

# ENVIRONMENTAL PRODUCT DECLARATION

IN ACCORDANCE WITH EN 15804+A2 & ISO 14025

**Frese Hydronic Control and Balancing Valve (Stainless steel)**

**Vexve Denmark | Frese A/S**



## EPD HUB, HUB-5421

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Valid until 17.02.2031

Life Cycle Assessment study has been performed in accordance with the requirements of EN 15804, EPD Hub PCR version 1.2 (24 Mar 2025) and JRC characterization factors EF 3.1.

## GENERAL INFORMATION

### MANUFACTURER

|                 |                                |
|-----------------|--------------------------------|
| Manufacturer    | Vexve Denmark   Frese A/S      |
| Address         | Sorøvej 8, DK-4200 Slagelse    |
| Contact details | dk.info@vexve.com              |
| Website         | www.frese.eu and www.vexve.com |

### EPD STANDARDS, SCOPE AND VERIFICATION

|                    |                                                                                                                                                                                        |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Program operator   | EPD Hub, hub@epdhub.com                                                                                                                                                                |
| Reference standard | EN 15804:2012+A2:2019/AC:2021 and ISO 14025                                                                                                                                            |
| PCR                | EPD Hub Core PCR Version 1.2, 24 Mar 2025                                                                                                                                              |
| Sector             | Manufactured product                                                                                                                                                                   |
| Category of EPD    | Third party verified EPD                                                                                                                                                               |
| Parent EPD number  | -                                                                                                                                                                                      |
| Scope of the EPD   | Cradle to gate with options, A4-A5, and modules C1-C4, D                                                                                                                               |
| EPD author         | Anne Damm, Vexve Denmark   Frese A/S                                                                                                                                                   |
| EPD verification   | Independent verification of this EPD and data, according to ISO 14025:<br><br><input type="checkbox"/> Internal verification <input checked="" type="checkbox"/> External verification |
| EPD verifier       | Yazan Badour, as authorized verifier acting for EPD HUB Limited                                                                                                                        |

This EPD is intended for business-to-business and/or business-to-consumer communication. The manufacturer has the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but from different programs may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804 and if they are not compared in a building context.

### PRODUCT

|                                            |                                                                                                                                                                                                                                |
|--------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Product name                               | Frese Hydronic Control and Balancing Valve (Stainless steel)                                                                                                                                                                   |
| Additional labels                          | This EPD covers: OPTIMA Compact HCR (DN15-DN80), ALPHA Sanitary (DN15-DN20), ALPHA Wafer (DN25-DN450), ALPHA HCR Cartridge Type 20, ALPHA HCR Cartridge Type 50, ALPHA HCR Cartridge Type 60, and ALPHA HCR Cartridge Type 70. |
| Product reference                          | Reference product is: ALPHA Sanitary DN15 P/T (58-9001M)                                                                                                                                                                       |
| Place(s) of raw material origin            | Asia and Europe                                                                                                                                                                                                                |
| Place of production                        | Denmark, Slagelse                                                                                                                                                                                                              |
| Place(s) of installation and use           | Global                                                                                                                                                                                                                         |
| Period for data                            | Calendar year 2024                                                                                                                                                                                                             |
| Averaging in EPD                           | Multiple products                                                                                                                                                                                                              |
| Variation in GWP-fossil for A1-A3 (%)      | -9,1%/+7,3%                                                                                                                                                                                                                    |
| GTIN (Global Trade Item Number)            | 5705564072818                                                                                                                                                                                                                  |
| NOBB (Norwegian Building Product Database) | -                                                                                                                                                                                                                              |
| A1-A3 Specific data (%)                    | 2,03                                                                                                                                                                                                                           |

## ENVIRONMENTAL DATA SUMMARY

|                                             |            |
|---------------------------------------------|------------|
| Declared unit                               | 1 kg       |
| Declared unit mass                          | 1 kg       |
| Mass of packaging                           | 0,30871 kg |
| GWP-fossil, A1-A3 (kgCO <sub>2</sub> e)     | 25,8       |
| GWP-total, A1-A3 (kgCO <sub>2</sub> e)      | 27,4       |
| Secondary material, inputs (%)              | 65,9       |
| Secondary material, outputs (%)             | 94         |
| Total energy use, A1-A3 (kWh)               | 113        |
| Net freshwater use, A1-A3 (m <sup>3</sup> ) | 0,25       |

## PRODUCT AND MANUFACTURER

### ABOUT THE MANUFACTURER

#### Vexve – Inspired by Your Flow

Vexve aims to be the leading provider of mission-critical valve solutions in the transition to a low-carbon future.

At Vexve Denmark, we develop and manufacture dynamic valves and innovative, energy-efficient solutions for hydronic systems in buildings and industrial applications, marine systems and district energy networks. Our technologies optimise energy use and enhance overall system performance.

With more than 80 years of experience under the Frese name, we are proud to be part of the Vexve Group. Together, we work to become the leading provider of mission-critical valve technologies in the shift towards a lower-carbon future.

We supply more than 70 countries and employ over 900 people across modern production facilities in Finland, the Czech Republic, Germany, China and Denmark.

Our mission is to advance energy efficiency – through deep technical expertise, reliable partnerships and solutions that make a real difference.

## PRODUCT DESCRIPTION

### Product description:

The Frese Hydronic Control and Balancing Valve (Stainless steel) range is a family of hydronic products that keep water-based heating, cooling and domestic hot water systems stable, energy efficient and easy to operate in buildings, industry and marine applications.

The product group in this EPD covers pressure independent control valves of the OPTIMA Compact HCR type, ALPHA Sanitary valves for domestic hot water circulation and ALPHA Wafer flow limiting valves. Together, these valves regulate and stabilise flow under changing differential pressure conditions so that coils, heat exchangers and domestic hot water branches receive the intended design flow during both full-load and part-load operation.

The pressure-bearing components and cartridges are primarily manufactured in stainless steel, providing high resistance to hot potable water, treated heating and cooling water and, in selected high corrosion resistant configurations, even aggressive media typically found in marine and other harsh environments.

OPTIMA Compact HCR valves provide pressure independent control for terminal units and process loads by combining automatic flow limitation with full authority control characteristics in a compact body, using stainless-steel internal parts to secure stable operation over a wide pressure and temperature range.

ALPHA Sanitary valves keep each domestic hot water branch in balance, independent of pressure changes and water temperature, so circulation losses are compensated, and hot water is available quickly at tapping points even under demanding operating conditions.

ALPHA Wafer valves provide automatic flow limitation at higher flows, using ALPHA cartridges in a wafer body for control of flow in larger pipes without the need for manual balancing and with options for high corrosion resistance where system conditions require it.

Across the range, the valves consist of stainless-steel bodies with internal stainless-steel cartridges, springs and seats, supported by elastomeric and polymer sealing elements, and are intended for long service life under typical and harsh operating conditions.

In many applications the valves are combined with electric or thermal actuators and external controllers, but in this Environmental Product Declaration only the passive mechanical valve assemblies are included; the environmental impacts of actuators and other external control equipment are not part of the assessed product system.

### Physical properties of the product:

Materials: The valves in this group are primarily made of stainless steel AISI 316, accounting for more than 95% of their total weight. Other materials include rubber (such as EPDM and FKM), and plastic (such as PTFE, SEPS and PE-LD).

