

Environmental Product Declaration

EN ISO 14025:2010

EN 15804:2012+A1:2013

Ceramic Tiles. Porcelain stone- ware tiles (water absorption group Bla EN 14411: 2016)

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MAINZU
c e r a m i c a

MANUFACTURA INDUSTRIAL AZULEJERA S.L.
(MAINZU, S.L.)



The EPD holder is responsible for the content of the Declaration. The holder is responsible for keeping the records and documents supporting the content of the Declaration

Holder of Declaration



MANUFACTURA INDUSTRIAL AZULEJERA S.L.
(MAINZU S.L.)
Camí de la Travessa, 17
12540 Vila-real (Castellón)
Spain

Tel (+34) 964 50 63 00
Mail mainzu@mainzu.com
Web www.mainzu.com



Instituto de Tecnología Cerámica

LCV Study

Instituto de Tecnología Cerámica – (ITC-AICE)
Campus Universitario Riu Sec,
Avda. de Vicent Sos Baynat s/n
12006 Castellón
Spain

Tel (+34) 964 34 24 24
Mail r_medioambiente@itc.uji.es
Web http://www.itc.uji.es

Operator of the GlobalEPD



AENOR CONFÍA, S.A.U.
Génova 6
28004 Madrid
Spain

Tel (+34) 902 102 201
Mail aenordap@aenor.com
Web www.aenor.com

AENOR is a founding member of ECO Platform, the European Association of Environmental Declarations Verification Programmes

EN 15804:2012+A1:2013 Standard serves as the core RCP

Independent verification of the declaration and data, according to EN ISO 14025:2010

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Internal



External

Verification body

AENOR

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1 General information

1.1. The organization

MANUFACTURA INDUSTRIAL AZULEJERA, S.L. (MAINZU) is a company that cares about technology innovation investment, in fact, innovation is one of our most important characteristics.

MAINZU is in a constant search of new designs, material effects, investigating new shapes and colours.

MAINZU has been in the market for 55 years, commercializing our ceramic products in a hundred countries. This has implied a high level of professionalization of every department.

However, our most important characteristic is that we have not forgotten our origin. MAINZU was created by a ceramist family. We love our work and the personal treatment is essential for us. From our point of view, earthenware tiles are not a simple product. Our ceramic products become part of households for many years, participating in the daily life of each home.

As workers in the industry MAINZU should, in addition to supply customers with an optimum quality product, provide proposals where people could identify themselves, making it possible the personalization of every home.

1.2. Scope of the Declaration

This Environmental Product Declaration includes environmental information about a product aggragation manufactured by MAINZU, in the geographical and technological environment of Spain in the year 2018.

The results show the environmental behaviour of the ceramic coverings belonging the average BIII group, as well as the environmental data of the tiles which present a minimum and maximum impact, thus delimitating the results obtained in the LCA for the average product. The scope of this Environmental Product Declaration (from now on EPD) is from cradle-to-grave.

1.3. Life Cycle and conformity

This EPD was drafted and verified in accordance with the EN ISO 14025:2010 and EN 15804:2012+A1:2013 Standards and the Product Category Rules (PCR) listed in table 1.

Title	Ceramic coverings
Conformity	UNE-EN 15804
Programme	GlobalEPD
Programme Operator	AENOR

Table 1. EPD information

This EPD may not be comparable with those developed in other programs or under different reference documents; it may not be comparable with EPD that are not developed under EN 15804:2012+A1:2013 standard. In the same way, Environmental Product Declarations cannot be subject to comparison if the origin of the data is different (the databases, for example), if not all relevant information modules are included, or if they are not based on the same scenarios.

Comparison of construction products shall be based on the same function, using the same functional unit at building level (or architectural or civil engineering works), i.e. including the performance of the product during the life cycle and the requirements stated in EN ISO 14025:2010.

