MAPEI

IN COMPLIANCE WITH EUROPEAN STANDARD EN 1504-3 R4 MAPEI REPAIR MORTAR

CE EN 1504-3

Mapegrout Hi-Flow TI 20

Polvere + Fibre 2in1 Powder + Fibers

Flowable shrinkage-compensated, fibre-reinforced, high-ductility cementitious mortar, with stiff steel fibres for repairing concrete

WHERE TO USE

The repair of concrete structures where greater thicknesses are required, or when repairs to complicated shapes require the use of a free-flowing mortar.

Some application examples

- Structural reintegration of pillars and beams in reinforced cement.
- Repairs to the lower sections in pre-tensioned beams in viaducts.
- Rebuilding and levelling of the upper part of pulvinos and reinforced concrete bearing elements on motorway viaduct piles.
- Reintegration of floor slabs after scarifying deteriorated areas.
- Repairing concrete floor surfaces (industrial, roads and in airports).
- Filling rigid joints between concrete elements.
- Repairs to joints in motorways.
- Repairs to hydraulic structures (breather channels, canals and forced run-off channels).

TECHNICAL CHARACTERISTICS

Mapegrout Hi-Flow TI 20 is a pre-blended mortar in powder form, made from high strength cement, selected aggregates, special admixtures, polyacrylonitrile synthetic fibres and stiff steel fibres according to a formula developed in MAPEI's own Research & Development Laboratories.
The hooked fibres in zinc-plated steel contained in **Mapegrout Hi-Flow TI 20** have the following characteristics:

– length:	30 mm
– diameter:	0.6 mm
– tensile strength:	> 1200 MPa
– modulus of elasticity:	210 GPa

When **Mapegrout Hi-Flow TI 20** is mixed with water, it forms a fluid mortar which is suitable for casting into formwork, without segregation, at a thickness of between 1 and 5 cm, and does not require electro-welded mesh as a support.
If **Mapegrout Hi-Flow TI 20** is mixed with water only, in order to guarantee that its expansive properties develop completely and correctly, it must be damp cured, a very difficult condition to create under normal site conditions. To guarantee that the expansive properties of **Mapegrout Hi-Flow TI 20** develop correctly with normal air curing, adding 0.25% of **Mapecure SRA** special admixture will offer great advantages to the mix, by reducing both plastic and hydraulic shrinkage.
In fact, **Mapecure SRA** has a very important role to play, in guaranteeing better curing of mortar. Also, when mixed with **Mapegrout Hi-Flow TI 20**, it may be considered a technologically advanced system, in that the admixture has the capacity of slowing down evaporation of the water from the mortar and of promoting the development of hydration reactions. Basically, **Mapecure SRA** behaves like an internal curing agent and, thanks to its interaction with some of the main components which make up the cement, it helps to reduce shrinkage by between 20 and 50% compared with the standard values of the product without the admixture. This will obviously lead to a reduced risk of cracking.

Mapegrout Hi-Flow TI 20

Once hardened, **Mapegrout Hi-Flow TI 20** has the following properties:
- high flexural and compressive strength;
- modulus of elasticity, coefficient of thermal expansion and coefficient of permeability to water vapour similar to those of high-quality concrete;
- waterproof;
- excellent bond to old concrete, if previously dampened with water, and with reinforcement rods, especially if treated beforehand with **Mapefer** or **Mapefer 1K**;
- high resistance to wear caused by abrasion and impact.

Mapegrout Hi-Flow TI 20 meets all the main principles for the EN 1504-9 Standards ("*Products and systems for the protection and repair of concrete structures: definitions, requirements, quality control and conformity assessment. General principles for the use of products and systems*") and the minimum requirements for EN 1504-3 Standards ("*Structural and non-structural repairs*") for class R4 structural mortar.

This product may also be used without adding **Mapecure SRA** if the weather conditions allow for optimum curing.
With **Mapegrout Hi-Flow TI 20**, repairs may be carried out up to a thickness of 5 cm. If thicker layers are required, we recommend adding 30 to 50% in weight of the product of selected aggregates, after first consulting our Technical Services Department.

