# Environmental Product Declaration

according to ISO 21930

# LFMMVM1-UT

Lead Free Thermostatic Mixing Valve

Product Family: Mixing Valves


## Sustainability Mission Statement

***A Safer World is a More Sustainable World***

Watts was founded on a simple premise: the water we use every day should be delivered safely and reliably. We influenced the codes that shaped the way the world uses water. Our goal has always been to be good stewards of this critical resource while creating solutions that keep our customers safe where they live, work, and play. Watts believes a safer world is a more sustainable world.

| | |
|---|---|
| **EPD Scope** | Cradle to Grave |

**Reference Standards**

| | |
|---|---|
| Core PCR | PCR for Building-Related Products and Services Part A v.3.2 |
| Sub-Category PCR | UL Part B: Kitchen and Bath Fixture Fittings and Accessory Products v.1 |

**Product Specifications**

Functional Unit: 1 packaged product

| Model Size | Packaged Weight (kg) |
|---|---|
| 0.5" LFMMVM1-UT | 0.929 |
| 0.75" LFMMVM1-UT | 1.118 |
| 1" LFMMVM1-UT | 1.347 |

| | |
|---|---|
| Product Service Life | 20 years |
| Building Service Life | 75 years |

**Manufacturing Specifications**

| | |
|---|---|
| Location | Franklin, NH |
| Energy Source | 100% Offsite Wind Power RECs* |

*Model results shows Grid results with REC results shown in Further Information section at end

**Greenhouse Gas Emission**

| Model Size | IPCC AR5 GWP 100 A1-A3 (kg $CO_2$ eq) |
|---|---|
| 0.5" LFMMVM1-UT | 12.3 |
| 0.75" LFMMVM1-UT | 19 |
| 1.0" LFMMVM1-UT | 22.7 |

Verified by:

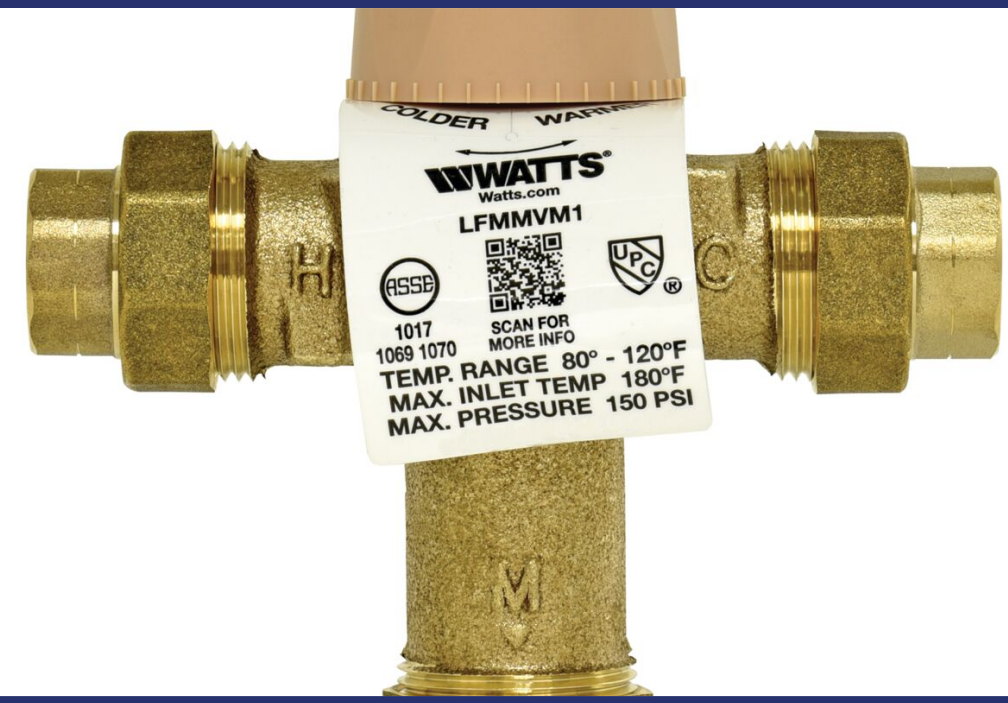
SMART EPD

# ENVIRONMENTAL PRODUCT DECLARATION

**IN ACCORDANCE WITH ISO 14025 AND ISO 21930:2017**

SmartEPD-2024-023-0170-01

## LFMMVM1-UT - Mixing Valve




WATTS®
Watts Water Technologies, Inc.

SMART EPD
CERTIFIED
ENVIRONMENTAL PRODUCT DECLARATION

**Date of Issue:** Sep 30, 2024

**Expiration:** Sep 30, 2029

**Last updated:** Sep 30, 2024

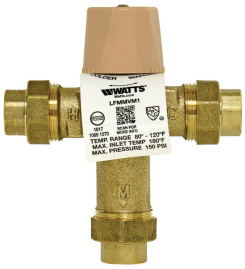
## General Information

Watts

815 Chestnut St, North Andover, MA 01845

1-978-689-6066

watts.com



| | |
|---|---|
| **Product Name:** | LFMMVM1-UT - Mixing Valve |
| **Functional Unit:** | 1 unit 1 packaged product |
| **Declaration Number:** | SmartEPD-2024-023-0170-01 |
| **Date of Issue:** | September 30, 2024 |
| **Expiration:** | September 30, 2029 |
| **Last updated:** | September 30, 2024 |
| **EPD Scope:** | Cradle to grave<br>A1 - A3, A4, A5, B1 - B7, C1 - C4 |
| **Market(s) of Applicability:** | North America, Europe |

## Reference Standards

| | |
|---|---|
| **Standard(s):** | ISO 14025 and ISO 21930:2017 |
| **Core PCR:** | PCR for Building-Related Products and Services Part A v.3.2<br>Date of issue: December 12, 2018 |
| **Sub-category PCR:** | UL Part B: Kitchen and Bath Fixture Fittings and Accessory Products v.1<br>Date of issue: October 08, 2020<br>Valid until: October 08, 2025 |
| **Sub-category PCR review panel:** | Contact Smart EPD for more information. |
| **General Program Instructions:** | Smart EPD General Program Instructions v.1.0, November 2022 |

## Verification Information

| | |
|---|---|
| **LCA Author/Creator:** | Olivia Tsamparlis \| Watts Water \| olivia.tsamparlis@wattswater.com<br>Vas Gnanadoss \| Watts Water \| vasanth.gnanadoss@wattswater.com |
| **EPD Program Operator:** | Smart EPD \| info@smartepd.com \| www.smartepd.com \|<br>585 Grove St., Ste. 145 PMB 966, Herndon, VA 20170, USA |

**Verification:**

Independent critical review of the LCA and data, according to ISO 14044 and ISO 14071 : External

Gaspard Philis | LCA.no | gaspard@lca.no

Independent external verification of EPD, according to ISO 14025 and reference PCR(s) : External

Gaspard Philis | LCA.no | gaspard@lca.no

## Limitations, Liability, and Ownership

Environmental declarations from different programs (ISO 14025) may not be comparable. Comparison of the environmental performance of products using EPD information shall be based on the product's use and impacts at the building level, and therefore EPDs may not be used for comparability purposes when not considering the whole building life cycle. EPD comparability is only possible when all stages of a life cycle have been considered. However, variations and deviations are possible. Example of variations: Different LCA software and background LCI datasets may lead to differences results for upstream or downstream of the life cycle stages declared. The EPD owner has sole ownership, liability, and responsibility for the EPD.