Product stage	A1	Raw material supply	X
	A2	Transport	X
	A3	Manufacturing	X
Const.	A4	Transport to construction work	MNE
	A5	Construction Installation process	MNE
Use stage	B1	Use	NR
	B2	Maintenance	MNE
	B3	Repair	NR
	B4	Replacement	NR
	B5	Refurbishment	NR
	B6	Operational energy use	NR
	B7	Operational water use	NR
End of life stage	C1	De-construction / demolition	NR
	C2	Transport	MNE
	C3	Waste processing	MNE
	C4	Disposal	MNE
	D	Benefits and loads beyond the system boundary	X
X = Information module included in LCA/EPD MNE = Module not evaluated			

Table 2. System boundaries. Information modules considered

2 The product

2.1. Identification of the product

This Environmental Product Declaration covers the ceramic tiles pertaining the water absorption group Bla (porcelain stoneware tiles), classification based on EN 14411:2016 (equivalent to ISO 13006:2018), this is their water absorption is less than 0.5%.

The porcelain stoneware tiles included in the study cover only one format.

2.2. Intended use of the product

The function of the product is to cover surfaces (floors). In this study the environmental behaviour of the porcelain stoneware tiles as indoor house surface covering has been assessed, however, the versatility of these pieces allows them to be installed in other places, such as offices, stores, hospitals, etc.

The product features are included in the technical datasheets which can be requested from the manufacturer, being them, the ones required by the EN 14411:2016 standard.

2.3. Composition of the product

None of the final product components are included in the Candidate List of Very Concerning Substances submitted to Authorisation.

Component	Content	Units
Clay, feldspar, sand and, deflocculants	98%	kg/m ²
Feldspar, carbonates, quartz, silica-tes, kaolin, zirconium oxide, clays, alumina, zinc oxide	2%	kg/m ²

Table 3. Product components



Figure 1. Installed product

3 Information regarding the LCA

3.1. Life Cycle Analysis

The Life Cycle Analysis which is the base of the present EPD has been carried out from the data directly provided by the manufacturer MAINZU, concerning its porcelain stoneware tiles manufactured between May 2019 – May 2020 in a production plant.

The Life Cycle Analysis in which this declaration is based has been carried out following the ISO 14040 and ISO 14044 standards, which meets the EN 15804:2012+A1:2013 standard.

The LCA has been carried out using GaBi 9.1.053 software and the data base version 8.007 (Thinkstep). The characterization factors used are those included in EN 15804:2012+A1:2013 standard.

3.2. Functional Unit

The functional unit considered is **“the covering of 1 m² surface (floor) for 50 years with ceramic tiles of porcelain stoneware”**.

3.3. Reference Service Life (RSL)

The durability of the product is the same as that of the building where it is installed, considering it is installed correctly, as it is a durable product which does not require substitution. A Reference Service Life of 50 years has been considered (see Table 4).

Parameter	Result
Reference service life	At least 50 years
Declared product properties (at the gate) and finishes, etc.	Values of the relevant characteristics according to standard EN 14411, Annex G Information included in the manufacturer's technical data sheet, according to the model.
Design application parameters (manufacturer's instructions), including the references to appropriate practices	MAINZU has instructions for installation, cleaning, and maintenance of ceramic tiles
An assumed quality of work, when installed in accordance with the manufacturer's instructions	MAINZU has instructions for installation, cleaning, and maintenance of ceramic tiles
Outdoor environment (for outdoor applications), e.g. weathering, pollutants, UV radiation and wind exposure, building orientation, shading, temperature	Values of the relevant characteristics according to standard EN 14411, Annex G Information included in the manufacturer's technical data sheet, according to the model.
Indoor environment (indoor applications), e.g. temperature, moisture, chemical exposure	Values of the relevant characteristics according to standard EN 14411, Annex G Information included in the manufacturer's technical data sheet, according to the model.
Usage conditions, e.g. frequency of use, mechanical exposure	Information included in the manufacturer's technical data sheet according to the model.
Maintenance, e.g. required frequency, type and quality and replacement of replaceable components	MAINZU has instructions for installation, cleaning, and maintenance of ceramic tiles

Table 4. Reference Service Life



Figure 2. Installed product

3.4. Allocation and cut off criteria

In this cradle-to-grave LCA study, a cut-off rule of 1% for the energy use (renewable and non-renewable) and 1% of total mass in those unitary processes, whose data is insufficient, have been applied. In total, more than 95% of all mass and energy inputs and outputs of the system have been included, excluding the not available nor quantified data.

