55014-2:2015, Electromagnetic compatibility –

Requirements
for household appliances, electric tools

and similar
apparatus – Part 2: Immunity – Product

family standard
(CISPR 14-2:2015)

EN 50581:2012

EN 50581:2012,
Technical documentation for the

assessment of
electrical and electronic products with

respect to the
restriction of hazardous substances

EN 60335-1

EN
60335-1:2012/A11:2014/A13:2017, Household

and similar
electrical appliances – Safety – Part 1:General requirements

EN 60335-2-51

EN
60335-2-51:2003-03 + A1:2008 + A2:2012, Household and similar electrical
appliances – Safety –Part 2-51: Particular requirements for stationary
circulation pumps for heating and service water installations

EN 61000-3-2

EN
61000-3-2:2014/2019, Electromagnetic compatibility (EMC) – Part 3-2: Limits –
Limits for harmonic current emissions (equipment input current =16 A per phase)

EN 61000-3-3

EN
61000-3-3:2013-08/ A1:2019, Electromagnetic compatibility (EMC) – Part 3-3:

Limits – Limitation of voltage changes, voltage fluctuations and flicker in public
low voltage supply systems, for equipment with

rated current
<= 16 A per phase and not subject to conditional connection

EN 61000-6-2

EN
61000-6-2:2008/2019, Electromagnetic compatibility (EMC) – Part 6-2: Generic
standards –Immunity for industrial environments

EN 16297-1

EN
16297-1:2012-10, Pumps – Rotodynamic pumps –Glandless circulators – Part 1:
General requirements and procedures for testing and calculation of energy
efficiency index (EEI)

EN 16297-2

EN 16297-2:2012-10,
Pumps – Rotodynamic pumps –Glandless circulators – Part 2: Calculation of
energy efficiency index (EEI) for standalone circulators

EN 16297-3

EN
16297-3:2012, Pumps – Rotodynamic pumps –Glandless circulators – Part 3: Energy
efficiency index (EEI) for circulators integrated in products

ISO 14001

EN ISO
14001:2015-09, Environmental management systems - Requirements with guidance
for use

ISO 14025

DIN EN /ISO
14025:2011-10, Environmental labels and declarations — Type III environmental
declarations — Principles and procedures

EN 15804

EN
15804:2012-04+A1 2013, Sustainability of construction works — Environmental
Product Declarations — Core rules for the product category of construction
products

PCR Part A

Institut Bauen
und Umwelt e.V., Berlin (pub.): Product Category Rules for Building-Related
Products and Services, Product Category Rules for Construction Products from
the range of Environmental Product Declarations of Institut Bauen und Umwelt
(IBU), Part A: Calculation Rules for the Life Cycle Assessment and Requirements
on the Project Report, Version 1.7 (2021)

PCR
Part B

Institut Bauen
und Umwelt e.V., Berlin (pub.): Product Category Rules for Building-Related
Products and Services, Product Category Rules for Construction Products from
the range of Environmental Product Declarations of Institut Bauen und Umwelt
(IBU), Part B: Requirements on the EPD for Pumps for liquids and liquids with
solids, Version 1.0 (2018)

Further references

CPR

REGULATION (EU)
No 305/2011 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 9 March 2011
laying down harmonised conditions for the marketing of construction products
and repealing Council Directive 89/106/EEC

CML 2001

Impact
assessment characterization factors Institute of Environmental Sciences, Leiden
University, Netherlands

ECHA candidate list

Candidate List
of substances of very high concern (SVHCs) for authorisation, European
Chemicals Agency (ECHA), Helsinki, Finland

Ecoinvent

Ecoinvent v3.5

GaBi ts

GaBi ts 9.2.1.68
(database schema 8007)

REACH

Regulation (EC)
No 1907/2006 of the European Parliament and of the Council of 18 December 2006

concerning the Registration, Evaluation, Authorisation and Restriction of
Chemicals (REACH) (Status: 27.06.2018)

Decision no.
20170712-n

SVR

Advisory Board
(formerly SVA)

The literature referred to in the Environmental Product Declaration must be listed in full.Standards already fully quoted in the EPD do not need to be listed here again.
The current version of PCR Part A and PCR Part B of the PCR document on which they are based must be referenced.

Publisher

Institut Bauen und Umwelt e.V.
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ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A2*

Owner of the Declaration	Grundfos Holding A/S
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-GRU-20240016-CBA1-EN
Issue date	21.03.2024
Valid to	20.03.2029

MAGNA3 40-80/100 (Stainless Steel)

Grundfos Holding A/S

Institut Bauen und Umwelt e.V.

ECO PLATFORM EPD VERIFIED

www.ibu-epd.com | https://epd-online.com

General Information

Grundfos Holding A/S

Programme holder

IBU – Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

Declaration number

EPD-GRU-20240016-CBA1-EN

This declaration is based on the product category rules:

Pumps for liquids and liquids with solids, 01.08.2021
(PCR checked and approved by the SVR)

Issue date

21.03.2024

Valid to

20.03.2029

Dipl.-Ing. Hans Peters
(Chairman of Institut Bauen und Umwelt e.V.)

Florian Pronold
(Managing Director Institut Bauen und Umwelt e.V.)

MAGNA3 40-80/100 (Stainless Steel)

Owner of the declaration

Grundfos Holding A/S
Poul Due Jensens Vej 7
8850 Bjerringbro
Denmark

Declared product / declared unit

1 PCS. of MAGNA3 40-80/100 (Stainless Steel)

Scope:

The declaration applies to 1 piece of MAGNA3 (Stainless Steel) pump. The product is produced in Wahlstedt, Germany, and the life cycle assessment is based on data collected at the production site.

Production has been modeled using annual production data from 2021.

The declaration covers two different types of the MAGNA3 40- product (80/100).
The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

The EPD was created according to the specifications of EN 15804+A2. In the following, the standard will be simplified as *EN 15804*.

Verification

The standard EN 15804 serves as the core PCR
Independent verification of the declaration and data according to ISO 14025:2011
☐ internally ☒ externally

Mrs Kim Allbury,
(Independent verifier)

Product

Product description/Product definition
The Grundfos MAGNA3 circulator pumps are designed for circulating liquids in heating systems, air conditioning and cooling systems and domestic hot water systems. However, the pump range can also be used in ground source heat pump systems and solar heating systems.

The MAGNA3 pump is a centrifugal pump powered by an electrical motor. It has a high-performance neodymium magnet rotor which increases motor efficiency and an insulation shell to reduce heat loss from the cast iron pump housing with threaded connections.

The declaration covers two types of the MAGNA3 pump. They are grouped as shown below. The group reference in the technical data and scenarios refers also to these. GROUP 1 - MAGNA3 40-80

GROUP 2 - MAGNA3 40-100

These are all the same physical products and 100 % identical in terms of design, dimensions and materials as well as supply chain and manufacturing processes, i.e., all cradle to gate processes (A1-A3).

The products are also identical in terms of packaging, distribution, reference service life and end-of-life treatment.

The only thing that differentiates the products from each other is the software which controls how the pump operates in the system in which it is installed, making them fit for different applications. Hence, all life cycle modules are identical, except use stage module B6, which will change, as the applied scenarios for electricity consumption changes. For the placing on the market in the European Union/European Free Trade Association (EU/EFTA) (with the exception of Switzerland) the following legal provisions apply:

Machinery Directive (2006/42/EC)

Standard used: *EN 809:1998 + A1:2009.*

Radio Equipment Directive (2014/53/EU)

Standards used:
EN 60335-1:2012/AC:2014 + A11:2014, EN 60335-2-51:2003 + A1:2008 + A2:2012, EN 62233:2008.

EN 55014-1:2006 + A1:2009 + A2:2011, EN 55014-1:2017, EN 61000-6-2:2005, EN 61000-3-2:2014, EN 61000-3-3:2013, ETSI EN 301 489-1 V2.2.0, ETSI EN 301 489-17 V3.2.0. ETSI EN 300 328 V2.1.1

Electromagnetic Compatibility (EMC) Directive (2014/30/EU)

Standards used:
EN 55014-1:2017, EN 55014-2:2015,

EN 61000-3-2:2014/2019, EN 61000-6-2:2008/2019,

EN 61000-3-3:2013 A1:2019

RoHS Directive 2011/65/EU and 2015/863//EU

Standard: *EN 50581:2012.*

Ecodesign Directive (2009/125/EC)

Commission Regulation (EC) No: 641/2009 and

Commission Regulation (EU) 622/2012

Standards used:
EN 16297-1:2012, EN 16297-2:2012, EN 16297-3:2012.

The CE marking takes into account the proof of conformity with the respective harmonized norms based on the legal provisions above.
MAGNA3 pumps are not harmonized in accordance with the *CPR.*

Application
For the application and use the respective nationalprovisions apply.

The pump is designed for circulating liquids in the

following systems:

· heating systems

· domestic hot-water systems

· air-conditioning and cooling systems

· ground-source heat-pump systems

· solar-heating systems

The pump is suitable for thin, clean, non-aggressive and non-explosive liquids, not containing solid particles or fibres that may attack the pump mechanically or chemically. In heating systems, the water must meet the requirements of accepted standards on water quality in heating systems. The pumps are also suitable for domestic hot-water systems.

Technical Data
The performance data of the product according to the harmonized norms, based on the harmonization provisions above apply.

The relevant technical specifications according to the *PCR Part B are* given in the table below.

Characteristics that are the same for all product groups are only given once. Others are given individually for all two groups.

Constructional data

Name	Value	Unit
Frequency	50	Hz
Voltage	230	V
Pumped liquid (e.g. water)	Clean Water	-
Energy Efficiency Index Gr.1	0,19	
Energy Efficiency Index Gr.2	0,18	
Flow range Gr. 1 (max)	18,5	m^3/h
Flow range Gr. 2 (max)	21,0	m^3/h
Head max. Gr.1	8	m
Head max. Gr.2	10	m
Power input Gr. 1 Average (from load profile describing use)	0,117	kW
Power input Gr. 2 Average (from load profile describing use)	0,163	kW
Nominal capacity Gr.1	0,267	kW
Nominal capacity Gr.2	0,359	kW

Performance data of the product according to the harmonised standards, based on provisions for harmonisation.

Base materials/Ancillary materials

Base materials / Ancillary materials

Name	Value	Unit
Aluminium	16,15	%
Ceramics	0,36	%
Copper	3,05	%
Electronics	0,27	%
Magnet Nd	1,3	%
Paper	0,6	%
PCB	4,47	%
Plastics	0,39	%
Plastics, foam	0,85	%
Plastics GF	6,17	%
Rubber	0,2	%
Stainless steel	51,68	%
Steel	6,08	%
Cardboard	8,33	%
Plastic film	0,08	%
TOTAL	100	%

REACH
This product/article/at least one partial article contains substances listed in the *ECHA candidate list* (date:

10.06.2022) exceeding 0.1 percentage by mass: **no**

The Wahlstedt production has been assessed and certified as meeting the requirements in *ISO 14001, ISO 50001, ISO 45001 and ISO 9001.*

Reference service life
No use stage scenario which refers to the lifetime of the product is declared. However, to facilitate building calculations, an estimated RSL of 10 years can be used.
This is an EU consensus-based estimation, referenced on page 37 in Appendix 7: *Lot 11 – Circulators in Buildings*, prepared by AEA Energy & Environment for the European Commission in the context of the Eco Design Directive:

There is no definitive information on the average circulator life available, there is consensus within the industry that it is at least 12 years. However, this is complicated by many factors, including many being scrapped prematurely when e.g. the boiler they are connected to is replaced.

From the estimated stock (140Mpa) and annual sales (14Mpa), the average lifetime of the circulator is taken as 10 years for the purposes of this study.

The RSL of the declared product is not directly influencing the results in this study, as no declared use stage scenario is dependent on the RSL; The use stage sub-module B6 is declared per year as required by the *PCR Part B.*

LCA: Calculation rules

Declared Unit
The declared unit is 1 piece (pcs.) of MAGNA3 (Stainless Steel) pump.

Declared unit

Name	Value	Unit
Declared unit	1	pce.
Mass reference	19.22	kg/pce
Conversion factor [Mass/Declared Unit]	19.22	

System boundary
This EPD is Cradle-To-Grave. The system boundaries

of the EPD follow the modular approach in *EN 15804.*
By decision no. 20170712-n of the *SVR*, the modules B3, B4 and B5 are by default declared as "MNR" (module not relevant).

