ENVIRONMENTAL PRODUCT DECLARATION

VITREOUS CHINA

Calculations based on ISO 14025,
EN 15804 and EN 16578

1. General Information

VITREOUS CHINA

Owner of the EPD:
Roca Sanitario S.A.
Av. Diagonal 513, 08029 Barcelona

Declaration number:
01/2018

Reference standards:
UNE-EN 15804:2012 + A1:2014 Sustainability in construction. Environmental product declarations.
UNE-EN 16578:2017 Ceramic sanitary appliances. Sustainability assessment.
UNE-EN ISO 14025:2010 Environmental labels and declarations. Type III environmental declarations. Principles and procedures.

Date of the declaration:
24th January 2018

Valid until:
24th January 2023

Declared product/unit:
This Environmental Product Declaration refers to one tonne of vitreous china, for an average product such as basins, bidets, urinals, cisterns and shower trays including accessories such as pedestals, trap covers and shelves.

Scope
The aim of this study is to prepare a LCA (Life Cycle Analysis) for the vitreous china produced
by the Roca Sanitario S.A.
Due to comparable manufacturing methods at the different plants, an average product is analyzed for basins, bidets, WCs, urinals, cisterns and shower trays, as well as complementary accessories; pedestals, trap covers and shelves, based on the total volume of sales of these products in 2017.
The owner of the declaration is resposible for the information included herein, the life cycle assessment data and the evidence.
UNE-EN 16578:2017 describes the rating of product categories.
The results are as shown in this document.

2. Product

2.1 PRODUCT DESCRIPTION

Vitreous china sanitary appliances mainly include basins, bidets, WCs, urinals, cisterns and shower trays, including the accessories mentioned above. These products are made of materials such as clay, kaolin, quartz and feldspar. After the preparation of the slip, the mixture is cast, dried, glazed and then finished to obtain vitreous china sanitary ware. To calculate the environmental impact, a representative average vitreous china product based on the total volume manufactured in 2017 has been considered.

2.2 APPLICATION

The group of vitreous china sanitary ware includes basins, bidets, WCs, urinals, shower trays and cisterns, including acccessories such as pedestals, trap covers and shelves, as well as specific bathroom products used for personal hygiene.

2.3 TECHNICAL DATA

This document has taken into account the wide variety of sizes manufactured of the different vitreous china products.

2.4 PLACING ON THE MARKET / APPLICATION RULES

The vitreous china sanitary ware manufactured in the different production plants of the Roca Sanitario S.A. are subject to the following international standards.

Europe (EU):
Directive (EU) No. 305/2011 applies for placing the products on the market in the EU/EFTA.
The products require a Declaration of Performance and CE marking taking into consideration:
EN 997:2012 and EN 997/A1:2015 WC pans and WC suites with integral trap and/or
EN 13407:2015 Wall-hung urinals
Functional requirements and test methods and/or
EN 14528:2015 Bidets - Functional requirements and test methods and/or
EN 14688:2015 Sanitary appliances-Washbasins -Functional requirements and test methods and/or
EN 14527:2016 Shower trays for domestic purposes.

Australia (AS):
AS 1976: Vitreous china used in sanitary appliances
AS 1172.1: Pans
AS 1172.2: Cisterns
AS 3982: Urinals
AS / NZS 1730: Washbasins
AS 3494: Bidettes and bidets
AS /NZS 6400: Water efficient products - Rating and labelling

USA (ASME):
ASME A112.19.2 / CSA B45.1: Ceramic plumbing fixtures
ASME Al 12.19.14: Six-litre water closets equipped with a dual flushing device
ASME Al 12.19.19: Vitreous china non-water urinals

France (NF):
NF D14-601: Sanitary appliances: material enamelled - General specifications
NF D12-101: Sanitary appliances - Sanitary ceramic WC pans
NF D12-203: Sanitary appliances - Equipped flushing cisterns for toilet bowl
NF D11-101: Sanitary appliances - Sanitary ceramic wash basins
NF D11-201+A1: Household management -Conditions of assembly and installation of wash basins
for accomodating handicapped