## Organization Information

Watts Water Technologies, Inc. (Watts) is a global leader of quality water solutions for residential, industrial, municipal, and commercial settings. Our family of brands offers one of the most varied product lines in the world, with world-class, water-related solutions focused on Drainage, HVAC and Hot Water, Plumbing & Flow Control and Water Quality & Rainwater Harvesting.

**Further information can be found at:** https://www.watts.com/

## Product Description

Mixing valves are designed to combine hot and cold water before reaching the user to ensure safe outlet temperature as well as playing a crucial part in avoiding scalding, thermal shock, and bacteria growth such as Legionella. This 1/2-inch lead free thermostatic mixing valve is designed for residential, commercial or institutional environments for supplying baths or lavatories with tempered water. The double throttling design controls both hot and cold water supply to the mixed outlet. It consists of a lead-free brass body, threaded union connections, solid wax hydraulic principle thermostat, integral filter washers and check valves with a locking mechanism for the temperature setting.

**Further information can be found at:** https://www.watts.com/products/plumbing-flow-control-solutions/mixing-valves/lavatory-mixing-valves/lfmmv/lfmmvm1-ut-12

## Product Information

| | |
|---|---|
| **Functional Unit:** | 1 unit 1 packaged product |
| **Mass:** | 1.3477 kg |
| **Reference Service Life:** | 20 Years |
| **Product Specificity:** | ✗ Product Average<br>✓ Product Specific |

**Averaging:**

Averaging was not conducted for this EPD. When a single value is shown it represents the largest value, or most conservative figure. When a range is shown it represents the smallest and largest extremes of a value for all sizes considered.

## Plants

Franklin Manufacturing Plant
583 S Main St, Franklin, NH 03235, USA

## Product Specifications

| | |
|---|---|
| **Product SKU(s):** | 0559116, 0559119, 0559122 |
| **Product Classification Codes:** | Masterformat - 15400<br>UNSPSC - 401416<br>EC3 - Plumbing -> PlumbingEquipment<br>EC3 - Plumbing -> PlumbingFixtures -> OtherPlumbingFixtures |

## Material Composition

| Material/Component Category | Origin | % Mass |
|---|---|---|
| Body_Bronze | US | 35-61 |
| Tailpiece_Brass | US | 12-44 |
| Union Nut_Brass | CN | 11-12 |
| Seal_Rubber | CN | 0-11 |
| Stem_Iron | US | 2-5 |
| Adapter_Polyphenylene sulfide (PPS) | CN | 0-2 |
| Thermostat_Brass | US | 1-2 |
| Adj Knob_Nylon 6/6 | CN | 1-2 |
| Seat_Brass | CN | 0-1 |
| Spring_Stainless Steel | US | 0-1 |
| Screw_Stainless Steel | US | 0-1 |
| Insert_Brass | US | 0-1 |

| Packaging Material | Origin | kg Mass |
|---|---|---|
| Paper | GLO | 0.099444991 |
| Plastics | GLO | 0.000907185 |

| Biogenic Carbon Content | kg C per unit |
|---|---|
| Biogenic carbon content in product | None |
| Biogenic carbon content in accompanying packaging | 0.056 |

| Hazardous Materials |
|---|
| No regulated hazardous or dangerous substances are included in this product. |

## EPD Data Specificity

**Primary Data Year:** 2022

**Manufacturing Specificity:**

- ✗ Industry Average
- ✗ Manufacturer Average
- ✓ Facility Specific

## Software and LCI Data Sources

| | | | |
|---|---|---|---|
| **LCA Software:** | SimaPro v. 9.5 | | |
| **LCI Foreground Database(s):** | Ecoinvent v. 3.9.1 | RoW | Cut-Off by Classification |
| **LCI Background Database(s):** | Ecoinvent v. 3.9.1 | RoW | Cut-Off by Classification |

