

Carboplate System

Pre-Impregnated, Pultruded Carbon Fiber Plate Used with Epoxy Resins and Primer for Structural Strengthening

PRODUCTS USED IN THIS SYSTEM

Carboplate E 170 • MapeWrap 11 or MapeWrap 12 • MapeWrap Primer 1

DESCRIPTION

Carboplate® System includes *Carboplate E 170* pultruded carbon-fiber-reinforced polymer (CFRP) plates designed for external structural strengthening of existing concrete, wood, masonry and steel members. In addition, the system includes a high-strength nonsagging epoxy resin – either *MapeWrap® 11* or *MapeWrap 12* – and *MapeWrap Primer 1*. *Carboplate E 170* is externally bonded onto the surface of the substrate to strengthen and stiffen existing structures, using an epoxy resin specifically designed for the application. *Carboplate E 170* is protected on both sides by a plastic film, eliminating the need for solvent cleaning of the plates before installation.

FEATURES AND BENEFITS

- Ease of installation with limited or no downtime of structure
- High tensile strength and modulus of elasticity
- Extremely lightweight with high strength-to-weight ratio
- High flexural and shear capacity
- Noncorrosive and alkali-resistant
- Excellent fatigue resistance
- Low aesthetic impact (easy to conceal)
- Nonintrusive; will not significantly change existing dimensions of structural member
- Removable “peel-ply” protective plastic film; no wiping with solvent required
- Plates can be cut to length on-site.

WHERE TO USE

- Interior/exterior
- Restores structural capacity to damaged or deteriorated concrete surfaces
- Increases load-bearing capacity of concrete beams, slabs and walls

- Improves seismic performance of masonry and concrete shear walls
- Improves blast resistance of concrete and masonry structures
- Provides additional strength and/or stiffness to steel and timber structures in some limited applications

LIMITATIONS

- Application temperature of the epoxy adhesive being used should be between 50°F and 90°F (10°C and 32°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.

SUITABLE SUBSTRATES

- Cured concrete (28 days old), 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 clean and free of loose particles, efflorescence, paints, tars, grease, asphaltic materials, bond breakers, curing compounds, wax, and any foreign substances that may interfere with proper bonding.
- Mechanically prepare the substrate to provide a proper surface profile, as determined by the engineer. The recommended surface profile is a concrete surface profile (CSP) of #3 to #5 per the ICRI 310.2R Guideline.
- Concrete defects must be repaired with an approved MAPEI repair mortar such as *Planitop® X* or *Planitop XS*.
- The surface flatness must be smooth (at no more than 40 mils or 1 mm in profile) and not vary by more than 1/4" (6 mm) in a 6-ft. (1.83-m) length. Any sharp edges must be ground smooth and flush.
- 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].
- Pull-off testing should be completed after the appropriate surface preparation has been achieved, as directed by the engineer. Bond strength to concrete should meet a minimum tensile strength specified by the engineers.
- Ensure that the substrate is dry and that no vapor transfer exists. The presence of humidity will have 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).
- The substrate temperature should be above the ambient dew point by 5.5 degrees Fahrenheit (2.8 degrees Celsius).
- The residual humidity of the substrate concrete must be a maximum of 4% per ASTM F2659.
- 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 Sheet for details.

- Use only *MapeWrap Primer 1* with either *MapeWrap 11* or *MapeWrap 12* as the adhesive for *Carboplate E 170* installations. Refer to the applicable resin's Technical Data Sheet for mixing instructions.
- Do not dilute or modify epoxies.

PRODUCT APPLICATION

Read all installation instructions thoroughly before installation.

