

Environmental Product Declaration



In accordance with ISO 14025 and EN 15804:2012+A2:2019 for:

MANTI® CERAMIC Technological

from

Műszer Automatika Ltd.



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General information

Programme information

Programme:	The International EPD® System
Address:	EPD International AB Box 210 60 SE-100 31 Stockholm Sweden
Website:	www.environdec.com
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CEN standard EN 15804 serves as the Core Product Category Rules (PCR)
Product category rules (PCR): 2019:14 v1.11, Construction products
PCR review was conducted by: Technical Committee of the International EPD System, Chair of the PCR review: Claudia A. Peña, the review panel may be contacted via info@environdec.com .
Independent third-party verification of the declaration and data, according to ISO 14025:2006: <input type="checkbox"/> EPD process certification <input checked="" type="checkbox"/> EPD verification
Third party verifier: Angela Schindler
Approved by: The International EPD® System
Procedure for follow-up of data during EPD validity involves third party verifier: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No

The EPD owner has the sole ownership, liability, and responsibility for the EPD.

EPDs within the same product category but from different programmes may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804. For further information about comparability, see EN 15804 and ISO 14025.



Company information

Owner of the EPD: Múszer Automatika Ltd.

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Description of the organization: During its 30+ years of operation, the Múszer Automatika Group (Group) has gained a great deal of experience in accurately assessing the needs of customers, identifying and analyzing their problems, and jointly developing the path to solutions. The Group's core business is the supply of energy and transport for safety-critical, high-availability automation and process control systems and devices. The companies of the group are connected to their customers either individually or through the project office of Múszer Automatika Ltd. More complex projects involving design, manufacturing, construction, implementation, and operation are managed through the project office. The Group has highly qualified, experienced, and technically qualified engineers, project managers and assistants with the necessary qualifications to carry out the activities.

The MANTI® CERAMIC product line is manufactured at Múszer Automatika Ltd.'s production plant in Celldömök, Hungary. The production plant in Celldömök covers an area of nearly 700 m², with a warehouse for raw materials and finished products, a laboratory, and other social facilities. In addition to the manufacturing equipment, a separate laboratory has been set up to monitor continuous quality assurance in the production unit, with the task of checking and reviewing the raw materials, finished products, and the production process. The laboratory also carries out the quality management and develops tasks necessary to ensure that the product is of the highest quality and reproducible.

Product-related or management system-related certifications: The company operates an ISO9001:2015 quality management system and an ISO14001:2015 environmental management system, so all activities in the plant are carried out according to the specifications of these two standards, from the laboratory quality control of raw materials and finished products to waste management.

Name and location of production site(s): Hungary, Celldömök 9500, Tó street 4.

Product information

Product name: MANTI® CERAMIC Technological

Product identification: white, crack-free, decorative coating with a matte surface, which reaches its final form within 24 hours.

Product description: The MANTI Ceramic Technological M pore-dry thermal protection coating is a water-based, solvent-free coating containing micro-sized vacuum ceramic spheres that can be applied as a thin layer like paint and form a stable coating. The surface formation created with the coating significantly reduces the heat load against solar radiation, mainly due to the reflection and infrared emission capabilities. It has a waterproof effect, forms a uniform decorative and aesthetic coating, provides extremely good adhesion on various surfaces, reduces thermal bridges, and reduces the possibility of mold and algae growth. When applied in a thin layer, savings in heating and cooling costs



can be achieved, while the feeling of comfort is improved. No hazardous waste is generated during its use.

The MANTI® CERAMIC product group is suitable for indoor and outdoor thermal protection application. The coating has a basic white color, which is a decorative coating on its own, but can also be mixed with suitable inorganic pigments to a pre-selected color. The color fastness of the coating is thus significantly better than other coloring paints containing organic pigments. It contains water repellent and biocide additives. All binders involved in aqueous solutions may contain biocides due to transport and storage. They are not included in the product as a separate substance (input), because biocide just potentially could be part of the respective main ingredients/raw materials. Thereby, biocides are not used as separate raw material, but are accompanied by raw materials, which results in very small amounts in the finally declared product. For further information on the biocide additives, please see the MSDS at <https://manti.hu/en/information-materials> or send an email to manti@manti.hu.

