

MapeWrap C Uni-Ax System

High-Strength, Uni-Directional
Carbon Fiber Fabric



* ICC-ES certification are available for MapeWrap® C Uni-Ax 300 and MapeWrap C Uni-Ax 600 (Reference No. ESR 3499).

PRODUCTS USED IN THE SYSTEM

MapeWrap C Uni-Ax 300 – MapeWrap C Uni-Ax 600 – MapeWrap C Uni-Ax 300W – MapeWrap C Uni-Ax 600W – MapeWrap C Uni-Ax 900 – MapeWrap C Uni-Ax 1200 – MapeWrap Primer 1 – MapeWrap 11 – MapeWrap 12 – MapeWrap 21 – MapeWrap 21 TG – MapeWrap 31 – MapeWrap 31 T [NA]

DESCRIPTION

MapeWrap C Uni-Ax is a high-strength, uni-directional carbon fiber fabric that, when used with the MapeWrap family of two-component epoxy adhesives, forms an externally bonded fiber-reinforced polymer (FRP) reinforcement system. MapeWrap C Uni-Ax fabric is part of an engineering solution that allows for an increase in the strength of structural elements without increasing the dead load supported by the structure. It is available in different weights (300, 600, 900 and 1200), each with different heights.

FEATURES AND BENEFITS

- High tensile modulus and strength
- Lightweight fabric for use in areas of limited access
- Non-corrosive
- Low aesthetic impact (easily concealed, with minimal change to profile)
- Excellent resistance to a wide range of environmental conditions
- Use for confinement, shear or flexural strengthening
- Alkali-resistant

- Flexible; will conform to the shape of complex surfaces
- Installs quickly with no special machinery or equipment

WHERE TO USE

- Structural strengthening: To enhance the load-carrying capacity of beams, columns and slabs
- Bridge rehabilitation: Reinforcing and repairing deteriorated or damaged bridge components
- Seismic retrofitting: Improving the seismic performance and ductility of structures
- Column wrapping: Strengthening and confining columns for improved resistance to axial and lateral loads
- Shear strengthening: Enhancing the shear capacity of structural elements, such as beams and slabs
- Flexural strengthening: Increasing the flexural strength of concrete members, such as beams and slabs
- Corrections to design and construction defects
- Pipeline repair: Rehabilitating and reinforcing pipelines or other cylindrical structures

LIMITATIONS

- Application temperature of the epoxy adhesive being used should be between 50°F and 86°F (10°C and 30°C). Contact MAPEI's Technical Services Department for installation recommendations when ambient temperatures are above or below this temperature range.
- Design calculations and project review should be carried out by an independent licensed engineer with carbon-fiber-reinforced polymer (CFRP) design experience, and in accordance with all local, state/provincial and federal building codes. Additional design examples/guidelines are available upon request from MAPEI's Technical Services Department or through the MAPEI Structural Design tool at structuraldesign.mapei.com.
- Installation of wet-layup FRP system should be done by applicators trained by MAPEI and with experience in the installation of similar FRP systems.

SUITABLE SUBSTRATES

- Use for interior/exterior applications on 28-day-cured concrete, masonry, wood, and steel.

Consult MAPEI's Technical Services Department for installation recommendations regarding substrates and conditions not listed.

SURFACE PREPARATION

- Concrete surfaces must be fully cured, clean, sound, dry and free of cavities or protrusions.
- Remove all fins and sharp protrusions, and detail the element as illustrated on the engineering documents.
- Remove all bond-inhibiting materials – including dust, laitance, oils, impregnations, coatings, form-release agents and any surface contaminants – before installation.
- Surface cracks greater than 10 mils (0.3 mm) must be sealed with MAPEI's epoxy injection products, such as *Epojet*™ [NA] or *Epojet LV* [NA].
- Clean all exposed reinforcement in accordance with the Steel Structures Painting Council (SSPC) and coat with *Planibond*® 3C and *Mapefer*™ 1K [NA].
- Mechanically prepare the substrate to provide a proper surface profile, as determined by the engineer. The recommended surface profile is CSP #3 to #5 per the ICRI 310.2R guidelines. In all cases, it is the

responsibility of the engineer to assess and specify the appropriate surface profile required to ensure system performance.