1. Use special care when unpacking *Carboplate E 170* plates. Each plate is rolled under tension and, before it is unpacked, it should be braced so as not to uncoil. Uncoil the required length of plate to be installed and cut it to the desired length.
2. *Carboplate E 170* should be cut with a guillotine-type cutting tool or industrial shears. Other cutting methods may be used, but special care must be taken to support both sides of *Carboplate E 170* to avoid splintering.
3. Because *Carboplate E 170* is protected with a plastic film, this film must be removed before installation from the side to be bonded to the substrate with the selected epoxy adhesive. Should a plate become dusty or dirty, wipe it clean with a solvent-based cleaner (such as MEK, xylene or toluene). There is no designated front or back of the plates, so either side may be used for bonding to the substrate.
4. Prime the surface with a brush or roller and with an even coat of *MapeWrap Primer 1*. Very porous substrates may require a second coat.
5. Apply a uniform 40- to 60-mil (1- to 1.5-mm) thick layer of *MapeWrap 11* or *MapeWrap 12* with a flat trowel over *Carboplate E 170* on the side where the protective film has been removed. *MapeWrap 11* should be used in temperatures between 40°F and 70°F (4°C and 21°C), and *MapeWrap 12* should be used in temperatures above 70°F (21°C) because it has a longer pot life.
6. Apply a 40-mil (1-mm) layer of *MapeWrap 11* or *MapeWrap 12*, depending on the temperature, with a 3/32" (2.5-mm) V-notched trowel on the clean and dry substrate that will receive the plate.
7. Install *Carboplate E 170* onto the concrete surface using a hard-rubber roller, applying constant pressure to the entire surface until the excess adhesive is forced out on both sides. Remove the excess adhesive with a steel trowel, paying special attention not to move the plate.
8. The consistency of the adhesive typically allows the plates to be installed in vertical and overhead applications without the need for supports to hold the plates. Do not disturb the plates or apply a protective coating over the plates for at least 24 hours after installation.
9. When a coating is required, do not remove the peel-ply from the exposed surface of *Carboplate E 170* until just before applying the coating. This will eliminate the need to wipe the plates clean with solvent before coating over the system.
10. Maintain *Carboplate E 170* at ambient or surface temperatures between 50°F and 68°F (10°C and 20°C) for *MapeWrap 11*, or above 68°F (20°C) for *MapeWrap 12*, for 24 hours after installation.
11. 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 *Carboplate System* with a protective coating such as *Mapelastic®*, *Elastocolor® Coat* or *Elastocolor Flex*. The *Carboplate System* should not be exposed more than 3 days to UV rays, particularly in direct sunlight.
12. The system reaches full strength after 7 days at 73°F (23°C) and 50% relative humidity (RH).

CLEANUP

- Due to the high bond strength of *MapeWrap Primer 1*, *MapeWrap 11* and *MapeWrap 12* on metal, clean any tools used with solvents (ethyl alcohol, toluene, etc.) before the product dries. Cured material can only be removed mechanically. Dispose of material in accordance with local disposal regulations.

Product Performance Properties of *Carboplate E 170*

Laboratory Tests	Results
Density	0.0582 lbs. per cu. in. (1.61 g per cm ³)
Tensile strength	
Mean value	443 Kpsi (3 060 MPa)
Design value (f_{fu})	373 Kpsi (2 574 MPa)
Modulus of elasticity	
Design value (E_f)	26 251 Kpsi (181 MPa)
Ultimate elongation	1.69%
Design strain (ϵ_{fu})	1.36%
Fiber volumetric content	> 68%
Temperature resistance	> 300°F (149°C)

Design properties are based on the ASTM 3039 tensile tests in addition to the requirements listed in ACI 440.2R-17.

Shelf Life and Product Characteristics of *Carboplate E 170*

Shelf life	Unlimited when stored in cool, dry place out of direct sunlight. Protect from freezing in shipment and storage.
Physical state	Laminate: Carbon fiber bound in an epoxy matrix
Color	Black

Physical Properties

Product	Thickness (t _f)	Width	Cross-Sectional Area	Tensile Strength
Carboplate E 170/50/1.2	0.047" (1.2 mm)	2" (50 mm)	0.094 sq. in. (61 mm ²)	3.777 x 10 ⁴ lbs. (168 kN)
Carboplate E 170/80/1.2*	0.047" (1.2 mm)	3" (80 mm)	0.149 sq. in. (96 mm ²)	6.047 x 10 ⁴ lbs. (269 kN)
Carboplate E 170/100/1.2	0.047" (1.2 mm)	4" (100 mm)	0.186 sq. in. (120 mm ²)	7.553 x 10 ⁴ lbs. (336 kN)
Carboplate E 170/50/1.4	0.055" (1.4 mm)	2" (50 mm)	0.109 sq. in. (70 mm ²)	4.406 x 10 ⁴ lbs. (196 kN)
Carboplate E 170/80/1.4**	0.055" (1.4 mm)	3" (80 mm)	0.174 sq. in. (112 mm ²)	7.037 x 10 ⁴ lbs. (313 kN)
Carboplate E 170/100/1.4	0.055" (1.4 mm)	4" (100 mm)	0.217 sq. in. (140 mm ²)	8.813 x 10 ⁴ lbs. (392 kN)
Carboplate E 170/120/1.4*	0.055" (1.4 mm)	5" (120 mm)	0.260 sq. in. (168 mm ²)	1.057 x 10 ⁵ lbs. (470 kN)
Carboplate E 170/150/1.4*	0.055" (1.4 mm)	6" (150 mm)	0.326 sq. in. (210 mm ²)	1.322 x 10 ⁵ lbs. (588 kN)