Malaysia (MS):
MS 147: Specification for quality of vitreous china sanitary appliances
MS 1522: Vitreous china water closet pans specification
MS 795-1: WC flushing cisterns - PART I: Specification
MS 795-2: WC flushing cisterns - PART II: Inlet Valves
MS 795-3: WC flushing cisterns - PART III: Flushing devices

Singapore (SS):
SS 574 Part I: Dual flush low capacity water closet (WC) up to 4.51/31, WC flushing cisterns
SS 574 Part II: Dual flush low capacity water closet (WC) up to 4.51/31, WC pans

PRC National standard / China (GB):
GB 6952: Sanitary ware

Philippines (PNS):
PNS 156: Ceramic plumbing fixtures

Indonesia (SNI):
SNI-03-797: Water closet

Thailand (TIS):
TIS 792: Ceramic sanitary ware: water closets

2.5 PRESENTATION OF THE PRODUCTS

Average weight of products upon delivery, excluding packaging:

Product	Weight	Units
Basins	16,3	Kg
Bidets	24,5	Kg
WCs	38,0	Kg
Urinals	37,0	Kg
Cisterns	11,2	Kg
Shower trays	37,0	Kg

2.6 BASE AND AUXILIARY MATERIALS

The following table provides an overview of the average composition of the vitreous china used in the manufacturing of the different products:

Material	Value	Unit
Clay and fireclay	407,91	kg/t
Kaolin	388,81	kg/t
Quartz	157,22	kg/t
Feldspar	408,20	kg/t
Chalk	0,00	kg/t
ZnO	3,17	kg/t
$BaCO_3$	0,20	kg/t
LiO_2	0,22	kg/t
ZrO_2	4,29	kg/t
Plaster	9,76	kg/t
Resin	0,04	kg/t

The packaging is calculated with an average weight evaluation per factory. For an average product, 37.90 kg of cardboard, 31.40 kg of wood and 4.55 kf of plastic are estimated to be required for packaging per declared unit (tonne).

1

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2.7 MANUFACTURING PROCESS

The raw materials supplied are mainly stored in silos. A small percentage of the raw materials used is supplied in sacks and/or big-bags. The stages of the production process are as follow:

1. Unloading of raw materials

Mineral raw materials (clay, kaolin, feldspar and silica) are unloaded from trucks in the areas marked for this purpose.

2. Preparation of the slip

The raw materials are taken to the mixer, where they are blended with osmotic water. The resulting mixture is sieved and pumped into the storage tanks and kept in suspension with the help of agitators. The paste resulting from this operation is known as slip.

3. Casting

Once the quality of the desired mixture has been obtained and controlled by the laboratory, the slip is pumped into the overhead casting tanks. From there, it feeds the casting lines by gravity, where it is injected into hermetically sealed plaster moulds, moulds in which the piece is formed. Other pieces are also produced using plastic moulds with medium pressure slip injection, although to a lesser extent. The plaster moulds used are produced in the same plant and are manufactured by filling a mixture of plaster and water into araldite master moulds. After setting, the master moulds are separated and the plaster moulds are removed and transported to the dryers for their first dehydration prior to their use.

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4. Drying

Once the piece has achieved a mechanical consistency within the plaster mould, it is removed manually or automatically, depending on the line or its difficulty. These pieces are placed on trolleys and transported to the different dryers, where they are dried with hot air. Once dry, they are transported again by trolleys, this time to the polishing and enamelling line.

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5. Enamelling

The enamel applied is prepared in an adjoining room where the raw materials, which are stored in silos, are weighed before being dissolved with osmotic water. The product obtained is fed into ball mills that reduce the base particles and pigments to the desired fineness.

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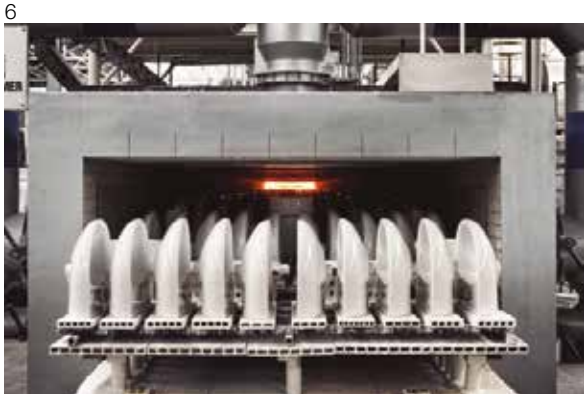

6. Firing

The enamelled pieces are then transported to the kiln area for their firing. The process of heating, firing, enamel vitrification and cooling takes place inside the kiln.