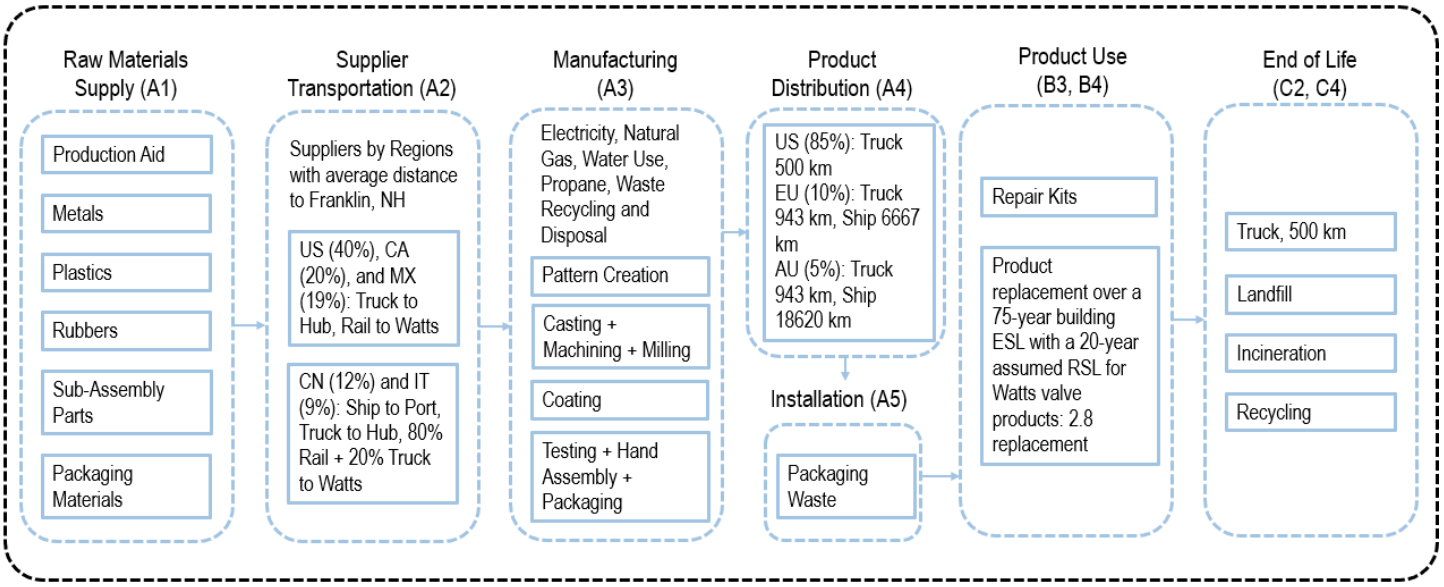
## Renewable Electricity

| | |
|---|---|
| **Renewable electricity is used:** | Yes |
| **Electricity Source:** | Offsite |
| **Renewable type:** | Wind |
| **Percent of EPD Owner's product-related electricity covered:** | 100 % |
| **Commitment pledged for entire EPD validity period:** | Yes |

## System Boundary

| | | | |
|---|---|---|---|
| Production | A1 | Raw material supply | ✓ |
| | A2 | Transport | ✓ |
| | A3 | Manufacturing | ✓ |
| Construction | A4 | Transport to site | ✓ |
| | A5 | Assembly / Install | ✓ |
| Use | B1 | Use | ✓ |
| | B2 | Maintenance | ✓ |
| | B3 | Repair | ✓ |
| | B4 | Replacement | ✓ |
| | B5 | Refurbishment | ✓ |
| | B6 | Operational Energy Use | ✓ |
| | B7 | Operational Water Use | ✓ |
| End of Life | C1 | Deconstruction | ✓ |
| | C2 | Transport | ✓ |
| | C3 | Waste Processing | ✓ |
| | C4 | Disposal | ✓ |
| Benefits & Loads Beyond System Boundary | D | Recycling, Reuse Recovery Potential | ND |

## Product Flow Diagram




## Life Cycle Module Descriptions

The system boundary for this study is cradle-to-grave with modules A1-C4, covering supplied raw materials (A1), transport from suppliers to Watts (A2), production of manufactured products (A3), transport from Watts to customers (A4), product's installation (A5), product repair (B3), replacement (B4), transport to end-of-life facilities (C2), and disposal of the product (C4).

Each module includes provision of all relevant materials, products, and energy. Potential impacts and aspects related to wastage (i.e. production, transport and waste processing and end-of-life stage of lost waste products and materials) are considered in the module in which the wastage occurs.

No impacts from the product's use (B1, B2, B5-B7) or from demolition (C1) or waste processing (C3) are included. Waste processing is not included because the product is sent directly to disposal (C4). The installation module A5 contains only the packaging waste, other impacts in this module are declared as having zero impact as the process is manual using hand tools that don't consume energy. The use stage modules B1, B2, B5 to B7 are declared as having zero impacts as there are no direct energy or water use during consume use, nor is any direct emissions from the valve products once they are installed. The other use stage modules account for B3, materials needed for repair (i.e., repair kits description) and B4, replacing the valve to match building service life.

## LCA Discussion

### Allocation Procedure

While conducting an LCA, if the life cycles of more than one product are connected, allocation of the process inputs should be avoided by using the system boundary expansion approach. In accordance with the ISO 14040 series and PCR, mass should be used as the primary basis for co-product allocation. The allocations of relevance for calculation (appropriation of impacts across various products) shall be indicated, at least:

- Allocation in the use of recycled and/or secondary raw materials.
- Allocation of energy, ancillary and operating materials used for individual products in a factory.

No multi-output allocation was necessary in the foreground of the study. Allocation of secondary data taken from ecoinvent v3.9.1 cut-off by classification has allocation applied to it.

Given that raw materials are key contributors to environmental performance, mass-based allocation of plant overhead utility consumption, resource use and waste generation was applied for Franklin facility, where all products in this study are manufactured. Operational manufacturing energy and water inputs and waste stream are allocated to total pound of product output per product category based on earned hours, then to 1 pound of product. No allocation is required for products at end-of-life: product scrap and packaging waste at the job site is assumed to be inert in landfills, so no landfill gas is produced from product waste.

## Cut-off Procedure

For the processes within the system boundary all energy and material flows have been included in the model. PCR allows for any mass flow to be omitted if it is less than 1%, with cumulative flows not exceeding 5%. In situations where gathering accurate weight data for smaller components acquired from suppliers, such as o-rings or tiny metal inserts, presents a challenge, the total weight of materials listed in the Bill of Materials (BOM) might not precisely align with the product's total weight as recorded in the system. To accommodate this discrepancy, a 5% cut-off criterion (note 1) has been implemented in the A1, Raw Material Calculation process. This approach helps ensure more accurate and realistic accounting of materials, despite the challenges in obtaining exact weights of smaller parts.

For other life cycle modules, this study includes 100% of the material flows; no known flows are excluded. Results from manufacturing are limited to the primary data obtained from product throughput and annual reports. The amount spent on production aides was minimal, so they were considered negligible and not included. All upstream and downstream activities are included using a combination of primary and secondary data. While the majority of inventory data are sourced from primary resources, representative proxies are used to close gaps in the absence of primary data.

This study uses the cut-off approach method for recycling. According to this approach, the first life of a material bears the environmental burdens of its production (e.g., raw material extraction and processing) and the second life (e.g., scrap input) bears the burdens of refurbishment (e.g., collection and refining of scrap). The burdens from waste treatment are taken by the life after which they occur.

Note 1: In the study, we have accounted for 100% of the materials by mass as detailed in the product's bill of materials, which includes not only the core components but also production aids and packaging. However, when aggregating the actual weights for each specific part, there may be a slight variance of up to +/- 5% between the sum of the weights of all components and the total product weight recorded in Watt's internal system. It is important to note that the internal system's figures are based on approximate product specifications and serve as a reference. Therefore, any perceived discrepancies or a 5% cut-off are due to these approximations and do not reflect omissions in our materials accounting.

## Data Quality Discussion

Life cycle inventory data used in this study are evaluated based on three categories: precision and completeness, consistency and reproducibility, and representativeness.

Precision and completeness: Foreground data are sourced from primary information provided by the client and has been reviewed internally to ensure precision and completeness. In order to balance out seasonal variations, operations data over a 12-month period is used to represent production activities. In addition, key model input such as mass balance, energy balance and emission inventory are reviewed by TrueNorth Collective team.
Ecoinvent v3.9.1 cut-off by classification is used as the main database for background data. This version is published in 2023. Ecoinvent is widely used in research and industry to support life cycle assessment practices. Each version of this database goes through thorough review process and documentation of precision and completeness is available by the provider.