- Test the prepared surface, as directed by the engineer. Bond strength to concrete should meet a minimum tensile strength specified by the engineers and exhibit no failure within the concrete substrate. Pull-off testing should be completed after the appropriate surface preparation has been achieved.
- Concrete defects must be repaired with an approved MAPEI repair mortar such as *Planitop® X*, *Planitop XS* or another approved MAPEI repair mortar.
- Ensure that the substrate is dry and there is no vapor transfer. The presence of humidity will have a negative effect on the bond of the resin. Do not install the reinforcement if rain or exposure to moisture is anticipated within 24 hours.
- If the substrate is exposed to the outside environment, check the dew point before starting the installation.
- Substrate and ambient temperatures must be between 50°F and 90°F (10°C and 32°C).
- Substrate temperature should be above ambient dew point by 5.5°F (3°C).
- The residual humidity according to ASTM F2659 of the substrate concrete must be a maximum of 4%.
- These conditions must be met 24 hours before the application and at least 48 hours after.

MIXING

Before product use, take appropriate safety precautions. Refer to the Safety Data Sheets of all related products for details.

- Do not dilute or modify epoxies.

PRODUCT APPLICATION

Depending on several factors (overhead application, environmental conditions, application fields, etc.), the fabrics could be applied using the “dry” or “wet” layup method; however, some local restrictions vary by jurisdiction and must be followed. Caltrans, for example, only permits the “wet” layup method for its projects.

- *MapeWrap C Uni-Ax 900* and *MapeWrap C Uni-Ax 1200* must be installed using the “wet” layup method.
- Resin yield can vary based on site conditions, surface roughness and application methods. For resin coverages with *MapeWrap* fabrics, contact your local MAPEI Concrete Restoration Systems sales representative or reach out to MAPEI’s Technical Services Department.

Common to both dry and wet layup

1. The installer and owner should read and follow all recommended personal protection equipment (PPE) procedures while preparing and installing *MapeWrap C Uni-Ax* and its adhesives.
2. When the product is applied in a closed environment, provide good ventilation. For further information, carefully read the SDS of each of the products used.
3. Cut *MapeWrap C Uni-Ax* to the desired length. Do not fold the fabric or expose it to contaminants or dust.
4. Prime the surface for reinforcement with an even coat of *MapeWrap Primer 1* at a rate of 150 to 190 sq. ft. per U.S. gal. (3.67 to 4.65 m² per L). Very porous substrates may require a second coat after the first coat has been completely absorbed.
5. On concrete surfaces sealed with *MapeWrap Primer 1* but requiring smoothing/leveling, apply a layer of *MapeWrap 11* or *MapeWrap 12* at an average thickness of 1/32" (1 mm) and maximum thickness of 1/6" (4 mm). Apply with a notched trowel while the primer is still wet or tacky. Use a flat trowel to smooth the surface and remove any imperfections. *MapeWrap 11* is recommended if the surrounding temperature is

between 41°F and 73°F (5°C and 23°C), while *MapeWrap 12* is recommended for higher temperatures. The application of *MapeWrap 11* or *MapeWrap 12* is highly recommended to increase the bond and to facilitate the application of heavier fabrics (equal to or greater than 18 U.S. oz. per sq. yd. [600 g/m²]). In the case of applying *MapeWrap 31 T* [NA], the use of *MapeWrap 11* or *MapeWrap 12* would not be necessary.

6. For wrapping columns, *MapeWrap C Uni-Ax* must be overlapped by at least 8" (20 cm) with the same fabric or otherwise specified by the engineer. All corners should be smooth at a radius of 4/5" (20 mm) or higher.

Dry layup

1. Spread an even first coat of *MapeWrap 31* or *MapeWrap 31 T* [NA] with a brush or short-nap roller at a thickness of 20 mils (0.5 mm) while the *MapeWrap 11* or *MapeWrap 12* is still wet or tacky.
2. Immediately place *MapeWrap C Uni-Ax* over the still tacky or wet *MapeWrap 31* or *MapeWrap 31 T* [NA], using a gloved hand (refer to the SDS for proper PPE) to thoroughly flatten out the fabric. Then use a hard-plastic roller to push the epoxy through the fibers on both sides of the fabric and to smooth out any wrinkles or air pockets. The roller should be run only in the direction of the primary fibers in the fabric.
3. Apply a second coat of *MapeWrap 31* or *MapeWrap 31 T* [NA] over the exposed surface to completely encapsulate the fabric. Use an aluminum ribbed roller to remove any remaining air bubbles formed during the application.
4. If an adhesive and protective layer should be applied, broadcast sand to rejection onto the wet surface of the saturation resin. Once hardened (after about 1 to 2 days at 73°F or 23°C) and if required by the engineer or if exposed to UV rays, coat the cured FRP with a protective coating like *Mapelastic*®, *Elastocolor*® Coat or *Elastocolor Flex*. The FRP should not be exposed more than 3 days to UV rays, particularly in direct sunlight.
5. The system reaches full strength after 7 days at 73°F (23°C) and 50% relative humidity (RH).

