

MapeWrap G UNI-AX System

**STRUCTURAL STRENGTHENING SYSTEM CONSISTING OF HIGH-STRENGTH
HIGH-MODULUS UNIDIRECTIONAL GLASS FIBRE FABRIC AND EPOXY RESINS
TO IMPREGNATE AND BOND THE FABRIC (FRP)**

**COVERED BY CERTIFICATE OF TECHNICAL ASSESSMENT (CVT)
N° 206/2019 CLASS 60G**

CVT

PRODUCTS USED IN THE SYSTEM:

MapeWrap G UNI-AX 900

MapeWrap 31

MapeWrap 11 - MapeWrap 12

MapeWrap Primer 1

WHERE TO USE

This system is recommended for repairing and increasing the structural capacity of under-dimensioned or damaged elements and structures in reinforced concrete, masonry, steel and wood, to improve the flexural strength, shear strength, compressive confinement capacity and bending/compressive capacity of concrete and masonry elements and structures, to upgrade or improve the seismic capacity of structures in high-risk areas, to improve the characteristics of beam-pillar hinge points and to increase the ductility of confined elements.

Some application examples

- Repairs and static upgrading of damaged or deteriorated structures where the shear strength of sections requires integrating.
- Confining compressed and pre-stressed elements (pillars, bridge piles, chimneys, storage tanks, etc.) to improve their load-bearing capacity or ductility.
- Seismic upgrading and restoration of domed structures without increasing their seismic mass and without the risk of liquids percolating towards their inner surfaces.
- Strengthening load-bearing elements in buildings whose structural system has been modified due to new architectural requirements or change in use.

The system is covered by Certificate of Technical Assessment (CVT) N° 206/2019 issued by the 2° Div. of the STC (Central Technical Service) of the CSLP (Ministry of Public Works).

TECHNICAL CHARACTERISTICS

MAPEWRAP G UNI-AX SYSTEM is the combined application of **MAPEWRAP G UNI-AX 900** glass

fibre fabric, a system of epoxy binders which includes **MAPEWRAP 31** epoxy resin to impregnate and bond the fabric, **MAPEWRAP 11** or **MAPEWRAP 12** epoxy grout to level off surfaces and bond the fabric and **MAPEWRAP PRIMER 1** epoxy primer recommended to consolidate the substrate. The use of epoxy grout **MAPEWRAP 11** or **MAPEWRAP 12** is recommended in particular to level surfaces with roughness equal to or greater than ± 2 mm. The application of epoxy grout is furthermore suggested to increase the adhesion and to facilitate the application of fabric with high weight (equal to or greater than 600 g/m²).

MAPEWRAP G UNI-AX 900 is a unidirectional glass fibre fabric.

MAPEWRAP 31 is a medium-viscosity epoxy adhesive used to impregnate **MAPEWRAP** fabrics and is made from:

- component A (resin);
- component B (catalyser).

MAPEWRAP 11 / MAPEWRAP 12 are epoxy grouts with a thixotropic consistency used to level off surfaces and to form structural bonds and are made from:

- component A (resin);
- component B (catalyser).

MAPEWRAP PRIMER 1 is an epoxy primer used to prepare the surface of concrete, reinforced concrete and masonry elements and structures before bonding **MAPEWRAP** fabrics and is made from:

- component A;
- component B.

MAPEWRAP 31, MAPEWRAP 11 and **MAPEWRAP 12** comply with the principles defined in EN 1504-9 (*“Products and systems for the protection and repair of concrete structures - Definitions, requirements, quality control and evaluation of conformity. General*

principles for the use of products and systems”), and the minimum requirements of EN 1504-4 (“Structural bonding”).

ADVANTAGES

Unlike work carried out using conventional techniques, thanks to its low weight, **MAPEWRAP G UNI-AX SYSTEM** may be installed by a smaller team of workers. The system may be applied extremely quickly and often without interrupting the use of the structure. Compared with the cladding technique with metal plates (beton plaqué), **MAPEWRAP G UNI-AX SYSTEM** may be modelled to suit any shape of element or structure requiring repair, it does not require temporary supports during application and there is no risk of corrosion to the strengthening system.

RECOMMENDATIONS

All workers must wear protective gloves and goggles and anti-solvent safety masks.