### Additional product information:

Find more details such as product specifications, applications, technical information, datasheets, images, etc. on our website: [www.frese.eu](http://www.frese.eu).

Further information can be found at: [www.frese.eu](http://www.frese.eu) and [www.vexve.com](http://www.vexve.com)

## PRODUCT RAW MATERIAL MAIN COMPOSITION

| Raw material category | Amount, mass % | Material origin |
|-----------------------|----------------|-----------------|
| Metals                | 98,71%         | Asia and Europe |
| Minerals              | 0              |                 |
| Fossil materials      | 1,29%          | Asia and Europe |
| Bio-based materials   | 0              |                 |

## BIOGENIC CARBON CONTENT

Product's biogenic carbon content at the factory gate

|                                            |       |
|--------------------------------------------|-------|
| Biogenic carbon content in product, kg C   | 0     |
| Biogenic carbon content in packaging, kg C | 0,057 |

## FUNCTIONAL UNIT AND SERVICE LIFE

|                        |      |
|------------------------|------|
| Declared unit          | 1 kg |
| Mass per declared unit | 1 kg |
| Functional unit        | -    |
| Reference service life | -    |

## SUBSTANCES, REACH - VERY HIGH CONCERN

| Substances of very high concern | EC | CAS |
|---------------------------------|----|-----|
| N/A                             | -  | -   |

The products included in this Environmental Product Declaration do not contain any substances of very high concern (SVHC) as listed on the Candidate List of Substances of Very High Concern for Authorisation under Regulation (EC) No 1907/2006 (REACH) in concentrations above 0.1% (w/w).

This statement is based on material specifications, supplier declarations, and current regulatory information applicable at the time of publication of this EPD.

# PRODUCT LIFE-CYCLE

## SYSTEM BOUNDARY

This EPD covers the life-cycle modules listed in the following table.

| Product stage |           |               | Assembly stage |          | Use stage |             |        |             |               |                        |                       | End of life stage          |           |                  |          | Beyond the system boundaries |          |           |
|---------------|-----------|---------------|----------------|----------|-----------|-------------|--------|-------------|---------------|------------------------|-----------------------|----------------------------|-----------|------------------|----------|------------------------------|----------|-----------|
| A1            | A2        | A3            | A4             | A5       | B1        | B2          | B3     | B4          | B5            | B6                     | B7                    | C1                         | C2        | C3               | C4       | D                            |          |           |
| x             | x         | x             | x              | x        | ND        | ND          | ND     | ND          | ND            | ND                     | ND                    | x                          | x         | x                | x        | x                            |          |           |
| Raw materials | Transport | Manufacturing | Transport      | Assembly | Use       | Maintenance | Repair | Replacement | Refurbishment | Operational energy use | Operational water use | Deconstruction/ demolition | Transport | Waste processing | Disposal | Reuse                        | Recovery | Recycling |

Not declared = ND.

## MANUFACTURING AND PACKAGING (A1-A3)

The environmental impacts considered for the product stage cover the manufacturing of raw materials used in the production as well as packaging materials and other ancillary materials. Also, fuels used by machines, and handling of waste formed in the production processes at the manufacturing facilities are included in this stage. The study also considers the material losses occurring during the manufacturing processes as well as losses during electricity transmission.

The valves are primarily made of stainless steel (>95%). Other materials include various plastic and rubber components. All components are

purchased ready-made from different suppliers, and the valves are assembled in-house. Pre-processed components include either lost-wax casted stainless steel or hot-rolled and metal worked stainless steel, as well as injection-moulded rubber and plastic parts. Raw materials origin from both Asia and Europe, but mostly China. Most parts come from Frese Valves Ningbo CNY, a subsidiary of Vexve Denmark | Frese A/S. Transport information is based on actual distances between suppliers of raw materials and components to the factory in Denmark.

At the Danish factory, electricity is used to power assembly lines, electric forklifts, and lighting. Electricity is also used for air pressure tests on the valves. District heating is used for space heating. A location-based approach was used for modelling the electricity mix utilized in the factory. No ancillary materials are used in the assembly process.

Once the valves are assembled, they are packaged using materials such as a paper installation guides, cardboard boxes, wooden EUR pallets, plastic wrap, and plastic bags. The valves are then shipped to the installation site. The transport distance to the installation site is calculated as the average distance to customers for the valves sold in 2024.

Production losses are not considered, as all components are purchased as ready-made parts, and only assembly is performed in-house. Production losses are not accounted for. Furthermore, as there are no in-house manufacturing and no use of ancillary materials, no manufacturing waste is generated within the declared system boundary.

## TRANSPORT AND INSTALLATION (A4-A5)

Transportation impacts occurred from final products delivery to construction site (A4) cover fuel direct exhaust emissions, environmental impacts of fuel production, as well as related infrastructure emissions.

The transport distance from the Danish factory to the installation site is calculated as an average of all kilometres travelled to deliver valves to customers during 2024. The calculation relies on relative annual sales percentages combined with actual distances in kilometres. The chosen transport method was lorries. Full truckloads are assumed, meaning the vehicle capacity utilization factor is set to one. It can vary, however, since transportation emissions play only a minor role in the overall environmental impact, those variations are considered negligible. Nothing gets lost during transport because the packaging is secure, and even nested packaging assumes full volume utilization.

The installation process is normally carried out using hand tools or handheld equipment with minimal energy use, therefore the resources required for A5 installation are considered negligible in this assessment.

During installation, the waste comes from packaging, and it falls into four material types: cardboard, paper, plastic, and wood. According to EUROSTAT cardboard, paper and plastic are mostly recycled, while wooden pallets are mostly landfilled (but typically reused).

### PRODUCT USE AND MAINTENANCE (B1-B7)

The life expectancy of a Frese valve is approximately 15 years, with a warranty period of 5 years.

Frese Hydronic Control and Balancing Valve (Stainless steel) do not need maintenance, repair or refurbishment. The use phase is not relevant for the life cycle emissions of this product and is therefore not accounted for in the assessment.

Air, soil, and water impacts during the use phase have not been studied.

### PRODUCT END OF LIFE (C1-C4, D)

Disassembly is typically done with hand tools or handheld equipment, using so little energy that the resources needed for this step (C1) are considered negligible in the assessment.