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7. Inspection and control

The pieces leaving the kiln are sent to the inspection and control area, where the defective pieces are separated from the conforming ones. Those that pass the final inspection are packed up and palletised for their transport to the dispatch warehouse. The complete cycle for the manufacturing of sanitary ware lasts approximately two to three days.

Production plants

The following production plants of the ROCA Group have been analysed for the preparation of this document:

- Gavà – Viladecans (Spain)
- Burgos (Spain)
- Colmeias (Portugal)
- Anadia (Portugal)
- Settat (Morocco)

Comments

• Some vitreous china models are manufactured in different productions plants of the ROCA Group.

• With the aim of ensuring a constant high quality, thorough inspections are carried out throughout all processes, starting with the delivery of the raw materials and during all stages.

• One of the objectives is to achieve a high recycling rate in order to avoid the generation of waste.

• The production plants analysed are certified under UNE-EN ISO 9001:2015. Work is under way to achieve UNE-EN ISO 14001:2015 certification in the five analysed production plants.

• Water and energy management systems are available in all processes, minimising the consumption of both resources being one of the main environmental priorities of the group.

2.8 ENVIRONMENT AND PREVENTION OF OCCUPATIONAL RISKS DURING THE MANUFACTURING OF PRODUCTS

All applicable legal requirements regarding the Environment and Occupational Risk Prevention are met in all the analysed production plants.

2.9 PROCESSING – INSTALLATION OF THE PRODUCTS

All applicable legal requirements are met for the processing machines and facilities existing in all analysed production plants. In particular, the manufacturing process complies with the applicable national legal requirements on dust extraction in each case. The necessary installation tools and/or the use of auxiliary materials for the finished products are listed in the assembly instructions supplied with the product.

2.10 PACKAGING

The vitreous china products are packed in cardboard boxes and shrink-wrapped plastic. They are then stacked on wooden pallets that are grouped together by strapping and/or shrink-wrapping.

2.11 CONDITIONS OF USE

There are no particular characteristics in the composition of the products to be taken into consideration during their use.

2.12 ENVIRONMENTAL REQUIREMENTS AND RISKS DURING USE

The vitreous china pieces are fired at very high temperatures, therefore their solid structure is chemically stable. The product has no negative impact on the environment and health during its entire life cycle.

2.13 REFERENTIAL LIFE CYCLE

By following the manufacturer's instructions for the use and maintenance of each product, a life cycle of approximately 40 years can be achieved for vitreous china products.

2.14 OTHER CONSIDERATIONS

Fire
Vitreous china sanitary ware, in compliance with DIN 4102-1, is classified as non-flammable building products.

Water
In the event of unforeseen impacts of water on vitreous china sanitary ware (e.g. flooding), no negative impacts on the product itself or on the environment are expected.

Mechanical damage
In the event of small and unexpected mechanical damage, no significant impact on the function of the vitreous china sanitary ware should be expected.

2.15 REUSE OF MATERIALS

The recycling of all materials that make up vitreous china sanitary ware is technically possible with adequate management processes.

2.16 ELIMINATION

In Europe, vitreous china sanitary ware is currently reused together with construction waste (refractory material, debris). The European Waste List (EWL) codes for the classification and management of waste produced after the use of the different materials that make up vitreous china sanitary ware are listed below:

- 101213. Waste resulting from the manufacturing of ceramic products, bricks, tiles and building materials
- 150101. Paper and cardboard packaging
- 150102. Plastic packaging
- 170107. Building and demolition waste: tiles and ceramic materials

2.17 ADDITIONAL INFORMATION

Additional information is available on www.roca.es

3. LCA: Calculation rules

3.1 DECLARED UNIT

Since the manufacturing methods at the different plants of the Roca Sanitario S.A. are comparable, the average product is made up of basins, bidets, WCs, urinals and shower trays as well as pedestals, trap covers and shelves as accessories, based on the total sales volume of the different products in 2017.

