MAPEWRAP C FIOCCO

High-strength carbon fibre unidirectional cord to be impregnated with MapeWrap 21 (two-component, super-fluid epoxy resin) to make “structural connections”





WHERE TO USE

Structural and functional restoration of concrete elements and masonry, including those of historical interest, which have been damaged by inclement weather and natural causes.

MapeWrap C FIOCCO, **MapeWrap G FIOCCO** and **MapeWrap B FIOCCO** are used as “structural connection” placed on the inside of old masonry to guarantee a better connection between the substrate (concrete, stone, bricks, wood, etc.) and the strengthening products with FRP and FRCM technology.

Some application examples

- Anchoring structural strengtheners made from mesh strengthening systems from the **Mapegrid** range on vaulted structures and brick, stone and tuff facing walls.
- Connections between old perimeter facing walls and carbon fibre pultruded sheets (**Carboplate**) or fabrics from the **MapeWrap** range used for structural strengthening of beams, floor slabs, etc.

TECHNICAL CHARACTERISTICS

MapeWrap C FIOCCO, **MapeWrap G FIOCCO** and **MapeWrap B FIOCCO** are part of the **MapeWrap** range of products, an innovative system for strengthening, static and seismic upgrading of reinforced concrete and masonry structures. The products are composed by unidirectional carbon fibre (**Mapewrap C FIOCCO**), glass fibre (**MapeWrap G FIOCCO**) and basalt fibre (**MapeWrap B FIOCCO**) threads inside a gauze wrapping which gives it its characteristic “cord” appearance.

The carbon and glass fibre “cords” are available in diameters of 6, 8, 10 and 12 mm. The basalt fibre “cords” are available in diameters of 10 and 12 mm. The cords are used in combination with fabrics from the **MapeWrap** range, **Carboplate** plates or the **Mapegrid** mesh in order to improve the anchorage, particularly in flexural and shear strengthening applications.

Thanks to its composition and production process, which guarantees the same properties in all points, **MapeWrap C FIOCCO**, **MapeWrap G FIOCCO** and **MapeWrap B FIOCCO** have the following characteristics:

- high tensile strength;
- lightweight;

- resistance to alkaline hydroxides in the concrete;
- resistance to corrosion, including when chlorides or other aggressive substances are present;
- excellent fatigue strength.

ADVANTAGES

Considerable increase of the connection between the reinforcement and the existing substrates. High durability of materials also in aggressive environments.

MapeWrap FIOCCO eliminates the risks of corrosion when steel is used. Also, thanks to its very low weight, it may be installed very quickly without the use of special lifting, and in many cases, without closing off the structure while in service.

RECOMMENDATIONS

- Workers must be provided with protective gloves and goggles and anti-solvent safety masks.
- After impregnating the end of the cord with **MapeWrap 21** and inserting it into the masonry, broadcast it with dry quartz sand.
- The substrate in which **MapeWrap FIOCCO** is inserted must be dry, clean, strong and free of dust.

APPLICATION PROCEDURE

Application phases

1. Preparation of the substrate
2. Drilling the holes
3. Preparation of **MapeWrap FIOCCO**
4. Preparation of **MapeWrap Primer 1**
5. Application of **MapeWrap Primer 1**
6. Preparation of **MapeWrap 31**, **MapeWrap 11** or **MapeWrap 12**, **Mapefix EP 100**, **Mapefix VE SF** or **Mapefix PolyBond** or **Mapefix PE SF**
7. Application of **MapeWrap 31**, **MapeWrap 11** or **MapeWrap 12**, **Mapefix EP 100**, **Mapefix VE SF** or **Mapefix PolyBond** or **Mapefix PE SF**
8. Insertion of **MapeWrap FIOCCO**

1. Preparation of the substrate

If the structure to be reinforced or where the bows must be inserted is particularly deteriorated, repair it before applying **MapeWrap FIOCCO**. We recommend removing damaged and deteriorated parts using a hammer, a jack-hammer or by hydro-scarifying. If there are metal reinforcement rods, remove all traces of rust and protect them using **Mapefer** two-component anti-corrosion cementitious mortar or **Mapefer 1K** one-component and anti-corrosion cementitious mortar (please refer to the respective Technical Data Sheet for each product for application procedures). Repair the substrates using a product from the **Mapegrout**, **MapeWall**, **Mape-Antique**, **Planitop HDM** range (choose the most suitable product according to the characteristics and type of structure).

2. Drilling the holes

MapeWrap FIOCCO has an outside diameter from 6 to 12 mm. The holes drilled in the substrate must be designed according to the diameter of the element impregnated and broadcasted with quartz. The depth of the holes is to be calculated according to the thickness of the masonry. If the above guidelines are followed, the material injected into the holes will completely embed **MapeWrap FIOCCO**. After drilling the hole, remove all dust and loose material with a vacuum cleaner.

3. Preparation of MapeWrap FIOCCO

Cut pieces of **MapeWrap FIOCCO** at a length that must be calculated according to the thickness of the substrate.