* Referenced products are special-order items with minimal lead times and all laminate sizes are available in 328-ft. (100-m) lengths.

CSI Division Classification

Composite Reinforcing	03 25 00

Approximate Coverage for MapeWrap 11 and MapeWrap 12**

Substrate	Plate Width	Coverage
Concrete	2" (50 mm)	60 to 75 linear ft. per 1 U.S. gal. (18.3 to 22.9 m per 3.79 L)
	4" (100 mm)	30 to 40 linear ft. per 1 U.S. gal. (9.14 to 12.2 m per 3.79 L)

** Coverage shown is for estimating purposes only. Actual jobsite coverage may vary according to substrate conditions and setting practices.

Packaging

Size
<i>Carboplate E 170/50/1.2</i> roll: 0.047" x 2" x 82 ft. (1.2 mm x 50 mm x 25 m)
<i>Carboplate E 170/50/1.2</i> roll: 0.047" x 2" x 328 ft. (1.2 mm x 50 mm x 100 m)
<i>Carboplate E 170/80/1.2</i> roll: 0.047" x 3.15" x 82 ft. (1.2 mm x 80 mm x 25 m)
<i>Carboplate E 170/100/1.2</i> roll: 0.047" x 4" x 82 ft. (1.2 mm x 100 mm x 25 m)
<i>Carboplate E 170/100/1.2</i> roll: 0.047" x 4" x 328 ft. (1.2 mm x 100 mm x 100 m)
<i>Carboplate E 170/50/1.4</i> roll: 0.055" x 2" x 82 ft. (1.4 mm x 50 mm x 25 m)
<i>Carboplate E 170/50/1.4</i> roll: 0.055" x 2" x 328 ft. (1.4 mm x 50 mm x 100 m)
<i>Carboplate E 170/80/1.4</i> roll: 0.055" x 3.15" x 164 ft. (1.4 mm x 80 mm x 50 m)
<i>Carboplate E 170/100/1.4</i> roll: 0.055" x 4" x 82 ft. (1.4 mm x 100 mm x 25 m)
<i>Carboplate E 170/100/1.4</i> roll: 0.055" x 4" x 328 ft. (1.4 mm x 100 mm x 100 m)
<i>Carboplate E 170/120/1.4</i> roll: 0.055" x 4.72" x 82 ft. (1.4 mm x 120 mm x 25 m)
<i>Carboplate E 170/150/1.4</i> roll: 0.055" x 5.90" x 82 ft. (1.4 mm x 150 mm x 25 m)
<i>MapeWrap Primer 1</i> kit: 1 U.S. gal. (3.79 L)
<i>MapeWrap 11</i> kit: 1 U.S. gal. (3.79 L)
<i>MapeWrap 12</i> kit: 1 U.S. gal. (3.79 L)

Note: Check availability of the 328-ft. (100-m) sizes with your sales representative.

ADDITIONAL INFORMATION

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).

WARNING

The test results shown in the TECHNICAL DATA table were obtained in compliance with test methods and curing cycles, if applicable, defined in the industry standards referenced on the Technical Data Sheet. Please note that the use of test procedures or methods other than those indicated in the table could lead to different values and that, in such cases, any liability of our company is excluded.

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.**

Before using, the user must determine the suitability of our products for the intended use, and the user alone assumes all risks and liability. **ANY CLAIM SHALL BE DEEMED WAIVED UNLESS MADE IN WRITING TO US WITHIN FIFTEEN (15) DAYS FROM DATE IT WAS, OR REASONABLY SHOULD HAVE BEEN, DISCOVERED.**

CONTACT INFORMATION

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Flooring: 1-800-992-6273

Concrete and heavy construction: 1-888-365-0614

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1-800-361-9309

Customer Service

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

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For the most current product data and BEST-BACKEDSM warranty information,
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