The data excluded is the following:

- Diffuse particle emissions to the atmosphere during the transportation and storage of powdery nature raw materials.
- Non-regulated pollutants emitted from channelled emissions generated during combustion stages (spray drying, drying and firing).
- The recycling and reutilization of the wastes generated during the life cycle of the ceramic coverings according to LCA. However, the recycling process of the wastes and the benefits obtained from this recycled will be quantified in module D.
- Machinery and industrial equipment production due to the difficulty of inventorying every good involved, and because the LCA community considers that the environmental impact per unit of product is low in comparison with the rest of the processes which are in fact included. Moreover,

the databases used do not include these processes, thus their inclusion would require an extra effort outside the scope of the present study. Additionally, the residues generated during the machinery and equipment maintenance are excluded due to the low impact they represent.

3.5. Representativeness, quality and selection of data

The raw data has been directly provided by MAINZU. The secondary data comes from GaBi database, 8007 compilation and it has been modeled with GaBi 9.2.058 version. All data correspond to a geographical Spanish scene (May 2019-May 2020).

The results presented are representative of ceramic coverings, expressed as average values weighted by the production of the ceramic coverings pertaining Bla group.

3.6. Other calculation rules and hypotheses

The load assignments applied have been the necessary ones to quantify the specific data of the ceramic tiles as a covering material.



Figure 3. Installed product

4 System boundaries, scenarios and additional technical information

4.1. Processes previous manufacturing (upstream) and manufacturing of the product (A1-A3)

The present environmental product declaration refers to the environmental behaviour of large-format ceramic tiles manufactured by MAINZU.

All the product stage modules, relevant for the ceramic coverings according to the PCRs, have been included (Figure 4).

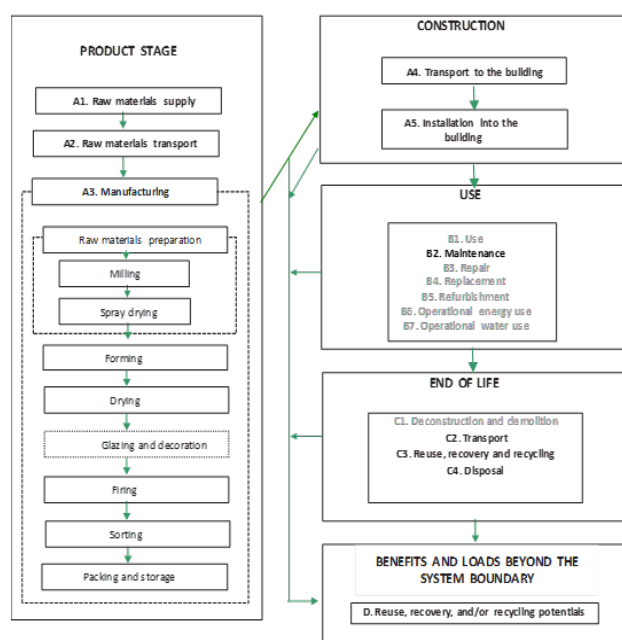


Figure 4. Boundaries of the system under study

Raw materials supply and transport (A1 y A2)

The raw materials required for the ceramic tiles manufacturing are classified as: plastic raw materials and non-plastic or degreasing raw materials. In general, it can be accepted that the proportion among these two types of raw materials should be such that the mixture obtained is as plastic as necessary to correctly mould the piece, and at the same time, it confers the enough resistance on green tiles to process them. The key plastic raw materials are clays and kaolins. The more common non-plastic or degreasing raw materials are silica sands and alkaline feldspars. Other raw materials to consider are the residues of the own plant, these can be sludge or fired or unfired tile scrap, which are introduced into the raw materials milling stage.

Regarding glaze raw materials, the most used in the formulation are the following ones: quartz, kaolin, alkaline feldspars, nepheline, calcium carbonate, dolomite, zircon, wollastonite, calcined alumina and ceramic frits. Moreover, ceramic pigments prepared in an external company are also used, generally by oxide calcination and additives, (deflocculants, bindings) in order to maintain the optimal rheologic properties of the suspension which would assist the glazing operations and the obtention of the required aspect (texture and colour uniformity).

The ceramic frits are insoluble glasses, prepared in an external company by complete fusion of their original raw materials, called "frits". It is estimated that around 25.5% of the raw materials used in the glaze applied on porcelain stoneware tiles are submitted to fritting process.