Wet layup

1. *MapeWrap C Uni-Ax* should be impregnated with *MapeWrap 21* or *MapeWrap 21 TG* using an automated, mechanically driven saturation device. This is a simple machine fitted with a bucket and a series of rollers that automatically saturates the fabric and allows any excess saturant to drip from the fabric easily and safely.
2. As an alternative, *MapeWrap C Uni-Ax* can be plunged into a plastic trough filled with 1/3 of the total volume with *MapeWrap 21* or *MapeWrap 21 TG*. Remove the fabric from the trough, let it drip and press it between gloved hands until the excess resin is completely removed. Take precaution not to wring the fabric or damage the carbon fibers.
3. Once saturated, apply *MapeWrap C Uni-Ax* over the still wet *MapeWrap 11* or *MapeWrap 12* that covers *MapeWrap Primer 1*. Use a gloved hand (refer to the SDS for proper PPE) to thoroughly flatten out the fabric, and then use a hard-plastic roller to smooth out any wrinkles or air pockets. The roller should be run only in the direction of the primary fibers of the fabric.
4. Pass over the impregnated fabric with a ribbed roller in order to completely eliminate any air bubbles formed during application of the fabric.
5. If an adhesive or protective layer should be applied, broadcast sand to rejection onto the wet surface of the saturation resin. Once hardened (after about 1 to 2 days at 73°F or 23°C) and if required by the engineers or if exposed to UV rays, cover the cured FRP with a protective coating like *Mapelastic*, *Elastocolor Coat* or *Elastocolor Flex*. The FRP shouldn't be exposed more than 3 days to UV rays, particularly in direct sunlight.
6. The system reaches full strength after 7 days at 73°F (23°C) and 50% RH.

CLEANUP

Due to the high bond strength of *MapeWrap* resin on metal, tools should be cleaned with approved solvents (ethyl alcohol, toluene, etc.) before the product dries. Cured materials can only be removed mechanically. Dispose of material in accordance with local disposal regulations.

Product Performance Properties

Laboratory Tests	Results
Fiber material	Ultra high-strength carbon
Color	Black
Primary fiber direction	0° (uni-directional)
Shelf life	Unlimited in proper storage conditions; store in a dry place with no exposure to direct sunlight

Dry Fiber Properties

Property	Typical Test Value
Base	Ultra high-strength, uni-directional carbon fiber fabric
Ultimate tensile strength	710,700 psi (4.90 GPa)
Tensile modulus	36.5×10^6 psi ($252 \pm 2\%$ GPa)
Elongation at break	$\geq 2.0\%$
Weight	<i>MapeWrap C Uni-Ax 300</i> : 9 U.S. oz. per sq. yd. (300 g per m ²) <i>MapeWrap C Uni-Ax 600</i> : 18 U.S. oz. per sq. yd. (600 g per m ²) <i>MapeWrap C Uni-Ax 900</i> : 27 U.S. oz. per sq. yd. (900 g per m ²) <i>MapeWrap C Uni-Ax 1200</i> : 36 U.S. oz. per sq. yd. (1 200 g per m ²)
Nominal thickness	<i>MapeWrap C Uni-Ax 300</i> : 0.0065" per ply (0.164 mm per ply) <i>MapeWrap C Uni-Ax 600</i> : 0.0131" per ply (0.331 mm per ply) <i>MapeWrap C Uni-Ax 900</i> : 0.0196" per ply (0.497 mm per ply) <i>MapeWrap C Uni-Ax 1200</i> : 0.0262" per ply (0.666 mm per ply)

Cured Laminate Properties with MapeWrap 21 and MapeWrap C Uni-Ax 300

Property	Average Value	Design Value ¹	ASTM Test Method
Tensile strength* (f_{fu})	132,000 psi (910 MPa)	88,000 psi (607 MPa)	D3039
Tensile modulus* (E_f)	7,398,000 psi (51 007 MPa)	7,398,000 psi (51 007 MPa)	D3039
Elongation at break* (ϵ_{fu})	1.8%	1.5%	D3039
Ply thickness* (t_f)	0.0324" (0.823 mm)	0.0324" (0.823 mm)	—

Cured Laminate Properties with MapeWrap 21 and MapeWrap C Uni-Ax 600

Property	Average Value	Design Value ¹	ASTM Test Method
Tensile strength* (f_{fu})	136,000 psi (938 MPa)	119,100 psi (821 MPa)	D3039
Tensile modulus* (E_f)	8,210,200 psi (56 607 MPa)	8,210,200 psi (56 607 MPa)	D3039
Elongation at break* (ϵ_{fu})	1.7%	1.4%	D3039
Ply thickness* (t_f)	0.0589" (1.496 mm)	0.0589" (1.496 mm)	–