Technical specifications	Value	Unit	Test standards
Density	940	kg/m ³	MSZ ISO 2811-1:2016
Solids content	62	%	MSZ EN ISO 3251:2019
pH value	9,1	log ₁₀ (aH ⁺)	MSZ ISO 787-9:2019
Water vapor diffusion equivalent air layer thickness	2,08	m	MSZ EN ISO 7783-2:2000 (withdrawn standard)
Water vapor diffusion resistance factor	297	g/m ² /day	
Gloss	2,1/0,4	60°/85°	MSZ EN ISO 2813:2015
Viscosity	7500	mPas	MSZ ISO 2555:2018
Lifting strength	1,3	N/mm ²	MSZ EN ISO 4624:2016
Accelerated weathering	UV-test 1000 h	no changing	MSZ 9640-16:1984 EOTA Technical Report TR-011
Curing time	24	h	MSZ ISO 9117-1:2009
Curing temperature	23	Celsius degree	Several of the above test standards are applicable

Fire protection

Information on the fire performance according to EN 13501:1 or established national standards.

According to EN 13501:1:

- The classes of building products regarding their fire performance are predefined as: A1, A2, B, C, D, E, and F;
- The classes of flaming droplets/particles are pre-defined as: d0, d1, or d2;
- The classes for smoke density are pre-defined as: s1, s2, or s3.



Technological	Value	Test standards
Building material class	E	MSZ EN 13501-1:2007+A1:2010
Burning droplets	NPD	
Smoke gas development	NPD	

UN CPC code: 35110

EAN code: 5 999568 160071

LCA information

Functional unit: m² (1,1 – 1,3 m² per liter; 0,94 kg per liter)

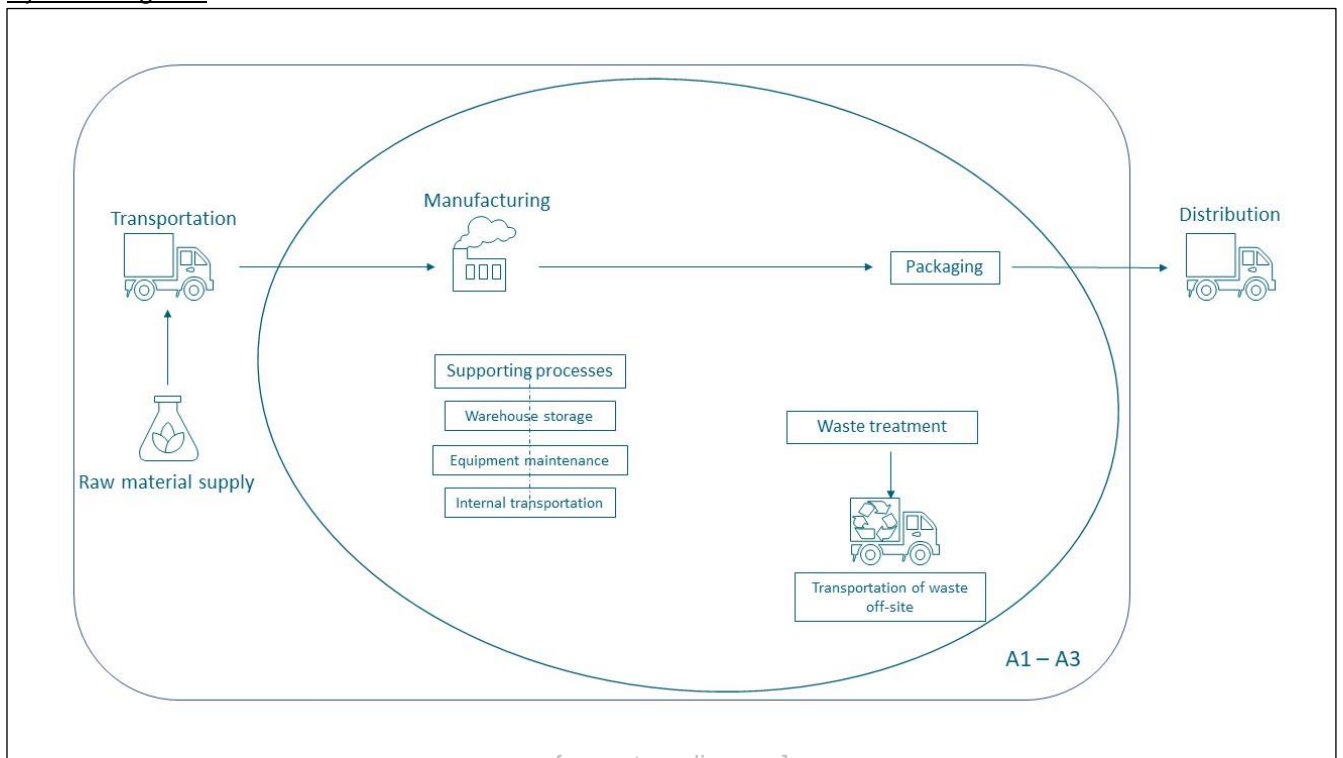
Reference service life: The company offers a 15-year lifetime guarantee for the MANTI® CERAMIC product line, but the expected lifetime in practice can probably reach 25-30 years. Nevertheless, only 8 years have passed since the first product was put on the market.