Consistency and reproducibility: To ensure consistency, primary data were collected at the same level of granularity. All input and output information, modelling assumptions and dataset choices are provided in this report for the purpose of reproducibility.

Representativeness: Refer to the sections above for details about representativeness.

# Results

## Environmental Impact Assessment Results

IPCC AR5 GWP 100, TRACI 2.1

per 1 unit.

LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

1/2" LFMMVM1-UT

| Impact Category | Method | Unit | A1A2A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GWP-total | IPCC AR5 GWP 100 | kg CO2 eq | 12.3 | 0.144 | 0.0566 | ND | ND | 0.308 | 35.1 | ND | ND | ND | ND | 0.0246 | ND | 0.018 |
| GWP-total | TRACI 2.1 | kg CO2 eq | 12.1 | 0.142 | 0.0472 | ND | ND | 0.279 | 34.6 | ND | ND | ND | ND | 0.0243 | ND | 0.0177 |
| ODP | TRACI 2.1 | kg CFC 11 eq | 2.25e-7 | 2.39e-9 | 9.65e-11 | ND | ND | 9.51e-9 | 6.38e-7 | ND | ND | ND | ND | 4.07e-10 | ND | 2.99e-10 |
| AP | TRACI 2.1 | kg SO2 eq | 0.371 | 0.000774 | 0.0000348 | ND | ND | 0.000773 | 1.04 | ND | ND | ND | ND | 0.000132 | ND | 0.000127 |
| EP-fw | TRACI 2.1 | kg N eq | 0.282 | 0.000147 | 0.000256 | ND | ND | 0.00144 | 0.792 | ND | ND | ND | ND | 0.0000251 | ND | 0.0000419 |
| POCP | TRACI 2.1 | kg O3 eq | 1.59 | 0.0217 | 0.000799 | ND | ND | 0.0111 | 4.53 | ND | ND | ND | ND | 0.00369 | ND | 0.00199 |

Abbreviations:

GWP = Global Warming Potential, 100 years (may also be denoted as GWP-total, GWP-fossil (fossil fuels), GWP-biogenic (biogenic sources), GWP-luluc (land use and land use change)), ODP = Ozone Depletion Potential, AP = Acidification Potential, EP = Eutrophication Potential, SFP = Smog Formation Potential, POCP = Photochemical oxidant creation potential, ADP-Fossil = Abiotic depletion potential for fossil resources, ADP-Minerals&Metals = Abiotic depletion potential for non-fossil resources, WDP = Water deprivation potential, PM = Particular Matter Emissions, IRP = Ionizing radiation, human health, ETP-fw = Eco-toxicity (freshwater), HTP-c = Human toxicity (cancer), HTP-nc = Human toxicity (non-cancer), SQP = Soil quality index.

per 1 unit.

3/4" LFMMVM1-UT

| Impact Category | Method | Unit | A1A2A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GWP-total | IPCC AR5 GWP 100 | kg CO2 eq | 19 | 0.173 | 0.0405 | ND | ND | 0.267 | 53.9 | ND | ND | ND | ND | 0.0316 | ND | 0.0232 |
| GWP-total | TRACI 2.1 | kg CO2 eq | 18.7 | 0.171 | 0.0338 | ND | ND | 0.239 | 53.1 | ND | ND | ND | ND | 0.0312 | ND | 0.0228 |
| ODP | TRACI 2.1 | kg CFC 11 eq | 3.02e-7 | 2.87e-9 | 6.91e-11 | ND | ND | 5.91e-9 | 8.55e-7 | ND | ND | ND | ND | 5.23e-10 | ND | 3.84e-10 |
| AP | TRACI 2.1 | kg SO2 eq | 0.661 | 0.00093 | 0.0000249 | ND | ND | 0.000568 | 1.85 | ND | ND | ND | ND | 0.00017 | ND | 0.000163 |
| EP-fw | TRACI 2.1 | kg N eq | 0.501 | 0.000177 | 0.000183 | ND | ND | 0.00126 | 1.4 | ND | ND | ND | ND | 0.0000323 | ND | 0.0000539 |
| POCP | TRACI 2.1 | kg O3 eq | 2.76 | 0.026 | 0.000572 | ND | ND | 0.00862 | 7.83 | ND | ND | ND | ND | 0.00475 | ND | 0.00256 |

Abbreviations:

GWP = Global Warming Potential, 100 years (may also be denoted as GWP-total, GWP-fossil (fossil fuels), GWP-biogenic (biogenic sources), GWP-luluc (land use and land use change)), ODP = Ozone Depletion Potential, AP = Acidification Potential, EP = Eutrophication Potential, SFP = Smog Formation Potential, POCP = Photochemical oxidant creation potential, ADP-Fossil = Abiotic depletion potential for fossil resources, ADP-Minerals&Metals = Abiotic depletion potential for non-fossil resources, WDP = Water deprivation potential, PM = Particular Matter Emissions, IRP = Ionizing radiation, human health, ETP-fw = Eco-toxicity (freshwater), HTP-c = Human toxicity (cancer), HTP-nc = Human toxicity (non-cancer), SQP = Soil quality index.

per 1 unit.

1" LFMMVM1-UT

| Impact Category | Method | Unit | A1A2A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GWP-total | IPCC AR5 GWP 100 | kg CO2 eq | 22.7 | 0.209 | 0.0416 | ND | ND | 0.258 | 64.3 | ND | ND | ND | ND | 0.0387 | ND | 0.0283 |
| GWP-total | TRACI 2.1 | kg CO2 eq | 22.3 | 0.206 | 0.0348 | ND | ND | 0.229 | 63.4 | ND | ND | ND | ND | 0.0381 | ND | 0.0278 |
| ODP | TRACI 2.1 | kg CFC 11 eq | 3.88e-7 | 3.46e-9 | 7.13e-11 | ND | ND | 5.69e-9 | 0.0000011 | ND | ND | ND | ND | 6.4e-10 | ND | 4.7e-10 |
| AP | TRACI 2.1 | kg SO2 eq | 0.757 | 0.00112 | 0.0000256 | ND | ND | 0.000527 | 2.12 | ND | ND | ND | ND | 0.000207 | ND | 0.000199 |
| EP-fw | TRACI 2.1 | kg N eq | 0.574 | 0.000213 | 0.000195 | ND | ND | 0.00123 | 1.61 | ND | ND | ND | ND | 0.0000395 | ND | 0.0000659 |
| POCP | TRACI 2.1 | kg O3 eq | 3.19 | 0.0314 | 0.00059 | ND | ND | 0.00811 | 9.04 | ND | ND | ND | ND | 0.00581 | ND | 0.00313 |