The raw materials used have different origins according to their nature and properties. The raw materials coming from outside Spain are transported by freighter to the port of Castelló, and from there by truck to the spray-dried granule production plants. For sea transport the freighter selected is a transoceanic one, whose distance traversed depends on the origin of each case, whereas for road transport a 27t truck which meets the Euro 6 standard has been chosen. All raw materials are transported in bulk, that is, they do not require packaging material, except the decoration materials which are transported in a 17,3t payload truck which meets the Euro5 standard, from the frits and glaze factory to MAINZU plant.

Product manufacturing (A3)

The raw material preparation of MAINZU is carried out by external companies. There, the origin and the proportion of raw materials is defined, adjusting it to the production process characteristics and the final performance required.

Once the spray – dried granule has been obtained, it is transported to MAINZU installations. The procedure is the following: the spray-dried powder is discharged in storage hoppers and with a feed system based in conveyor belts with weight control, this granule is sent to the forming stage by uniaxial dry pressing, carried out by hydraulic or oleodinamic presses. This is the most indicated method to control the pressing cycle.

UThe pieces formed are placed in a continuous dryer to reduce their humidity, duplicating or triplicating their mechanical resistance, what allows their subsequent processing.

The tiles coming from the dryer are covered with one or more thin layers of engobe and glaze, which are applied over the ceramic body through spraying and digital glaze techniques. Then, they are decorated using different types of applications. This treatment is used to confer the product surface a series of technique and aesthetic features, as impermeability, ease of cleaning, brightness, colour, superficial texture, chemical and mechanical resistance.

Firing is the most important stage of the ceramic tiles production process, as it is when the pieces, previously shaped, suffer a fundamental modification of their features, resulting tough, water and chemical resistant product. The ceramic pieces are subject to a single firing single-deck roller kilns.

Once the quality controls are met, the classified pieces are packaged in primary cardboard packs and wood pallets. Finally, they are covered with film.

4.2. Construction process

Transport to the construction site (A4)

Product distribution is as follows: 18% in Spain, 20% in Europe, and 62% to the rest of the world. Three transport scenarios were estimated.

Road transport was estimated based on a 27t truck, EURO VI class. Transcontinental transport was estimated based on an average transoceanic freighter. All models used are included in the database [GaBi v.9].

Parameter	Result
Fuel type and consumption	0.0131 l/m ² diesel oil (27 t truck) 0.0007 l/m ² fuel oil (freighter)
Distance	18% in Spain (300 km) 20% to the rest of Europe (1390 km) 62% to the rest of the world (6250 km)
Capacity utilisation (including empty returns)	85% in trucks 100% freighter
Bulk density of the transported products	415,4 kg/m ³
Volume capacity utilisation factor (factor: =1 or < 1 or □ 1 for compressed or nested packaged products)	0,18

Table 5. Transport to the construction site

Installation into the building (A5)

The product is then duly unpacked for installation. Data show that, in a real scenario, the tiles need to be installed with fast-setting mortars. Fast-setting mortars are cementitious adhesives that consist of a mixture of hydraulic binders, mineral fillers, and organic additives, which only need to be mixed with water or a liquid addition just before use. These mortars consist of a mixture of grey or white cement, mineral fillers of a siliceous and/or limestone nature, and organic additives: water retainers, water-redispersible polymers, rheological modifiers, fibres, etc.

Tile packaging waste is separately handled; the disposal mode depends on the geographic location of the installation site.

Parameter	Result
Material 1: Cementitious adhesive	3,5 kg/m ²
Use of fresh water	0,875 l/m ²
Use of other resources	Not applicable
Quantitative description of energy type (regional mix) and consumption during the installation process	Not applicable
Wastage of materials on the construction site before waste processing, generated by the product's installation (specified by type)	Packaging waste: Cardboard: 71,9 g Plastics: 12,6 g Wood: 331,4g
Output materials (specified by type) as a result of waste processing at the construction site	Incineration of cardboard: 9g Recycled cardboard: 37g Landfill disposal of cardboard: 26g Incineration of plastics: 2g Recycled plastics: 6g Landfill disposal of plastics: 5g Incineration of wood: 42g Recycled wood: 168g Landfill disposal of wood: 121g
Direct emissions to ambient air, soil, and water	Not applicable

Table 6. Installation into the building

4.3. Use stage related to the operation and structure of the building (B1)

Once it is installed, the earthenware product requires no energy input for use. Nor does it require any maintenance after installation, except normal cleaning operations. Consequently, of all the modules mentioned previously, only the environmental loads related to product maintenance are considered (Module B2). The rest of life cycle modules are considered as not relevant.