A declared unit of one tonne is taken as the basis for calculating the LCA (Life Cycle Assessment) for vitreous china sanitary ware. All the environmental impacts of the product are calculated on the basis of one tonne (t) of vitreous china sanitary ware.

Chapter 2.5 details the average weights of the different manufactured types of products.

Per declared unit (1t), the packaging of an average product is estimated at 37.90 kg of cardboard, 31.40 kg of wood and 4.55 kg of plastic.

A1

A2

A3

3.2 LIMITS OF THE CALCULATION SYSTEM

The calculation system includes all relevant stages during the manufacturing of vitreous china sanitary ware. In accordance with UNE-EN 15804, therefore, all the processes included in the three main phases A1-A2-A3 defined below are considered:

•Phase A1: Supply and production of raw materials and packaging materials

•Phase A2: Transport of raw materials and packaging materials to the production plants

•Phase A3: Production of vitreous china sanitary ware and processing and elimination of production waste.

The subsequent transport of the finished products to the places of use and/or distribution is not taken into account in the calculations made.

The images shown below represent a general description of the system limits in this study:

3.3 ESTIMATES AND GENERAL CONSIDERATIONS

The manufacturing processes are directly controlled, therefore the accuracy of the data included in this report is considerable, minimizing the data estimation.

3.4 CRITERIA FOR DATA COLLECTION

All data for the period described in Chapter 3.7 are taken into account. Considering the reliability and accuracy of the processed data, the sum of the fractions of products not taken into account in the calculations shall not exceed 5% of the total flow by weight.

3.5 BACKGROUND INFORMATION

To carry out the calculations included in this document and model the life cycle of the analysed products, a data processing system developed internally by the Environment Department has been used. All the relevant data records on the manufacturing and disposal of products come from databases controlled by the different analysed plants.

3.6 QUALITY OF THE ANALYSED DATA

All data used in this document come from the databases controlled by the different analysed plants, including internal production assessment data, environmental data, data relevant to LCA within the supply chain and relevant data on energy supply. The mentioned data are verified internally on a regular and consistent basis and are therefore considered to be clearly representative.

3.7 REVISED PERIOD

This document considers the data corresponding to the year 2017.

3.8 ASSIGNMENT

The information contained in this document refers to the reference products. No production data has been assigned.

3.9 COMPARABILITY

A comparison of the EPD (Environmental Production Declaration) data is only possible if all the data sets to be compared are created according to UNE-EN 15804 and both the context of the building and the specific characteristics of the product are taken into account.

4. LCA: Scenarios and additional technical information

The following technical information defines the declared modules. It can be used to develop specific scenarios in the context of the evaluation of a building if the modules are not declared (NDM).

1. Production stage	2. Assembly stage	3. Use stage	4. End-of-life-cycle stage	5. Benefits and burdens outside the system
(Declared)	(Non declared module)	(Non declared module)	(Non declared module)	(Non declared module)
-Supply of raw materials (A1) -Transport (A2) -Production (A3)	-Transport to the place of use -Assembly	-Use -Maintenance -Repairs -Replacement -Refurbishment -Operational use of energy -Operational use of water	-Demolition -Transport -Water processing -Deposition	-Reuse -Recovery -Recycling potential

5. Results of the LCA (life cycle assessment)

ENVIRONMENTAL IMPACT PER 1 TN OF VITREOUS CHINA SANITARY WARE

			Supply	Transport	Manufacturing	EPD data summary
4.2.4.2	Global Warming Potential	[kg CO_2 - Aq./t]	3,63E+02	1,64E-02	3,38E+03	3,74E+03
4.2.4.3	Depletion potential of the stratospheric ozone layer	[kg CFC11 – Aq. /t]	6,35E-08	0,00E+00	4,75E-07	5,38E-07
4.2.4.4	Acidification potential of land and water	[kg SO_2 – Aq. /t]	8,10E-01	3,63E-03	3,48E+00	4,29E+00
4.2.4.5	Eutrophication potential	[kg PO^{3-}_4 - Aq/t]	1,14E-01	7,66E-04	1,95E-01	3,09E-01
4.2.4.6	Formation potential of tropospheric ozone photochemical oxidants	[kg Ethen. – Aq. /t]	1,46E+00	3,59E-02	7,09E-01	2,20E+00
4.2.4.7	Abiotic depletion potential for non fossil resources	[kg Sb – Aq. /t]	0,00E+00	0,00E+00	9,57E-03	9,57E-03
4.2.4.8	Abiotic depletion potential for fossil resources	[MJ/t]	9,29E+01	3,30E-07	6,79E+02	7,72E+02

