

Carbotube

Pultruded carbon fibre tube impregnated with epoxy resin used in combination with Injectors Ø23 to carry out “reinforced stitching”



WHERE TO USE

Structural and functional restoration of concrete elements and brickwork, including those of historical interest, damaged by inclement weather and natural causes using the “reinforced stitching” technique.

Some application examples

- Injection of reinforced consolidation in vaulted structures and brick, stone and tuff facing walls in combination with epoxy resin or fluid slurry.
- Structural repairs and consolidation by injecting into elements which are unstable or cracked due to subsidence or seismic activity.

TECHNICAL CHARACTERISTICS

Carbotube is part of the MAPEI FRP System (an innovative system for strengthening and static upgrading reinforced cement, concrete and masonry structures) which comprises pultruded carbon fibre tubes impregnated with epoxy resin. The outside diameter of the tubes is 10 mm and the inside diameter is 8 mm. This material may be used alone for injection and structural consolidation operations, or in combination with fabrics from the **MapeWrap** range to improve anchorage, and in particular when an increase in flexural and shear strength is required.

Thanks to its composition and production process, which guarantees the same properties in all points, **Carbotube** possesses the following characteristics:

- high tensile strength;
- low weight;
- resistant to alkaline hydroxides in the concrete;
- resistant to corrosion, including when chlorides or other aggressive substances are present;
- excellent fatigue strength.

ADVANTAGES

Considerable increase in the durability of materials used for building or repairing civil and industrial structures in aggressive environments where “reinforced stitching” must be applied. **Carbotube** eliminates the risks deriving from corrosion to the reinforcement where steel is used. Also, thanks to its very low weight, it may be installed very quickly without the use of special lifting means, and in many cases, without closing off the structure while in service.

RECOMMENDATIONS

- Before applying **Carbotube** make sure the protective plastic film has been removed.

APPLICATION PROCEDURE

Preparation of the substrate

If the structure to be consolidated is highly deteriorated, repair the various elements before applying **Carbotube**. Remove damaged and deteriorated parts using a hammer, a jack-hammer or by hydro-scarifying. If there

TECHNICAL DATA (typical values)	
PRODUCT IDENTITY	
Matrix:	epoxy resin
Reinforcement:	high-strength carbon
Customs class:	3916 90 15
PRODUCT CHARACTERISTICS	
Density (kg/m ³):	1,610
Outside diameter (mm):	10
Inside diameter (mm):	8
Content of fibre by weight (%):	68
FINAL PERFORMANCE	
Tensile strength (N/mm ²):	3,100
Tensile modulus of elasticity (N/mm ²):	170,000
Elongation at breakage (%):	1.6
Coefficient of thermal expansion (m/m/°C):	0.6 x 10 ⁻⁶

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 anti-corrosion cementitious mortar (please refer to the respective Technical Data Sheet for each product for application procedures). Then repair the surfaces using products from the **Mapegrout**, **Mape-Antique** or **PoroMap** ranges (choose the most suitable product according to the characteristics and type of structure).

Drilling the holes

The outside diameter of **Carbotube** is 10 mm, so the holes drilled in the element must be 12 mm diameter (if resin is used) and 5 cm deeper than the length of the tube. If fluid grout is used, on the other hand, the hole in the element should be 14 mm in diameter. If these instructions are followed, it is guaranteed that the product injected will flow from the end of the tube and fill all the cavities around the tube so that it is perfectly embedded. Also, enlarge the entrance to the hole to help insert and block the **Injector Ø23** with a non-return valve in place (outside diameter 23 mm, length 80 mm, injection hole 5 mm diameter), which is used to inject the material. After drilling the hole, remove all the dust and loose material with compressed air.

Positioning Carbotube

Carbotube is supplied in lengths of 200 cm. Cut to the required length on site using a grinder with a diamond disk. After removing the protective film from the **Carbotube** with the help of a trimming knife, to help get a good grip on the protective film, place **Injector Ø23** at one end of the tube by twisting it and pressing lightly. Then insert **Carbotube** in the hole drilled into the element to be consolidated until the end part of the injector is blocked in position. Make sure the tube is perfectly in line with the hole during this operation. Once the product injected into the hole has hardened, remove the injectors and seal the holes with a product from the **Mapegrout**, **Mape-Antique** or **PoroMap** ranges of products.

Products used in combination with Carbotube

Pultruded tubes from the **Carbotube** range may be used in combination with epoxy resin such as **Epojet** and **Epojet LV**, or with fluid grout such as **Mape-Antique I** and **Mape-Antique F21**, which are completely cement-free and used for injecting into masonry structures, including those of historical interest. Refer to the relevant Technical Data Sheet of each of the above products for details on how to prepare them.

Cleaning

If an epoxy products is used, because of its high bond strength also to metals, we

recommend cleaning work tools with solvent (such as ethanol, xylene, thinners, etc.) before it hardens.

PACKAGING

Carbotube is available in boxes of 10 tubes 2 m long.

CONSUMPTION OF RESIN AND GROUT

The consumption of the material used in combination with **Carbotube** depends on the size of the hole in the element to be consolidated. As a rough guide, the consumption for a 12 mm hole 1 m deep is as follows:

Epojet and Epojet LV	0.3 kg
Mape-Antique F21	0.28 kg
Mape-Antique I	0.38 kg

If the size of the hole is 14 mm, the consumption is as follows:

Epojet and Epojet LV	0.38 kg
Mape-Antique F21	0.36 kg
Mape-Antique I	0.5 kg

STORAGE

Store in a covered dry area.

SAFETY INSTRUCTIONS FOR PREPARATION AND INSTALLATION

Workers must wear protective, waterproof rubber gloves, goggles and anti-solvent safety masks when preparing and applying these epoxy systems. Avoid the products coming into contact with the skin and eyes. If they come into contact, wash off with plenty of soap and water and seek medical

attention. If the products are applied in closed environments, make sure they are well ventilated to guarantee a continuous circulation of fresh air. While using or handling these products, never use naked flames and do not smoke.

For further and complete information about a safety use of our product please refer to our latest version of the Material Safety Data Sheet.

Please refer to the current version of the Technical Data Sheet, available from our web site www.mapei.com

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 applications. For this reason, anyone who intends using 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.

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

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1013-7-2010

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