The product stage (A1-A3)
comprises raw material extraction and processing, transport processes as well as the manufacturing process. The final production and assembly of the MAGNA3 pump takes place at a Grundfos manufacturing site in Germany. However, the full supply-chain leading to the finished product at the gate is rather complex and includes a large amount of raw materials, components and semi-finished parts which comes from both external suppliers as well as other Grundfos production facilities

The product stage is included in the study, and according to *EN 15804* the system boundary with nature is set to include those

processes that provide the material and energy inputs into the system and the following manufacturing, transport up to the factory gate as well as the processing any waste arising from those processes.

Wastes and losses are included in the modules where they occur according to the polluter pays principle and the modular approach of *EN 15804.*

The product includes:

· A1 Extraction and processing of raw materials;

· A1 Reuse of products or materials from a previous product system;

· A1 Processing of secondary materials;

· A1 Generation of electricity, steam and heat from primary energy resources, also including their extraction, refining and transport;

· A1 Energy recovery and other recovery processes from secondary fuels;

· A2 Transportation up to the factory gate and internal transport;

· A3 Production of ancillary materials or pre products;

· A3 Manufacturing of products and coproducts;

· A3 Manufacturing of packaging;

· A1-A3 processing up to the end-of-waste state or disposal of final residues.

For secondary material inputs, the system boundary to the previous system (providing the secondary material) is set where outputs reach the end-of-waste state. The recycling of secondary material into new raw materials is included in the system boundary of this study. Waste

materials from production processes that are recycled without any modification of the material's inherent characteristics are modelled as closed-loop within A1-A3. This is done up to the input mass flow that was used during production.

Waste for incineration arising in the product stage is accounted for in the module where the waste is produced. The environmental loads from the incineration process are declared in the module where it occurs and the electricity and heat which are produced from the incineration is considered as closed-loop within A1-A3, as described in *PCR Part A,*
5.5.1. The input of biogenic carbon from the production of packaging material is inventoried in A3. As required by *PCR Part A*, the corresponding end-of-life module of the packaging material, A5, is also declared and the emissions of biogenic carbon are inventoried.

The construction process stage (A4-A5) includes:

A4:

· Transportation from factory gate to the distribution center:

· Consumption of electricity, thermal energy and water at the distribution center;

· Transportation from distribution center to construction site;

· Wastage during distribution.

A5:

· Installation process;

· Transport of packaging waste to treatment site;

· Waste treatment of packaging.

The packaging material does not reach the end of waste state but is incinerated as waste. According to European statistics, the average R1 value of incineration plants is > 0.6. Therefore, it is assumed

that packaging material is treated thermally in an incineration plant with R1 > 0.6. The loads from the combustion process of packaging are declared in module A5 and the resulting energy benefits in module

D, as required by the *PCR Part A*, 5.5.2.

Use stage (B1-B7):

The use stage, related to the building fabric includes:

· B1, use or application of the installed product;

· B2, maintenance.

The use stage related to the operation of the building

includes:

· B6, operational energy use;

· B7, operational water use.

In this study, all use stage modules are assessed, though B1, B2 and B7 are assessed to be zero. By decision no. 20170712-n of the *SVR*, the modules B3, B4 and B5 are by default declared as "MNR" (module

not relevant). The modules include the provision and transport of all materials, products and related energy and water use, as well as waste processing up to the end-of-waste state or disposal of final residues during the use stage. They also include all impacts and

aspects related to the losses during the use stage (i.e. production, transport, and waste processing and disposal of the lost products and materials).

Generally, the geographical coverage of the datasets used matches the actual processes taking place. Meaning, that when modelling taking place in Grundfos Bjerringbro, the Danish electricity grid mix is used in the model and thermal energy from natural gas. These are generally of very high quality with very good technological, temporal and geographical representativeness.

Contributions to operational energy use during the use stage (B6) come from the electricity consumption of the product. The annual electricity consumption is calculated by multiplying the average power input, which is based on a defined load profile, with the annual running hours. For use stage (B6) European Average electricity grid mix has been used. These values are declared in the scenarios section.

The End-of-Life stage (C1-C4)
includes all activities from when the product reaches the end of its service life and no longer provides any functionality and until all materials and components are processed for

reuse/recycling or disposed of.

According to *EN 15804* and the *PCR Part A,*
the end-of-life stage includes:

· C1 deconstruction of the product from the

· building, including initial on-site sorting of the

· materials;

· C2 transportation of the discarded product to a recycling site and transportation of waste to final disposal;

· C3 waste processing, collection of waste fractions from the deconstruction and waste processing of material flows intended for reuse, recycling and energy recovery;

· C4 waste disposal including physical pretreatment and management of the disposal site.

At the end of life, the MAGNA3 pump is manually disassembled from the piping system in which it has been installed. The definition of the applied end-of-life scenario in this EPD follows the requirements in the

PCR Part A, 6.2 regarding complex products, with a combination of recycling, thermal waste treatment and landfilling. 100 % of the material is considered in the end of life scenario as required by the *PCR*.
An overall collection rate of 90 % has been assumed.

Materials from which energy is recovered in an incineration process with an R1-value above 0.60 are in this study included with the environmental burdens from the incineration process inventoried in C3, the recovered energy is declared as exported energy in C3

and the energy benefits are declared in D. This procedure is according to the *PCR Part A*, 5.5.6. C3 includes the mechanical separation of the product followed by a series of sorting steps. Metal fractions are recycled and plastics, cardboard and electronics are assumed incinerated with energy recovery. The residual fractions are landfilled and declared in C4.

The specific amounts are shown in the scenarios section.

Beyond system boundary (D):
According to *EN 15804* module D includes the reuse, recovery and/or recycling potentials, expressed as net impacts and benefits. Any declared benefits and loads from net

flows leaving the product system that have not been allocated as co-products and that have passed the end-of-waste state are included in module D.

Contributions to module D comes from waste incineration processes in A5 and C3 as well as material recycling in C3. The specific fractions and net flows are shown in the scenarios section.

Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to *EN 15804* and the building context, respectively the product-specific characteristics of performance, are taken into account.

Geographic Representativeness
Land or region, in which the declared product system is manufactured, used or handled at the end of the product´s lifespan: Europe

Comparability
Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to *EN 15804* and the building context, respectively the product-specific characteristics of performance, are taken into account. Software and databases used: *LCA for Experts 10.7.1.28*
Schema 8007
Sphera and Ecoinvent databases

LCA: Scenarios and additional technical information

Characteristic product properties of biogenic carbon
The biogenic carbon content quantifies the amount of biogenic carbon in a construction product leaving the factory gate, and it will be separately declared for the product and for any accompanying packaging, as required from the *PCR Part A*.
The Carbon content of Cardboard and Paper is assumed to 0.46 kg C generally. This means that 46% of the weight of paper and cardboard is assumed to be biogenic carbon. Overall, there is an amount of weight-% Carbon in the product leaving the factory gate and it has to be considered.

Information on describing the biogenic Carbon Content at factory gate

Name	Value	Unit
Biogenic carbon content in accompanying packaging	0.79	kg C

Note: 1 kg of biogenic carbon is equivalent to 44/12 kg of CO2

Transport from the gate to the site (A4)

Name	Value	Unit
Litres of fuel	0,0332	l/100km
Transport distance	2003	km
Capacity utilisation (including empty runs)	85	%
Gross density of products transported	360	kg/m^3
Wastage during distribution	0,02	%

Installation into the building (A5)

Name	Value	Unit
Packaging waste for incineration (LDPE film)	0,016	kg
Packaging waste for incineration (Paper/Cardboard)	1,717	kg

An estimated
RSL of 10 years can be used to facilitate building calculations. This is an EU
consensus-based estimation, referenced in Appendix 7: Lot 11 – Circulators in
Buildings, prepared by AEA Energy & Environment for the European Commission
in the context of the Eco Design Directive.

Reference service life

Name	Value	Unit
Life Span according to the manufacturer	10	a

Operational energy use (B6)

Name	Value	Unit
Electricity consumption, Group 1	585	kWh/a
Electricity consumption, Group 2	815	kWh/a
Average power input, Group 1	0,117	kW
Average power input, Group 2	0,163	kW
Running hours (all groups)	5.000	h/a

End of life (C1-C4)

Name	Value	Unit
Collected as mixed construction waste	17,488	kg
Transportation distance (C2)	500	km
Aluminium for recycling	2,74	kg
Steel for recycling	1,03	kg
Copper for recycling	0,52	kg
Stainless steel for recycling	8,76	kg
Plastics for incineration w/energy	1,29	kg
Electronics for incineration w/energy	0,80	kg
Landfilling	2,34	kg

Reuse, recovery and/or recycling potentials (D), relevant scenario information

Name	Value	Unit
A5, incineration w/energy recov. thermal energy	7,97	MJ
A5, incineration w/energy recov. electric energy	4,41	MJ
C3, steel for recycling (net amounts)	-0,333	kg
C3, stainless steel for recycling (net amounts)	2,67	kg
C3, aluminium for recycling (net amounts)	-0,434	kg
C3, copper for recycling (net amounts)	0,221	kg
C3, incineration w/energy recov. thermal energy.	12,6	MJ
C3, incineration w/energy recov. electric energy	6,97	MJ

LCA: Results

Characterization model: *EN 15804* - 2012+A2 - 2019, PEF. By Decision no. 20170712-n of the IBU SVR, the modules B3, B4, B5 are marked as MNR (module not relevant) as default. The LCA results in module B6 are given on a period of one year, according to *PCR Part B*. To obtain the results from module B6 over the entire life cycle, the LCA results of module B6 must be multiplied by the estimated RSL of 10 years. The indicator results for module B6 are declared for Group 1. B6 indicator results for other groups can be derived by multiplying the B6 indicator results with the following factors:

Group 2: 1,39

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

Product stage			Construction process stage		Use stage							End of life stage				Benefits and loads beyond the system boundaries
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	X	X	MNR	MNR	MNR	X	X	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1PCS of MAGNA3 40-80/100

Parameter	Unit	A1	A2	A3	A4	A5	B1	B2	B6	B7	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq	9.85E+01	4.16E+00	8.22E-01	1.47E+00	2.83E+00	0	0	1.9E+02	0	0	6.01E-01	5.58E+00	1.16E-01	-7.94E+00
GWP-fossil	kg CO_2 eq	9.84E+01	4.16E+00	3.62E+00	1.48E+00	4.61E-01	0	0	1.89E+02	0	0	6.04E-01	5.56E+00	1.17E-01	-7.92E+00
GWP-biogenic	kg CO_2 eq	-3.75E-03	-7.35E-03	-2.83E +00	-2.18E-02	2.37E+00	0	0	1.64E+00	0	0	-8.92E-03	1.22E-02	-1.45E-03	-2.11E-02
GWP-luluc	kg CO_2 eq	6.06E-02	6.71E-03	2.95E-02	1.34E-02	8.54E-05	0	0	2.05E-02	0	0	5.6E-03	1.82E-04	1.06E-04	-2.44E-03
ODP	kg CFC11 eq	4.73E-08	3.29E-13	4.06E-09	2E-11	3.77E-13	0	0	3.48E-09	0	0	7.87E-14	2.65E-11	1.96E-13	-2.16E-11
AP	mol H^+ eq	7.28E-01	1.23E-01	1.63E-02	8.81E-03	7.62E-04	0	0	4.03E-01	0	0	3.64E-03	3.77E-03	3.62E-04	-7.46E-02
EP-freshwater	kg P eq	1.49E-03	3.41E-06	6.21E-05	5.65E-06	1.4E-07	0	0	7.04E-04	0	0	2.21E-06	7.5E-06	1.35E-05	-1.14E-05
EP-marine	kg N eq	7.93E-02	2.93E-02	3.64E-03	4.25E-03	2.78E-04	0	0	9.64E-02	0	0	1.77E-03	9.95E-04	8.62E-05	-8.56E-03
EP-terrestrial	mol N eq	8.48E-01	3.21E-01	3.65E-02	4.71E-02	3.5E-03	0	0	1.01E+00	0	0	1.96E-02	1.13E-02	9.47E-04	-9.19E-02
POCP	kg NMVOC eq	2.49E-01	8.27E-02	1.02E-02	8.09E-03	7.24E-04	0	0	2.57E-01	0	0	3.36E-03	2.66E-03	2.72E-04	-2.76E-02
ADPE	kg Sb eq	8.32E-03	7.91E-08	5.16E-05	1.25E-06	3.87E-09	0	0	2.92E-05	0	0	4.01E-08	2.21E-07	3.15E-09	-1.02E-03
ADPF	MJ	1.39E+03	5.19E+01	5.39E+01	2.02E+01	1.04E+00	0	0	3.97E+03	0	0	8.24E+00	3.09E+01	1.75E+00	-9.48E+01
WDP	m^3 world eq deprived	3.48E+01	1.44E-02	3.97E-03	2.38E-02	3.39E-01	0	0	4.21E+01	0	0	7.31E-03	7.44E-01	-1.63E-03	-5.33E-01

GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential)

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1PCS of MAGNA3 40-80/100

Parameter	Unit	A1	A2	A3	A4	A5	B1	B2	B6	B7	C1	C2	C3	C4	D
PERE	MJ	3.74E+02	8.96E-01	4.99E+01	1.57E+00	2.35E-01	0	0	2.37E+03	0	0	6E-01	1.8E+01	1.58E-01	4.67E+00
PERM	MJ	0	0	0	0	0	0	0	3.97E+03	0	0	8.27E+00	3.09E+01	1.75E+00	-9.47E +01
PERT	MJ	3.74E+02	8.96E-01	4.99E+01	1.57E+00	2.35E-01	0	0	2.37E+03	0	0	6E-01	1.8E+01	1.58E-01	4.67E+00
PENRE	MJ	1.39E+03	5.2E+01	5.39E+01	2.03E+01	1.04E+00	0	0	3.97E+03	0	0	8.27E+00	3.09E+01	1.75E+00	-9.47E +01
PENRM	MJ	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PENRT	MJ	1.39E+03	5.2E+01	5.39E+01	2.03E+01	1.04E+00	0	0	0	0	0	0	0	0	0
SM	kg	1.11E+01	0	2.31E-01	2.81E-03	0	0	0	0	0	0	0	0	0	0
RSF	MJ	1.46E-23	0	0	2.99E-27	0	0	0	1.92E+00	0	0	6.57E-04	2.44E-02	1.83E-05	2.58E-02
NRSF	MJ	1.71E-22	0	0	3.51E-26	0	0	0	2.37E+03	0	0	6E-01	1.8E+01	1.58E-01	4.67E+00
FW	m^3	1.03E+00	1.02E-03	1.99E-02	1.77E-03	8E-03	0	0	2.37E+03	0	0	6E-01	1.8E+01	1.58E-01	4.67E+00

PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw

materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1PCS of MAGNA3 40-80/100

Parameter	Unit	A1	A2	A3	A4	A5	B1	B2	B6	B7	C1	C2	C3	C4	D
HWD	kg	7.01E-06	1.63E-10	1.21E-04	7.1E-08	2.6E-11	0	0	4.67E-07	0	0	2.56E-11	3.49E-09	1.46E-10	-1.66E-03
NHWD	kg	7.41E+00	5.35E-03	3.53E-01	4.08E-03	1.13E-01	0	0	2.91E+00	0	0	1.26E-03	5.56E-01	2.03E+00	1.84E+00
RWD	kg	4.74E-02	6.79E-05	1.66E-03	5.22E-05	4.72E-05	0	0	6.31E-01	0	0	1.55E-05	4.77E-03	2.06E-05	-1.8E-03
CRU	kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MFR	kg	0	0	0	0	0	0	0	0	0	0	0	1.3E+01	0	0
MER	kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
EEE	MJ	0	0	0	0	4.41E+00	0	0	0	0	0	0	6.97E+00	0	0
EET	MJ	0	0	0	0	7.97E+00	0	0	0	0	0	0	1.26E+01	0	0

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

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: 1PCS of MAGNA3 40-80/100

Parameter	Unit	A1	A2	A3	A4	A5	B1	B2	B6	B7	C1	C2	C3	C4	D
PM	Disease incidence	8.94E-06	2.12E-06	2.55E-07	5.65E-08	4.54E-09	0	0	3.39E-06	0	0	2.3E-08	3.2E-08	3.67E-09	-1.83E-06
IR	kBq U235 eq	6.22E+00	9.83E-03	2.68E-01	7.43E-03	7.36E-03	0	0	1.05E+02	0	0	2.31E-03	7.94E-01	3.05E-03	-1.23E-01
ETP-fw	CTUe	7.23E+02	3.67E+01	1.88E+01	1.43E+01	5.06E-01	0	0	1.1E+03	0	0	5.91E+00	8.96E+00	1.1E+00	-1.15E+01
HTP-c	CTUh	1.64E-05	6.84E-10	6.46E-07	7.64E-10	2.76E-11	0	0	5.84E-08	0	0	1.2E-10	5.03E-10	7.06E-11	-3.65E-07
HTP-nc	CTUh	1.54E-06	2.36E-08	3.81E-08	1.32E-08	1.06E-09	0	0	9.32E-07	0	0	5.34E-09	1.04E-08	6.03E-09	-4.31E-08
SQP	SQP	3.43E+02	4.22E+00	9.34E+01	8.35E+00	3.05E-01	0	0	1.56E+03	0	0	3.44E+00	1.2E+01	1.57E-01	-1.61E+01

PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); SQP = Potential soil quality index

Disclaimer 1 – for the indicator 'Potential Human exposure efficiency relative to U235'.
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 or radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – for the indicators 'abiotic depletion potential for non-fossil resources', 'abiotic depletion potential for fossil resources', 'water (user) deprivation potential, deprivation-weighted water consumption', 'potential comparative toxic unit for ecosystems', 'potential comparative toxic unit for humans – cancerogenic', 'Potential comparative toxic unit for humans - not cancerogenic', 'potential soil quality index'. The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high as there is limited experience with the indicator.

Disclaimer 3: *JRC Technical Reports, Version 2, 2018* Page 6, for the indicator "EP-freshwater". This indicator has been calculated as 'kg P eq' as required in the characterization model EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe; This EPD was created using a software tool.

References

Standards

Machinery Directive

DIRECTIVE 2006/42/EC OF THE EUROPEAN

PARLIAMENT AND OF THE COUNCIL of 17 May

2006 on machinery

Radio Equipment Directive

DIRECTIVE 2014/53/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of

radio equipment

Electromagnetic Compatibility (EMC) Directive

DIRECTIVE 2014/30/EU OF THE EUROPEAN

PARLIAMENT AND OF THE COUNCIL of 26 February

2014 on the harmonistion of the laws of the Member

States relating to electromagnetic compatibility

Ecodesign Directive

DIRECTIVE 2009/125/EC OF THE EUROPEAN

PARLIAMENT AND OF THE COUNCIL of 21 October

2009 establishing a framework for the setting of

ecodesign requirements for energy-related products

EC 641/2009

COMMISSION REGULATION (EC) No 641/2009 of 22 July 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign

requirements for glandless standalone circulators and glandless circulators integrated in

products

EC 622/2012

COMMISSION REGULATION (EU) No 622/2012 of 11 July 2012 amending Regulation (EC) No 641/2009 with regard to ecodesign requirements for glandless standalone circulators and glandless circulators integrated in products

DIRECTIVE 2011/65/EU

DIRECTIVE 2011/65/EU OF THE EUROPEAN

PARLIAMENT AND OF THE COUNCIL of 8 June 2011

on the restriction of the use of certain hazardous

substances in electrical and electronic equipment

DIRECTIVE 2015/863/EU

DIRECTIVE 2015/863/EU of 31 March 2015 amending

Annex II to Directive 2011/65/EU of the European

Parliament and of the Council as regards the list of

restricted substances

ETSI EN 301 489-1

ETSI EN 301 489-1 V2.2.0, Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements

ETSI EN 301 489-17

ETSI EN 301 489-17 V3.2.0, Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for Broadband Data Transmission Systems

ETSI EN 300 328 V2.1.1

ETSI EN 300 328 V2.1.1, Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques

EN 809

EN 809:1998-10 + A1:2009, Pumps and pump units for

liquids - Common safety requirements

EN 55014-1

EN 55014-1:2017, Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission

EN 55014-2

EN 55014-2:2015, Electromagnetic compatibility –

Requirements for household appliances, electric tools

and similar apparatus – Part 2: Immunity – Product

family standard (CISPR 14-2:2015)

EN 50581:2012

EN 50581:2012, Technical documentation for the

assessment of electrical and electronic products with

respect to the restriction of hazardous substances

EN 60335-1

EN 60335-1:2012/A11:2014/A13:2017, Household

and similar electrical appliances – Safety – Part 1:General requirements

EN 60335-2-51

EN 60335-2-51:2003-03 + A1:2008 + A2:2012, Household and similar electrical appliances – Safety –Part 2-51: Particular requirements for stationary circulation pumps for heating and service water installations

EN 61000-3-2

EN 61000-3-2:2014/2019, Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current =16 A per phase)

EN 61000-3-3

EN 61000-3-3:2013-08/ A1:2019, Electromagnetic compatibility (EMC) – Part 3-3:
Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low voltage supply systems, for equipment with

rated current <= 16 A per phase and not subject to conditional connection

EN 61000-6-2

EN 61000-6-2:2008/2019, Electromagnetic compatibility (EMC) – Part 6-2: Generic standards –Immunity for industrial environments

EN 16297-1

EN 16297-1:2012-10, Pumps – Rotodynamic pumps – Glandless circulators – Part 1:
General requirements and procedures for testing and calculation of energy efficiency index (EEI)

EN 16297-2

EN 16297-2:2012-10, Pumps – Rotodynamic pumps – Glandless circulators – Part 2: Calculation of energy efficiency index (EEI) for standalone circulators

EN 16297-3

EN 16297-3:2012, Pumps – Rotodynamic pumps –Glandless circulators – Part 3: Energy efficiency index (EEI) for circulators integrated in products

ISO 14001

EN ISO 14001:2015-09, Environmental management systems - Requirements with guidance for use

ISO 14025

DIN EN /ISO 14025:2011-10, Environmental labels and declarations — Type III environmental declarations — Principles and procedures

EN 15804

EN 15804:2012-04+A1 2013, Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

PCR Part A

Institut Bauen und Umwelt e.V., Berlin (pub.): Product Category Rules for Building-Related Products and Services, Product Category Rules for Construction Products from the range of Environmental Product Declarations of Institut Bauen und Umwelt (IBU), Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report, Version 1.7 (2021)

PCR Part B

Institut Bauen und Umwelt e.V., Berlin (pub.): Product Category Rules for Building-Related Products and Services, Product Category Rules for Construction Products from the range of Environmental Product Declarations of Institut Bauen und Umwelt (IBU), Part B: Requirements on the EPD for Pumps for liquids and liquids with solids, Version 1.0 (2018)

Further references

CPR

REGULATION (EU) No 305/2011 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC

CML 2001

Impact assessment characterization factors Institute of Environmental Sciences, Leiden University, Netherlands

ECHA candidate list

Candidate List of substances of very high concern (SVHCs) for authorisation, European Chemicals Agency (ECHA), Helsinki, Finland

EUTREND model

Struijs et al., 2009b
AEA Energy & Environment

Circulators in Buildings

Ecoinvent
Ecoinvent v3.9.1

LCA for ExpertsLCA for Experts

10.7.1.28Schema 8007

REACH

Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) (Status: 27.06.2018)

SVR

Advisory Board (formerly SVA)

Decision no.
20170712-n

Publisher

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ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A2*

Owner of the Declaration	Grundfos Holding A/S
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-GRU-20230076-CBC1-EN
Issue date	21.11.2023
Valid to	20.11.2028

MAGNA3 40-120/150/180 (Cast Iron)

Grundfos Holding A/S

Institut Bauen und Umwelt e.V.