Time representativeness: 2021

Database(s) and LCA software used: ecoinvent 3.8 and Microsoft Excel

Description of system boundaries: The scope of the study is cradle to gate covering the product stage (modules A1-A3) since the product fulfils the three conditions required by EN 15804:2012+A2 about the exclusion of modules C1-C4 and module D. In addition, Műszer Automatika Ltd. asserts that it is not necessary to carry out any activity at the end of the life cycle, the company presumes it will wear off the surface. Thus far, the company has not carried out tests related to recycling.

System diagram:





More information: Detailed information on the product can be found at <https://manti.hu/>. The underlying LCA study was carried out by denkstatt Hungary Ltd. (contact: denkstatt@denkstatt.hu).

Data quality: ISO 14044 was applied in terms of data collection and quality requirements. The data concerning the modules A1 (raw material supply), A2 (transportation) and A3 (product manufacturing) were provided by Műszer Automatika Ltd. and involved all input and output materials to the plant, the consumed utilities (energy, water) and the distances and means of transport for each input stream. Data reliability is considered very good for energy consumption, material inputs, material outputs, transportation, and waste management. Proxy had to be applied for hollow glass microsphere, because the ecoinvent 3.8 database does not contain such data; after researching the material and the available information in ecoinvent 3.8, it was deemed that frit production for ceramic tile was the most similar activity to substitute the ingredient and its environmental impacts.

Allocation: Since the MANTI® CERAMIC product line consists of three products (Manti Ceramic Architectural Medium Density, Manti Ceramic Architectural High Density, Manti Ceramic Technological) and they are manufactured in the same facility and in the same machineries, energy consumption, water usage, storage and support processes, transportation, waste packaging treatment, and wastewater treatment of 2021 were allocated by product volume. In addition, the delivery kilometers of the common ingredients were also allocated amongst the three products based on the total amount of production.

Cut-off rules: The cut-off rule for insufficient data or data gaps that are less than 1% of the total input mass or mass per module was applied. In case of insufficient input data or data gaps for unit process, the cut-off criteria shall be 1% of renewable and nonrenewable primary energy usage and 1% of the total mass input of that unit process. The total of neglected input flows for the stages 'cradle through gate' shall be a maximum of 5% of energy usage and mass." (EN 15804:2012+A2:2019). Regarding the LCA model, the default cut-off criteria are applied for all processes from the Ecoinvent database. In addition, all custom processes developed for the specific purposes of the project are consistent with the rules and guidelines of the Ecoinvent database, and hence the same cut-off criteria are applied.