Unroll the protective gauze from the cord to a length equal to the depth of the hole. Impregnate this portion with **MapeWrap 21** (see the respective Technical Data Sheet for the preparation of **MapeWrap 21**).

In order to guarantee a good bond when embedding the cord in the hole, the surface of the impregnated portion of cord must be saturated with dry quartz sand to make it rough. Once hardened, the "bow" formed as described above is ready to be applied.

4. Preparation of MapeWrap Primer 1

The two components which make up **MapeWrap Primer 1** must be mixed together. Pour component B into component A and mix with a low-speed drill with a mixing attachment until the resin is completely blended. Mixing ratio: 3 parts by weight of component A and 1 part by weight of component B. To avoid dosage mistakes, use the entire contents of the two components. If only partial quantities are required, use high-precision electronic scales to weigh out the components (this procedure may also be adopted for the other products).

Once prepared, the workability time of **MapeWrap Primer 1** is approximately 90 minutes at +23°C.

5. Application of MapeWrap Primer 1

After drilling and preparing the holes, apply **MapeWrap Primer 1** using a round brush or pipe-cleaner.

If the substrate is particularly absorbent, apply a second coat of **MapeWrap Primer 1** once the first coat has been completely absorbed. Then apply **MapeWrap 31**, **MapeWrap 11**, **MapeWrap 12**, **Mapefix EP 100**, **Mapefix VE SF**, or **Mapefix PolyBond** or **Mapefix PE SF** (choose the most suitable product according to the type of substrate) while the product underneath is still "fresh".

6. Preparation of MapeWrap 31, MapeWrap 11 or MapeWrap 12 Mapefix EP 100, Mapefix VE SF or Mapefix PolyBond or Mapefix PE SF

The product choice must be made according to the type of the substrates and of the hole to be filled. For horizontal holes, holes in ceilings or holes in particularly porous substrates, it is better to use **MapeWrap 11** or **MapeWrap 12** epoxy grout, while for holes in floors, holes at a slight angle or holes in very compact substrates without internal cracks (e.g. concrete), the use of **MapeWrap 31** epoxy resin with a medium viscosity is recommended.

The cord is fastened to concrete structures using **Mapefix EP 100** (ETA Seismic performance C1 and C2) pure epoxy chemical anchors, and to masonry using **Mapefix VE SF** (ETA Seismic performance C1) vinylester resin chemical anchors or **Mapefix PolyBond** or **Mapefix PE SF** polyester resin-based chemical anchors.

MapeWrap 11 or MapeWrap 12

MapeWrap 11 or **MapeWrap 12** must be chosen according to the surrounding temperature and workability time (**MapeWrap 12** has a higher workability time than **MapeWrap 11**).

Pour component B into component A and mix with a low-speed drill with a mixing attachment until they form an even, grey paste.

Mixing ratio for both products: 3 parts by weight of component A and 1 part by weight of component B. At +23°C **MapeWrap 11** is workable for around 35 minutes after mixing while **MapeWrap 12** is workable for around 50 minutes.

MapeWrap 31

Pour component B into component A and mix with a low-speed drill with a mixing attachment until they form an even, yellow paste. Mixing ratio: 4 parts by weight of component A and 1 part by weight of component B. After mixing, the product remains workable for approximately 40 minutes at +23°C.

Mapefix EP 100

Mapefix EP 100 is a two-component product supplied in 585 ml bi-axial cartridges containing two separate components, A (resin) and B (catalyser). The two components are mixed together when they are extruded through a static mixer supplied with the cartridge. This product may be applied at 0°C to +40°C.

Mapefix VE SF

Mapefix VE SF is a two-component chemical anchor supplied in 300 and 380 ml cartridges containing two components, A (resin) and B (catalyser), at the correct mixing ratio in volume. The two components are mixed together when they are extruded through a static mixer supplied with the cartridge. This product may be applied at temperatures as low as -10°C.

Mapefix PolyBond

Mapefix PolyBond is a two-component product supplied in 300 and 420 ml bi-axial cartridges containing two separate components, A (resin) and B (catalyser). The two components are mixed together when they are extruded through a static mixer supplied with the cartridge.

Mapefix PE SF

Mapefix PE SF is a two-component product supplied in 300 and 420 ml bi-axial cartridges containing two separate components, A (resin) and B (catalyser). The two components are mixed together when they are extruded through a static mixer supplied with the cartridge.

7. Application of MapeWrap 31, MapeWrap 11 or MapeWrap 12, Mapefix EP 100, Mapefix VE SF or Mapefix PolyBond or Mapefix PE SF

Completely fill the holes previously treated with **MapeWrap Primer 1** while it is still "fresh". **MapeWrap 11** or **MapeWrap 12** must be applied inside the holes using an empty silicon tube and an extrusion gun, while **MapeWrap 31** may be applied by pouring it into the holes.

Mapefix EP 100, **Mapefix VE SF** or **Mapefix PolyBond** or **Mapefix PE SF** are applied with a static mixer attached to an extrusion gun.

