MAPEI

IN COMPLIANCE WITH EUROPEAN STANDARD
EN 1504-2 (C)
PRINCIPLES
PI-MC-IR
MAPEI
SURFACE PROTECTION SYSTEMS FOR CONCRETE

CE
EN 1504-2

Mapelastic Guard

Two-component, flexible cementitious mortar for protecting large concrete structures subjected to high stress

WHERE TO USE
Protecting concrete structures against aggressive atmospheric agents.

Some application examples
- Protecting concrete piles and decks on road and railway viaducts from carbon dioxide penetration.
- Protecting structures with insufficient concrete cover around reinforcing steel.
- Protecting concrete surfaces that come into contact with seawater, de-icing salts such as sodium chloride and calcium and sulphate salts.
- Protecting concrete with cracks caused by shrinkage to block the penetration of water and aggressive agents present in the atmosphere.
- Flexible skimming layers on concrete structures with thin sections, including those subjected to small deformations when under load (for example prefabricated elements).

TECHNICAL CHARACTERISTICS
Mapelastic Guard is a two-component, flexible, light grey mortar made from cementitious binders, fine-grained selected aggregates, special additives and synthetic polymers in water dispersion according to a formula developed in the MAPEI Research & Development Laboratories.

When the two components are mixed together, a free-flowing mix is obtained which may be applied at thicknesses up to 2 mm, including on vertical surfaces. Due to its high content of quality synthetic resins, the hardened layer of **Mapelastic Guard** maintains its flexibility under all environmental conditions, and is totally impermeable to water at pressures up to 1.5 atmospheres and the penetration of de-icing salts, sulphates, chlorides and carbon dioxide.
Mapelastic Guard also has excellent adhesion on all concrete surfaces, providing they are sound and sufficiently clean. These properties, together with its excellent resistance to U.V. rays, ensures that structures protected with **Mapelastic Guard** are durable, even when located in areas with particular climatic conditions, in coastal areas with a saline-rich atmosphere or in industrial areas where the air is highly polluted.

Mapelastic Guard complies with the principles defined in EN 1504-9 (*"Products and systems for protecting and repairing concrete structures: definitions, requirements, quality control and conformity assessment. General principles for the use of products and systems")* and the minimum requirements of EN 1504-2 coating (C) according to principles PI, MC and IR *("Concrete surface protection systems").*

RECOMMENDATIONS
- Do not use **Mapelastic Guard** for thick coatings.

- Do not apply **Mapelastic Guard** at temperatures below +8°C.

- Do not add cement, aggregates or water to **Mapelastic Guard**.

- Protect from rain and accidental spillages of water for the first 24 hours after application.

APPLICATION PROCEDURE

Substrate preparation

The surface to be treated must be sound and perfectly clean. Remove cement laitance, loose and crumbling parts and traces of dust, grease, oil and form release agents by hydro-sandblasting or with high pressure water jets.

If the structure to be protected with **Mapelastic Guard** is deteriorated, proceed as follows:

- remove all deteriorated and loose concrete to obtain a sound, strong, rough substrate. Any areas previously repaired and which are not bonded must be removed; the damaged parts must be removed by manual or mechanical abrading, or by hydro-demolition or hydro-scarifying. The last two techniques require the use of high pressure water. They are particularly recommended because they do not damage the reinforcing steel and structures are not subjected to vibrations that could provoke the formation of micro-cracking in the surrounding concrete;

- after preparation, the surface of the substrate must have an irregular finish with at least 5 mm roughness;

- remove all dust, rust, cement laitance, grease, oil and old paint from the concrete and reinforcing steel by hydro-sandblasting;

- treat reinforcing steel with **Mapefer** or **Mapefer 1K**, according to the procedure illustrated in the relative technical data sheet for each product;

- wait until **Mapefer** or **Mapefer 1K** has dried;

- saturate the substrate with water;

- before carrying out repairs, wait until excess water has evaporated off. If necessary, use compressed air to help remove excess water;

- repair the concrete using a shrinkage-compensating mortar from the **Mapegrout** or **Planitop** ranges.