ECO PLATFORM EPD VERIFIED

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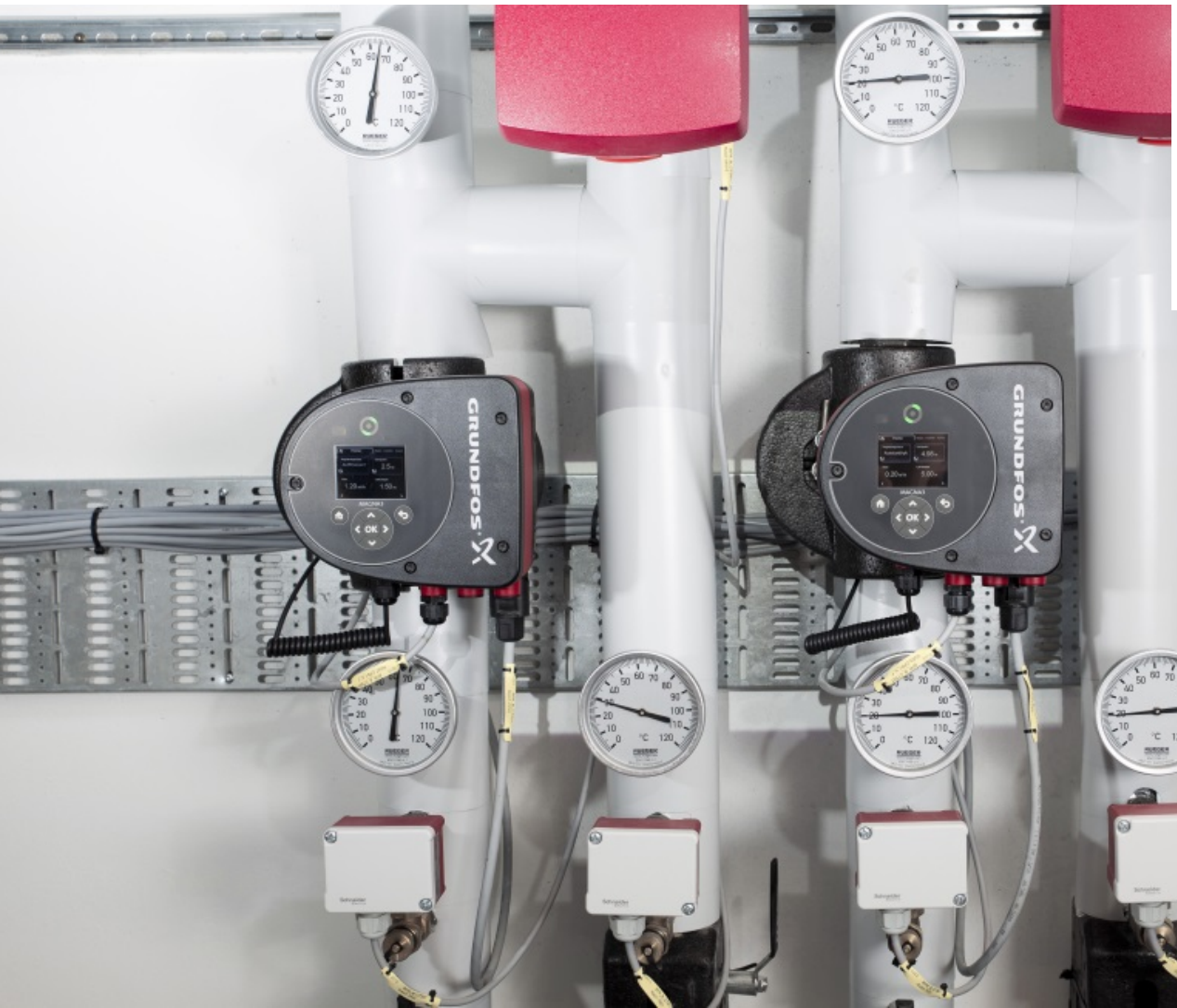


General Information

Grundfos Holding A/S

Programme holder

IBU – Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

Declaration number

EPD-GRU-20230076-CBC1-EN

This declaration is based on the product category rules:

Pumps for liquids and liquids with solids, 01.08.2021
(PCR checked and approved by the SVR)

Issue date

21.11.2023

Valid to

20.11.2028

Dipl.-Ing. Hans Peters
(Chairman of Institut Bauen und Umwelt e.V.)

Florian Pronold
(Managing Director Institut Bauen und Umwelt e.V.)

MAGNA3 40-120/150/180 (Cast Iron)

Owner of the declaration

Grundfos Holding A/S
Poul Due Jensens Vej 7
8850 Bjerringbro
Denmark

Declared product / declared unit

1 PCS. of MAGNA3 40-120/150/180 (Cast Iron)

Scope:

The declaration applies to 1 piece of MAGNA3 (Cast Iron) pump.

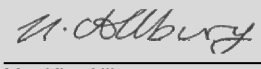
The product is produced in Wahlstedt, Germany, and the life cycle assessment is based on data collected at the production site. Production has been modeled using annual production data from 2021. The declaration covers three different types of the MAGNA3 40- product (120/150/180).

The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

The EPD was created according to the specifications of EN 15804+A2. In the following, the standard will be simplified as *EN 15804*.

Verification

The standard EN 15804 serves as the core PCR
Independent verification of the declaration and data according to ISO 14025:2011
☐ internally ☒ externally



Mrs Kim Allbury,
(Independent verifier)

Product

Product description/Product definition
The Grundfos MAGNA3 circulator pumps are designed for circulating liquids in heating systems, air conditioning and cooling systems and domestic hot water systems. However, the pump range can also be used in ground source heat pump systems and solar heating systems.

The MAGNA3 pump is a centrifugal pump powered by an electrical motor. It has a high-performance neodymium magnet rotor which increases motor efficiency and an insulation shell to reduce heat loss from the cast iron pump housing with threaded connections.

The declaration covers three types of the MAGNA3 pump. They are grouped as shown below. The group reference in the technical data and scenarios refers also to these.

GROUP 1 - MAGNA3 40-120

GROUP 2 - MAGNA3 40-150 GROUP 3 - MAGNA3 40-180
These are all the same physical products and 100 % identical in terms of design, dimensions and materials as well as supply chain and manufacturing processes, i.e., all cradle to gate processes (A1-A3).

The products are also identical in terms of packaging, distribution, reference service life and end-of-life treatment. The only thing that differentiates the products from each other is the software which controls how the pump operates in the system in which it is installed, making them fit for different applications. Hence, all life cycle modules are identical, except use stage module B6, which will change, as the applied scenarios for electricity consumption changes. For the placing
on the market in the European Union/European Free Trade Association (EU/EFTA) (with the exception of Switzerland) the following
legal provisions apply:

Machinery
Directive (2006/42/EC)

Standard used: *EN 809:1998 + A1:2009.*

Radio Equipment
Directive (2014/53/EU)

Standards used:
EN 60335-1:2012/AC:2014 + A11:2014, EN 60335-2-51:2003 + A1:2008 + A2:2012,
EN 62233:2008.

EN 55014-1:2006
+ A1:2009 + A2:2011, EN 55014-1:2017, EN 61000-6-2:2005, EN 61000-3-2:2014, EN
61000-3-3:2013, ETSI EN 301 489-1 V2.2.0, ETSI EN 301 489-17 V3.2.0. ETSI EN
300 328 V2.1.1

Electromagnetic
Compatibility (EMC) Directive (2014/30/EU)

Standards used:
EN 55014-1:2017, EN 55014-2:2015,

EN
61000-3-2:2014/2019, EN 61000-6-2:2008/2019,

EN
61000-3-3:2013 A1:2019

RoHS Directive
2011/65/EU and 2015/863//EU

Standard: *EN 50581:2012.*

Ecodesign
Directive (2009/125/EC)

Commission
Regulation (EC) No: 641/2009 and

Commission
Regulation (EU) 622/2012

Standards used:
EN 16297-1:2012, EN 16297-2:2012, EN 16297-3:2012.

The CE marking takes into account the proof of conformity with the respective harmonized norms based on the legal provisions above.

MAGNA3 pumps
are not harmonized in accordance with the *CPR*.

Application
For the application and use the respective national

provisions apply.

The pump is designed for circulating liquids in the

following systems:

· heating systems

· domestic hot-water systems

· air-conditioning and cooling systems

· ground-source heat-pump systems

· solar-heating systems

The pump is suitable for thin, clean, non-aggressive and non-explosive liquids, not containing solid particles or fibres that may attack the pump mechanically or chemically. In heating systems, the water must meet the requirements of accepted standards on water quality in heating systems. The pumps are also suitable for domestic hot-water systems.

Technical Data
The performance
data of the product according to the harmonized norms, based on the
harmonization provisions above apply.

The relevant
technical specifications according to the *PCR Part B* are given in
the table below.

Characteristics
that are the same for all product groups are only given once.

Others are given
individually for all two groups.

Constructional data

Name	Value	Unit
Frequency	50	Hz
Voltage	230	V
nominal capacity	-	kW
Pumped liquid (e.g. water)	Clean Water	-
Energy Efficiency Index Gr.1	0,18	
Energy Efficiency Index Gr.2	0,17	
Energy Efficiency Index Gr.3	0,17	
Flow range Gr. 1 (max)	23,0	m^3/h
Flow range Gr. 2 (max)	25,0	m^3/h
Flow range Gr. 3 (max)	25,0	m^3/h
Head max. Gr.1	12	m
Head max. Gr.2	15	m
Head max. Gr.3	18	m
Power input Gr. 1 Average (from load profile describing use)	0,179	kW
Power input Gr. 2 Average (from load profile describing use)	0,252	kW
Power input Gr. 3 Average (from load profile describing use)	0,252	kW
Nominal capacity Gr.1	0,427	kW
Nominal capacity Gr. 2	0,608	kW
Nominal capacity Gr.3	0,609	kW

Performance
data of the product according to the harmonized standards, based on provisions for harmonization.

Base materials/Ancillary materials

Base materials / Ancillary materials

Name	Value	Unit
Aluminium	17	%
Cast iron	45	%
Ceramics	0,4	%
Copper	3	%
Electronics	0,3	%
Magnet Nd	1	%
Paper	1	%
PCB	5	%
Plastics	0,4	%
Plastics, foam	1	%
Plastics GF	7	%
Rubber	0,2	%
Stainless steel	5	%
Steel	6	%
Cardboard	7	%
Plastic film	0,1	%
TOTAL	100	%

REACH

This product/article/at least one partial article contains

substances listed in the *ECHA candidate list* (date: 10.06.2022) exceeding 0.1 percentage by mass: **no**

There is no definitive information on the average circulator life available, there is consensus within the industry that it is at least 12 years. However, this is complicated by many factors, including many being scrapped prematurely when e.g. the boiler they are connected to is replaced.

The Wahlstedt production has been assessed and certified as meeting the requirements in *ISO 14001, ISO 50001, ISO 45001 and ISO 9001.*

From the estimated stock (140Mpa) and annual sales (14Mpa), the average lifetime of the circulator is taken as 10 years for the purposes of this study.

Reference service life

No use stage scenario which refers to the lifetime of the product is declared. However, to facilitate building calculations, an estimated RSL of 10 years can be used. This is an EU consensus-based estimation, referenced on page 37 in Appendix 7: *Lot 11 – Circulators in Buildings*, prepared by AEA Energy & Environment for the European Commission in the context of the Eco Design Directive:

The RSL of the declared product is not directly influencing the results in this study, as no declared use stage scenario is dependent on the RSL; The use stage sub-module B6 is declared per year as required by the *PCR Part B.*

LCA: Calculation rules

Declared Unit

The declared unit is 1 piece (pcs.) of MAGNA3 (Cast iron) pump.

Declared unit

Name	Value	Unit
Declared unit	1	pce.
Mass reference	18.06	kg/pce
Conversion factor [Mass/Declared Unit]	18.06	

For IBU core EPDs (where clause 3.6 is part of the EPD): for average EPDs, an estimate of the robustness of the LCA values must be made, e.g. concerning the variability of the production process, geographical representativeness and the influence of background data and preliminary products compared to the environmental impacts caused by the actual production.

System boundary

This EPD is Cradle-To-Grave. The system boundaries of the EPD follow the modular approach in *EN 15804*. By decision no. 20170712-n of the *SVR*, the modules B3, B4 and B5 are by default declared as "MNR" (module not relevant).

The product stage (A1-A3) comprises raw material extraction and processing, transport processes as well as the manufacturing process. The final production and assembly of the MAGNA3 pump takes place at a Grundfos manufacturing site in Germany. However, the full supply-chain leading to the finished product at the gate is rather complex and includes a large amount of raw materials, components and semi-finished parts which comes from both external suppliers as well as other Grundfos production facilities.

The product stage is included in the study, and according to *EN 15804* the system boundary with nature is set to include those processes that provide the material and energy inputs into the system and the following manufacturing, transport up to the factory gate as well as the processing any waste arising from those processes.

Wastes and losses are included in the modules where they occur according to the polluter pays principle and the modular approach of *EN 15804.*

The product includes:

· A1
Extraction and processing of raw materials;

· A1 Reuse
of products or materials from a previous product system;

· A1
Processing of secondary materials;

· A1
Generation of electricity, steam and heat from primary energy resources, also including their extraction, refining and transport;

· A1 Energy
recovery and other recovery processes from secondary fuels;

· A2
Transportation up to the factory gate and internal transport;

· A3
Production of ancillary materials or pre products;

· A3 Manufacturing
of products and coproducts;

· A3
Manufacturing of packaging;

· A1-A3
processing up to the end-of-waste state or disposal of final residues.

For secondary material inputs, the system boundary to the previous system (providing the secondary material) is set where outputs reach the end-of-waste state. The recycling of secondary material into new raw materials is included in the system boundary of this study. Waste

materials from production processes that are recycled without any modification of the material's inherent characteristics are modelled as closed-loop within A1-A3. This is done up to the input mass flow that was used during production.