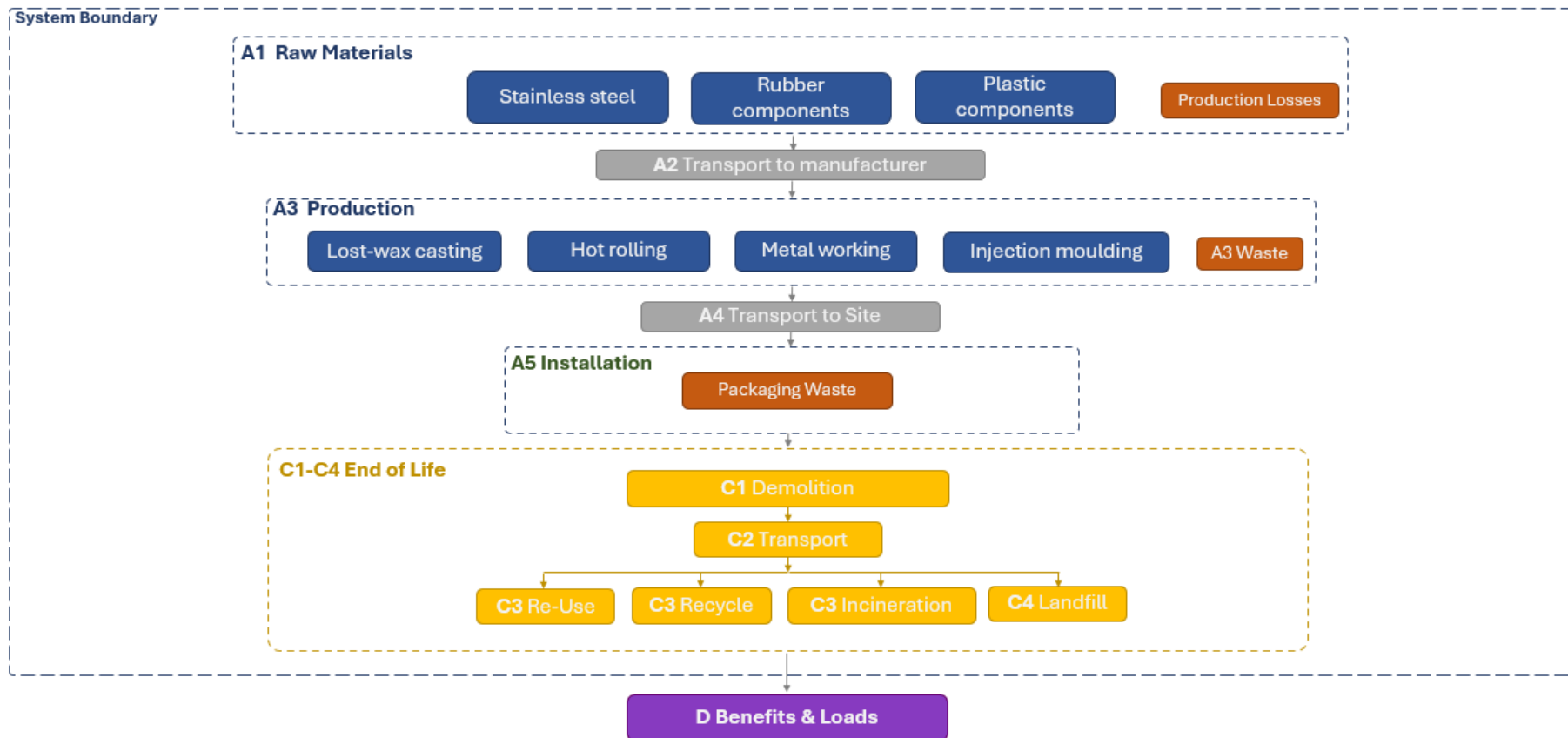
At the end of life, products are assumed to be transported by lorry to the nearest waste handling site, with an average distance of 20 km (C2).

In module C3, energy and resources are used to sort and process stainless steel, rubber, plastics, and composite materials for recycling or incineration with energy recovery (efficiency above 60%). Waste that is incinerated without energy recovery or sent to landfill is included in module C4. 95% of steel is recycled, the remaining 5% of stainless steel is landfilled, according to [worldstainless.org](https://worldstainless.org). For rubber and plastic components, 73% is incinerated with energy recovery, and 27% is landfilled, according to [plasticseurope.org](https://plasticseurope.org).

As parts of the product and its packaging can be recycled, using recycled materials reduces the need to produce new raw materials. Additionally, energy gained from incinerating waste with energy recovery can replace electricity and heat that would otherwise come from primary sources.

All environmental benefits and impacts from incineration and recycling (module C), as well as from waste packaging in modules A5, are included in module D.

## SYSTEM DIAGRAM



## LIFE-CYCLE ASSESSMENT

### CUT-OFF CRITERIA

The study does not exclude any modules or processes which are stated mandatory in the reference standard and the applied PCR. The study does not exclude any hazardous materials or substances. The study includes all major raw material and energy consumption. All inputs and outputs of the unit processes, for which data is available for, are included in the calculation. There is no neglected unit process more than 1% of total mass or energy flows. The module specific total neglected input and output flows also do not exceed 5% of energy usage or mass.

The production of capital equipment, construction activities, and infrastructure, maintenance and operation of capital equipment, personnel-related activities, energy and water use related to company management and sales activities are excluded.

This LCA study includes the provision of all materials, transportation, energy and emission flows, and end of life processing of product. All industrial processes from raw material acquisition and pre-processing, production, product distribution and installation and end-of-life management are included. For easier modelling and due to lack of accuracy in available modelling resources, some constituents under 1% of product mass are excluded. This includes the adhesive/glue and lubricant (silicone oil/grease) of the valves which constitute a very small amount and have a negligible impact on the emissions of the product. Costs for large equipment and buildings, construction work and infrastructure, as well as the upkeep and operation of major machinery, employee-related activities, and energy and water used for office management and sales are not included.

Adhesives and lubricants have been excluded because they represent less than 1% of the valve's total weight ( $\leq 0.00008$  kg per 1 kg valve). At end of life, the adhesive and lubricant remain attached to the valve components and are therefore treated together with the respective materials. During steel

recycling, the adhesive is thermally degraded during remelting. When plastic and rubber components are incinerated with energy recovery, the lubricant is combusted and contributes a minor energy input. Alternatively, if components are landfilled, both adhesive and lubricant are disposed of together with the materials. Given the very small quantities involved, their contribution to the overall environmental impact is negligible, and this exclusion is considered acceptable.

### VALIDATION OF DATA

Data collection for production, transport, and packaging was conducted using time and site-specific information, as defined in the general information section on page 1 and 2. Upstream process calculations rely on generic data as defined in the Bibliography section. Manufacturer-provided specific and generic data were used for the product's manufacturing stage. The analysis was performed in One Click LCA EPD Generator, with the 'Cut-Off, EN 15804+A2' allocation method, and characterization factors according to EN 15804:2012+A2:2019/AC:2021 and JRC EF 3.1.

### ALLOCATION, ESTIMATES AND ASSUMPTIONS

Allocation is required if some material, energy, and waste data cannot be measured separately for the product under investigation. All allocations are done as per the reference standards and the applied PCR. In this study, allocation has been done in the following ways:

| Data type                      | Allocation                  |
|--------------------------------|-----------------------------|
| Raw materials                  | No allocation               |
| Packaging material             | Allocated by mass or volume |
| Ancillary materials            | Not applicable              |
| Manufacturing energy and waste | Allocated by mass or volume |

## PRODUCT & MANUFACTURING SITES GROUPING

|                                      |                                   |
|--------------------------------------|-----------------------------------|
| Type of grouping                     | Multiple products                 |
| Grouping method                      | Based on a representative product |
| Variation in GWP-fossil for A1-A3, % | -9,1%/+7,3%                       |

ALPHA Sanitary DN15 P/T (58-9001M) has been selected as the representative valve. It was chosen because it is one of the best-selling Frese Hydronic Control and Balancing Valve (Stainless steel) products and is closest to the general average mass of Frese Hydronic Control and Balancing Valve (Stainless steel) products. Most of the materials and components seen in 58-9001M are also used in the other products in the group.