Abbreviations:

GWP = Global Warming Potential, 100 years (may also be denoted as GWP-total, GWP-fossil (fossil fuels), GWP-biogenic (biogenic sources), GWP-luluc (land use and land use change)), ODP = Ozone Depletion Potential, AP = Acidification Potential, EP = Eutrophication Potential, SFP = Smog Formation Potential, POCP = Photochemical oxidant creation potential, ADP-Fossil = Abiotic depletion potential for fossil resources, ADP-Minerals&Metals = Abiotic depletion potential for non-fossil resources, WDP = Water deprivation potential, PM = Particular Matter Emissions, IRP = Ionizing radiation, human health, ETP-fw = Eco-toxicity (freshwater), HTP-c = Human toxicity (cancer), HTP-nc = Human toxicity (non-cancer), SQP = Soil quality index.

Comparisons cannot be made between product-specific or industry average EPDs at the design stage of a project, before a building has been specified. Comparisons may be made between product-specific or industry average EPDs at the time of product purchase when product performance and specifications have been established and serve as a functional unit for comparison. Environmental impact results shall be converted to a functional unit basis before any comparison is attempted. Any comparison of EPDs shall be subject to the requirements of ISO 21930 or EN 15804. EPDs are not comparative assertions and are either not comparable or have limited comparability when they have different system boundaries. EPDs are not comparative assertions and are either not comparable or have limited comparability when they have different system boundaries, are based on different product category rules or are missing relevant environmental impacts. Such comparison can be inaccurate, and could lead to erroneous selection of materials or products which are higher-impact, at least in some impact categories.

## Resource Use Indicators

per 1 unit.

1/2" LFMMVM1-UT

| Indicator | Unit | A1A2A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PERE | MJ | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| PERM | MJ | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| PERT | MJ | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| PENRE | MJ | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| PENRM | MJ | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| PENRT | MJ | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| RPRE | MJ | 33.7 | 0.0258 | 0.00157 | ND | ND | 1.42 | 94.4 | ND | ND | ND | ND | 0.0044 | ND | 0.0155 |
| RPRM | MJ | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| RPRT | MJ | 33.7 | 0.0258 | 0.00157 | ND | ND | 1.42 | 94.4 | ND | ND | ND | ND | 0.0044 | ND | 0.0155 |
| NRPRE | MJ | 211 | 2.17 | 0.0797 | ND | ND | 2.25 | 599 | ND | ND | ND | ND | 0.37 | ND | 0.3 |
| NRPRM | MJ | 1.16 | ND | ND | ND | ND | ND | 3.25 | ND | ND | ND | ND | ND | ND | ND |
| NRPRT | MJ | 212 | 2.17 | 0.0797 | ND | ND | 2.25 | 603 | ND | ND | ND | ND | 0.37 | ND | 0.3 |
| ADP-fossil | MJ | 18.3 | 0.286 | 0.0101 | ND | ND | 0.216 | 52.2 | ND | ND | ND | ND | 0.0488 | ND | 0.0305 |
| SM | kg | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| RSF | MJ | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| NRSF | MJ | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| FW | m3 | 0.000294 | ND | ND | ND | ND | ND | 0.000823 | ND | ND | ND | ND | ND | ND | ND |

Abbreviations:

RPRE or PERE = Renewable primary resources used as energy carrier (fuel), RPRM or PERM = Renewable primary resources with energy content used as material, RPRT or PERT = Total use of renewable primary resources with energy content, NRPRE or PENRE = Non-renewable primary resources used as an energy carrier (fuel), NRPRM or PENRM = Non-renewable primary resources with energy content used as material, NRPRT or PENRT = Total non-renewable primary resources with energy content, SM: Secondary materials, RSF = Renewable secondary fuels, NRSF = Non-renewable secondary fuels, RE = Recovered energy, ADPF = Abiotic depletion potential, FW = Use of net freshwater resources, VOCs = Volatile Organic Compounds.

per 1 unit.

3/4" LFMMVM1-UT

| Indicator | Unit | A1A2A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PERE | MJ | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| PERM | MJ | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| PERT | MJ | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| PENRE | MJ | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| PENRM | MJ | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| PENRT | MJ | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| RPRE | MJ | 53.3 | 0.031 | 0.00112 | ND | ND | 1.33 | 149 | ND | ND | ND | ND | 0.00566 | ND | 0.0199 |
| RPRM | MJ | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| RPRT | MJ | 53.3 | 0.031 | 0.00112 | ND | ND | 1.33 | 149 | ND | ND | ND | ND | 0.00566 | ND | 0.0199 |
| NRPRE | MJ | 313 | 2.61 | 0.0571 | ND | ND | 1.76 | 885 | ND | ND | ND | ND | 0.476 | ND | 0.386 |
| NRPRM | MJ | 1.49 | ND | ND | ND | ND | ND | 4.18 | ND | ND | ND | ND | ND | ND | ND |
| NRPRT | MJ | 314 | 2.61 | 0.0571 | ND | ND | 1.76 | 890 | ND | ND | ND | ND | 0.476 | ND | 0.386 |
| ADP-fossil | MJ | 26.3 | 0.344 | 0.00723 | ND | ND | 0.184 | 74.9 | ND | ND | ND | ND | 0.0628 | ND | 0.0392 |
| SM | kg | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| RSF | MJ | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| NRSF | MJ | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| FW | m3 | 0.000378 | ND | ND | ND | ND | ND | 0.00106 | ND | ND | ND | ND | ND | ND | ND |

Abbreviations:

RPRE or PERE = Renewable primary resources used as energy carrier (fuel), RPRM or PERM = Renewable primary resources with energy content used as material, RPRT or PERT = Total use of renewable primary resources with energy content, NRPRE or PENRE = Non-renewable primary resources used as an energy carrier (fuel), NRPRM or PENRM = Non-renewable primary resources with energy content used as material, NRPRT or PENRT = Total non-renewable primary resources with energy content, SM: Secondary materials, RSF = Renewable secondary fuels, NRSF = Non-renewable secondary fuels, RE = Recovered energy, ADPF = Abiotic depletion potential, FW = Use of net freshwater resources, VOCs = Volatile Organic Compounds.

per 1 unit.