Modules declared, geographical scope, share of specific data (in GWP-GHG indicator) and data variation (NA: Not Assessed):



	Product stage			Construction process stage		Use stage							End of life stage				Resource recovery stage
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
Module	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Modules declared	x	x	x	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Geographic location	GL	GL	HU	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Specific data used	> 90%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	Not relevant			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	Not relevant			-	-	-	-	-	-	-	-	-	-	-	-	-	-



Content information (20 l product components' weight in a 20-l plastic bucket)

Product components	Weight, kg	Post-consumer material, weight-%	Renewable material, weight-%
Deionized water	5,09	0	0
Acrylic binder	6,66	0	0
Wetting and dispersing additive	0,35	0	0
Rutile titanium dioxide pigment	1,52	0	0
Talc	1,94	0	0
Hollow Glass Microspheres	2,87	0	0
TOTAL	18,80	0	0
Packaging materials	Weight, kg	Weight-% (versus the product)	
Polypropylene	0,714	4%	
TOTAL	0,714	4%	



Environmental Information

Potential environmental impact – mandatory indicators according to EN 15804:2012+A2

		Results per functional unit			
Indicator	Unit	Manufacturing			
		A1	A2	A3	Tot. A1-A3
GWP-fossil	kg CO ₂ eq.	9,01E-01	3,15E-02	1,81E-01	1,11E+00
GWP-biogenic	kg CO ₂ eq.	1,17E-02	8,59E-05	8,41E-02	9,60E-02
GWP-luluc	kg CO ₂ eq.	7,35E-04	1,29E-05	2,43E-04	9,91E-04
GWP-total	kg CO ₂ eq.	9,14E-01	3,16E-02	2,66E-01	1,21E+00
ODP	kg CFC 11 eq.	1,03E-07	7,32E-09	1,47E-08	1,25E-07
AP	mol H ⁺ eq.	5,88E-03	1,62E-04	2,12E-03	8,15E-03
EP-freshwater	kg P eq.	4,07E-04	2,09E-06	4,23E-04	8,33E-04
EP-marine	kg N eq.	1,01E-03	5,51E-05	7,96E-03	9,03E-03
EP-terrestrial	mol N eq.	1,04E-02	6,02E-04	6,02E-03	1,70E-02
POCP	kg NMVOC eq.	3,39E-03	1,72E-04	8,72E-04	4,43E-03
ADP-minerals & metals*	kg Sb eq.	3,05E-05	1,18E-07	2,61E-06	3,33E-05
ADP-fossil*	MJ	1,78E+01	4,71E-01	2,13E+00	2,04E+01
WDP	m ³	5,33E-01	2,20E-03	1,69E+00	2,23E+00
GWP-GHG ¹	kg CO ₂ eq.	9,02E-01	3,15E-02	1,82E-01	1,12E+00
Acronyms	GWP-fossil = Global Warming Potential fossil fuels; GWP-biogenic = Global Warming Potential biogenic; GWP-luluc = Global Warming Potential land use and land use change; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential, Accumulated Exceedance; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals & metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption				

* Disclaimer: The results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator.

¹ The indicator includes all greenhouse gases included in GWP-total but excludes biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. This indicator is thus almost equal to the GWP indicator originally defined in EN 15804:2012+A1:2013.



Use of resources

Results per functional unit					
Indicator	Unit	Manufacturing			
		A1	A2	A3	Tot. A1-A3
PERE	MJ	1,00E+00	6,93E-03	2,34E-01	1,24E+00
PERM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	1,00E+00	6,93E-03	2,34E-01	1,24E+00
PENRE	MJ	1,91E+01	5,09E-01	2,27E+00	2,19E+01
PENRM	MJ	0,00E+00	0,00E+00	3,37E+01	3,37E+01
PENRT	MJ	1,91E+01	5,09E-01	3,59E+01	5,56E+01
SM	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	m ³	ND	ND	ND	ND ²
Acronyms	PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy re-sources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water				

² The values for net water consumption cannot be declared due to missing information in the database.