## LCA SOFTWARE AND BIBLIOGRAPHY

This EPD has been created using One Click LCA EPD Generator for EPD Hub V3 and EPD Process Certification v3.2.3. The LCA and EPD have been prepared according to the reference standards and ISO 14040/14044. The EPD Generator uses Ecoinvent v3.10.1/3.11 and One Click LCA databases as sources of environmental data. Allocation used in Ecoinvent 3.10.1/3.11 environmental data sources follow the methodology 'allocation, Cut-off, EN 15804+A2'.

Additionally, the EPD Generator also uses IDEMAT as a source of environmental data. IDEMAT provides life cycle inventory data for materials and processes and includes the Eco-costs LCIA method, which monetizes environmental impacts and complies with ISO 14008.

References for installation waste (A5) are taken from EUROSTAT [\[env waspac\] - Eurostat](#) "Packaging waste by waste management operations" (2021).

End-of-Life recycling rate references are sourced from:

Worldstainless.org [Recycling - worldstainless](#) "The global life cycle of stainless steels" (2019) reporting that 95% of stainless steel is recycled.

Plasticseurope.org [Building & construction - Plastics Europe](#) "Overview of Plastic Waste from Building and Construction by Polymer and by Recycling, Energy Recovery and Disposal" (2018) reporting that approximately 73% of plastic and rubber waste is treated via incineration with energy recovery.

## ENVIRONMENTAL IMPACT DATA

The estimated impact results are only relative statements which do not indicate the end points of the impact categories, exceeding threshold values, safety margins or risks.

### CORE ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, EF 3.1

| Impact category                     | Unit                   | A1       | A2       | A3        | A1-A3    | A4       | A5       | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1       | C2       | C3        | C4        | D         |
|-------------------------------------|------------------------|----------|----------|-----------|----------|----------|----------|----|----|----|----|----|----|----|----------|----------|-----------|-----------|-----------|
| GWP – total <sup>1)</sup>           | kg CO <sub>2</sub> e   | 2,68E+01 | 2,60E-01 | 3,09E-01  | 2,74E+01 | 2,50E-02 | 2,16E-01 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 2,15E-03 | 5,08E-02  | 6,33E-04  | -4,54E+00 |
| GWP – fossil                        | kg CO <sub>2</sub> e   | 2,51E+01 | 2,60E-01 | 4,96E-01  | 2,58E+01 | 2,50E-02 | 1,06E-02 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 2,15E-03 | 5,08E-02  | 6,33E-04  | -4,49E+00 |
| GWP – biogenic                      | kg CO <sub>2</sub> e   | 1,67E+00 | 4,11E-05 | -1,96E-01 | 1,48E+00 | 5,26E-06 | 2,05E-01 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 4,52E-07 | -4,53E-05 | -3,19E-07 | -4,74E-02 |
| GWP – LULUC                         | kg CO <sub>2</sub> e   | 3,53E-02 | 1,39E-04 | 9,83E-03  | 4,52E-02 | 9,38E-06 | 8,16E-06 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 8,07E-07 | 2,64E-05  | 2,02E-07  | -4,34E-03 |
| Ozone depletion pot.                | kg CFC-11e             | 2,74E-07 | 3,75E-09 | 1,41E-08  | 2,92E-07 | 5,02E-10 | 8,39E-11 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 4,32E-11 | 2,95E-10  | 9,88E-12  | -3,03E-08 |
| Acidification potential             | mol H <sup>+</sup> e   | 1,15E-01 | 7,23E-03 | 2,37E-03  | 1,25E-01 | 8,06E-05 | 4,17E-05 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 6,93E-06 | 2,57E-04  | 2,47E-06  | -2,52E-02 |
| EP-freshwater <sup>2)</sup>         | kg Pe                  | 1,28E-02 | 8,86E-06 | 2,88E-04  | 1,31E-02 | 1,68E-06 | 2,42E-06 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 1,45E-07 | 1,38E-05  | 2,95E-08  | -1,36E-03 |
| EP-marine                           | kg Ne                  | 2,60E-02 | 1,80E-03 | 8,39E-04  | 2,87E-02 | 2,74E-05 | 6,63E-05 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 2,35E-06 | 5,76E-05  | 8,21E-06  | -4,51E-03 |
| EP-terrestrial                      | mol Ne                 | 2,41E-01 | 2,00E-02 | 7,16E-03  | 2,68E-01 | 2,98E-04 | 1,44E-04 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 2,56E-05 | 6,50E-04  | 1,02E-05  | -4,82E-02 |
| POCP (“smog”) <sup>3)</sup>         | kg NMVOCe              | 7,92E-02 | 5,45E-03 | 1,90E-03  | 8,66E-02 | 1,31E-04 | 4,99E-05 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 1,13E-05 | 1,92E-04  | 3,71E-06  | -1,54E-02 |
| ADP-minerals & metals <sup>4)</sup> | kg Sbe                 | 1,70E-04 | 2,81E-07 | 5,86E-06  | 1,76E-04 | 6,89E-08 | 5,20E-08 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 5,93E-09 | 1,51E-06  | 5,76E-10  | -1,17E-04 |
| ADP-fossil resources                | MJ                     | 3,51E+02 | 3,22E+00 | 7,58E+00  | 3,62E+02 | 3,62E-01 | 8,32E-02 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 3,11E-02 | 2,89E-01  | 8,39E-03  | -4,86E+01 |
| Water use <sup>5)</sup>             | m <sup>3</sup> e depr. | 6,80E+00 | 9,46E-03 | 4,00E-01  | 7,21E+00 | 1,85E-03 | 3,01E-03 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 1,59E-04 | 6,66E-03  | 2,62E-05  | -1,29E+00 |

1) GWP = Global Warming Potential; 2) EP = Eutrophication potential. Required characterisation method and data are in kg P-eq. Multiply by 3,07 to get PO4e; 3) POCP = Photochemical ozone formation; 4) ADP = Abiotic depletion potential; 5) EN 15804+A2 disclaimer for Abiotic depletion and Water use and optional indicators except Particulate matter and Ionizing radiation, human health. The results of these environmental impact indicators shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.

## ADDITIONAL (OPTIONAL) ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, EF 3.1

| Impact category                  | Unit      | A1       | A2       | A3       | A1-A3    | A4       | A5       | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1       | C2       | C3       | C4       | D         |
|----------------------------------|-----------|----------|----------|----------|----------|----------|----------|----|----|----|----|----|----|----|----------|----------|----------|----------|-----------|
| Particulate matter               | Incidence | 1,75E-06 | 8,79E-09 | 2,01E-08 | 1,78E-06 | 2,48E-09 | 5,59E-10 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 2,14E-10 | 3,45E-09 | 5,58E-11 | -3,59E-07 |
| Ionizing radiation <sup>6)</sup> | kBq       | 2,38E+00 | 1,55E-03 | 8,71E-02 | 2,47E+00 | 4,36E-04 | 5,48E-04 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 3,75E-05 | 2,43E-03 | 5,66E-06 | -1,92E-01 |
| Ecotoxicity (freshwater)         | CTUe      | 1,89E+03 | 2,51E-01 | 8,71E+01 | 1,98E+03 | 4,26E-02 | 2,64E-01 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 3,67E-03 | 2,15E-01 | 1,28E-02 | -1,27E+01 |
| Human toxicity, cancer           | CTUh      | 1,45E-08 | 5,44E-11 | 3,08E-10 | 1,49E-08 | 4,11E-12 | 6,87E-12 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 3,53E-13 | 1,93E-11 | 9,54E-14 | -4,04E-09 |
| Human tox. non-cancer            | CTUh      | 2,44E-07 | 8,75E-10 | 6,85E-09 | 2,52E-07 | 2,35E-10 | 3,66E-10 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 2,02E-11 | 1,30E-09 | 9,18E-12 | -8,95E-08 |
| SQP <sup>7)</sup>                | -         | 8,85E+01 | 4,61E-01 | 2,60E+01 | 1,15E+02 | 3,64E-01 | 7,84E-02 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 3,13E-02 | 5,56E-01 | 1,68E-02 | -2,33E+01 |

6) EN 15804+A2 disclaimer for Ionizing radiation, human health. This impact category deals mainly with the eventual impact of low-dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator; 7) SQP = Land use related impacts/soil quality.