1" LFMMVM1-UT

| Indicator | Unit | A1A2A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PERE | MJ | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| PERM | MJ | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| PERT | MJ | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| PENRE | MJ | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| PENRM | MJ | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| PENRT | MJ | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| RPRE | MJ | 62.3 | 0.0373 | 0.00115 | ND | ND | 1.32 | 175 | ND | ND | ND | ND | 0.00691 | ND | 0.0243 |
| RPRM | MJ | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| RPRT | MJ | 62.3 | 0.0373 | 0.00115 | ND | ND | 1.32 | 175 | ND | ND | ND | ND | 0.00691 | ND | 0.0243 |
| NRPRE | MJ | 386 | 3.14 | 0.0587 | ND | ND | 1.51 | 1090 | ND | ND | ND | ND | 0.582 | ND | 0.471 |
| NRPRM | MJ | 1.83 | ND | ND | ND | ND | ND | 5.11 | ND | ND | ND | ND | ND | ND | ND |
| NRPRT | MJ | 387 | 3.14 | 0.0587 | ND | ND | 1.51 | 1100 | ND | ND | ND | ND | 0.582 | ND | 0.471 |
| ADP-fossil | MJ | 33.4 | 0.415 | 0.00745 | ND | ND | 0.155 | 94.9 | ND | ND | ND | ND | 0.0767 | ND | 0.0479 |
| SM | kg | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| RSF | MJ | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| NRSF | MJ | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| FW | m3 | 0.000462 | ND | ND | ND | ND | ND | 0.00129 | ND | ND | ND | ND | ND | ND | ND |

Abbreviations:

RPRE or PERE = Renewable primary resources used as energy carrier (fuel), RPRM or PERM = Renewable primary resources with energy content used as material, RPRT or PERT = Total use of renewable primary resources with energy content, NRPRE or PENRE = Non-renewable primary resources used as an energy carrier (fuel), NRPRM or PENRM = Non-renewable primary resources with energy content used as material, NRPRT or PENRT = Total non-renewable primary resources with energy content, SM: Secondary materials, RSF = Renewable secondary fuels, NRSF = Non-renewable secondary fuels, RE = Recovered energy, ADPF = Abiotic depletion potential, FW = Use of net freshwater resources, VOCs = Volatile Organic Compounds.

## Waste and Output Flow Indicators

per 1 unit.

1/2" LFMMVM1-UT

| Indicator | Unit | A1A2A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HWD | kg | 0.263 | ND | ND | ND | ND | ND | 0.735 | ND | ND | ND | ND | ND | ND | ND |
| NHWD | kg | 0.025 | ND | ND | ND | ND | ND | 0.0701 | ND | ND | ND | ND | ND | ND | ND |
| RWD | kg | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| HLRW | kg | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| ILLRW | kg | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| CRU | kg | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| MFR | kg | 0.289 | ND | ND | ND | ND | ND | 0.809 | ND | ND | ND | ND | ND | ND | ND |
| MER | kg | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| MNER | kg | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| EEE | MJ | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| EET | MJ | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |

Abbreviations:

HWD = Hazardous waste disposed, NHWD = Non-hazardous waste disposed, RWD = Radioactive waste disposed, HLRW = High-level radioactive waste, ILLRW = Intermediate- and low-level radioactive waste, CRU = Components for re-use, MFR or MR = Materials for recycling, MER = Materials for energy recovery, MNER = Materials for incineration, no energy recovery, EE or EEE = Recovered energy exported from the product system, EET = Exported thermal energy.

per 1 unit.

3/4" LFMMVM1-UT

| Indicator | Unit | A1A2A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HWD | kg | 0.338 | ND | ND | ND | ND | ND | 0.946 | ND | ND | ND | ND | ND | ND | ND |
| NHWD | kg | 0.0322 | ND | ND | ND | ND | ND | 0.0901 | ND | ND | ND | ND | ND | ND | ND |
| RWD | kg | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| HLRW | kg | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| ILLRW | kg | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| CRU | kg | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| MFR | kg | 0.318 | ND | ND | ND | ND | ND | 0.891 | ND | ND | ND | ND | ND | ND | ND |
| MER | kg | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| MNER | kg | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| EEE | MJ | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| EET | MJ | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |

Abbreviations:

HWD = Hazardous waste disposed, NHWD = Non-hazardous waste disposed, RWD = Radioactive waste disposed, HLRW = High-level radioactive waste, ILLRW = Intermediate- and low-level radioactive waste, CRU = Components for re-use, MFR or MR = Materials for recycling, MER = Materials for energy recovery, MNER = Materials for incineration, no energy recovery, EE or EEE = Recovered energy exported from the product system, EET = Exported thermal energy.

per 1 unit.

1" LFMMVM1-UT

| Indicator | Unit | A1A2A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HWD | kg | 0.413 | ND | ND | ND | ND | ND | 1.16 | ND | ND | ND | ND | ND | ND | ND |
| NHWD | kg | 0.0393 | ND | ND | ND | ND | ND | 0.11 | ND | ND | ND | ND | ND | ND | ND |
| RWD | kg | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| HLRW | kg | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| ILLRW | kg | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| CRU | kg | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| MFR | kg | 0.342 | ND | ND | ND | ND | ND | 0.958 | ND | ND | ND | ND | ND | ND | ND |
| MER | kg | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| MNER | kg | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| EEE | MJ | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| EET | MJ | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |

Abbreviations:

HWD = Hazardous waste disposed, NHWD = Non-hazardous waste disposed, RWD = Radioactive waste disposed, HLRW = High-level radioactive waste, ILLRW = Intermediate- and low-level radioactive waste, CRU = Components for re-use, MFR or MR = Materials for recycling, MER = Materials for energy recovery, MNER = Materials for incineration, no energy recovery, EE or EEE = Recovered energy exported from the product system, EET = Exported thermal energy.

## Carbon Emissions and Removals

per 1 unit.

1/2" LFMMVM1-UT

| Indicator | Unit | A1A2A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCRP | kg CO2 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| BCEP | kg CO2 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| BCRK | kg CO2 | -0.25 | ND | ND | ND | ND | -0.174 | -0.701 | ND | ND | ND | ND | ND | ND | ND |
| BCEK | kg CO2 | ND | ND | 0.282 | ND | ND | 0.0435 | 0.789 | ND | ND | ND | ND | ND | ND | ND |
| BCEW | kg CO2 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| CCE | kg CO2 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| CCR | kg CO2 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| CWNR | kg CO2 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |

Abbreviations:

BCRP = Biogenic Carbon Removal from Product, BCEP = Biogenic Carbon Emission from Product, BCRK = Biogenic Carbon Removal from Packaging, BCEK = Biogenic Carbon Emission from Packaging, BCEW = Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes, CCE = Calcination Carbon Emissions, CCR = Carbonation Carbon Removals, CWNR = Carbon Emissions from Combustion of Waste from Non-Renewable Sources used in Production Processes, GWP-luc = Carbon Emissions from Land-use Change.

per 1 unit.