8. Inserting Mapewrap FIOCCO

Once the holes have been filled, slowly and carefully insert **MapeWrap FIOCCO**, prepared as previously described, to help expel the excess resin from the holes. Remove the excess resin with a metal trowel. To prevent the section where **MapeWrap FIOCCO** is to be applied becoming too thick and to increase its adhesion, splay the remaining part of the "bows" (the part not inserted in the holes) and spread the fibres over the structure to be connected. Apply a coat of **MapeWrap 31** or **MapeWrap 11** or **MapeWrap 12** on the substrate before applying the splayed "bows" and then impregnate all the fibres with the same product. While the resin is still wet, broadcast the surface with dry quartz sand to create a rough bonding surface for the next step.

Even though epoxy resin is an insulating material, if steel elements need to be connected using **MapeWrap C FIOCCO**, we recommend applying an "insulating" layer of glass fibre fabric between the two elements.

If this precaution is not taken, "galvanic currents" may be generated because of the different electro-chemical potential between the metal and the carbon fibres, thus causing corrosion. Apply an even layer of **MapeWrap 31** with a brush or roller over the layer of grout applied previously while it is still "wet" (refer to the Technical Data Sheet for preparation instructions). Then immediately lay **MapeWrap G UNI-AX** fabric on the **MapeWrap 31** while it is still "wet", making sure there are no creases or folds. Apply a second layer of **MapeWrap 31** and go over the surface with a **MapeWrap Roller** so that the adhesive completely penetrates through the fibres of the fabric and any air bubbles could be entrapped during application. The splayed carbon fibre "bow" may now be applied.

Note: *If a finishing coat is to be applied, the final layer of epoxy resin must be saturated with fine, dry sand while it is still "fresh" to guarantee a good bond with the next product.*

Protective coating

Various protective coatings may be applied once the epoxy strengthening system has completely hardened - for example **Mapelastic** flexible cementitious mortar, **Elastocolor Paint** flexible acrylic paint, **Planitop 200** one-component cementitious mortar, **Planitop HDM Maxi**, two-component, pozzolanic-reaction cementitious mortar, or **Planitop HDM Restauro**, two-component mortar based on hydraulic lime (NHL) and material with pozzolanic reactivity (please refer to each product's Technical Data Sheet for application instructions).

The products mentioned above form an efficient barrier against UV rays, which make them particularly recommended for structures exposed to direct sunlight.



Drilling the hole



Impregnating a portion of MapeWrap FIOCCO



Curing for 24 hours



Inserting MapeWrap FIOCCO in the hole



The splayed end of a piece of MapeWrap FIOCCO



Impregnating MapeWrap FIOCCO



Broadcast with quartz sand



Connection point made from MapeWrap B FIOCCO

PRECAUTIONS TO BE TAKEN DURING AND AFTER APPLICATION

- The temperature during application must be at least +5°C (or +10°C in case **MapeWrap Primer 1** is used) and the structure must also be dry and protected from rain and dust carried by the wind.
- After completing the application, make sure the treated surfaces are kept at a temperature higher than +5°C (or +10°C in case **MapeWrap Primer 1** is used) until the products are completely cured.
- Protect the surface from rain for at least 24 hours if the temperature does not drop below +15°C and for at least 3 days if the temperature is lower.

CLEANING

Because of the high bond strength of the epoxy systems above, we recommend cleaning work tools with solvent (such as ethanol, xylene, thinners, etc.) before they harden.

PACKAGING

MapeWrap G FIOCCO, **MapeWrap C FIOCCO** and **MapeWrap B FIOCCO** are available in various diameters packed in boxes containing 10 m rolls.

STORAGE

Store in a covered and dry area.

SAFETY INSTRUCTIONS FOR PREPARATION AND APPLICATION

MapeWrap C FIOCCO, **MapeWrap G FIOCCO** and **MapeWrap B FIOCCO** are articles and referring to the current European regulations (Reg. 1906/2007/CE - REACH) do not require the preparation of the Safety Data Sheet. During use it is recommended to wear gloves and goggles and follow the safety requirements of the workplace.

PRODUCT FOR PROFESSIONAL USE.

TECHNICAL DATA (typical values)

PRODUCT IDENTITY			
	MapeWrap C FIOCCO	**MapeWrap G FIOCCO**	**MapeWrap B FIOCCO**
Type of fibre:	high-strength carbon	Type E glass	high-strength basalt
Appearance:	"cord" formed by one-directional fibres wrapped in a protective gauze sheath		
Density:	1.8 g/cm^3	2.66 g/cm^3	2.67 g/cm^3
Tensile strength of fibres:	4,830 N/mm^2	2,290 N/mm^2	2,900 N/mm^2
Modulus of elasticity of fibres:	234,000 N/mm^2	81,400 N/mm^2	85,000 N/mm^2
Elongation at failure:	2%	2.8%	3.4%
Equivalent surface area of dry fabric:			
Ø 6:	15.43 mm^2	14.44 mm^2	-
Ø 8:	20.72 mm^2	18.95 mm^2	-
Ø 10:	25.77 mm^2	24.36 mm^2	23.97 mm^2
Ø 12:	31.08 mm^2	28.87 mm^2	28.46 mm^2

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

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