APPLICATION PROCEDURE

Preparation of the substrate

The surface on which **MAPEWRAP G UNI-AX 900** fabric is to be applied must be perfectly clean, dry and strong. Masonry structures: before applying the fabric, remove all loose or crumbling areas or areas at risk of becoming detached and level off the surfaces with a layer of **PLANITOP HDM MAXI**. Wooden structures: repair wooden elements and structures, where required, by applying adhesives from the **MAPEWOOD** range. Concrete structures in good condition: sandblast the surface to remove all traces of stripping compound, paint and cement laitance. Damaged concrete structures: remove



MapeWrap G UNI-AX System

all damaged areas with a hammer, a jack-hammer or by hydro-scarifying. Remove all traces of rust from the steel reinforcement and protect the reinforcement by applying **MAPEFER** two-component anti-corrosion cementitious mortar or **MAPEFER 1K** one-component anti-corrosion cementitious mortar. Repair the surface of concrete with products from the **MAPEGROUT** range. Wait at least three weeks before applying **MAPEWRAP G UNI-AX 900**. If structural strengthening work on concrete structures needs to be carried out immediately, use **ADESILEX PG1** or **ADESILEX PG2** to carry out repairs. Seal any cracks in the structure by injecting them with **EPOJET** or **EPOJET LV** (suitable only for dry or slightly damp cracks) or with **FOAMJET T** or **FOAMJET F** (suitable for damp cracks or if water is seeping in). Refer to the relative Technical Data Sheet for details on how to apply the aforementioned products. Round off all sharp edges and corners on concrete or masonry elements and structures which are to be strengthened with **MAPEWRAP G UNI-AX 900** (such as beams and pillars) with a jack-hammer or other suitable tools. It is recommended to round them off to a bending radius of at least 2 cm (in compliance with CNR-DT 200 R1/2013 guidelines).

Application procedure for MAPEWRAP G UNI-AX SYSTEM

Application phases

1. Preparation of **MAPEWRAP PRIMER 1**.
2. Application of **MAPEWRAP PRIMER 1**.
3. Preparation of **MAPEWRAP 11** or **MAPEWRAP 12**.
4. Application of **MAPEWRAP 11** or **MAPEWRAP 12**.
5. Preparation of **MAPEWRAP 31**.
6. Application of the first coat of **MAPEWRAP 31**.
7. Application of **MAPEWRAP G UNI-AX** fabric.

1. 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 drill at low speed with a mixing attachment until the resin is completely blended. Mixing ratio: 3 parts by weight of component A with 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 must also be adopted for the other products). Once prepared, the workability time of **MAPEWRAP PRIMER 1** is around 90 minutes at +23°C.

2. Application of MAPEWRAP PRIMER 1

Apply an even coat of **MAPEWRAP PRIMER 1** with a brush or roller on the clean, dry surface of the concrete or masonry.

If the surface is particularly absorbent, apply a second coat of **MAPEWRAP PRIMER 1** once the first coat has been completely absorbed.

3. Preparation of MAPEWRAP 11 or MAPEWRAP 12

Choose whether to use **MAPEWRAP 11** or **MAPEWRAP 12** according to the surrounding temperature and their workability times (the workability time of **MAPEWRAP 12** is higher than **MAPEWRAP 11**). Pour component B into component A and mix with a drill at low speed with a mixing attachment to form an even grey paste. Mixing ratio for both products: 3 parts by weight of component A with 1 part by weight of component B. At +23°C **MAPEWRAP 11** remains workable for approximately 35 minutes after mixing, while **MAPEWRAP 12** remains workable for approximately 50 minutes. **MAPEWRAP 11** is particularly recommended if the surrounding temperature is between +5°C and +23°C, while **MAPEWRAP 12** is recommended for higher temperatures.

4. Application of MAPEWRAP 11 or MAPEWRAP 12

On concrete or masonry surfaces previously treated with **MAPEWRAP PRIMER 1**, and while it is still wet, apply a layer around 1 mm thick of **MAPEWRAP 11** or **MAPEWRAP 12** with a notched trowel then smooth over the surface using a flat trowel to remove any imperfections on the surface. Using the same product, fill and round off the corners to form an edge with a bending radius of at least 2 cm.