3/4" LFMMVM1-UT

| Indicator | Unit | A1A2A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCRP | kg CO2 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| BCEP | kg CO2 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| BCRK | kg CO2 | -0.179 | ND | ND | ND | ND | -0.174 | -0.502 | ND | ND | ND | ND | ND | ND | ND |
| BCEK | kg CO2 | ND | ND | 0.202 | ND | ND | 0.0435 | 0.565 | ND | ND | ND | ND | ND | ND | ND |
| BCEW | kg CO2 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| CCE | kg CO2 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| CCR | kg CO2 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| CWNR | kg CO2 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |

Abbreviations:

BCRP = Biogenic Carbon Removal from Product, BCEP = Biogenic Carbon Emission from Product, BCRK = Biogenic Carbon Removal from Packaging, BCEK = Biogenic Carbon Emission from Packaging, BCEW = Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes, CCE = Calcination Carbon Emissions, CCR = Carbonation Carbon Removals, CWNR = Carbon Emissions from Combustion of Waste from Non-Renewable Sources used in Production Processes, GWP-luc = Carbon Emissions from Land-use Change.

per 1 unit.

1" LFMMVM1-UT

| Indicator | Unit | A1A2A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCRP | kg CO2 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| BCEP | kg CO2 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| BCRK | kg CO2 | -0.182 | ND | ND | ND | ND | -0.174 | -0.51 | ND | ND | ND | ND | ND | ND | ND |
| BCEK | kg CO2 | ND | ND | 0.205 | ND | ND | 0.0435 | 0.575 | ND | ND | ND | ND | ND | ND | ND |
| BCEW | kg CO2 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| CCE | kg CO2 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| CCR | kg CO2 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| CWNR | kg CO2 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |

Abbreviations:

BCRP = Biogenic Carbon Removal from Product, BCEP = Biogenic Carbon Emission from Product, BCRK = Biogenic Carbon Removal from Packaging, BCEK = Biogenic Carbon Emission from Packaging, BCEW = Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes, CCE = Calcination Carbon Emissions, CCR = Carbonation Carbon Removals, CWNR = Carbon Emissions from Combustion of Waste from Non-Renewable Sources used in Production Processes, GWP-luc = Carbon Emissions from Land-use Change.

# Scenarios

## Transport to the building/construction site (A4)

A4 Module

| | |
|---|---|
| **Fuel Type:** | Diesel |
| **Liters of Fuel:** | 27.6 l/100km |
| **Vehicle Type:** | 16-32 metric ton, EURO3 Truck |
| **Transport Distance:** | 2700 km |
| **Capacity Utilization:** | 37 % |
| **Packaging Mass:** | 0.3 kg |
| **Weight of products transported:** | 1.3477 kg |
| **Capacity utilization volume factor:** | <1 |
| **Assumptions for scenario development:** | Products are shipped out from Watts facility in Franklin, NH, on pallets to customers directly. 85% of customers are based in US, 10% in Europe, mostly France and 5% in Australia. The study uses a conservative assumption that packaged products are shipped via a 16-32 metric ton, EURO3 truck using diesel fuel for US, EU, and AU and a freight container ship using heavy fuel oil for EU and AU. Above information represents North American transport as this covers 85% of transportation. The total transportation impacts of the A4 phase were calculated based on a weighted average of:<br><br>•Franklin, NH to US Customer: 2700 km by truck (85%)<br>•Franklin, NH to EU Customer: 943 km by truck and 6667 km by ship (10%)<br>•Franklin, NH to AU Customer: 943 km by truck and 18520 km by ship (5%) |
| **Truck Distance (weighted average for US, EU and AU customer):** | 2436.45 km |
| **Freight Container Ship Distance (weighted average for EU and AU customer):** | 1592.7 km |

## Installation in to the building/construction site (A5)

A5 Module

| | |
|---|---|
| **Mass of Packaging Waste Specified by Type:** | 0.099444991 kg |
| **Biogenic Carbon Contained in Packaging:** | 0.056 kg |
| **Assumptions for scenario development:** | The installation process is manual using hand tools that don't consume energy. Therefore, only product packaging waste is included in this module. It is assumed all packaging wastes are transported to a waste treatment facility with an average of 100 km by truck. Other impacts in this module are declared as having zero impact. The paper and paperboard packaging EOL assumptions are based on the EPA recommendation of:<br>-Recycled Percentage: 68.21%<br>-Incineration Percentage: 6.23%<br>-Landfill Percentage: 25.55% |
| **Plastic Packaging:** | 0.000907185 kg |

## Reference Service Life
B1 Module

| | |
|---|---|
| **RSL:** | 20 Years |

## Repair (B3)
B3 Module

| | |
|---|---|
| **Repair Cycle:** | 1 Cycles/RSL |
| **Repair Process Information:** | Repair processes are done manually. Parts are replaced with identical parts from a standard repair kit specific to the product. |
| **Further assumptions for scenario development:** | There is no repair kit available for this specific SKU. |

## Replacement (B4)
B4 Module

| | |
|---|---|
| **Reference Service Life:** | 20 Years |
| **Replacement Cycle:** | 2.8 (ESL/RSL)-1 |
| **Further assumptions for scenario development:** | Product replacement over a 75-year building ESL with a 20-year assumed RSL for Watts valve products, is calculated as a total of 3.8 [75 / 20 = 3.75, rounded-up to the nearest tenth] of valves needed over the building's lifetime. Total replacement is calculated as 2.8 [75 / 20 – 1 = 2.75, rounded-up to the nearest tenth] of valves. B4 includes these life cycle stages (A1-A5, C2 and C4). |

## End of Life
C1 - C4 Modules

### Collection Process

| | |
|---|---|
| **Collected Separately:** | 1.247379018 kg |

### Recovery

| | |
|---|---|
| **Landfill:** | 1.247379018 kg |

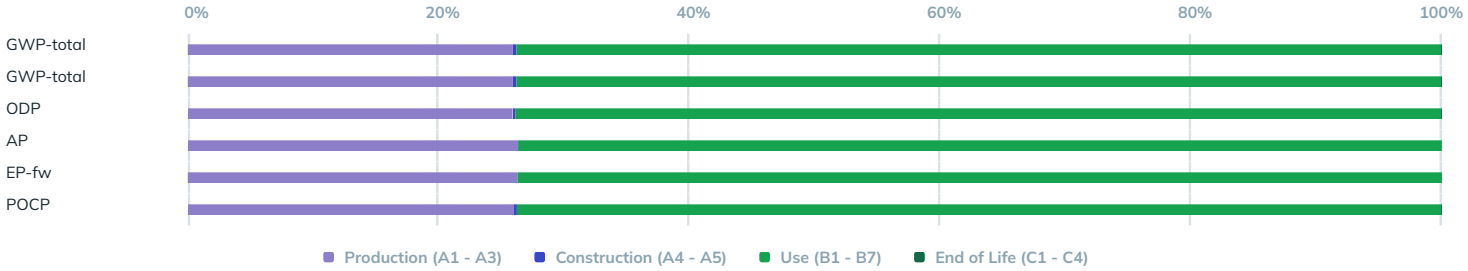
**Assumptions for scenario development:**

A 16-32 metric ton, EURO3 truck is used for EOL transportation with an average distance of 100 km by truck (C2).
Due to mixed materials product is assumed to be landfilled at 100% rate (C4).