Waste for incineration arising in the product stage is accounted for in the module where the waste is produced. The environmental loads from the incineration process are declared in the module where it occurs and the electricity and heat which are produced from the incineration is considered as closed-loop within A1-A3, as described in *PCR Part A,* 5.5.1. The input of biogenic carbon from the production of packaging material is inventoried in A3. As required by *PCR Part A*, the corresponding end-of-life module of the packaging material, A5, is also declared and the emissions of biogenic carbon are inventoried.

The construction process stage (A4-A5) includes:

A4:

·
Transportation from factory gate to distribution center:

.
Consumption of electricity, thermal energy and water at distribution center;

.
Transportation from distribution center to construction site;

· Wastage
during distribution.

A5:

.
Installation process;

· Transport
of packaging waste to treatment site;

· Waste
treatment of packaging.

The packaging material does not reach the end of waste state but is incinerated as waste. According to European statistics, the
average R1 value of incineration plants is > 0.6. Therefore, it is assumed

that packaging material is treated thermally in an incineration plant with R1 > 0.6. The loads from the combustion process of
packaging are declared in module A5 and the resulting energy benefits in module

D, as required by the *PCR Part A*, 5.5.2.

Use stage (B1-B7):

The use stage, related to the building fabric includes:

· B1, use or
application of the installed product;

· B2,
maintenance.

The use stage related to the operation of the building

includes:

· B6,
operational energy use;

· B7,
operational water use.

In this study, all use stage modules are assessed, though B1, B2 and B7 are assessed to be zero. By decision no. 20170712-n of the
SVR, the modules B3, B4 and B5 are by default declared as "MNR" (module

not relevant). The modules include the provision and transport of all materials, products and related energy and water use, as well
as waste processing up to the end-of-waste state or disposal of final residues
during the use stage. They also include all impacts and

aspects related to the losses during the use stage (i.e. production, transport, and waste processing and disposal of the lost
products and materials).

Generally, the geographical coverage of the datasets used matches the actual processes taking place. Meaning, that when modelling
taking place in Grundfos Bjerringbro, the Danish electricity grid mix is used
in the model and thermal energy from natural gas. These are generally
of very high quality with very good technological, temporal and geographical
representativeness.

Contributions to operational energy use during the use stage (B6) come from the electricity consumption of the product. The annual electricity consumption is calculated by multiplying the average power input, which is based on a defined load profile, with the annual running hours. For use stage (B6) European Average electricity grid mix has been used. These values are declared in the scenarios section.

The End-of-Life stage (C1-C4) includes all activities from when the product reaches the end of its service life and no longer provides any functionality and until all materials and components are processed for reuse/recycling or disposed of.

According to *EN 15804* and the *PCR Part A,* the end-of-life stage includes:

· C1
deconstruction of the product from the building,
including initial on-site sorting of the materials;

· C2
transportation of the discarded product to a recycling site and transportation of waste to final disposal;

· C3 waste
processing, collection of waste fractions from the deconstruction and waste processing of material flows intended for reuse, recycling and energy recovery;

· C4 waste
disposal including physical pretreatment and management of the disposal site.

At the end of life, the MAGNA3 pump is manually disassembled from the piping system in which it has been installed. The definition of the applied end-of-life scenario in this EPD follows the requirements in the *PCR Part A*, 6.2 regarding complex products, with a combination of recycling, thermal waste treatment and landfilling. 100 % of the material is considered in the end of life scenario as required by the *PCR*. An overall collection rate of 90 % has been assumed.

Materials from which energy is recovered in an incineration process with an R1-value above 0.60 are in this study included with the environmental burdens from the incineration process inventoried in C3, the recovered energy is declared as exported energy in C3 and the energy benefits are declared in D. This procedure is according to the *PCR Part A*, 5.5.6. C3 includes the mechanical separation of the product followed by a series of sorting steps. Metal fractions are recycled and plastics, cardboard and electronics are assumed incinerated with energy recovery. The residual fractions are landfilled and declared in C4.

The specific amounts are shown in the scenarios section.

Beyond system boundary (D):
According to *EN 15804* module D includes the reuse, recovery and/or recycling potentials, expressed as net impacts and benefits. Any declared benefits and loads from net

flows leaving the product system that have not been allocated as co-products and that have passed the end-of-waste state are
included in module D.

Contributions to module D comes from waste incineration processes in A5 and C3 as well as material recycling in C3. The
specific fractions and net flows are shown in the scenarios section.

Geographic Representativeness

Land or region, in which the declared product system is manufactured, used or handled at the end of the product´s lifespan: Europe

Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to *EN 15804* and the building context, respectively the product-specific characteristics of performance, are taken into account. Software and databases used: *GaBi ts*

9.2.1.68
(database schema 8007) *Ecoinvent v3.5.*.

LCA: Scenarios and additional technical information

Characteristic product properties of biogenic carbon

The
biogenic carbon content quantifies the amount of biogenic carbon in a
construction product leaving the factory gate, and it will be separately
declared for the product and for any accompanying packaging, as required from
the *PCR Part A.* The Carbon content of Cardboard and Paper is assumed to
0.46 kg C. Overall, there is an amount of 9 weight-% Carbon in the product
leaving the factory gate and has to be considered

Information on describing the biogenic Carbon Content at factory gate

Name	Value	Unit
Biogenic carbon content in accompanying packaging	0.74	kg C

Note: 1 kg of biogenic carbon is equivalent to 44/12 kg of CO2

The following technical scenario information is required for the declared modules and optional for non-declared modules. Modules for which no information is declared can be deleted; additional information can also be listed if necessary.

The following technical information is a basis for the declared modules or can be used for developing specific scenarios in the context of a building assessment if modules are not declared (MND).

A5 is not declared including the disposal of the packaging material on the construction site, the amounts of packaging materials included in the LCA calculations must be declared as technical scenario information for Module A5.

Transport from the gate to the site (A4)

Name	Value	Unit
Litres of fuel	0,052	l/100km
Transport distance	2003	km
Capacity utilisation (including empty runs)	85	%
Gross density of products transported	347	kg/m^3
Wastage during distribution	0,02	%

Installation into the building (A5)

Name	Value	Unit
Packaging waste for incineration (LDPE film)	0,031	kg
Packaging waste for incineration (Paper/Cardboard)	1,42	kg

An
estimated RSL of 10 years can be used to facilitate building calculations. This
is an EU consensus-based estimation, referenced in Appendix 7: Lot 11 –
Circulators in Buildings, prepared by AEA Energy & Environment for the
European Commission in the context of the Eco Design Directive.

Reference service life

Name	Value	Unit
Life Span according to the manufacturer	10	a

Operational energy use (B6)

Name	Value	Unit
Electricity consumption, Group 1	895	kWh/a
Electricity consumption, Group 2	1260	kWh/a
Electricity consumption, Group 3	1260	kWh/a
Average power input, Group 1	0,179	kW
Average power input, Group 2	0,252	kW
Average power input, Group 3	0,252	kW
Running hours (all groups)	5.000	h/a

End of life (C1-C4)

Name	Value	Unit
Collected as mixed construction waste	16,77	kg
Transportation distance (C2)	500	km
Aluminium for recycling	2,79	kg
Steel for recycling	8,19	kg
Copper for recycling	0,51	kg
Stainless steel for recycling	0,82	kg
Plastics for incineration w/energy	1,28	kg
Electronics for incineration w/energy	0,81	kg
Landfilling	1,89	kg

Reuse, recovery and/or recycling potentials (D), relevant scenario information

Name	Value	Unit
A5, incineration w/energy recov. (LDPE foil)	3,21	MJ
A5, incineration w/energy recov. (Paper/Cardboard)	5,82	MJ
C3, steel for recycling (net amounts)	-0,935	kg
C3, stainless steel for recycling (net amounts)	0,53	kg
C3, aluminium for recycling (net amounts)	-0,383	kg
C3, copper for recycling (net amounts)	0,221	kg
C3, plastics for incineration, w/ energy recov.	1,28	kg
C3, electronics for incineration, w/ energy recov.	0,814	kg

LCA: Results

Characterization model: *EN 15804* - 2012+A2 - 2019, PEF. By Decision no. 20170712-n of the IBU SVR, the modules B3, B4, B5 are marked as MNR (module not relevant) as default. The LCA results in module B6 are given on a period of one year, according to *PCR Part B*. To obtain the results from module B6 over the entire life cycle, the LCA results of module B6 must be multiplied by the estimated RSL of 10 years. The indicator results for module B6 are declared for Group 1. B6 indicator results for other groups can be derived by multiplying the B6 indicator results with the following factors:

Group 2: 1,37

Group 3: 1,37

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; ND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

Product stage			Construction process stage		Use stage							End of life stage				Benefits and loads beyond the system boundaries
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	MND	MND	MNR	MNR	MNR	X	MND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1PCS of MAGNA3 40-120/150/180 (Cast Iron)

Parameter	Unit	A1	A2	A3	A4	A5	B6	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq	9.2E+01	1.15E+00	1.3E+00	1.13E+00	2.09E+00	3.62E+02	0	4.63E-01	5.81E+00	1.12E-01	-4.09E-01
GWP-fossil	kg CO_2 eq	9.15E+01	1.15E+00	3.59E+00	1.12E+00	1.32E-01	3.6E+02	0	4.6E-01	5.8E+00	1.15E-01	-4.05E-01
GWP-biogenic	kg CO_2 eq	2.89E-01	-1.47E-03	-2.32E+00	-2.26E-03	1.96E+00	1.2E+00	0	-7.76E-04	4.96E-03	-3.46E-03	-1.93E-03
GWP-luluc	kg CO_2 eq	1.37E-01	8.07E-03	3.3E-02	8.88E-03	7.12E-05	5.22E-01	0	3.74E-03	2.49E-03	1.01E-04	-2.48E-03
ODP	kg CFC11 eq	9.14E-08	1.97E-16	4.06E-09	1.91E-11	3.85E-16	7.93E-12	0	8.48E-17	3.74E-14	2.59E-16	-7.53E-13
AP	mol H^+ eq	5.36E-01	9.54E-03	1.59E-02	6.55E-03	5.99E-04	7.95E-01	0	2.72E-03	4.44E-03	3.57E-04	-1.24E-02
EP-freshwater	kg P eq	1.58E-03	3.07E-06	5.17E-05	3.67E-06	8.8E-08	9.62E-04	0	1.41E-06	6.59E-06	1.25E-05	-3.96E-06
EP-marine	kg N eq	6.59E-02	3.16E-03	2.81E-03	3.12E-03	2.18E-04	1.77E-01	0	1.31E-03	1.1E-03	8.24E-05	-6.13E-04
EP-terrestrial	mol N eq	6.92E-01	3.49E-02	2.84E-02	3.45E-02	2.72E-03	1.86E+00	0	1.45E-02	1.24E-02	9.04E-04	-6.22E-03
POCP	kg NMVOC eq	2.04E-01	7.48E-03	8.27E-03	5.94E-03	5.7E-04	4.84E-01	0	2.49E-03	2.99E-03	2.65E-04	-2.09E-03
ADPE	kg Sb eq	5.57E-03	8.45E-08	5.94E-05	1.22E-06	6.41E-09	1.04E-04	0	3.74E-08	4.93E-07	7.77E-09	-6.17E-04
ADPF	MJ	1.25E+03	1.52E+01	4.99E+01	1.51E+01	7.23E-01	6.33E+03	0	6.16E+00	3.06E+01	1.65E+00	-1.72E+01
WDP	m^3 world eq deprived	2.54E+01	9.99E-03	1.03E-01	1.67E-02	2.57E-01	7.85E+01	0	4.5E-03	7.93E-01	-1.27E-03	-3.63E-01

GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential)

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1PCS of MAGNA3 40-120/150/180 (Cast Iron)

Parameter	Unit	A1	A2	A3	A4	A5	B6	C1	C2	C3	C4	D
PERE	MJ	3.27E+02	7.75E-01	3.9E+01	9.47E-01	1.25E-01	2.81E+03	0	3.56E-01	1.32E+01	1.16E-01	6.16E+00
PERM	MJ	0	0	0	0	0	0	0	0	0	0	0
PERT	MJ	3.27E+02	7.75E-01	3.9E+01	9.47E-01	1.25E-01	2.81E+03	0	3.56E-01	1.32E+01	1.16E-01	6.16E+00
PENRE	MJ	1.25E+03	1.25E+03	4.99E+01	1.52E+01	7.23E-01	6.33E+03	0	6.19E+00	3.06E+01	1.65E+00	-1.7E+01