5. Preparation of MAPEWRAP 31

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

6. Application of the first coat of MAPEWRAP 31

Apply a first, even coat around 0.5 mm thick of **MAPEWRAP 31** on **MAPEWRAP 11** or **MAPEWRAP 12** while they are still wet with a brush or a roller.

7. Application of MAPEWRAP G UNI-AX fabric

Immediately lay the **MAPEWRAP G UNI-AX** fabric over **MAPEWRAP 31** while it is still "wet", making sure it is applied by hand (wear protective rubber gloves), without any creases or folds and pass over the surface several times with **MAPEWRAP ROLLER** so that the adhesive completely penetrates into the fibres of the fabric.

Apply a second coat of **MAPEWRAP 31** over the **MAPEWRAP G UNI-AX** fabric. Go over the surface of the impregnated fabric with **MAPEWRAP ROLLER** to remove any air bubbles trapped in the layers during the previous phases.

While the resin is still wet, broadcast the surface with 1.2 mm to 1.9 mm quartz sand.

(For further information on the technical characteristics of each resin product used for **MAPEWRAP G UNI-AX SYSTEM** refer to the relative Technical Data Sheet).

Joints

The overlap of the ends of the strips of **MAPEWRAP G UNI-AX** fabric must be at least 20 cm.

It is not necessary to overlap the strips widthways; in this case, make sure each strip is butted up to the adjacent strip. After applying and pressing the fabric with **MAPEWRAP ROLLER**, the **MAPEWRAP G UNI-AX** fabric must not be moved or adjusted.

"Wet" application procedure (within 24 hours) for additional layers of MAPEWRAP G UNI-AX fabric

Application of the first coat of **MAPEWRAP 31**, application of the first layer of **MAPEWRAP G UNI-AX** and application of the second coat of **MAPEWRAP 31**. Application of the next layer of **MAPEWRAP G UNI-AX** and the next coat of **MAPEWRAP 31**, and so on for any other additional layers required. To exploit the mechanical characteristics of **MAPEWRAP G UNI-AX** as much as possible, it is recommended to apply no more than three layers.

Note: if additional layers of fabric need to be applied after more than 24 hours, the surface of the hardened resin must be roughened up by sanding.

FINISHING AND PROTECTING THE SYSTEM

A protective coating may be applied once the epoxy system has completely set (around 2-3 days at +23°C) and there are various solutions available:

- render: in this case, broadcast the last coat of **MAPEWRAP 31** with dry sand so that the render can bond more firmly. The render must also be admixed with **PLANICRETE** synthetic latex rubber for cementitious mortar. If the last coat of **MAPEWRAP 31** has not been broadcast while still wet

with sand, to guarantee a good bond for the render, roughen the surface with sandpaper and apply a coat of **EPORIP** epoxy resin for second pours;

- **MAPELASTIC** elastic cementitious mortar applied with a spreader or by spray (refer to the relative Technical Data Sheet for more information);
- **ELASTOCOLOR** elastic acrylic paint (refer to the relative Technical Data Sheet for more information).

These products also form an efficient barrier against UV rays, which makes them particularly recommended for structures exposed to direct sunlight.

PRECAUTIONS TO BE TAKEN DURING AND AFTER APPLICATION

- The temperature during application must be at least +5°C (or at least +10°C if **MAPEWRAP PRIMER 1** has been 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 of at least +5°C (or +10°C if **MAPEWRAP PRIMER 1** has been used).
- Protect surfaces 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

Epoxy systems form an extremely strong bond and we recommend cleaning all work tools with solvent (such as ethanol, toluene, etc.) before they harden.

PACKAGING AND STORAGE

MAPEWRAP G UNI-AX is supplied in a cardboard box containing 1 roll x 50 metres long.

MAPEWRAP 31 is supplied in 5 kg units comprising one 4 kg drum (component A) and one 1 kg can (component B).

MAPEWRAP 11 and **MAPEWRAP 12** are supplied in 6 kg units comprising

one 4.5 kg drum (component A) and one 1.5 kg can (component B).

All the products from the system must be stored in a dry, covered area.