RECOMMENDATIONS
- Do not use **Mapegrout Hi-Flow TI 20** on smooth concrete substrates. Roughen the surface and, if required, add steel rods.
- Do not use **Mapegrout Hi-Flow TI 20** for precision anchoring (use **Mapefill** or **Mapefill R**).
- Do not use **Mapegrout Hi-Flow TI 20** for vertical applications by spraying or with a trowel (use **Mapegrout Thixotropic**).
- Do not add cement or admixtures to **Mapegrout Hi-Flow TI 20**.
- Do not add water once the mix has started to set.
- Do not apply **Mapegrout Hi-Flow TI 20** if the temperature is lower than +5°C.
- Do not use **Mapegrout Hi-Flow TI 20** if the bag is damaged or if it has already been opened.

APPLICATION PROCEDURE
Preparation of the substrate
- Remove deteriorated concrete and any areas which are at risk of detachment, until a solid, strong and rough substrate is achieved. All previous repair work which is not perfectly bonded must be removed.
- Remove all traces of dust, rust, cement laitance, grease, oil and old paintwork from the concrete and reinforcement rods by sandblasting.
- Saturate the substrate with water.
- Before applying the product, wait until all excess water has evaporated off. If necessary, use compressed air.

Preparation of the mortar
Pour 3.5-4.0 litres of water into a cement mixer and slowly add **Mapegrout Hi-Flow TI 20**.
If improved open-air curing of the mortar is required, add **Mapecure SRA** at the end of the mixing phase at a rate of 0.25% in weight of the mortar (0.25 kg every 100 kg of **Mapegrout Hi-Flow TI 20**).
Mix for 3-4 minutes, remove all the powder which has not blended with the mix from the sides of the mixer and continue mixing for 2-3 minutes, until a fluid, lump-free blend is obtained.
Either a cement mixer or a drill equipped with a mixing attachment may be used, according to the amount of material to be prepared.
Avoid excessive entrainment of air during the mixing phase.
Only under exceptional circumstances should the product be mixed by hand. In this case, only mix small quantities and blend for at least 5-6 minutes until a homogenous mix is obtained.
Please note that more water is required when the product is mixed by hand, which will have a negative impact on certain characteristics, such as strength, shrinkage and waterproofing properties.
Mapegrout Hi-Flow TI 20 remains workable for approximately 1 hour at +20°C.
The expansion rate of **Mapegrout Hi-Flow TI 20** has been calculated in order to compensate for hygrometric shrinkage.
If there is insufficient boundary support, filling layers of more than 5 cm must only be applied after inserting steel rods and roughening the surface of the concrete. A layer of at least 2 cm thick must be applied over the rods.
Thinner layers may be applied if there are no reinforcement rods, but the surface of the substrate must be well roughened before application to contrast expansion. Expansion of the product takes place during the first few days of hardening.

Application of the mortar
Pour **Mapegrout Hi-Flow TI 20** into the formwork in a continuous flow and from one side only, in order to help all air to be expelled.
The formwork must not absorb water from **Mapegrout Hi-Flow TI 20**, therefore, treatment of the formwork with a stripping product (such as **Form Release Agent DMA 1000**) is recommended.
Make sure that the deteriorated parts are completely filled and, if necessary, help the mortar flow into particularly tight areas with pieces of wood, metal bars or by lightly vibrating using a vibration rod.
The complete repair cycle includes painting the surfaces with another coat of **Elastocolor Paint**.

PRECAUTIONS TO BE TAKEN DURING AND AFTER APPLICATION
- Only use bags of **Mapegrout Hi-Flow TI 20** which have been stored on their original sealed pallets.

TECHNICAL DATA (typical values)

PRODUCT IDENTITY	
Material class according to EN 1504-3	R4
Type:	CC
Consistency:	powder
Colour:	grey
Maximum size of aggregate (mm):	2.5
Bulk density (kg/m³):	1,400
Dry solids content (%):	100
Content of chloride ions: – minimum requirement ≤ 0.05% according to EN 1015-17 (%):	≤ 0.05
APPLICATION DATA (at +20°C and 50% R.H.)	
Colour of mix:	grey
Mixing ratio:	100 parts of **Mapegrout Hi-Flow TI 20** with 14-16 parts of water (3.5-4.0 l of water per 25 kg bag), and 0.25% of **Mapecure SRA** (1 0.25 kg canister every 4 kg bags of **Mapegrout Hi-Flow TI 20**)
Consistency of the mix:	fluid
Slump according to EN 13395/1 (mm):	195
Density of the mix (kg/m³):	2,300
pH of mix:	> 12.5
Application temperature range:	from +5°C to +35°C
Pot life of the mix:	approx. 1 hour