PENRM	MJ	0	0	0	0	0	0	0	0	0	0	0
PENRT	MJ	1.25E+03	1.52E+01	4.99E+01	1.52E+01	7.23E-01	6.33E+03	0	6.19E+00	3.06E+01	1.65E+00	-1.7E+01
SM	kg	1.32E+01	0	2.31E-01	2.68E-03	0	0	0	0	0	0	0
RSF	MJ	1.46E-23	0	0	2.91E-27	0	0	0	0	0	0	0
NRSF	MJ	1.71E-22	0	0	3.42E-26	0	0	0	0	0	0	0
FW	m^3	7.64E-01	9.07E-04	1.92E-02	1.18E-03	6.06E-03	3.25E+00	0	4.15E-04	2.51E-02	2.1E-05	2.65E-02

PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1PCS of MAGNA3 40-120/150/180 (Cast Iron)

Parameter	Unit	A1	A2	A3	A4	A5	B6	C1	C2	C3	C4	D
HWD	kg	2.16E-04	6.17E-07	1.22E-04	7.44E-07	3.75E-09	2.62E-06	0	2.86E-07	1.59E-08	6.61E-09	-3.3E-04
NHWD	kg	3.97E+00	2.31E-03	2.75E-01	3.35E-03	7.04E-02	4.49E+00	0	9.81E-04	5.41E-01	1.89E+00	1.45E+00
RWD	kg	5.09E-02	2.67E-05	1.38E-03	4.15E-05	3.47E-05	9.61E-01	0	1.14E-05	4.51E-03	1.97E-05	-1.15E-03
CRU	kg	0	0	0	0	0	0	0	0	0	0	0
MFR	kg	0	0	0	0	0	0	0	0	1.23E+01	0	0
MER	kg	0	0	0	0	0	0	0	0	0	0	0
EEE	MJ	0	0	0	0	3.21E+00	0	0	0	6.93E+00	0	0
EET	MJ	0	0	0	0	5.82E+00	0	0	0	1.25E+01	0	0

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

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: 1PCS of MAGNA3 40-120/150/180 (Cast Iron)

Parameter	Unit	A1	A2	A3	A4	A5	B6	C1	C2	C3	C4	D
PM	Disease incidence	6.35E-06	1.2E-07	2.23E-07	3.9E-08	3.41E-09	6.67E-06	0	1.59E-08	3.77E-08	3.64E-09	-2.99E-07
IR	kBq U235 eq	5.61E+00	3.93E-03	2.17E-01	5.78E-03	5.33E-03	1.58E+02	0	1.68E-03	7.4E-01	2.8E-03	-5.89E-02
ETP-fw	CTUe	7.8E+02	1.13E+01	1.68E+01	1.11E+01	3.67E-01	2.71E+03	0	4.61E+00	1.34E+01	1.16E+00	-5.83E+00
HTP-c	CTUh	1.63E-06	2.31E-10	6.46E-07	6.85E-10	1.8E-11	7.48E-08	0	9.55E-11	4.13E-10	6.66E-11	-6.95E-08
HTP-nc	CTUh	2.34E-06	1.25E-08	5.15E-08	1.35E-08	8.68E-10	2.76E-06	0	5.47E-09	1.68E-08	5.81E-09	-4.89E-09
SQP	SQP	3.49E+02	4.67E+00	7.08E+01	5.22E+00	1.96E-01	2.02E+03	0	2.16E+00	9.64E+00	1.19E-01	-1.43E+01

PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); SQP = Potential soil quality index

Disclaimer
1 – for the indicator 'Potential Human exposure efficiency relative to U235'. 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 or radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – for the indicators 'abiotic depletion potential for non-fossil resources', 'abiotic depletion potential for fossil resources', 'water (user) deprivation potential, deprivation-weighted water consumption', 'potential comparative toxic unit for ecosystems', 'potential comparative toxic unit for humans – cancerogenic', 'Potential comparative toxic unit for humans - not cancerogenic', 'potential soil quality index'. The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high as there is limited experience with the indicator.

Disclaimer 3: *JRC*

Technical Reports, Version 2, 2018 Page 6, for the indicator "EP-freshwater". This indicator has been calculated as 'kg P eq' as required in the characterization model EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe; This EPD was created using a software tool.

References

Standards

EN 15804

EN 15804:2012+A1 2013, Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products.

EN 15804

EN 15804:2012+A2:2019+AC:2021, Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products.

ISO 14025

EN ISO 14025:2011, Environmental labels and declarations — Type III environmental declarations — Principles and procedures.

Further References

Title of the software/database

Title of the software/database. Addition to the title, version. Place: Publisher, Date of publication [Access on access date].

IBU 2021

Institut Bauen und Umwelt e.V.: General Instructions for the EPD programme of Institut Bauen und Umwelt e.V., Version 2.0, Berlin: Institut Bauen und Umwelt e.V., 2021 www.ibu-epd.com

Standards

Machinery Directive

DIRECTIVE 2006/42/EC OF THE EUROPEAN

PARLIAMENT AND OF THE COUNCIL of 17 May

2006 on machinery

Radio Equipment Directive

DIRECTIVE 2014/53/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of

radio equipment

Electromagnetic Compatibility (EMC) Directive

DIRECTIVE 2014/30/EU OF THE EUROPEAN

PARLIAMENT AND OF THE COUNCIL of 26 February

2014 on the harmonistion of the laws of the Member

States relating to electromagnetic compatibility

Ecodesign Directive

DIRECTIVE 2009/125/EC OF THE EUROPEAN

PARLIAMENT AND
OF THE COUNCIL of 21 October

2009
establishing a framework for the setting of

ecodesign
requirements for energy-related products

EC 641/2009

COMMISSION
REGULATION (EC) No 641/2009 of 22 July 2009 implementing Directive 2005/32/EC
of the European Parliament and of the Council with regard to ecodesign
requirements for glandless standalone circulators and glandless circulators integrated
in

products

EC 622/2012

COMMISSION
REGULATION (EU) No 622/2012 of 11 July 2012 amending Regulation (EC) No
641/2009 with regard to ecodesign requirements for glandless standalone
circulators and glandless circulators integrated in products

**DIRECTIVE
2011/65/EU**

DIRECTIVE
2011/65/EU OF THE EUROPEAN

PARLIAMENT AND
OF THE COUNCIL of 8 June 2011

on the
restriction of the use of certain hazardous

substances in
electrical and electronic equipment

**DIRECTIVE
2015/863/EU**

DIRECTIVE
2015/863/EU of 31 March 2015 amending

Annex II to
Directive 2011/65/EU of the European

Parliament and
of the Council as regards the list of

restricted
substances

**ETSI EN 301
489-1**

ETSI EN 301
489-1 V2.2.0, Electromagnetic Compatibility (EMC) standard for radio equipment
and services; Part 1: Common technical requirements

**ETSI EN 301
489-17**

ETSI EN 301

489-17 V3.2.0, Electromagnetic Compatibility (EMC) standard for radio equipment
and services; Part 17: Specific conditions for Broadband Data Transmission
Systems

ETSI EN 300 328
V2.1.1

ETSI EN 300 328
V2.1.1, Wideband transmission systems; Data transmission equipment operating in
the 2,4 GHz ISM band and using wide band modulation techniques

EN 809

EN 809:1998-10
+ A1:2009, Pumps and pump units for

liquids -
Common safety requirements

EN 55014-1

EN
55014-1:2017, Electromagnetic compatibility – Requirements for household
appliances, electric tools and similar apparatus – Part 1: Emission

EN 55014-2

EN
55014-2:2015, Electromagnetic compatibility –

Requirements
for household appliances, electric tools

and similar
apparatus – Part 2: Immunity – Product

family standard
(CISPR 14-2:2015)

EN 50581:2012

EN 50581:2012,
Technical documentation for the

assessment of
electrical and electronic products with

respect to the
restriction of hazardous substances

EN 60335-1

EN
60335-1:2012/A11:2014/A13:2017, Household

and similar
electrical appliances – Safety – Part 1:General requirements

EN 60335-2-51

EN
60335-2-51:2003-03 + A1:2008 + A2:2012, Household and similar electrical
appliances – Safety –Part 2-51: Particular requirements for stationary
circulation pumps for heating and service water installations

EN 61000-3-2

EN
61000-3-2:2014/2019, Electromagnetic compatibility (EMC) – Part 3-2: Limits –
Limits for harmonic current emissions (equipment input current =16 A per phase)

EN 61000-3-3

EN
61000-3-3:2013-08/ A1:2019, Electromagnetic compatibility (EMC) – Part 3-3:
Limits – Limitation of voltage changes, voltage fluctuations and flicker in public
low voltage supply systems, for equipment with

rated current
<= 16 A per phase and not subject to conditional connection

EN 61000-6-2

EN
61000-6-2:2008/2019, Electromagnetic compatibility (EMC) – Part 6-2: Generic
standards –Immunity for industrial environments

EN 16297-1

EN
16297-1:2012-10, Pumps – Rotodynamic pumps –Glandless circulators – Part 1:
General requirements and procedures for testing and calculation of energy
efficiency index (EEI)

EN 16297-2

EN 16297-2:2012-10,
Pumps – Rotodynamic pumps –Glandless circulators – Part 2: Calculation of
energy efficiency index (EEI) for standalone circulators

EN 16297-3

EN
16297-3:2012, Pumps – Rotodynamic pumps –Glandless circulators – Part 3: Energy
efficiency index (EEI) for circulators integrated in products

ISO 14001

EN ISO
14001:2015-09, Environmental management systems - Requirements with guidance
for use

and liquids with
solids, Version 1.0 (2018)

ISO 14025

DIN EN /ISO
14025:2011-10, Environmental labels and declarations — Type III environmental
declarations — Principles and procedures

EN 15804

EN
15804:2012-04+A1 2013, Sustainability of construction works — Environmental
Product Declarations — Core rules for the product category of construction
products

PCR Part A

Institut Bauen
und Umwelt e.V., Berlin (pub.): Product Category Rules for Building-Related
Products and Services, Product Category Rules for Construction Products from
the range of Environmental Product Declarations of Institut Bauen und Umwelt
(IBU), Part A: Calculation Rules for the Life Cycle Assessment and Requirements
on the Project Report, Version 1.7 (2021)

PCR Part B

Institut Bauen
und Umwelt e.V., Berlin (pub.): Product Category Rules for Building-Related
Products and Services, Product Category Rules for Construction Products from
the range of Environmental Product Declarations of Institut Bauen und Umwelt
(IBU), Part B: Requirements on the EPD for Pumps for liquids

Further references

CPR

REGULATION (EU)
No 305/2011 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 9 March 2011
laying down harmonised conditions for the marketing of construction products
and repealing Council Directive 89/106/EEC

CML 2001

Impact
assessment characterization factors Institute of Environmental Sciences, Leiden
University, Netherlands

ECHA candidate list

Candidate List
of substances of very high concern (SVHCs) for authorisation, European

Chemicals Agency (ECHA), Helsinki, Finland

Ecoinvent

Ecoinvent v3.5

GaBi ts

GaBi ts 9.2.1.68
(database schema 8007)

REACH

Regulation (EC)
No 1907/2006 of the European Parliament and of the Council of 18 December 2006
concerning the Registration, Evaluation, Authorisation and Restriction of
Chemicals (REACH) (Status: 27.06.2018)

SVR

Advisory Board
(formerly SVA)

Decision no.
20170712-n

Publisher

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ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A2*

Owner of the Declaration	Grundfos Holding A/S
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-GRU-20240015-CBA1-EN
Issue date	21.03.2024
Valid to	20.03.2029

MAGNA3 40-120/150/180 (Stainless Steel)

Grundfos Holding A/S

Institut Bauen und Umwelt e.V.

ECO PLATFORM EPD VERIFIED

www.ibu-epd.com | https://epd-online.com

General Information

Grundfos Holding A/S

Programme holder

IBU – Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

Declaration number

EPD-GRU-20240015-CBA1-EN

This declaration is based on the product category rules:

Pumps for liquids and liquids with solids, 01.08.2021
(PCR checked and approved by the SVR)

Issue date

21.03.2024

Valid to

20.03.2029

Dipl.-Ing. Hans Peters
(Chairman of Institut Bauen und Umwelt e.V.)

Florian Pronold
(Managing Director Institut Bauen und Umwelt e.V.)

MAGNA3 40-120/150/180 (Stainless Steel)

Owner of the declaration

Grundfos Holding A/S
Poul Due Jensens Vej 7
8850 Bjerringbro
Denmark

Declared product / declared unit

1 PCS. of MAGNA3 40-120/150/180 (Stainless Steel)

Scope:

The declaration applies to 1 piece of MAGNA3 (Stainless Steel) pump.

The product is produced in Wahlstedt, Germany, and the life cycle assessment is based on data collected at the production site. Production has been modeled using annual production data from 2021. The declaration covers three different types of the MAGNA3 40- product (120/150/180).