NOTES

Procedures regarding the safe handling of the products are contained in the Safety Data Sheet for each single product in the system. However, the use of protective gloves and goggles is recommended when mixing and applying the products.

WARNING

Although the technical details and recommendations contained in this data sheet correspond to the best of our knowledge and experience, all the above information must, in all cases, be taken as merely indicative and subject to confirmation after long-term, practical applications. For this reason, anyone who intends using this product must ensure beforehand that it is suitable for

the envisaged application. In all cases, the user alone is fully responsible for any consequences deriving from the use of this product.

SAFETY INSTRUCTIONS FOR PREPARATION AND APPLICATION

MAPEWRAP G UNI-AX 900 is an article and referring to the current European regulations (Reg. 1906/2007/CE - REACH) does 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 in which work is carried out.

PRODUCT FOR PROFESSIONAL USE.

Regarding **MAPEWRAP 31**, **MAPEWRAP 11**, **MAPEWRAP 12** and **MAPEWRAP PRIMER 1**, always refer to the latest, updated version of the Technical Data Sheet available on the company website www.mapei.com



Application of MapeWrap Primer 1



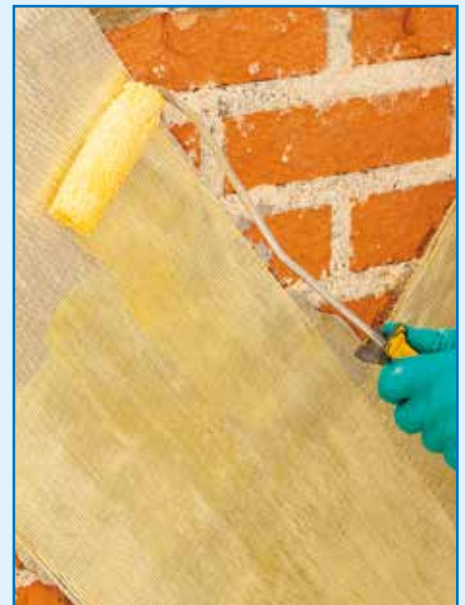
Skim-coat of MapeWrap 11 or MapeWrap 12



First coat of MapeWrap 31



Application of MapeWrap G UNI-AX fabric



Second coat of MapeWrap 31

SYSTEM SPECIFICATIONS

Repairing and increasing the structural capacity of under-dimensioned or damaged elements and structures in reinforced concrete, masonry, steel and wood, improving the flexural strength, shear strength, compressive confinement capacity and bending/compressive capacity of concrete and masonry elements and structures, upgrading or improving the seismic capacity of structures in high-risk areas, improving the characteristics of beam-pillar hinge points and increasing the ductility of confined elements by applying a strengthening system (such as the **MAPEWRAP G UNI-AX SYSTEM** by MAPEI S.p.A.) comprising **MAPEWRAP G UNI-AX** unidirectional glass fibre fabric by using the following procedure:

- application of **MAPEWRAP PRIMER 1**;
- levelling off the substrate with **MAPEWRAP 11** or **MAPEWRAP 12**;
- impregnating the fabric with **MAPEWRAP 31**.

Depending on the type of work to be carried out, the fabric, which weighs 900 g/m², is available in two standard widths (30 cm and 60 cm); other widths are available on request.

The system is applied according to Certificate of Technical Assessment (CVT) N° 206/2019 issued by the 2° Div. of the STC (Central Technical Service) of the CSLP (Ministry of Public Works) and must have the following characteristics:

Class according to Legislation DPCS (Prime Ministerial Decree) LL.PP. No. 220, 9.7.2015: 60G

Properties of dry fabric:

Weight (g/m ²):	900
Equivalent thickness of dry fabric (mm):	0.354
Resistant area per unit of width (mm ² /m):	354
Tensile strength of dry fabric (N/mm ²):	2,560
Maximum load per unit of width (kN/m):	> 800
Tensile modulus of elasticity (N/mm ²):	80,700
Elongation at failure (%):	3-4

Properties of the system:

Modulus of elasticity of laminate (refers to net area of fibres) average for 3 layers E _f (MPa):	≥ 80,000
Strength of laminate (refers to net area of fibres) average for 3 layers f _{fib,k} (MPa):	≥ 1,700
Deformation at failure ε _{fib} (%):	≥ 1.89
Adhesion to concrete (N/mm ²):	> 3 (failure of substrate)