Waste production and output flows

Waste production

Results per functional unit					
Indicator	Unit	Manufacturing			Tot. A1-A3
		A1	A2	A3	
Hazardous waste disposed	kg	8,61E-02	6,20E-03	2,59E-01	3,51E-01
Non-hazardous waste disposed	kg	8,19E+02	1,19E+02	1,02E+03	1,95E+03
Radioactive waste disposed	kg	2,64E-01	1,60E-02	4,57E-02	3,26E-01

Output flows

Results per functional unit					
Indicator	Unit	Manufacturing			Tot. A1-A3
		A1	A2	A3	
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Material for recycling	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for energy recovery	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy, electricity	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy, thermal	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00

Information on biogenic carbon content

Results per functional or declared unit		
BIOGENIC CARBON CONTENT	Unit	QUANTITY
Biogenic carbon content in product	kg C	0,00E+00
Biogenic carbon content in packaging	kg C	0,00E+00

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



Additional information

MANTI® CERAMIC is a thin-layered thermal protection material. Its main components are ceramic spheres filled with a vacuum cavity produced with nanotechnology at a high temperature. The hollow glass microspheres' nano-scale wall thickness almost completely blocks the flow of heat.

MANTI® CERAMIC provides thermal protection for buildings. It does not let heat in during summer and does not let heat out during winter. It is recommended to coat the external wall surfaces of the buildings with MANTI® CERAMIC with a thickness of 1-1.5 mm. The thermal barrier is available in colored and photocatalytic, self-cleaning versions. Its application on the interior surfaces of buildings significantly increases the efficiency of energy savings and provides a pleasant feeling of comfort. Coating the wall surface behind radiators with MANTI® CERAMIC creates a thermal shield, thus increasing the heating efficiency and preventing dust formation on the wall behind the radiator.

MANTI® CERAMIC coatings are easy to apply and form a white suspension. After drying, they form a crack-free, self-cleaning, decorative, off-white layer. The thermal properties of the coating are not only influenced by its composition but also by the quality of application. Improperly applied coatings are uneven and do not form a layer with a permanent structure. Poorly applied layers significantly reduce the efficiency of the coating. In order to avoid this, Múszér Automatika Ltd. not only guarantees quality in product development and production, but also in the execution of the work. For the benefit of the clients, a process has been developed which, with precise technological discipline, ensures excellent thermal protection performance and a long service life of the coating. With their skilled professionals and high technical standards, Múszér Automatika Ltd. also guarantees the quality of workmanship.

During winter, heat flows from indoors to outdoors. The warm heat flow, which slows down in the wall, encounters strong resistance in the MANTI® CERAMIC layer, transferring energy to the wall material. The wall stores the heat. This 'accumulator' effect prevents cold radiations and creates a pleasant feeling of comfort. During summer, heat flows from the outside to the inside. In this case, however, solar and infrared radiation reaches the MANTI® CERAMIC layer first. Approximately 85 percent of the broad-spectrum electromagnetic heat radiation does not pass through the MANTI® CERAMIC layer, the remaining 15 percent is stored in the masonry by slowing down the flow. The 1-1.5 mm thick MANTI® CERAMIC layer has practically no heat storage capacity.

The MANTI® CERAMIC coatings provide double thermal protection. On the one hand, they greatly curb the heat absorption of the coated wall surfaces, and on the other hand, the thermal insulation performance is also significant due to the complex and large surface area of the ceramic spheres. The combination of these two phenomena and considering the outstanding properties of the coating in relation to its thickness, MANTI® CERAMIC product line is not a thermal insulation material in the traditional sense.