Cured Laminate Properties with MapeWrap 21 and MapeWrap C Uni-Ax 900

Property	Average Value	Design Value ¹	ASTM Test Method
Tensile strength* (f_{fu})	204,200 psi (1 408 MPa)	177,800 psi (1 226 MPa)	D3039
Tensile modulus* (E_f)	11,791,000 psi (81 296 MPa)	11,791,000 psi (81 296 MPa)	D3039
Elongation at break* (ϵ_{fu})	1.73%	1.5%	D3039
Ply thickness* (t_f)	0.05" (1.30 mm)	0.05" (1.30 mm)	–

Cured Laminate Properties with MapeWrap 21 and MapeWrap C Uni-Ax 1200

Property	Average Value	Design Value ¹	ASTM Test Method
Tensile strength* (f_{fu})	163,600 psi (1 128 MPa)	145,600 psi (1 004 MPa)	D3039
Tensile modulus* (E_f)	11,696,700 psi (80 646 MPa)	11,696,700 psi (80 646 MPa)	D3039
Elongation at break* (ϵ_{fu})	1.41%	1.24%	D3039
Ply thickness* (t_f)	0.079" (2.0 mm)	0.079" (2.0 mm)	–

Cured Laminate Properties with MapeWrap 31 and MapeWrap C Uni-Ax 300

Property	Average Value	Design Value ¹	ASTM Test Method
Tensile strength* (f_{fu})	237,000 psi (1 634 MPa)	216,100 psi (1 490 MPa)	D3039
Tensile modulus* (E_f)	12,164,200 psi (83 869 MPa)	12,164,200 psi (83 869 MPa)	D3039
Elongation at break* (ϵ_{fu})	2.0%	1.7%	D3039

Nominal layer thickness* (t_f)	0.0199" (0.50 mm)	0.0199" (0.50 mm)	–
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Cured Laminate Properties with MapeWrap 31 and MapeWrap C Uni-Ax 600

Property	Average Value	Design Value ¹	ASTM Test Method
Tensile strength* (f_{fu})	236,100 psi (1 628 MPa)	210,000 psi (1 448 MPa)	D3039
Tensile modulus* (E_f)	11,878,200 psi (81 897 MPa)	11,878,200 psi (81 897 MPa)	D3039
Elongation at break* (ϵ_{fu})	2.0%	1.76%	D3039
Nominal layer thickness* (t_f)	0.0397" (1.01 mm)	0.0397" (1.01 mm)	–

* 24 sample coupons per test series according to ACI 440 (CAN/CSA S806-12). Testing is in accordance with ASTM D3039.

¹ Average value minus 3 standard deviations, according to ACI 440.2R (section 4.3.1)

Packaging

Size
MapeWrap C Uni-Ax 300 roll: 164 ft. (50.0 m) long and 15.75" (40 cm) wide
MapeWrap C Uni-Ax 600 roll: 164 ft. (50.0 m) long and 15.75" (40 cm) wide
MapeWrap C Uni-Ax 600 roll: 164 ft. (50.0 m) long and 23.6" (60 cm) wide (U.S. only)
MapeWrap C Uni-Ax 900 roll: 98.43 ft. (30 m) long and 23.6" (30 cm) wide
MapeWrap C Uni-Ax 1200 roll: 82 ft. (25.0 m) long and 15.75" (40 cm) wide
MapeWrap C Uni-Ax 1200 roll: 164 ft. (50.0 m) long and 15.75" (40 cm) wide
MapeWrap C Uni-Ax 1200 roll: 82 ft. (25.0 m) long and 24" (61 cm) wide

ADDITIONAL INFORMATION

Refer to the SDS for specific data related to health and safety as well as product handling.

For information on MAPEI's commitment to sustainability and transparency, as well as how MAPEI products may contribute to green building standards and certification systems, contact sustainability_USA@mapei.com (USA) or sustainability-durabilite@mapei.com (Canada).

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 nor replace requirements per the TDS in effect at the time of the MAPEI product installation. For the most up-to-date TDS and warranty information, please visit our website at www.mapei.com. **ANY ALTERATIONS TO THE WORDING OR REQUIREMENTS CONTAINED IN OR DERIVED FROM THIS TDS SHALL VOID ALL RELATED MAPEI WARRANTIES.**

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CONTACT INFORMATION

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Flooring: 1-800-992-6273

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1-800-361-9309

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1-800-42-MAPEI (1-800-426-2734)

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