The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

The EPD was created according to the specifications of EN 15804+A2. In the following, the standard will be simplified as *EN 15804*.

Verification

The standard EN 15804 serves as the core PCR
Independent verification of the declaration and data according to ISO 14025:2011
☐ internally ☒ externally

Mrs Kim Allbury,
(Independent verifier)

Product

Product description/Product definition
The Grundfos MAGNA3 circulator pumps are designed for circulating liquids in heating systems, air conditioning and cooling systems and domestic hot water systems. However, the pump range can also be used in ground source heat pump systems and solar heating systems.

The MAGNA3 pump is a centrifugal pump powered by an electrical motor. It has a high-performance neodymium magnet rotor which increases motor efficiency and an insulation shell to reduce heat loss from the cast iron pump housing with threaded connections.

The declaration covers three types of the MAGNA3 pump. They are grouped as shown below. The group reference in the technical data and scenarios refers also to these.

GROUP 1 - MAGNA3 40-120

GROUP 2 - MAGNA3 40-150 GROUP 3 - MAGNA3 40-180
These are all the same physical products and 100 % identical in terms of design, dimensions and materials as well as supply chain and manufacturing processes, i.e., all cradle to gate processes (A1-A3).

The products are also identical in terms of packaging, distribution, reference service life and end-of-life treatment. The only thing that differentiates the products from each other is the software which controls how the pump operates in the system in which it is installed, making them fit for different applications. Hence, all life cycle modules are identical, except use stage module B6, which will change, as the applied scenarios for electricity consumption changes. For the placing on the market in the European Union/European Free Trade Association (EU/EFTA) (with the exception of Switzerland) the following legal provisions apply:

Machinery Directive (2006/42/EC)

Standard used: *EN 809:1998 + A1:2009.*

Radio Equipment Directive (2014/53/EU)

Standards used:
EN 60335-1:2012/AC:2014 + A11:2014, EN 60335-2-51:2003 + A1:2008 + A2:2012, EN 62233:2008.

EN 55014-1:2006 + A1:2009 + A2:2011, EN 55014-1:2017, EN 61000-6-2:2005, EN 61000-3-2:2014, EN 61000-3-3:2013, ETSI EN 301 489-1 V2.2.0, ETSI EN 301 489-17 V3.2.0. ETSI EN 300 328 V2.1.1

Electromagnetic Compatibility (EMC) Directive (2014/30/EU)

Standards used:
EN 55014-1:2017, EN 55014-2:2015,

EN 61000-3-2:2014/2019, EN 61000-6-2:2008/2019,

EN 61000-3-3:2013 A1:2019

RoHS Directive 2011/65/EU and 2015/863//EU

Standard: *EN 50581:2012.*

Ecodesign Directive (2009/125/EC)

Commission Regulation (EC) No: 641/2009 and

Commission Regulation (EU) 622/2012

Standards used:
EN 16297-1:2012, EN 16297-2:2012, EN 16297-3:2012.

The CE marking takes into account the proof of conformity with the respective harmonized norms based on the legal provisions above.

MAGNA3 pumps are not harmonized in accordance with the *CPR.*

Application
For the application and use the respective national provisions apply.

The pump is designed for circulating liquids in the following systems:

· heating systems

· domestic hot-water systems

· air-conditioning and cooling systems

· ground-source heat-pump systems

· solar-heating systems

The pump is suitable for thin, clean, non-aggressive and non-explosive liquids, not containing solid particles or fibres that may attack the pump mechanically or chemically. In heating systems, the water must meet the requirements of accepted standards on water quality in heating systems. The pumps are also suitable for domestic hot-water systems.

Technical Data
The performance data of the product according to the harmonized norms, based on the harmonization provisions above apply.

The relevant technical specifications according to the *PCR Part B* are given in the table below.

Characteristics that are the same for all product groups are only given once. Others are given individually for all two groups.

Constructional data

Name	Value	Unit
Frequency	50	Hz
Voltage	230	V
nominal capacity	-	kW
Pumped liquid (e.g. water)	Clean Water	-
Energy Efficiency Index Gr.1	0,18	
Energy Efficiency Index Gr.2	0,18	
Energy Efficiency Index Gr.3	0,17	
Flow range Gr. 1 (max)	23,0	m^3/h
Flow range Gr. 2 (max)	25,0	m^3/h
Flow range Gr. 3 (max)	25,0	m^3/h
Head max. Gr.1	12	m
Head max. Gr.2	15	m
Head max. Gr.3	18	m
Power input Gr. 1 Average (from load profile describing use)	0,179	kW
Power input Gr. 2 Average (from load profile describing use)	0,252	kW
Power input Gr. 3 Average (from load profile describing use)	0,252	kW
Nominal capacity Gr.1	0,427	kW
Nominal capacity Gr. 2	0,608	kW
Nominal capacity Gr.3	0,609	kW

Performance data of the product according to the harmonised standards, based on provisions for harmonisation.

Base materials/Ancillary materials

Base materials / Ancillary materials

Name	Value	Unit
Aluminium	16,68	%
Ceramics	0,37	%
Copper	3,15	%
Electronics	0,28	%
Magnet Nd	1,34	%
Paper	0,62	%
PCB	4,62	%
Plastics	0,4	%
Plastics, foam	0,88	%
Plastics GF	6,38	%
Rubber	0,21	%
Stainless steel	51,71	%
Steel	6,27	%
Cardboard	7	%
Plastic film	0,09	%
TOTAL	100	%

REACH

This product/article/at least one partial article contains substances listed in the *ECHA candidate list* (date: 10.06.2022) exceeding 0.1 percentage by mass: **no**

The Wahlstedt production has been assessed and certified as meeting the requirements in *ISO 14001, ISO 50001, ISO 45001 and ISO 9001.*

Reference service life

No use stage scenario which refers to the lifetime of the product is declared. However, to facilitate building calculations, an estimated RSL of 10 years can be used. This is an EU consensus-based estimation, referenced on page 37 in Appendix 7: *Lot 11 – Circulators in Buildings*, prepared by AEA Energy & Environment for the European Commission in the context of the Eco Design Directive:

There is no definitive information on the average circulator life available, there is consensus within the industry that it is at least 12 years. However, this is complicated by many factors, including many being scrapped prematurely when e.g. the boiler they are connected to is replaced.

From the estimated stock (140Mpa) and annual sales (14Mpa), the average lifetime of the circulator is taken as 10 years for the purposes of this study.

The RSL of the declared product is not directly influencing the results in this study, as no declared use stage scenario is dependent on the RSL; The use stage sub-module B6 is declared per year as required by the *PCR Part B.*

LCA: Calculation rules

Declared Unit

The declared unit is 1 piece (pcs.) of MAGNA3 (Stainless Steel) pump.

Declared unit

Name	Value	Unit
Declared unit	1	pce.
Mass reference	18.61	kg/pce
Conversion factor [Mass/Declared Unit]	18.61	

System boundary

This EPD is Cradle-To-Grave. The system boundaries

of the EPD follow the modular approach in *EN 15804*.
By decision no. 20170712-n of the *SVR*, the modules B3, B4 and B5 are by default declared as "MNR" (module not relevant).

The product stage (A1-A3)

comprises raw material extraction and processing, transport processes as well as the manufacturing process. The final production and assembly of the MAGNA3 pump takes place at a Grundfos manufacturing site in Germany. However, the full supply-chain leading to the finished product at the gate is rather complex and includes a large amount of raw materials,

components and semi-finished parts which comes from both external suppliers as well as other Grundfos production facilities.

The product stage is included in the study, and according to *EN 15804* the system boundary with nature is set to include those processes that provide the material and energy inputs into the system and the following manufacturing, transport up to the factory gate as well as the processing any waste arising from those processes.

Wastes and losses are included in the modules where they occur according to the polluter pays principle and the modular approach of *EN 15804.*

The product includes:

· A1 Extraction and processing of raw materials;

· A1 Reuse of products or materials from a previous product system;

· A1 Processing of secondary materials;

· A1 Generation of electricity, steam and heat from primary energy resources, also including their extraction, refining and transport;

· A1 Energy recovery and other recovery processes from secondary fuels;

· A2 Transportation up to the factory gate and internal transport;

· A3 Production of ancillary materials or pre products;

· A3 Manufacturing of products and coproducts;

· A3 Manufacturing of packaging;

· A1-A3 processing up to the end-of-waste state or disposal of final residues.

For secondary material inputs, the system boundary to the previous system (providing the secondary material) is set where outputs reach the end-of-waste state. The recycling of secondary material into new raw materials is included in the system boundary of this study. Waste

materials from production processes that are recycled without any modification of the material's inherent characteristics are modelled as closed-loop within A1-A3. This is done up to the input mass flow that was used during production.

Waste for incineration arising in the product stage is accounted for in the module where the waste is produced. The environmental loads from the incineration process are declared in the module where it occurs and the electricity and heat which are produced from the incineration is considered as closed-loop within A1-A3, as described in *PCR Part A,*
5.5.1. The input of biogenic carbon from the production of packaging material is inventoried in A3. As required by *PCR Part A*, the corresponding end-of-life module of the packaging material, A5, is also declared and the emissions of biogenic carbon are inventoried.

The construction process stage (A4-A5) includes:

A4:

· Transportation from factory gate to the distribution center:

· Consumption of electricity, thermal energy and water at the distribution center;

· Transportation from distribution center to construction site;

· Wastage during distribution.

A5:

· Installation process;

· Transport of packaging waste to treatment site;

· Waste treatment of packaging.

The packaging material does not reach the end of waste state but is incinerated as waste. According to European statistics, the average R1 value of incineration plants is > 0.6. Therefore, it is assumed

that packaging material is treated thermally in an incineration plant with R1 > 0.6. The loads from the combustion process of packaging are declared in module A5 and the resulting energy benefits in module

D, as required by the *PCR Part A*, 5.5.2.

Use stage (B1-B7):

The use stage, related to the building fabric includes:

· B1, use or application of the installed product;

· B2, maintenance.

The use stage related to the operation of the building

includes:

· B6, operational energy use;

· B7, operational water use.

In this study, all use stage modules are assessed, though B1, B2 and B7 are assessed to be zero. By decision no. 20170712-n of the *SVR*, the modules B3, B4 and B5 are by default declared as "MNR" (module

not relevant). The modules include the provision and transport of all materials, products and related energy and water use, as well as waste processing up to the end-of-waste state or disposal of final residues during the use stage. They also include all impacts and

aspects related to the losses during the use stage (i.e. production, transport, and waste processing and disposal of the lost products and materials).

Generally, the geographical coverage of the datasets used matches the actual processes taking place. Meaning, that when modelling taking place in Grundfos Bjerringbro, the Danish electricity grid mix is used in the model and thermal energy from natural gas. These are generally of very high quality with very good technological, temporal and geographical representativeness.

Contributions to operational energy use during the use stage (B6) come from the electricity consumption of the product. The annual electricity consumption is calculated by multiplying the

average power input, which is based on a defined load profile, with the annual running hours. For use stage (B6) European Average electricity grid mix has been used. These values are declared in the scenarios section.

The End-of-Life stage (C1-C4)
includes all activities from when the product reaches the end of its service life and no longer provides any functionality and until all materials and components are processed for

reuse/recycling or disposed of.

According to *EN 15804* and the *PCR Part A,*
the end-of-life stage includes:

· C1 deconstruction of the product from the

· building, including initial on-site sorting of the

· materials;

· C2 transportation of the discarded product to a recycling site and transportation of waste to final disposal;

· C3 waste processing, collection of waste fractions from the deconstruction and waste processing of material flows intended for reuse, recycling and energy recovery;

· C4 waste disposal including physical pretreatment and management of the disposal site.

At the end of life, the MAGNA3 pump is manually disassembled from the piping system in which it has been installed. The definition of the applied end-of-life scenario in this EPD follows the requirements in the

PCR Part A, 6.2 regarding complex products, with a combination of recycling, thermal waste treatment and landfilling. 100 % of the material is considered in the end of life scenario as required by the *PCR*.
An overall collection rate of 90 % has been assumed.

Materials from which energy is recovered in an incineration process with an R1-value above 0.60 are in this study included with the environmental burdens from the incineration process inventoried in C3, the recovered energy is declared as exported energy in C3

and the energy benefits are declared in D. This procedure is according to the *PCR Part A*, 5.5.6. C3 includes the mechanical separation of the product followed by a series of sorting steps. Metal fractions are recycled and plastics, cardboard and electronics are assumed incinerated with energy recovery. The residual fractions are landfilled and declared in C4.

The specific amounts are shown in the scenarios section.