According to MAINZU, the reference service life of the product is the same as that of the building where it is installed because, provided it is properly installed, it is a durable product that will not require replacing. The product is assumed to have a service life of 50 years.

Maintenance (B2)

Cleaning is performed with a moist cloth and, if the surface exhibits any dirt or grease, cleaning agents such as detergents or bleaches can be added. The present study has considered water consumption

once a week and water and detergent consumption once every two weeks in a residential use scenario.

Parameter	Result
Maintenance process	Washing once a week with water and washing with water and detergent every two weeks (residential use)
Maintenance cycle	Not applicable
Ancillary materials for maintenance (e.g. cleaning agent) (specify materials)	Detergent: 1.34E-04 kg/washing
Desperdicio de material durante el mantenimiento (especificando el tipo)	Not applicable
Net fresh water consumption	0,1 l/m ²
Energy input during maintenance (e.g. vacuum cleaning), energy carrier type (e.g. electricity), and amount, if applicable and relevant	Not applicable

Table 7. Use stage related to the building

4.4. End of life

Deconstruction and demolition (C1)

When its service life has ended, the product is removed, either as part of building refurbishment or building demolition. In building demolition, the impacts assignable to product disassembly are negligible.

Transport (C2)

Product waste is transported in a truck that conforms to Euro 6 regulations, over a distance of 50 km to the waste destination.

Waste processing for reuse, recovery and/or recycling (C3)

Based on the distribution of the tiles (A5), it has been considered that 88% (Europe) and 70% (Spain and other countries) of the construction and demolition waste is destined for reuse, recovery and recycling.

Disposal (C4)

12% (Europe) and 30% (Spain and other countries) of the product are sent to a controlled landfill

Parameter	Result
Collection process specified by type	23 kg/m ² collected with mixed construction and demolition waste
Recovery system specified by type	16,9 kg for recycling
Disposal specified by type	6,1 kg to a controlled landfill
Assumptions for scenario development (e.g. transportation)	The product waste is transported in a large-tonnage truck (24 t) that meets Euro 6 standard. A distance of 50 km is assumed both to the final disposal site and to the recycling plant. A truck return trip (100% empty returns) is also included in accordance with the typical scenarios in the Spanish PCR for ceramic coverings

Table 8. End of life stage

4.5. Benefits and loads outside the limits of the building system

Module D. Benefits and loads beyond the system boundary from reuse, recovery, and/or recycling potentials

It is assumed that loads are avoided in manufacturing (such as cardboard, film, and wood waste), in product installation (such as cardboard, plastics, and wood packaging waste) and in product end-of-life.



Figure 5. Installed product

5 Declaration of the environmental parameters of the LCA and LCI

The following tables include the averaged data of the LCA parameters.

	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
 GWP	6,6	3,3E-01	9,1E-01		2,7E-01							1,2E-01	0	8,5E-02	-2,4E-01
 ODP	4,9E-08	5,5E-17	1,4E-13		1,3E-07							2,0E-17	0	8,7E-14	-1,5E-09
 AP	9,7E-02	3,4E-04	1,3E-03		1,5E-03							9,2E-05	0	5,0E-04	-7,4E-04
 EP	5,5E-03	6,6E-05	3,1E-04	NR	3,6E-04	NR	NR	NR	NR	NR	NR	2,1E-05	0	6,9E-05	-9,2E-05
 POCP	4,7E-03	4,2E-05	1,3E-04		4,7E-04							1,4E-05	0	4,0E-05	-6,7E-05
 ADPE	2,8E-05	2,6E-08	1,2E-06		3,7E-07							9,1E-09	0	3,1E-08	-7,1E-08
 ADPF	109,5	4,5	4,2		1,4							1,6	0	1,1	-4,3