RESOURCES USED FOR 1 TN OF VITREOUS CHINA SANITARY WARE

			Supply	Transport	Manufacturing	EPD data summary
4.2.2.1	Use of renewable primary energy	[MJ/t]	1,70E+01	1,43E-06	1,24E+02	1,41E+02
4.2.2.2	Use of renewable primary energy resources used as raw materials	[MJ/t]	0,00E+00	0,00E+00	1,24E+02	1,24E+02
4.2.2.3	Total use of renewable primary energy resources	[MJ/t]	1,70E+01	1,43E-06	2,48E+02	2,65E+02
4.2.2.4	Use of non renewable primary energy	[MJ/t]	3,80E+02	1,69E-05	2,76E+03	3,14E+03
4.2.2.5	Use of non renewable primary energy resources used as raw materials	[MJ/t]	0,00E+00	0,00E+00	2,61E+01	2,61E+01
4.2.2.6	Total use of non renewable primary energy resources	[MJ/t]	3,80E+02	1,69E-05	2,78E+03	3,16E+03
4.2.2.7	Use of secondary material	[kg/t]	1,43E+01	-4,56E-02	1,05E+02	1,19E+02
4.2.2.8	Use of renewable secondary fuels	[MJ/t]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
4.2.2.9	Use of non renewable secondary fuels	[MJ/t]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
4.2.2.10	Use of net fresh water	[m^3/t]	1,44E+01	8,83E-01	4,55E+00	1,98E+01

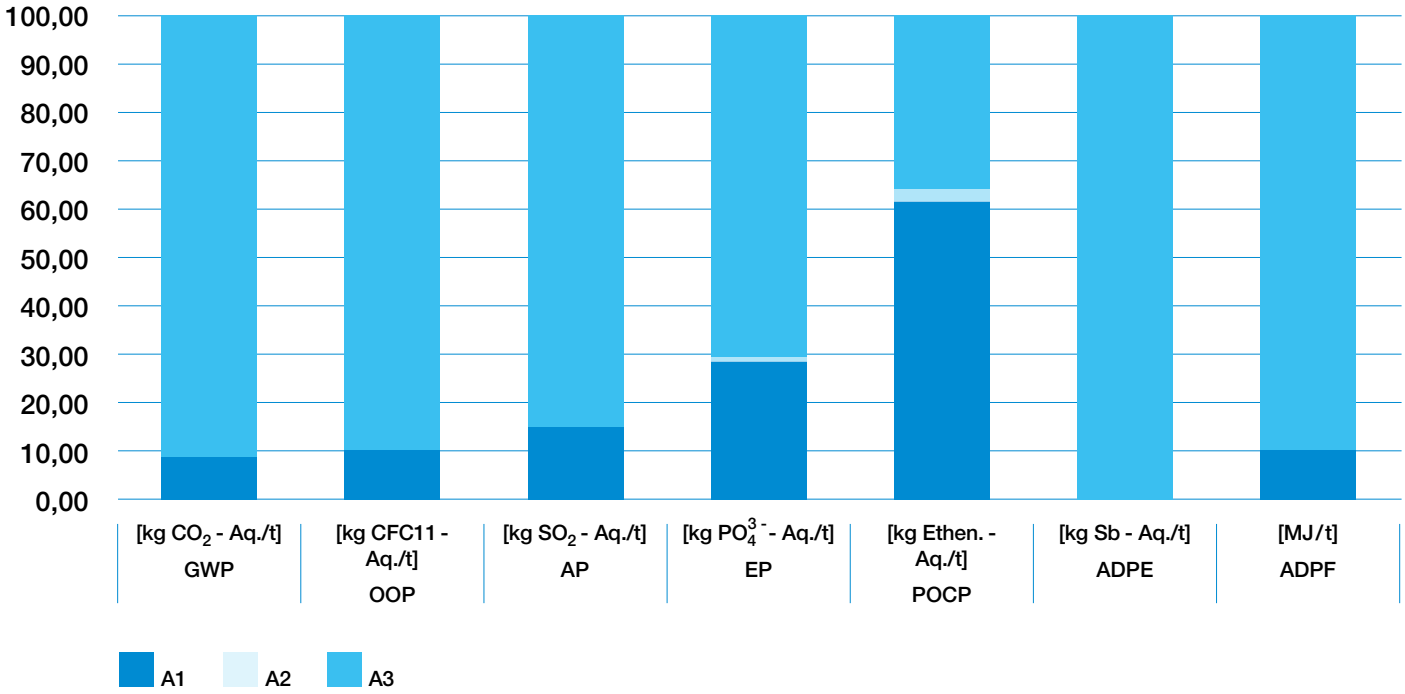
OUTPUT FLOWS AND WASTE CATEGORIES GENERATED BY 1TN OF VITREOUS CHINA SANITARY WARE