Beyond system boundary (D):
According to *EN 15804* module D includes the reuse, recovery and/or recycling potentials, expressed as net impacts and benefits. Any declared benefits and loads from net

flows leaving the product system that have not been allocated as co-products and that have passed the end-of-waste state are included in module D.

Contributions to module D comes from waste incineration processes in A5 and C3 as well as material recycling in C3. The specific fractions and net flows are shown in the scenarios section.

Geographic Representativeness
Land or region, in which the declared product system is manufactured, used or handled at the end of the product´s lifespan: Europe

Comparability
Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to *EN 15804* and the building context, respectively the product-specific characteristics of performance, are taken into account. Software and databases used: *LCA for Experts 10.7.1.28*
Schema 8007
Sphera and Ecoinvent databases

LCA: Scenarios and additional technical information

Characteristic product properties of biogenic carbon
The biogenic carbon content quantifies the amount of biogenic carbon in a construction product leaving the factory gate, and it will be separately declared for the product and for any accompanying packaging, as required from the *PCR Part A*.
The carbon content of cardboard and paper is assumed to 0.46 kg C, meaning 46% of the paper and cardboard packaging is biogenic carbon. Overall, there is an amount of weight-% Carbon in the product leaving the factory gate and has to be considered

Information on describing the biogenic Carbon Content at factory gate

Name	Value	Unit
Biogenic carbon content in accompanying packaging	0.65	kg C

Note: 1 kg of biogenic carbon is equivalent to 44/12 kg of CO2

Transport from the gate to the site (A4)

Name	Value	Unit
Litres of fuel	0,0332	l/100km
Transport distance	2003	km
Capacity utilisation (including empty runs)	85	%
Gross density of products transported	347	kg/m^3
Wastage during distribution	0,02	%

Installation into the building (A5)

Name	Value	Unit
Packaging waste for incineration (LDPE film)	0,016	kg
Packaging waste for incineration (Paper/Cardboard)	1,417	kg

An estimated RSL of 10 years can be used to facilitate building calculations. This is an EU consensus-based estimation, referenced in Appendix 7: Lot 11 – *Circulators in Buildings*, prepared by *AEA Energy & Environment* for the European Commission in the context of the *Eco Design Directive*.

Reference service life

Name	Value	Unit
Life Span according to the manufacturer	10	a

Operational energy use (B6)

Name	Value	Unit
Electricity consumption, Group 1	895	kWh/a
Electricity consumption, Group 2	1260	kWh/a
Electricity consumption, Group 3	1260	kWh/a
Average power input, Group 1	0,179	kW
Average power input, Group 2	0,252	kW
Average power input, Group 3	0,252	kW
Running hours (all groups)	5.000	h/a

End of life (C1-C4)

Name	Value	Unit
Collected as mixed construction waste	17,178	kg
Transportation distance (C2)	500	km
Aluminium for recycling	2,74	kg
Steel for recycling	1,03	kg
Copper for recycling	0,52	kg
Stainless steel for recycling	8,49	kg
Plastics for incineration w/energy	1,29	kg
Electronics for incineration w/energy	0,80	kg
Landfilling	2,31	kg

Reuse, recovery and/or recycling potentials (D), relevant scenario information

Name	Value	Unit
A5, incineration w/energy recov. thermal energy	6,84	MJ
A5, incineration w/energy recov. electric energy	3,78	MJ
C3, steel for recycling (net amounts)	-0,282	kg
C3, stainless steel for recycling (net amounts)	2,59	kg
C3, aluminium for recycling (net amounts)	-0,423	kg
C3, copper for recycling (net amounts)	0,223	kg
C3, incineration w/energy recov. thermal energy	12,6	MJ
C3, incineration w/energy recov. electric energy	7	MJ

LCA: Results

Characterization model: *EN 15804* - 2012+A2 - 2019, PEF. By Decision no. 20170712-n of the IBU SVR, the modules B3, B4, B5 are marked as MNR (module not relevant) as default. The LCA results in module B6 are given on a period of one year, according to *PCR Part B*. To obtain the results from module B6 over the entire life cycle, the LCA results of module B6 must be multiplied by the estimated RSL of 10 years. The indicator results for module B6 are declared for Group 1. B6 indicator results for other groups can be derived by multiplying the B6 indicator results with the following factors:

Group 2: 1,37

Group 3: 1,37

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

Product stage			Construction process stage		Use stage							End of life stage				Benefits and loads beyond the system boundaries
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	X	X	MNR	MNR	MNR	X	X	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1PCS of MAGNA3 40-120/150/180

Parameter	Unit	A1	A2	A3	A4	A5	B1	B2	B6	B7	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq	9.81E+01	4.11E+00	1.18E+00	1.43E+00	2.42E+00	0	0	2.91E+02	0	0	5.93E-01	5.57E+00	1.14E-01	-7.74E+00
GWP-fossil	kg CO_2 eq	9.8E+01	4.11E+00	3.45E+00	1.44E+00	4.53E-01	0	0	2.89E+02	0	0	5.96E-01	5.56E+00	1.16E-01	-7.71E+00
GWP-biogenic	kg CO_2 eq	-3.71E-03	-7.33E-03	-2.29E+00	-2.12E-02	1.97E+00	0	0	2.51E+00	0	0	-8.8E-03	1.2E-02	-1.43E-03	-1.99E-02
GWP-luluc	kg CO_2 eq	6.04E-02	6.66E-03	2.83E-02	1.3E-02	7.3E-05	0	0	3.14E-02	0	0	5.53E-03	1.79E-04	1.05E-04	-2.5E-03
ODP	kg CFC11 eq	4.73E-08	3.25E-13	4.05E-09	1.06E-11	3.26E-13	0	0	5.33E-09	0	0	7.77E-14	2.61E-11	1.93E-13	-2.04E-11
AP	mol H^+ eq	7.23E-01	1.21E-01	1.79E-02	8.63E-03	6.41E-04	0	0	6.17E-01	0	0	3.59E-03	3.73E-03	3.58E-04	-7.29E-02
EP-freshwater	kg P eq	1.49E-03	3.38E-06	5.47E-05	5.47E-06	1.2E-07	0	0	1.08E-03	0	0	2.18E-06	7.4E-06	1.33E-05	-1.1E-05
EP-marine	kg N eq	7.89E-02	2.89E-02	3.35E-03	4.14E-03	2.33E-04	0	0	1.48E-01	0	0	1.75E-03	9.87E-04	8.53E-05	-8.35E-03
EP-terrestrial	mol N eq	8.44E-01	3.17E-01	3.38E-02	4.59E-02	2.95E-03	0	0	1.54E+00	0	0	1.94E-02	1.12E-02	9.36E-04	-8.96E-02
POCP	kg NMVOC eq	2.48E-01	8.15E-02	9.64E-03	7.89E-03	6.08E-04	0	0	3.94E-01	0	0	3.32E-03	2.64E-03	2.69E-04	-2.69E-02
ADPE	kg Sb eq	8.3E-03	7.83E-08	6.04E-05	1.77E-06	3.34E-09	0	0	4.47E-05	0	0	3.96E-08	2.18E-07	3.11E-09	-1.02E-03
ADPF	MJ	1.38E+03	5.12E+01	5.12E+01	1.97E+01	8.96E-01	0	0	6.08E+03	0	0	8.13E+00	3.05E+01	1.73E+00	-9.16E+01
WDP	m^3 world eq deprived	3.47E+01	1.43E-02	-4.51E-03	2.5E-02	2.88E-01	0	0	6.43E+01	0	0	7.21E-03	7.42E-01	-1.61E-03	-5.29E-01

GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential)

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1PCS of MAGNA3 40-120/150/180

Parameter	Unit	A1	A2	A3	A4	A5	B1	B2	B6	B7	C1	C2	C3	C4	D
PERE	MJ	3.73E+02	8.88E-01	4.31E+01	1.54E+00	2.03E-01	0	0	3.63E+03	0	0	5.92E-01	1.78E+01	1.56E-01	4.87E+00
PERM	MJ	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PERT	MJ	3.73E+02	8.88E-01	4.31E+01	1.54E+00	2.03E-01	0	0	3.63E+03	0	0	5.92E-01	1.78E+01	1.56E-01	4.87E+00
PENRE	MJ	1.39E+03	5.13E+01	5.12E+01	1.98E+01	8.97E-01	0	0	6.08E+03	0	0	8.16E+00	3.05E+01	1.73E+00	-9.15E +01
PENRM	MJ	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PENRT	MJ	1.39E+03	5.13E+01	5.12E+01	1.98E+01	8.97E-01	0	0	6.08E+03	0	0	8.16E+00	3.05E+01	1.73E+00	-9.15E +01
SM	kg	1.09E+01	0	2.31E-01	2.23E-03	0	0	0	0	0	0	0	0	0	0
RSF	MJ	1.46E-23	0	0	2.91E-27	0	0	0	0	0	0	0	0	0	0
NRSF	MJ	1.71E-22	0	0	3.42E-26	0	0	0	0	0	0	0	0	0	0
FW	m^3	1.03E+00	1.01E-03	1.69E-02	1.78E-03	6.79E-03	0	0	2.93E+00	0	0	6.48E-04	2.43E-02	1.81E-05	2.51E-02

PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1PCS of MAGNA3 40-120/150/180

Parameter	Unit	A1	A2	A3	A4	A5	B1	B2	B6	B7	C1	C2	C3	C4	D
HWD	kg	7.01E-06	1.61E-10	1.21E-04	2.57E-08	2.18E-11	0	0	7.14E-07	0	0	2.53E-11	3.43E-09	1.45E-10	-1.61E-03
NHWD	kg	7.36E+00	5.29E-03	3.56E-01	4.66E-03	9.98E-02	0	0	4.45E+00	0	0	1.24E-03	5.52E-01	2.01E+00	1.81E+00
RWD	kg	4.72E-02	6.71E-05	1.57E-03	4.99E-05	4.03E-05	0	0	9.66E-01	0	0	1.53E-05	4.71E-03	2.04E-05	-1.65E-03
CRU	kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MFR	kg	0	0	0	0	0	0	0	0	0	0	0	1.28E+01	0	0
MER	kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
EEE	MJ	0	0	0	0	3.78E+00	0	0	0	0	0	0	7E+00	0	0
EET	MJ	0	0	0	0	6.84E+00	0	0	0	0	0	0	1.26E+01	0	0

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

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: 1PCS of MAGNA3 40-120/150/180

Parameter	Unit	A1	A2	A3	A4	A5	B1	B2	B6	B7	C1	C2	C3	C4	D
PM	Disease incidence	8.88E-06	2.09E-06	2.61E-07	5.59E-08	3.88E-09	0	0	5.19E-06	0	0	2.27E-08	3.17E-08	3.63E-09	-1.78E-06
IR	kBq U235 eq	6.19E+00	9.71E-03	2.52E-01	7.33E-03	6.26E-03	0	0	1.61E+02	0	0	2.28E-03	7.84E-01	3.01E-03	-1.04E-01
ETP-fw	CTUe	7.21E+02	3.63E+01	1.81E+01	1.39E+01	4.41E-01	0	0	1.69E+03	0	0	5.83E+00	8.85E+00	1.09E+00	-1.13E+01
HTP-c	CTUh	1.62E-05	6.75E-10	6.46E-07	3.66E-09	2.4E-11	0	0	8.94E-08	0	0	1.19E-10	4.98E-10	6.99E-11	-3.54E-07
HTP-nc	CTUh	1.53E-06	2.33E-08	3.78E-08	1.28E-08	9.74E-10	0	0	1.43E-06	0	0	5.26E-09	1.03E-08	5.96E-09	-4.19E-08
SQP	SQP	3.42E+02	4.19E+00	7.76E+01	8.12E+00	2.61E-01	0	0	2.38E+03	0	0	3.4E+00	1.18E+01	1.55E-01	-1.58E+01

PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); SQP = Potential soil quality index

Disclaimer 1 – for the indicator 'Potential Human exposure efficiency relative to U235'.
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 or radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – for the indicators 'abiotic depletion potential for non-fossil resources', 'abiotic depletion potential for fossil resources', 'water (user) deprivation potential, deprivation-weighted water consumption', 'potential comparative toxic unit for ecosystems', 'potential comparative toxic unit for humans – cancerogenic', 'Potential comparative toxic unit for humans - not cancerogenic', 'potential soil quality index'. The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high as there is limited experience with the indicator.

Disclaimer 3: *JRC Technical Reports, Version 2, 2018* Page 6, for the indicator "EP-freshwater". This indicator has been calculated as 'kg P eq' as required in the characterization model EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe; This EPD was created using a software tool.

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SVR

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