GWP [kg CO ₂ eq]	Global warming potential
ODP [kg CFC-11 eq]	Ozone depletion potential
AP [kg SO ₂ eq]	Acidification potential of soil and water
EP [kg (PO ₄) ³⁻ eq]	Eutrophication potential
POCP [kg etileno eq]	Photochemical ozone formation potential
ADPE [kg Sb eq]	Abiotic depletion potential for non-fossil resources
ADPF [MJ]	Abiotic depletion potential for fossil resources

Table 9. Parameters describing environmental impacts as defined in EN 15804 standard

	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
 PERE	8,0	2,6E-01	1,0	NR	5,2	NR	NR	NR	NR	NR	NR	9,3E-02	0	1,3E-01	-1,4E
PERM	0	0	0		0							0	0	0	0
PERT	8,0	2,6E-01	1,0		5,2							9,3E-02	0	1,3E-01	-1,4E
 PENRE	112,4	4,5	4,7		1,6							1,6	0	1,1	-4,6
PENRM	0	0	0		0							0	0	0	0
PENRT	112,4	4,5	4,7		1,6							1,6	0	1,1	-4,6
 SM	0	0	0		0							0	0	0	0
 RSF	0	0	0		0							0	0	0	0
NRSF	0	0	0		0							0	0	0	0
 FW	1,9	1,9E-02	3,2E-01		2,1E-01							6,7E-03	0	6,4E-02	-4,3E-01

PERE [MJ] Use of renewable primary energy excluding renewable primary energy resources used as raw materials

PERM [MJ] Use of renewable primary energy used as raw materials

PERT [MJ] Total use of renewable primary energy

PENRE [MJ] Use of non-renewable primary energy, excluding non-renewable primary energy resources used as raw material

PENRM [MJ] Use of non-renewable primary energy used as raw materials

PENRT [MJ] Total use of non-renewable primary energy resources

SM [MJ] Use of secondary fuels

RSF [MJ] Use of renewable secondary fuels

NRSF [MJ] Use of non-renewable secondary fuels

FW [m³] Use of net freshwater resources

Table 10. Parameters describing the use of resources

		A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
	HWD	5,1E-03	0	0	MNE	0	MNE	MNE	MNE	MNE	MNE	MNE	0	0	0	2,1E-04
	NHWD	33,8	1,5E-02	1,4		1,5E-01							5,4E-03	0	10,8	-6,2
	RWD	5,5E-04	6,2E-06	2,0E-04		1,8E-05							2,2E-06	0	1,6E-05	-2,1E-05
	CRU	0	0	0		0							0	0	0	0
	MFR	0	0	1,6E-01		0							0	14,8	0	-6,3E-03
	MER	0	0	0		0							0	0	0	0
	EE	0	0	0	MNE	0	MNE	MNE	MNE	MNE	MNE	MNE	0	0	0	0
	EET	0	0	0		0							0	0	0	0

HWD	[kg]	Hazardous waste disposed
NHWD	[kg]	Non-hazardous waste disposed
RWD	[kg]	Radioactive waste disposed
CRU	[kg]	Components for re-use
MFR	[kg]	Materials for recycling
MER	[kg]	Materials for energy recovery
EE	[M]	Exported energy
EET	[M]	Exported energy (thermal)

Tabla 11. Parameters describing output flows and waste categories

6 Additional environmental information

6.1. Indoor air emissions

In the ceramic covering manufacturing process, tiles are subjected to a thermal process above 1000°C. At these temperatures, any organic compound in the compositions decomposes, yielding an inert end-product free of any volatile organic compounds that might be released in the stage use.

6.2. Release to soil and water

Ceramic coverings release no compounds into the soil or water during their use stage, because a completely inert product is involved that undergoes no physical, chemical, or biological transformations, is neither soluble nor combustible, and does not react physically or chemically or in any other way, is not biodegradable, and does not adversely affect other materials with which it enters into contact such that it might produce environmental pollution or harm human health. It is a non-leaching product, so that it does not endanger the quality of surface water or groundwater.

References

- [1] Product Category Rules of ceramic coverings. GlobalEPD. AENOR. February 2016
- [2] EN ISO 14025:2010
- [3] EN 15804:2012+A1:2013
- [4] Life Cycle Assessment Study of porcelain stoneware tiles manufactured by MAINZU. Annex I, report number C202089 (Instituto de Tecnología Cerámica).
- (5) EN 14411:2016
- (6) ISO 13006:2018

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