			Supply	Transport	Manufacturing	EPD data summary
4.2.3.1	Hazardous waste disposed	[kg/t]	7,10E-01	0,00E+00	7,80E-01	1,49E+00
4.2.3.2	Non hazardous waste disposed	[kg/t]	7,29E+02	1,54E-03	5,37E+03	6,10E+03
4.2.3.3	Radioactive waste disposed	[kg/t]	1,43E-02	0,00E+00	0,00E+00	1,43E-02
4.2.3.4	Components for re-use	[kg/t]	7,14E+00	0,00E+00	1,12E+01	1,83E+01
4.2.3.5	Materials for recycling	[kg/t]	2,09E+00	0,00E+00	5,25E-02	2,14E+00
4.2.3.6	Materials for energy recovery	[kg/t]	7,17E-01	0,00E+00	7,34E-04	7,17E-01
4.2.3.7	Exported electrical energy	[MJ/t]	0,00E+00	0,00E+00	0,00E+00	0,00E+00
4.2.3.8	Exported thermal energy	[MJ/t]	0,00E+00	0,00E+00	0,00E+00	0,00E+00

6. LCA: Interpretation

The following chart aims to show the interpretation of the LCA results included in section 5:

Results chart



The chart shows the main parameters that make up the product's environmental profile.

In phase A1, the main environmental impacts are related to the consumption of energy and resources (raw materials).

Phase A2, representing the transport of raw materials to production plants, represents a relatively small impact on the outcome of the LCA.

Phase A3 includes the impacts caused by the production processes in the different manufacturing plants. It is the stage with the greatest environmental impact, especially in terms of energy and resource consumption.

7. Evidences (Reach)

With regard to the compliance with the REACH regulations, the production of vitreous china sanitary ware by the Roca Sanitario S.A. does not imply the need to carry out any registration procedure or to prepare safety data sheets associated with the manufactured products.

Product sustainability: see section 9 of this document for an assessment of sustainability according to UNE-EN 16578.

8. Product rating according to UNE-EN 16578

Pillar 1

"Ecological requirements" covers the applicable requirements of information modules A1 to A5 of UNE-EN 15804.

Pillar 2

"Economic requirements" covers the applicable requirements of information modules B1, B6 and B7 of UNE-EN 15804.

Pillar 3

"Social requirements" covers other applicable requirements of the information modules B2 to B5 of UNE-EN 15804.

The weighting factors for the three pillars are in accordance with UNE-EN 16578 (Annex B, chart B.4):

Factor 3	for Pillar 1 (e.g. raw material, transport, production and transport to the market).
Factor 2	for Pillar 2 (e.g. water and energy consumption).
Factor 1	for Pillar 3 (e.g. cleaning and noise).

For assessment purposes, the analysed products have been grouped into categories, considering that the result of the assessment of any product in the category is representative for all products in the same category.

The final results are presented according to the evaluation scheme established in UNE-EN 16578 Annex B, from S1 to S7, with S7 being the highest level.

Correlation of the achieved rating value with the sustainability class:

Range of rating values (%)	Sustainability class
<79	S1
>79 - <87	S2
>87 - <96	S3
>96 - <104	S4
>104 - <113	S5
>113 - <121	S6
>121	S7

8.2. RATING OF WCs

For the rating of the product according to UNE-EN 16578 Annex B (Evaluation scheme), all the ranges of manufactured WCs were taken into account.