Broadcasting of quartz sand

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GEOMETRICAL AND PHYSICAL CHARACTERISTICS

Property	Test method reference standard	MAPEWRAP G UNI-AX HM 900
Type of fibre	–	glass type E
Appearance	–	unidirectional fabric
Density of fibres ρ_{fib} (tex)	ASTM D 4018	2,280-2,550
Weight of fibres per unit of area p_x (g/m ²)	–	900
Density of resin ρ_m (g/cm ³)	ISO 1889	1.06
Equivalent area of dry fabric A_{rt} (mm ² /m)	–	354
Equivalent thickness of dry fabric t_{eq} (mm)	–	0.354
Amount of fibres in the composite by weight (%)	ASTM D 3171	60-68
Amount of fibres in the composite by volume (%)	ASTM D 3171	35-45
Glass transition temperature of resin used to impregnate the fibres $T_{g,im}$ (°C)	ISO 11357-2:2013(E) DSC ⁽¹⁾	+65
TGlass transition temperature of levelling putty (optional) $T_{g,re}$ (°C)	ISO 11357-2:2013(E) DSC ⁽¹⁾	71
Minimum and maximum service temperature (°C) ⁽²⁾	ACI 440.2R-08	-20 to +50 ⁽³⁾
Reaction to fire	–	N/A
Resistance to fire	–	N/A

Notes:

(1) On samples cured for 7 days at +23°C.

(2) Refers to the temperature of the resin, not the environmental temperature.

(3) Maximum service temperature is considered to be 15°C lower than the glass transition temperature of the adhesive, as specified in CNR-DT 200 R1/2013 ref. ACI 440.2R-08.

Note: this assumption is highly precautionary; the ACI mentioned refers to Tg values measured by DMA (Dynamic Mechanical Analysis), a method that gives reading around 15-20°C higher than the DSC (Differential Scansion Calorimeter) method used in this case as specified by European standards.

MECHANICAL PROPERTIES OF DRY FABRIC

Property	MAPEWRAP G UNI-AX 900
Tensile strength (N/mm ²):	2,560
Maximum load per unit of width (kN/m):	> 800
Tensile modulus of elasticity (N/mm ²):	80,700
Deformation at failure (%):	3-4

MECHANICAL PROPERTIES OF MAPEWRAP G UNI-AX SYSTEM ACCORDING TO CVT N° 206/2019

Class according to Legislation DPCS (Prime Ministerial Decree) LL.PP. No. 220, 9.7.2015

60G

Modulus of elasticity of laminate (for net area of fibres) (GPa)

Chart value

60

Strength of laminate (for net area of fibres) (MPa)

Chart value

1,300

Property	Test method reference standard	MAPEWRAP G UNI-AX 900	
		for 1 layer of fabric	for 3 layers of fabric
Modulus of elasticity of laminate (refers to net area of fibres) average value E_t (GPa)	EN 2561	≥ 70	≥ 80
Strength of laminate (refers to net area of fibres) average for 3 layers $f_{fib,k}$ (MPa)		≥ 1,300	≥ 1,700
Elongation failure ϵ_{fib} (%)		≥ 1.93	≥ 1.89
Adhesion to concrete (N/mm ²)		> 3 (failure of substrate)	

PACKAGING - MapeWrap G UNI-AX fabric is available in 50 metre rolls in a cardboard box with the following codes:

	Weight (g/m²):	Width (cm)	Area (m²/m)	Area (m²/roll)
MapeWrap G UNI-AX 900/30	900	30	0.3	15
MapeWrap G UNI-AX 900/60	900	60	0.6	30

CONSUMPTION OF EPOXY SYSTEMS

Priming, evening out and skimming surfaces

	Consumption (g/m²)
MapeWrap Primer 1	250-300
MapeWrap 11 or MapeWrap 12	1,500-1,600 per mm of thickness

Impregnating MapeWrap G UNI-AX

	Weight (g/m²):	Consumption (g/m²)	Width (cm)	Consumption (g/m):
MapeWrap 31	900	900-1,000	30	270-300
			60	540-600