## USE OF NATURAL RESOURCES

| Impact category                    | Unit           | A1       | A2       | A3       | A1-A3    | A4       | A5        | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1       | C2       | C3        | C4        | D         |
|------------------------------------|----------------|----------|----------|----------|----------|----------|-----------|----|----|----|----|----|----|----|----------|----------|-----------|-----------|-----------|
| Renew. PER as energy <sup>8)</sup> | MJ             | 4,11E+01 | 2,60E-02 | 3,60E+00 | 4,47E+01 | 5,89E-03 | -4,77E+00 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 5,07E-04 | 5,34E-02  | 8,71E-05  | -1,14E+01 |
| Renew. PER as material             | MJ             | 0,00E+00 | 0,00E+00 | 4,19E+00 | 4,19E+00 | 0,00E+00 | -4,19E+00 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 0,00E+00 | 0,00E+00  | 0,00E+00  | 4,21E-01  |
| Total use of renew. PER            | MJ             | 4,11E+01 | 2,60E-02 | 7,79E+00 | 4,89E+01 | 5,89E-03 | -8,96E+00 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 5,07E-04 | 5,34E-02  | 8,71E-05  | -1,10E+01 |
| Non-re. PER as energy              | MJ             | 3,51E+02 | 3,22E+00 | 7,47E+00 | 3,62E+02 | 3,62E-01 | 1,85E-02  | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 3,11E-02 | 3,45E-02  | -1,19E-01 | -4,86E+01 |
| Non-re. PER as material            | MJ             | 3,52E-01 | 0,00E+00 | 1,73E-01 | 5,25E-01 | 0,00E+00 | -1,73E-01 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 0,00E+00 | -2,57E-01 | -9,51E-02 | 5,13E-02  |
| Total use of non-re. PER           | MJ             | 3,51E+02 | 3,22E+00 | 7,64E+00 | 3,62E+02 | 3,62E-01 | -1,55E-01 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 3,11E-02 | -2,23E-01 | -2,14E-01 | -4,85E+01 |
| Secondary materials                | kg             | 6,59E-01 | 1,52E-03 | 2,19E-01 | 8,79E-01 | 1,56E-04 | 1,35E-04  | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 1,35E-05 | 3,52E-04  | 2,20E-06  | 5,28E-01  |
| Renew. secondary fuels             | MJ             | 2,28E-03 | 4,32E-06 | 6,50E-02 | 6,73E-02 | 1,97E-06 | 7,90E-07  | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 1,70E-07 | 1,63E-05  | 4,50E-08  | -1,22E-03 |
| Non-ren. secondary fuels           | MJ             | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00  | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 0,00E+00 | 0,00E+00  | 0,00E+00  | 0,00E+00  |
| Use of net fresh water             | m <sup>3</sup> | 2,41E-01 | 2,37E-04 | 9,06E-03 | 2,51E-01 | 5,34E-05 | -1,54E-04 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 4,59E-06 | 1,80E-04  | -5,17E-06 | -3,93E-02 |

8) PER = Primary energy resources.

## END OF LIFE – WASTE

| Impact category     | Unit | A1       | A2       | A3       | A1-A3    | A4       | A5       | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1       | C2       | C3       | C4       | D         |
|---------------------|------|----------|----------|----------|----------|----------|----------|----|----|----|----|----|----|----|----------|----------|----------|----------|-----------|
| Hazardous waste     | kg   | 6,81E+00 | 4,33E-03 | 2,63E-02 | 6,84E+00 | 5,24E-04 | 1,46E-03 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 4,50E-05 | 2,78E-03 | 9,87E-06 | -4,39E+00 |
| Non-hazardous waste | kg   | 1,49E+02 | 6,04E-02 | 1,20E+00 | 1,50E+02 | 1,05E-02 | 3,31E-01 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 9,01E-04 | 7,80E-02 | 1,76E-02 | -9,14E+00 |
| Radioactive waste   | kg   | 5,85E-04 | 3,79E-07 | 2,06E-05 | 6,06E-04 | 1,08E-07 | 1,39E-07 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 9,28E-09 | 6,24E-07 | 1,38E-09 | -4,73E-05 |

## END OF LIFE – OUTPUT FLOWS

| Impact category               | Unit | A1       | A2       | A3       | A1-A3    | A4       | A5       | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1       | C2       | C3       | C4       | D        |
|-------------------------------|------|----------|----------|----------|----------|----------|----------|----|----|----|----|----|----|----|----------|----------|----------|----------|----------|
| Components for re-use         | kg   | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Materials for recycling       | kg   | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 2,12E-01 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 0,00E+00 | 9,40E-01 | 0,00E+00 | 0,00E+00 |
| Materials for energy rec      | kg   | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Exported energy               | MJ   | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 2,34E-01 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 0,00E+00 | 9,37E-02 | 0,00E+00 | 0,00E+00 |
| Exported energy – Electricity | MJ   | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 9,77E-02 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 0,00E+00 | 3,94E-02 | 0,00E+00 | 0,00E+00 |
| Exported energy –             | MJ   | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 1,37E-01 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 0,00E+00 | 5,43E-02 | 0,00E+00 | 0,00E+00 |

## ENVIRONMENTAL IMPACTS – EN 15804+A1, CML

| Impact category      | Unit                               | A1       | A2       | A3       | A1-A3    | A4       | A5       | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1       | C2       | C3       | C4       | D         |
|----------------------|------------------------------------|----------|----------|----------|----------|----------|----------|----|----|----|----|----|----|----|----------|----------|----------|----------|-----------|
| Global Warming Pot.  | kg CO <sub>2</sub> e               | 2,62E+01 | 2,59E-01 | 5,06E-01 | 2,70E+01 | 2,48E-02 | 3,42E-02 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 2,13E-03 | 5,07E-02 | 6,17E-04 | -4,47E+00 |
| Ozone depletion Pot. | kg CFC <sub>11</sub> e             | 2,38E-07 | 2,98E-09 | 1,21E-08 | 2,53E-07 | 4,00E-10 | 6,90E-11 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 3,44E-11 | 2,43E-10 | 7,85E-12 | -2,56E-08 |
| Acidification        | kg SO <sub>2</sub> e               | 9,54E-02 | 5,77E-03 | 1,79E-03 | 1,03E-01 | 6,11E-05 | 3,15E-05 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 5,25E-06 | 2,06E-04 | 1,83E-06 | -2,10E-02 |
| Eutrophication       | kg PO <sub>4</sub> <sup>3</sup> e  | 1,85E-02 | 6,39E-04 | 1,83E-03 | 2,10E-02 | 1,54E-05 | 3,92E-05 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 1,33E-06 | 3,03E-05 | 8,82E-07 | -2,87E-03 |
| POCP (“smog”)        | kg C <sub>2</sub> H <sub>4</sub> e | 6,43E-03 | 2,88E-04 | 1,52E-04 | 6,87E-03 | 5,74E-06 | 8,04E-06 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 4,94E-07 | 1,22E-05 | 2,15E-07 | -1,27E-03 |
| ADP-elements         | kg Sbe                             | 1,67E-04 | 2,77E-07 | 5,83E-06 | 1,73E-04 | 6,73E-08 | 5,09E-08 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 5,79E-09 | 1,50E-06 | 5,64E-10 | -1,17E-04 |
| ADP-fossil           | MJ                                 | 3,13E+02 | 3,19E+00 | 6,22E+00 | 3,23E+02 | 3,54E-01 | 7,38E-02 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 3,05E-02 | 2,47E-01 | 8,30E-03 | -4,57E+01 |