Preparation of the mortar

Pour component B (liquid) into a suitable clean container and slowly add component A (powder) while stirring with a mixer. Carefully mix **Mapelastic Guard** for several minutes, making sure no powder remains attached to the sides or bottom of the container. Keep mixing until completely blended. A mechanical mixer at low speed is recommended for this operation, to prevent entraining too much air into the mix. Avoid mixing the product manually.
Mapelastic Guard may also be prepared using a mortar mixer, generally supplied with rendering machines. We recommend that it is well mixed and there are no lumps before it is discharged from the pump hopper.
Mapelastic Guard remains workable for approximately 1 hour at +20°C.

Manual application of the mortar

Skim the damp, prepared surface to a feather edge with a thin layer of **Mapelastic Guard** with a smooth trowel then, while still fresh, apply a second layer to form a total thickness of at least 2 mm. For structures with micro-cracks or structures that are particularly stressed, we recommend embedding **Mapenet 150** with a mesh size of 4.5 x 4 mm in the first layer of **Mapelastic Guard** to reinforce the mortar (refer to the technical data sheet for **Mapenet 150**). After embedding the mesh, finish off the surface with a flat trowel and apply the second layer of **Mapelastic Guard** when the first layer has hardened (after 4-5 hours). Take special care around expansion and structural joints and in irregular areas subject to high dynamic stress by applying **Mapeband TPE** tape made from thermo-plastic polymers and synthetic elastomers.
After applying **Mapelastic Guard**, the structure may be further protected by applying a coloured acrylic resin-based finishing product in water dispersion from the **Elastocolor** range. The products in the **Elastocolor** range are available in a wide choice of colours using the **ColorMap®** automatic colouring system. When completely dry, they form an elastic coating which is impermeable to water and aggressive agents present in the surrounding environment (CO_2 - SO_2), while remaining permeable to vapour. Apply the elastic coating at least 7 days after application of **Mapelastic Guard**. In good weather and at the right temperature, this period may be reduced to 3 days.

Applying the mortar by spray

Apply **Mapelastic Guard** on a well-prepared, damp substrate by spray with

Mapelastic Guard: ***two-component, elastic cementitious mortar for protecting large concrete structures subjected to high stress in compliance with the requirements of EN 1504-2 coating (C) principles PI, MC and IR***

TECHNICAL DATA (typical values)

PRODUCT IDENTITY		
	comp. A	**comp. B**
Consistency:	powder	liquid
Colour:	light grey	white
Bulk density (g/cm³):	1.4	–
Density (g/cm³):	–	1.1
Dry solids content (%):	100	50

APPLICATION DATA OF PRODUCT (at +20°C – 50% R.H.)	
Colour of mix:	light grey
Mixing ratio:	component A : component B = 3 : 1
Consistency of mix:	plastic-trowellable
Density of mix (kg/m³):	1,700
Density after application by spray (kg/m³):	2,200
Application temperature range:	from +8°C to +35°C
Pot life of mix:	1 h

FINAL PERFORMANCE (thickness 2.0 mm)

Performance characteristic	Test method	Requirements according to EN 1504-2 coating (C) principles PI, MC and IR	Performance of product	
Adhesion on concrete (substrate type MC 0.45) according to EN 1766 (N/mm²):	EN 1542	flexible systems with no traffic: ≥ 0.8 with traffic: ≥ 1.5	1.0	
Thermal compatibility measured as adhesion according to EN 1542 (N/mm²): – freeze-thaw cycles with de-icing salts:	EN 13687/1		0.8	
Adhesion on concrete (substrate type MC 0.45) according to EN 1766 after 7 days at +20°C and 50% R.H. + 21 days in water (N/mm²):	EN 1542	not required	0.6	
Elasticity expressed as elongation: – after 28 days at 20°C and 50% R.H. (%):	DIN 53504 mod.	not required	30	
Static crack-bridging at -20°C expressed as maximum crack width (mm):	EN 1062-7	from class A1 (0.1 mm) to class A5 (2.5 mm)	class A3 (-20°C) (> 0.5 mm)	
Dynamic crack-bridging at -20°C of a film of Mapelastic Guard reinforced with Mapetex Sel, expressed as resistance to cracking cycles:		from class B1 to class B4.2	class B3.1 (-20°C) No failure of the test piece after 1,000 crack cycles with movement of crack from 0.10 to 0.30 mm	
Permeability to water vapour – equivalent air layer thickness S_D- (m):	EN ISO 7783-1	Class I S_D < 5 m (permeable to vapour)	S_D	μ
			2.1	1,160
Impermeability expressed as coefficient of permeability to free water (kg/m²·h$^{0.5}$):	EN 1062-3	W < 0.1	W < 0.02 Class III (low permeability) according to EN 1062-1	
Permeability to carbon dioxide (CO_2) – diffusion in equivalent air layer thickness S_{DCO2} (m):	EN 1062-6 Method B	> 50	> 50	
Reaction to fire:	EN 13501-1	Euroclass	E	