One of the main components of MANTI® CERAMIC products are the micro-ceramic spheres created with nanotechnology with a diameter of 10-70 µm and an average wall thickness of 300 nm. There is a near vacuum inside the spheres. It is partly this vacuum that gives the coatings their property of forming an almost insurmountable barrier to the various heat flows. Another important advantage of this structure is that the contact area between the spheres is minimal. The heat flux travels a long and tortuous path, despite the coating thickness being only 0.5-3 mm. The micro-sized ceramic spheres are held together by a special bonding agent. In addition to the thermodynamic advantages, this



structure also gives the MANTI® CERAMIC thermal barrier layer a high degree of mechanical flexibility.

The effectiveness of the coating is not only determined by the ceramic spheres. Micro-ceramics cannot be used as a 'magic powder' on their own. Mixing ceramic spheres into a paint or other binder of your choice will not achieve the desired thermal protection effect. Research and development has resulted in an innovative binder and additive formulation that forms the best performing suspension with the ceramic spheres. MANTI® CERAMIC products can be used as both external and internal coatings. The task-oriented selection of ingredients and the precise adherence to proportions guarantee optimum performance, long guarantee periods, and consistent product quality.

ÉMI-TÜV SÜD Ltd. verifies that the MANTI® CERAMIC product family complies with the following European regulation (305/2011/EU) and technical standards. Furthermore, the comparative studies performed confirmed that the properties of the product family meet the requirements for summertime heat protection based on reflectance.

Area of use: as a heat protective coating for the thermal insulation of roof waterproofing systems. Natural stone, concrete, brick wall, gypsum and cement plasters, wood, PVC, plastic, sintered sheet metal.

Storage, shelf life: Store in unopened packaging, at a temperature between +5 and +40°C, in a well-ventilated, cool, dry place. Exposure to heat, direct sunlight should be avoided. Danger of freezing! In case of unopened packaging, the manufacturer guarantees a usage period of 2 years from the date of production.

Preparation of the base surface: The base surface must be dry, absorbent, clean, free of oil, grease, and other contaminants. The base surface should be inspected and cleaned, if necessary, while loose layers should be removed. Remove larger surface depressions and cracks by smoothing and patching in several layers. When used on carbon steel surfaces, it requires an anti-corrosion primer.

Application: The contents of the bucket must be mixed thoroughly with a paint mixer at low speed (maximum 200 rpm) until a completely homogeneous dispersion is obtained. The mixing time is usually 2-3 minutes, which depends on the power and speed of the mixer. Make sure that no air bubbles form in the product during mixing. If air bubbles form, reduce the speed of the mixer. If necessary, the product can be diluted with up to 2% deionized or distilled water.

Special, high-pressure 'airless' spraying equipment is required to create the coating. The coating must be applied in several layers until the desired final layer thickness (0.6 – 1.0 mm) is reached. Recommended paint sprayer: Graco UltraMax II 1095, Titan PowrTwin PLUS DI 6900. Recommended spray pressure: 120 – 140 bar, with 517, 519, 621, 625 nozzles. A short-haired paint roller or brush can be used for subsequent repair of the coating.

Before application, it must be ensured that there is at least 48 hours of rain-free (and preferably windless) time so that the coating can dry within the prescribed time. The temperature of the surface to be coated should not be lower than +5°C, the relative humidity of the air should not be higher than 80%. Tool cleaning should take place immediately after use with water.



References

CEN, "EN 15804:2012+A2:2019 Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products", European Committee for Standardization, Brussels, 2019.

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General Programme Instructions of the International EPD[®] System. Version 3.01.

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ISO 14044 Environmental management — Life cycle assessment — Requirements and guidelines

MSZ 9640-16:1984 EOTA

MSZ EN 13501-1:2007+A1:2010

MSZ EN ISO 7783-2:2000 (withdrawn standard)

MSZ EN ISO 3251:2019

MSZ EN ISO 2813:2015

MSZ EN ISO 4624:2016

MSZ ISO 2811-1:2016

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MSZ ISO 2555:2018

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