## ADDITIONAL INDICATOR – GWP-GHG

| Impact category       | Unit                 | A1       | A2       | A3       | A1-A3    | A4       | A5       | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1       | C2       | C3       | C4       | D         |
|-----------------------|----------------------|----------|----------|----------|----------|----------|----------|----|----|----|----|----|----|----|----------|----------|----------|----------|-----------|
| GWP-GHG <sup>9)</sup> | kg CO <sub>2</sub> e | 2,51E+01 | 2,60E-01 | 5,05E-01 | 2,59E+01 | 2,50E-02 | 1,06E-02 | ND | ND | ND | ND | ND | ND | ND | 0,00E+00 | 2,15E-03 | 5,08E-02 | 6,33E-04 | -4,50E+00 |

9) This indicator includes all greenhouse gases excluding biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. In addition, the characterisation factors for the flows – CH<sub>4</sub> fossil, CH<sub>4</sub> biogenic and Dinitrogen monoxide – were updated. This indicator is identical to the GWP-total of EN 15804:2012+A2:2019 except that the characterisation factor for biogenic CO<sub>2</sub> is set to zero.

## SCENARIO DOCUMENTATION

### DATA SOURCES

#### Manufacturing energy scenario documentation

1. Market for electricity, low voltage, Denmark, Ecoinvent, 0.19 kgCO<sub>2</sub>e/kWh
2. Heat and power co-generation, natural gas, 1MW electrical, lean burn, Denmark, Ecoinvent, 0.0291 kgCO<sub>2</sub>e/MJ

#### Transport scenario documentation - A4 (Transport resources)

1. Transport, freight, lorry >32 metric ton, EURO5, 178.02 km

| Scenario parameter                                        | Value                                                       |
|-----------------------------------------------------------|-------------------------------------------------------------|
| Capacity utilization (including empty return) %           | <ul style="list-style-type: none"> <li>Lorry 50%</li> </ul> |
| Bulk density of transported products (kg/m <sup>3</sup> ) | 0,000211 m <sup>3</sup>                                     |
| Volume capacity utilization factor                        | <ul style="list-style-type: none"> <li>Lorry = 1</li> </ul> |

#### Installation scenario documentation - A5 (Installation waste)

| Scenario information                                                                                                           | Value                     |         |
|--------------------------------------------------------------------------------------------------------------------------------|---------------------------|---------|
| Waste materials on the building site before waste processing, generated by the product's installation (specified by type) / kg | Wood packaging            | 0,08796 |
|                                                                                                                                | Paper/Cardboard packaging | 0,21916 |
|                                                                                                                                | Plastic packaging         | 0,00159 |

| Output materials (specified by type) as result of waste processing at the building site e.g. collection for recycling, for energy recovery, disposal (specified by route) / kg |                 | Wood packaging | Paper / Cardboard | Plastic packaging |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------------|-------------------|-------------------|
|                                                                                                                                                                                | Recycling       | 0,02815        | 0,18190           | 0,00064           |
|                                                                                                                                                                                | Energy recovery | 0,02639        | 0,01753           | 0,00059           |
|                                                                                                                                                                                | Disposal        | 0,03342        | 0,01972           | 0,00037           |

#### End-of-Life scenario documentation - C1-C4 (Data source)

| Scenario information                               | Value                                                                                                                        |
|----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| Collection process – kg collected separately       | 1 kg                                                                                                                         |
| Collection process – kg collected with mixed waste | 0 kg                                                                                                                         |
| Recovery process – kg for re-use                   | 0 kg                                                                                                                         |
| Recovery process – kg for recycling                | 0,93774 kg                                                                                                                   |
| Recovery process – kg for energy recovery          | 0,00942 kg                                                                                                                   |
| Disposal (total) – kg for final deposition         | 0,05284 kg                                                                                                                   |
| Scenario assumptions e.g. transportation           | Transportation is estimated to be 20 km to the closest waste handling site from client location. By > 32-ton lorry (Euro 5). |

## THIRD-PARTY VERIFICATION STATEMENT

EPD Hub declares that this EPD is verified in accordance with ISO 14025 by an independent, third-party verifier. The project report on the Life Cycle Assessment and the report(s) on features of environmental relevance are filed at EPD Hub. EPD Hub PCR and ECO Platform verification checklist are used.

EPD Hub is not able to identify any unjustified deviations from the PCR and EN 15804+A2 in the Environmental Product Declaration and its project report.

EPD Hub maintains its independence as a third-party body; it was not involved in the execution of the LCA or in the development of the declaration and has no conflicts of interest regarding this verification.

The company-specific data and upstream and downstream data have been examined as regards plausibility and consistency. The publisher is responsible for ensuring the factual integrity and legal compliance of this declaration.

The software used in creation of this LCA and EPD is verified by EPD Hub to conform to the procedural and methodological requirements outlined in ISO 14025:2010, ISO 14040/14044, EN 15804+A2, and EPD Hub Core Product Category Rules and General Program Instructions.

### Verified tools

Tool verifier: Magaly Gonzalez Vazquez

Tool verification validity: 27 March 2025 - 26 March 2028

Yazan Badour, as authorized verifier acting for EPD HUB Limited

18.02.2026



## ANNEX

| Number                    | Name & Group                 | Weight (kg) | GTIN          |
|---------------------------|------------------------------|-------------|---------------|
| <b>OPTIMA Compact HCR</b> |                              |             |               |
| <b>58-8180</b>            | OPTIMA Compact HCR DN15      | 3.468       | 5705564071163 |
| <b>58-8181</b>            | OPTIMA Compact HCR DN20      | 4.343       | 5705564071170 |
| <b>58-8182</b>            | OPTIMA Compact HCR DN25      | 5.349       | 5705564071187 |
| <b>58-8183</b>            | OPTIMA Compact HCR DN32      | 6.614       | 5705564071194 |
| <b>58-8184</b>            | OPTIMA Compact HCR DN40      | 11.002      | 5705564071217 |
| <b>58-8110</b>            | OPTIMA Compact HCR DN50 PN16 | 17.016      | 5705564069658 |
| <b>58-8111</b>            | OPTIMA Compact HCR DN65 PN16 | 23.546      | 5705564069689 |
| <b>58-8112</b>            | OPTIMA Compact HCR DN80 PN16 | 35.792      | 5705564069672 |
| <b>58-8130</b>            | OPTIMA Compact HCR DN50 PN25 | 17.22       | 5705564069696 |
| <b>58-8131</b>            | OPTIMA Compact HCR DN65 PN25 | 23.277      | 5705564069702 |
| <b>58-8132</b>            | OPTIMA Compact HCR DN80 PN25 | 35.792      | 5705564069719 |
| <b>ALPHA Sanitary</b>     |                              |             |               |
| <b>58-9001M</b>           | ALPHA Sanitary DN15 P/T      | 0.35        | 5705564072818 |
| <b>58-9006M</b>           | ALPHA Sanitary DN15 plugs    | 0.35        | 5705564067975 |
| <b>58-9011M</b>           | ALPHA Sanitary DN20 P/T      | 0.39        | 5705564072771 |
| <b>58-9016M</b>           | ALPHA Sanitary DN20 plugs    | 0.39        | 5705564067982 |