a rendering machine with one of the following types of equipment:
– Turbosol T6 or similar;
– Strobot 406S;
– Putzmeister MP12;
– Putzmeister S5 EV/TM/2.

Whatever type of equipment is employed, use a skimming lance with an 8-10 mm diameter nozzle and a pump or air compressor with a capacity of 800 l/min.
Apply a layer of **Mapelastic Guard** at least 2 mm thick. To acheive a more even surface, we recommend applying **Mapelastic Guard** in 2 layers. Apply successive layers when the previous layer has dried (after 4-5 hours). In areas with micro-cracks or which are particularly stressed, we recommend embedding **Mapenet 150** with a mesh size of 4.5 x 4 mm in the first layer of **Mapelastic Guard** while still fresh.
Smooth over the **Mapelastic Guard** with a flat trowel immediately after embedding the mesh. If the mesh needs to be covered even more, apply another layer of **Mapelastic Guard** by spray.
Take special care around expansion and structural joints and in irregular areas subject to high dynamic stress by applying **Mapeband TPE** tape made from thermoplastic polymers and synthetic elastomers.
After applying **Mapelastic Guard**, the structure may be further protected by applying a coloured acrylic resin-based finishing product in water dispersion from the **Elastocolor** range.

The products in the **Elastocolor** range are available in a wide choice of colours using the **ColorMap®** automatic colouring system. When completely dry, they form an elastic coating which is impermeable to water and aggressive agents present in the surrounding environment (CO_2 - SO_2), while remaining to vapour. Apply the elastic coating at least 7 days after **Mapelastic Guard**. In good weather and at the right temperature, this period may be reduced to 3 days.

PRECAUTIONS TO BE TAKEN DURING AND AFTER APPLICATION

No particular precautions need to be taken if the temperature is around +20°C.
In hot weather, we recommend avoiding exposure of the material to the sun before use (powder and liquid).
In particularly dry, warm or windy weather, protect the surface with sheets after applying the product to prevent rapid evaporation.

PERFORMANCE DATA

Thanks to its crack-bridging capacity, **Mapelastic Guard** protects concrete structures against the formation of cracks generated by dynamic loads, shrinkage, temperature variations, etc., even in particularly rigid weather conditions.
Also, according to tests carried out by external laboratories as described below, results show that **Mapelastic Guard** is highly resistant to chemical aggression and offers efficient protection for concrete against the penetration of CO_2 (carbonation) and chlorides.
Both types of aggression trigger off corrosion in reinforcing steel resulting in a loss in structural integrity.
Carbon dioxide (CO_2) penetrates into the concrete at a parabolic rate:

$$x = K \cdot t^{½}$$

where:
x is the thickness of concrete penetrated by the CO_2
K is the diffusion coefficient of CO_2
t is the period of exposure to an atmosphere containing CO_2

The value of K depends mainly on the characteristics of the concrete (type of cement, additives where applicable, water/cement ratio, curing time, etc.) and environmental factors (humidity, temperature, concentration of CO_2, etc.), and must be determined experimentally, therefore, for each case.
Tests carried out by the *Società Autostrade per l'Italia* (Italian Motorways Society) research laboratories have measured the value of the diffusion coefficient K on concrete with water/cement ratios of 0.5 and 0.6.
Results gave an average K value of 7.6 for concrete with a water/cement of 0.5, and of 8.0 for concrete with a water/cement ration of 0.6.
If we assume a thickness of concrete cover of x = 30 mm and these values are applied in the formula $x = K \cdot t^{½}$, we get:

$t_{concrete}$ = 900 mm^2/(57.76 mm^2 · year $^{-1}$)
~15.6 years for concrete with a water/cement ratio of 0.5

$t_{concrete}$ = 900 mm^2/(64 mm^2 · year $^{-1}$)
~ 14 years for concrete with a water/cement ratio of 0.6

where t represents the time required for carbonation to penetrate through all the concrete cover.

The same tests were carried out on concrete samples protected with **Mapelastic Guard**, and the results showed K values of 0.25 to 0.29. If we assume an average K value for **Mapelastic Guard** of 0.27 (mm · year^{½}) and then use the formula:

$$x = K \cdot t^{1/2}$$

where x is the thickness of **Mapelastic Guard** equal to 2 mm, we can calculate that, by applying **Mapelastic Guard** on the surface of concrete, it is possible to increase the durability of structures by providing an

efficient barrier to the penetration of CO_2 to more than 50 years.

As far as aggression from chlorides is concerned, according to the Danish certification body COWI (Consultancy within Engineering, Environmental Science and Economics), a 2.5 mm thick layer of **Mapelastic Guard** corresponds to 30 mm of concrete cover made from concrete with a water/cement ratio of 0.45.

Cleaning
Because of the high adhesion of **Mapelastic Guard**, including on metals, we recommend cleaning tools with water before the mortar starts to set. Once hardened, cleaning must be carried out mechanically.

CONSUMPTION
Manual application:
– approximately 1.7 kg/m² per mm of thickness.
Spray application using a rendering machine:
– approximately 2.2 kg/m² per mm of thickness.

NB: the consumption figures indicated are for a seamless film on a flat surface, and could be higher if the substrate is uneven (e.g. ridges or pores).

PACKAGING
32 kg kits:
component A: 24 kg bags;
component B: 8 kg canisters.

STORAGE
Mapelastic Guard component A may be stored for 12 months in its original packaging in a dry place.
The product complies with the conditions of Annex XVII to Regulation (EC) N° 1907/2006 (REACH), item 47.
Mapelastic Guard component B may be stored for 24 months.
Store **Mapelastic Guard** in a dry place at a temperature of at least +5°C.

SAFETY INSTRUCTIONS FOR PREPARATION AND APPLICATION
Mapelastic Guard component A contains cement that, when in contact with sweat or other body fluids, causes irritant alkaline reaction and allergic reactions to those predisposed. It can cause damage to eyes.

Mapelastic Guard component B is not considered dangerous according to the European regulation regarding the classification of mixtures. During use wear gloves and goggles and take the usual precautions for handling chemicals.
In case of contact with eyes or skin wash immediately with plenty of water and seek medical attention. It is recommended to use protective gloves and goggles.
For further and complete information about the safe use of our product please refer to the latest version of our Material Safety Data Sheet.

PRODUCT FOR PROFESSIONAL USE.

WARNING
Although the technical details and recommendations contained in this product data sheet correspond to the best of our knowledge and experience, all the above information must, in every case, be taken as merely indicative and subject to confirmation after long-term practical application; for this reason, anyone who intends to use the product must ensure beforehand that it is suitable for the envisaged application. In every case, the user alone is fully responsible for any consequences deriving from the use of the product.

Please refer to the current version of the Technical Data Sheet, available from our website www.mapei.com

LEGAL NOTICE
The contents of this Technical Data Sheet ("TDS") may be copied into another project-related document, but the resulting document shall not supplement or replace requirements per the TDS in force at the time of the MAPEI product installation. The most up-to-date TDS can be downloaded from our website www.mapei.com. ANY ALTERATION TO THE WORDING OR REQUIREMENTS CONTAINED OR DERIVED FROM THIS TDS EXCLUDES THE RESPONSIBILITY OF MAPEI.

All relevant references for the product are available upon request and from www.mapei.com

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