# Interpretation

The analysis of Watts valve products provides useful insights regarding the cradle-to-grave environmental impacts. The LCA results also identify where substantial impacts are occurring to allow further process and materials improvements to be implemented by Watts. The cradle-to-grave impacts for all products are dominated by the B4 replacement phase as ~2.8 declared units are needed to reach the 75 year building lifespan per the PCR requirement. This stage typically accounts for ~70%

of the impacts throughout the products' lifecycle. After this the second largest contributor is the A1 Raw Materials Extraction and Processing stage. This stage accounts for ~10-20% of the lifecycle impacts. The A3 Manufacturing stage accounts for 5-10% of the impacts, with the other stages accounting for <1%.




## Environmental Activities and Certifications

| Certification |
| --- |
| ISO 9001 |
| ISO 14001 |

# Further Information

## Impact Assessment with REC

| LCIA Method | Impact Category | Unit | 1/2" A1A2A3 | 3/4" A1A2A3 | 1" A1A2A3 |
|---|---|---|---|---|---|
| IPCC AR5 GWP 100 | IPCC AR5 GWP 100 | kg CO2 eq | 1.06E+01 | 1.68E+01 | 2.00E+01 |
| TRACI 2.1 | GWP 100 | kg CO2 eq | 1.05E+01 | 1.67E+01 | 1.99E+01 |
| TRACI 2.1 | ODP | kg CFC 11 eq | 1.67E-07 | 2.13E-07 | 2.82E-07 |
| TRACI 2.1 | AP | kg SO2 eq | 4.17E-01 | 7.43E-01 | 8.51E-01 |
| TRACI 2.1 | EP | kg N eq | 1.28E-01 | 2.26E-01 | 2.59E-01 |
| TRACI 2.1 | POCP | kg O3 eq | 1.62E-02 | 2.86E-02 | 3.29E-02 |

## Impact Assessment Percent Reduction with REC

The 1/2" to 1" product range percent reduction of cradle-to-gate impacts with Renewable Energy Credits (RECs) is calculated as:

IPCC AR5 GWP 100, GWP-total = 11.76% -13.79% reduction
TRACI 2.1, GWP-total = 11.76% -13.79% reduction
TRACI 2.1, ODP = 2.69%-2.87% reduction
TRACI 2.1, AP = 0.18% -0.23% reduction
TRACI 2.1, EP-fw = 0.19% -0.24% reduction
TRACI 2.1, POCP = 0.55% -0.70% reduction

## Functional Unit for Each Size

1/2 LFMMVM1-UT: 1 packaged product with a mass of 0.929 kg
3/4 LFMMVM1-UT: 1 packaged product with a mass of 1.118 kg
1 LFMMVM1-UT: 1 packaged product with a mass of 1.347 kg

# References

Product Page: https://www.watts.com/products/plumbing-flow-control-solutions/hydronic-steam-heating/boiler-feed-water-pressure-regulators/b911/b911s-m3
Product Specification: https://www.watts.com/dfsmedia/0533dbba17714b1ab581ab07a4cbb521/20277-source/es-911-pdf
BOM information: Internal ERP System

Other References:
ACLCA. (2019). ACLCA Guidance to Calculating Non-LCIA Inventory Metrics in Accordance with ISO 21930:2017. ACLCA.
Bare, J., Gloria, T., & Norris, G. (2006). Development of the Method and U.S. Normalization Database for Life Cycle Impact Assessment and Sustainability Metrics. Environmental Science & Technology .
Bare, J., Norris, G., Pennington, D., & McKone, T. (2003). TRACI: The Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts. Journal of Industrial Ecology .
Boulay A.M., B. J. (2018). The WULCA consensus characterization model for 108 water scarcity footprints: Assessing impacts of water consumption based on available water remaining (AWARE). . The International Journal of Life Cycle Assessment .
Center of Environmental Science, L. U. (2016). CML-IA Characterisation Factors.
Frischknecht, R., Jungbluth, N., Althaus, H., Doka, G., Dones, R., Hischier, R., . . . Nemecek, T. (2007). Implementation of Life Cycle Impact Assessment Methods: Data v2.0. Dübendorf, Switzerland: ecoinvent report No. 3, Swiss centre for Life Cycle Inventories.
IPCC, I. P. (2013). IPCC Fith Assessment report. The PhysicalSceince Basis. Retrieved from http://www.ipcc.ch/report/ar5/wg1/.

ISO 14025. (2006). ISO 14025:2006: Environmental labels and declarations — Type III environmental declarations — Principles and procedures. International Organization for Standardization.
ISO 14040. (2006). ISO14040:2006/Amd 1:2020 -- Environmental management -- Life cycle assessment -- Principles and framework. International Organization for Standardization.
ISO. (2006). ISO 14040:2006 Environmental management - Life cycle assessment - Principles and framework. International Organization for Standardization (ISO).
ISO. (2006). ISO 14044:2006 Environmental management - Life cycle assessment - Requirements and guidelines. International organization for Standardization (ISO).
ISO 21930. (2017). Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services.
UL. (2018). Product Category Rules for Building Related Products and Services, Part A: Life Cycle Assessment Calculation Rules and Report Requirements UL 10010, v3.2. UL.
UL. (2020). Product Category Rules (PCR) Guidance for Building-Related Products and Services – Part B: Kitchen and Bath Fixture Fittings and Accessory Products EPD Requirements, UL Environment, (UL 10010-34, Edition 2).
UL. (2024). Product Category Rules for UL Part B: Kitchen and Bath Fixture Fittings and Accessory Products EPD Requirements, UL Standard 10010-28, Version 1.0.
Weidema B P, B. C. (2013). Overview and methodology. Data quality guideline for the ecoinvent database version 3. St. Gallen: The ecoinvent Centre.