| Number                                       | Name & Group                         | Weight (kg) | GTIN          |
|----------------------------------------------|--------------------------------------|-------------|---------------|
| <b>ALPHA Wafer</b>                           |                                      |             |               |
| <b>58-9038L</b>                              | ALPHA Wafer DN25 PN16 P/T            | 1.124       | 5705564070005 |
| <b>58-9058L</b>                              | ALPHA Wafer DN40 PN25 P/T            | 1.669       | 5705564070203 |
| <b>58-9073L</b>                              | ALPHA Wafer DN50 PN16 P/T            | 4.04        | 5705564070210 |
| <b>58-9076L</b>                              | ALPHA Wafer DN50 PN16 Plug           | 3.995       | 5705564071668 |
| <b>58-9083L</b>                              | ALPHA Wafer DN65 PN16 P/T            | 5.93        | 5705564070227 |
| <b>58-9093L</b>                              | ALPHA Wafer DN80 PN16 P/T            | 8.842       | 5705564070234 |
| <b>58-9103L</b>                              | ALPHA Wafer DN100 PN16 P/T           | 9.76        | 5705564070241 |
| <b>58-9163L</b>                              | ALPHA Wafer DN125 PN16 P/T           | 11.752      | 5705564070258 |
| <b>58-9113M</b>                              | ALPHA Wafer DN150 PN16 P/T           | 11.979      | 5705564070265 |
| <b>58-9123M</b>                              | ALPHA Wafer DN200 PN16 P/T           | 18.596      | 5705564070272 |
| <b>58-9133M</b>                              | ALPHA Wafer DN250 PN16 P/T           | 24.892      | 5705564070289 |
| <b>58-9143M</b>                              | ALPHA Wafer DN300 PN16 P/T           | 35.761      | 5705564070296 |
| <b>58-9153M</b>                              | ALPHA Wafer DN350 PN16 P/T           | 45.858      | 5705564070302 |
| <b>58-9173M</b>                              | ALPHA Wafer DN400 PM16 P/T           | 52.68       | 5705564070333 |
| <b>58-9183M</b>                              | ALPHA Wafer DN450 PM16 P/T           | 59.855      | 5705564106629 |
| <b>ALPHA HCR Cartridge Type 20 - AISI316</b> |                                      |             |               |
| <b>47-20120</b>                              | ALPHA Cartridge w/orifice 0.020 m3/h | 0.064       | 5705564090751 |

| Number   | Name & Group                          | Weight (kg) | GTIN          |
|----------|---------------------------------------|-------------|---------------|
| 47-20170 | ALPHA Cartridge w/orifice 0.040 m3/h  | 0.065       | 5705564069443 |
| 47-20200 | ALPHA Cartridge w/orifice 0.060 m3/h  | 0.065       | 5705564072832 |
| 47-20230 | ALPHA Cartridge w/orifice 0.080 m3/h  | 0.064       | 5705564069450 |
| 47-20260 | ALPHA Cartridge w/orifice 0.0105 m3/h | 0.064       | 5705564069467 |
| 47-20300 | ALPHA Cartridge w/orifice 0.135 m3/h  | 0.064       | 5705564069474 |
| 47-20250 | ALPHA Cartridge w/orifice 0.180 m3/h  | 0.064       | 5705564069481 |
| 47-20400 | ALPHA Cartridge w/orifice 0.240 m3/h  | 0.064       | 5705564069498 |
| 47-20460 | ALPHA Cartridge w/orifice 0.310 m3/h  | 0.064       | 5705564069504 |
| 47-20510 | ALPHA Cartridge w/orifice 0.410 m3/h  | 0.064       | 5705564069511 |
| 47-20530 | ALPHA Cartridge w/orifice 0.450 m3/h  | 0.064       | 5705564090768 |
| 47-20570 | ALPHA Cartridge w/orifice 0.500 m3/h  | 0.064       | 5705564090775 |
| 47-20590 | ALPHA Cartridge w/orifice 0.550 m3/h  | 0.064       | 5705564090782 |
| 47-20620 | ALPHA Cartridge w/orifice 0.600 m3/h  | 0.064       | 5705564090812 |
| 47-20680 | ALPHA Cartridge w/orifice 0.700 m3/h  | 0.063       | 5705564090836 |
| 47-20740 | ALPHA Cartridge w/orifice 0.800 m3/h  | 0.063       | 5705564090843 |

| Number                                | Name & Group                        | Weight (kg) | GTIN          |
|---------------------------------------|-------------------------------------|-------------|---------------|
| ALPHA HCR Cartridge Type 50 - AISI316 |                                     |             |               |
| 51-55179                              | ALPHA Cartridge w/orifice 1.061 l/s | 0.881       | 5705564040251 |
| 51-55184                              | ALPHA Cartridge w/orifice 1.092 l/s | 0.833       | 5705564068460 |
| 51-55189                              | ALPHA Cartridge w/orifice 1.125 l/s | 0.832       | 5705564068477 |
| 51-55194                              | ALPHA Cartridge w/orifice 1.167 l/s | 0.831       | 5705564068484 |
| 51-55200                              | ALPHA Cartridge w/orifice 1.222 l/s | 0.83        | 5705564040299 |
| 51-55206                              | ALPHA Cartridge w/orifice 1.289 l/s | 0.829       | 5705564040305 |
| 51-55213                              | ALPHA Cartridge w/orifice 1.375 l/s | 0.828       | 5705564040312 |
| 51-55220                              | ALPHA Cartridge w/orifice 1.475 l/s | 0.826       | 5705564068491 |
| 51-55227                              | ALPHA Cartridge w/orifice 1.583 l/s | 0.825       | 5705564040336 |
| 51-55235                              | ALPHA Cartridge w/orifice 1.725 l/s | 0.823       | 5705564040343 |
| 51-55243                              | ALPHA Cartridge w/orifice 1.808 l/s | 0.824       | 5705564068507 |
| 51-55251                              | ALPHA Cartridge w/orifice 1.967 l/s | 0.825       | 5705564068514 |
| 51-55260                              | ALPHA Cartridge w/orifice 2.194 l/s | 0.827       | 5705564040374 |
| 51-55269                              | ALPHA Cartridge w/orifice 2.472 l/s | 0.831       | 5705564040381 |