Rating according to EN 16578 (WCs)	WC 1	WC 2	WC 3	WC 4
Average flush volume per WC	3,75 L (suite)	3,38 L (suite)	2,50 L (suite)	3,38 L (suite)
Name / Product Type	6/3 WC	4,5/3 WC	4/2 WC	WC Intank A893301000
Part 1: Ecological criteria (4.2.)	103 %	103 %	103 %	103 %
Part 2: Economic criteria (4.3.)	125 %	129 %	137 %	113 %
Part 3: Social and Functional Criteria (4.4.)	93 %	93 %	93 %	93%
Full rating	109 %	110 %	113 %	105 %
Sustainability class	S5	S5	S5	S5

8.3. RATING OF URINALS

For the rating of the product according to UNE-EN 16578 Annex B (Evaluation scheme), all the urinals manufactured according to the LCA data in accordance with UNE-EN 16578 / UNE-EN 15804 shown in point 5 (Results) were taken into account.

Rating according to EN 16578 (Urinals)	Urinals 1	Urinals 2
Average flush volume per piece	1,00 L	3,00 L
Name / Product Type	1L Urinal	Urinario EURET A35945E000
Part 1: Ecological criteria (4.2.)	103 %	103 %
Part 2: Economic criteria (4.3.)	128 %	111 %
Part 3: Social and Functional criteria (4.4.)	87 %	87 %
Full rating	109 %	103 %
Sustainability class	S5	S4

8.4. RATING OF ADDITIONAL VITREOUS CHINA APPLIANCES

For the rating of the product according to UNE-EN 16578 Annex B (evaluation scheme), all ceramic medical devices manufactured according to LCA data in accordance with UNE-EN 16578 / UNE-EN 15804 shown in point 5 (Results) were taken into account.

Rating according EN 16578 (further products)	Basins	Bidets	Shower trays	Kitchen sinks	Others
Part 1: Ecological criteria (4.2.)	103 %	103 %	103 %	103 %	103 %
Part 2: Economic criteria (4.3.)	128 %	128 %	128 %	128 %	128 %
Part 3: Social and Functional criteria (4.4.)	87 %	87 %	87 %	87%	100 %
Full rating	109 %	109 %	109 %	109 %	111 %
Sustainability class	S5	S5	S5	S5	S5

9. References

UNE-EN 16578 has been used as Product Category Rules (PCR)
DIN EN ISO 14025:2011-10: Environmental labels and declarations-Type III environmental declarations — Principles and procedures

ISO 14040: 2006, Environmental management-Life Cycle Assessment- Principles and framework
ISO 14044: 2006, Environmental management- Life Cycle Assessment- Requirements and guideline
UNE-EN 15804: 2012+A1 2014: Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products
UNE-EN 16578: 2017 Ceramics sanitary appliances — Sustainability assessment ecoinvent - Database for ecobalancing, version 2.2. Swiss Centre for Life Cycle Inventories, St. Gallen.

Europe (EN):
EN 997:2012 and EN 997/A1:2015 WC pans and WC suites with integral trap and/or
EN 13407:2015 Wall-hung urinals - Functional requirements and test methods/ and/or
EN 14528:2015 Bidets- Functional requirements and test methods and/or
EN 14688:2015 Sanitary appliances-Washbasins - Functional requirements and test methods and/or
EN 14527: 2016 Shower trays for domestic purposes

ELCD - European Reference Life Cycle Database, version 2.0. European Commission,
Joint Research Centre - Institute for Environment and Sustainability and DG Environment - Directorate G (2008)

JRC - European Reference Life Cycle Database, version 2.0. European Commission,
Joint Research Centre - Institute for Environment and Sustainability and DG Environment - Directorate G (2008)
Waste keys-COMMISSION DECISION of 18 December 2014 amending Decision 2000/532/EC on the list of waste pursuant to Directive 2008/98/EC of the European Parliament and of the Council (2014/955/EU)

Abbreviations:
PCR = Product Category Rules
EPD = Environmental Product Declaration
LCA = Life Cycle Analysis

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