FINAL PERFORMANCE (with 14% mixing water)

Performance characteristics	Test method	Requirements according to EN 1504-3 for R4 class mortar	Performance of product
Compressive strength (MPa):	EN 12190	> 45 (after 28 days)	> 30 (after 1 day) > 50 (after 7 days) > 70 (after 28 days)
Flexural strength (MPa):	EN 196/1	not required	> 10 (after 1 day) > 13 (after 7 days) > 16 (after 28 days)
Compressive modulus of elasticity (GPa):	EN 13412	> 20 (after 28 days)	27 (after 28 days)
Adhesion to concrete (MC 0.40 type substrate - water/cement ratio = 0.40) according to EN 1766 (MPa):	EN 1542	> 2 (after 28 days)	> 2 (after 28 days)
Impeded contraction in open air (μm/m):	UNI 8147 mod.	not required	> 400 after 1 day (*)
Warp test:	//	not required	convex (*)
Crack resistance:	"O Ring Test"	not required	no cracks after 180 days (*)
Resistance to accelerated carbonation:	EN 13295	carbonation depth < reference concrete (MC 0.45-type, water/cement ratio = 0.45) according to UNI 1766	meets specifications
Impermeability to water – penetration depth - (mm):	EN 12390/8	not required	< 5
Capillary absorption (kg/m²·h$^{0.5}$):	EN 13057	< 0.5	< 0.3
Resistance of reinforcement rods to slipping - adhesion stress - (MPa):	RILEM-CEB-FIP RC6-78	not required	> 25
Thermal compatibility measured as bonding according to EN 1542 (MPa): – freeze-thaw cycles with deicing salts: – storm cycle: – dry thermal cycle:	 EN 13687/1 EN 13687/2 EN 13687/4	 ≥ 2 (after 50 cycles) ≥ 2 (after 30 cycles) ≥ 2 (after 30 cycles)	 > 2 > 2 > 2
Toughness: – load at first cracking: – toughness factor:	ASTM C1018	 not required not required	 > 20 kN I_{20} > 20
Reaction to fire:	EN 13501-1	Euroclass	A1

(*) *Performance figures reached by adding 0.25% of* ***Mapecure SRA***

Mapegrout Hi-Flow TI 20

- In hot weather, store the product in a cool place and use only cold water to blend the mortar.
- In cold weather, store the product in a place which is protected from frost at a temperature of +20°C, and use tepid water to blend the mortar.
- After applying **Mapegrout Hi-Flow TI 20**, careful curing is highly recommended, especially in hot or windy weather, to avoid the water evaporating off too quickly and causing the formation of surface cracks due to plastic shrinkage. Spray water on the surface 8-12 hours after applying the mortar, and repeat the operation (every 3-4 hours) for at least the first 48 hours.

As an alternative, after tamping the mortar, spray on a layer of **Mapecure E** anti-evaporation treatment in watery emulsion with a low-pressure pump, **Mapecure S** solvent-based curing film for mortar and concrete, or **Elastocolor Primer** solvent-based, high-penetration primer for absorbent substrates and curing agent for repair mortar. **Mapecure E** and **Mapecure S**, as with all the best quality products in the same category which are currently available on the market, impede bonding of successive dressing layers. Therefore, if a smoothing layer or paint is to be applied later, they must be completely removed by sandblasting.
If **Elastocolor Primer** is used as an anti-evaporation treatment, on the other hand, a final protective layer of **Elastocolor Paint** or **Elastocolor Rasante** may be applied directly on the treated surface without having to remove it.

Cleaning
The mortar may be removed from tools using water before it hardens. Once set, it is difficult to remove the mortar and cleaning must be carried out using mechanical means.

CONSUMPTION
Approx. 20 kg/m^2 per cm of thickness.

PACKAGING
Mapegrout Hi-Flow TI 20 is supplied in 25 kg bags.

STORAGE
Mapegrout HI-Flow TI 20 may be stored for up to 12 months in its original packaging.

The product complies with the conditions of Annex XVII to Regulation (EC) N° 1907/2006 (REACH), item 47.
The product is available in special 25 kg vacuum-packed polyethylene bags which may be stored outside for the entire duration of site operations. Rain has no effect on its characteristics.

SAFETY INSTRUCTIONS FOR PREPARATION AND APPLICATION
Mapegrout Hi-Flow TI 20 is irritant, it 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. 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

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

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