| Number                                       | Name & Group                        | Weight (kg) | GTIN          |
|----------------------------------------------|-------------------------------------|-------------|---------------|
| 51-55279                                     | ALPHA Cartridge w/orifice 2.889 l/s | 0.826       | 5705564040398 |
| 51-55287                                     | ALPHA Cartridge w/orifice 3.154 l/s | 0.844       | 5705564068521 |
| 51-55292                                     | ALPHA Cartridge w/orifice 3.470 l/s | 0.848       | 5705564040411 |
| 51-55298                                     | ALPHA Cartridge w/orifice 3.722 l/s | 0.854       | 5705564040428 |
| 51-55303                                     | ALPHA Cartridge w/orifice 4.100 l/s | 0.862       | 5705564040435 |
| 51-55308                                     | ALPHA Cartridge w/orifice 4.444 l/s | 0.869       | 5705564040442 |
| <b>ALPHA HCR Cartridge Type 60 - AISI316</b> |                                     |             |               |
| 51-66285                                     | ALPHA Cartridge w/orifice 4.733 l/s | 0.866       | 5705564039774 |
| 51-66292                                     | ALPHA Cartridge w/orifice 5.041 l/s | 0.865       | 5705564039781 |
| 51-66301                                     | ALPHA Cartridge w/orifice 5.221 l/s | 0.863       | 5705564039798 |
| 51-66305                                     | ALPHA Cartridge w/orifice 5.408 l/s | 0.862       | 5705564068538 |
| 51-66312                                     | ALPHA Cartridge w/orifice 5.684 l/s | 0.86        | 5705564039811 |
| 51-66319                                     | ALPHA Cartridge w/orifice 5.980 l/s | 0.858       | 5705564039828 |
| 51-66326                                     | ALPHA Cartridge w/orifice 6.236 l/s | 0.856       | 5705564039835 |
| 51-66332                                     | ALPHA Cartridge w/orifice 6.523 l/s | 0.855       | 5705564039842 |

| Number    | Name & Group                         | Weight (kg) | GTIN          |
|-----------|--------------------------------------|-------------|---------------|
| 51-66338  | ALPHA Cartridge w/orifice 6.815 l/s  | 0.853       | 5705564039859 |
| 51-66344  | ALPHA Cartridge w/orifice 7.117 l/s  | 0.851       | 5705564039866 |
| 51-66349  | ALPHA Cartridge w/orifice 7.369 l/s  | 0.85        | 5705564039873 |
| 51-66356  | ALPHA Cartridge w/orifice 7.690 l/s  | 0.848       | 5705564039880 |
| 51-66362  | ALPHA Cartridge w/orifice 8.099 l/s  | 0.846       | 5705564068545 |
| 51-66367  | ALPHA Cartridge w/orifice 8.320 l/s  | 0.845       | 5705564039903 |
| 51-66373  | ALPHA Cartridge w/orifice 8.605 l/s  | 0.843       | 5705564039910 |
| 51-66379  | ALPHA Cartridge w/orifice 8.961 l/s  | 0.841       | 5705564039927 |
| 51-66385  | ALPHA Cartridge w/orifice 9.324 l/s  | 0.839       | 5705564039934 |
| 51-66391  | ALPHA Cartridge w/orifice 9.709 l/s  | 0.838       | 5705564039941 |
| 51-66393  | ALPHA Cartridge w/orifice 10.093 l/s | 0.837       | 5705564039958 |
| 51-66398  | ALPHA Cartridge w/orifice 10.468 l/s | 0.835       | 5705564039965 |
| 51-66400  | ALPHA Cartridge w/orifice 10.724 l/s | 0.835       | 5705564039972 |
| 51-66407  | ALPHA Cartridge w/orifice 11.381 l/s | 0.832       | 5705564039989 |
| 51-66407H | ALPHA Cartridge w/orifice 12.500 l/s | 0.826       | 5705564068453 |

| Number                                       | Name & Group                        | Weight (kg) | GTIN          |
|----------------------------------------------|-------------------------------------|-------------|---------------|
| <b>ALPHA HCR Cartridge Type 70 - AISI316</b> |                                     |             |               |
| <b>51-76285</b>                              | ALPHA Cartridge w/orifice 3.257 l/s | 0.824       | 5705564071767 |
| <b>51-76292</b>                              | ALPHA Cartridge w/orifice 3.389 l/s | 0.822       | 5705564071774 |
| <b>51-76301</b>                              | ALPHA Cartridge w/orifice 3.639 l/s | 0.82        | 5705564071781 |
| <b>51-76305</b>                              | ALPHA Cartridge w/orifice 3.785 l/s | 0.819       | 5705564071798 |
| <b>51-76312</b>                              | ALPHA Cartridge w/orifice 3.938 l/s | 0.817       | 5705564071804 |
| <b>51-76319</b>                              | ALPHA Cartridge w/orifice 4.104 l/s | 0.815       | 5705564071811 |
| <b>51-76326</b>                              | ALPHA Cartridge w/orifice 4.316 l/s | 0.813       | 5705564071828 |
| <b>51-76332</b>                              | ALPHA Cartridge w/orifice 4.472 l/s | 0.812       | 5705564071835 |
| <b>51-76338</b>                              | ALPHA Cartridge w/orifice 4.708 l/s | 0.81        | 5705564071842 |
| <b>51-76344</b>                              | ALPHA Cartridge w/orifice 4.993 l/s | 0.809       | 5705564071859 |
| <b>51-76349</b>                              | ALPHA Cartridge w/orifice 5.069 l/s | 0.807       | 5705564071866 |
| <b>51-76356</b>                              | ALPHA Cartridge w/orifice 5.306 l/s | 0.805       | 5705564071873 |
| <b>51-76362</b>                              | ALPHA Cartridge w/orifice 5.556 l/s | 0.803       | 5705564071880 |
| <b>51-76367</b>                              | ALPHA Cartridge w/orifice 5.686 l/s | 0.802       | 5705564071897 |

| Number           | Name & Group                         | Weight (kg) | GTIN          |
|------------------|--------------------------------------|-------------|---------------|
| <b>51-76373</b>  | ALPHA Cartridge w/orifice 5.914 l/s  | 0.8         | 5705564071903 |
| <b>51-76379</b>  | ALPHA Cartridge w/orifice 6.174 l/s  | 0.798       | 5705564071910 |
| <b>51-76385</b>  | ALPHA Cartridge w/orifice 6.389 l/s  | 0.797       | 5705564071927 |
| <b>51-76391</b>  | ALPHA Cartridge w/orifice 6.667 l/s  | 0.795       | 5705564071934 |
| <b>51-76393</b>  | ALPHA Cartridge w/orifice 6.764 l/s  | 0.794       | 5705564071941 |
| <b>51-76398</b>  | ALPHA Cartridge w/orifice 6.986 l/s  | 0.792       | 5705564071958 |
| <b>51-76400</b>  | ALPHA Cartridge w/orifice 7.146 l/s  | 0.792       | 5705564071965 |
| <b>51-76407</b>  | ALPHA Cartridge w/orifice 0.7444 l/s | 0.79        | 5705564071972 |
| <b>51-76407H</b> | ALPHA Cartridge w/orifice 8.500 l/s  | 0.784       | 5705564071989 |
| <b>51-76420</b>  | ALPHA Cartridge w/orifice 9.014 l/s  | 0.779       | 5705564071996 |