PBO-JOINT

PBO fibre anchor for FRCM systems

FIELDS OF APPLICATION

Anchoring system used with Ruregold **MX-JOINT** inorganic matrix for anchoring FRCM strengthening systems and enhancing their adhesion to the existing substrate, in the following cases (see Section 6 CNR DT215/2018):

- Strengthening on one face of a masonry wall (for all types of masonry).
- Strengthening on two sides of unconnected cavity walls.
- In strengthening reinforced concrete columns against combined axial and flexural forces to ensure that the action of the strengthening system is transferred to the structure continuously.
- Shear strengthening of reinforced concrete beams when it is not possible to guarantee an anchoring length of, at least, 300 mm (11.81 in).
  In absence of experimental evidence, you provide adequate development length determined per ICC-ES AC 434.
- Structural strengthening of reinforced concrete walls.
- Connecting non-structural elements to structural support elements in reinforced concrete, such as beams and columns, etc.

METHOD OF USE

Preparing the substrate

- After preparing the substrate, as indicated in the Ruregold PBO FRCM structural strengthening system technical data sheets both for concrete and masonry, drill the holes in the substrate, having a diameter of 16 mm (0.63 in) or greater in the case of **PBO-JOINT 3 mm (0.12 in)**, and 18 mm (0.71 in) in the case of **PBO-JOINT 6 mm (0.24 in)**. The depth, inclination, and pitch of the anchoring systems must conform to the design requirements and be approved by the Works Manager.
- Eliminate any dust and loose parts caused by drilling using compressed air or an equivalent method.
- Protect the hole using pipes or similar elements and then apply the Ruregold PBO FRCM system (consult the technical data sheet available on the web site **Ruregold.com).**
- Wait until the FRCM strengthening system inorganic matrix has set completely before installing the connection system.

Preparing the inorganic matrix

MX–JOINT does not require any additional materials and may be prepared using a low-speed paddle mixer.

Preparing the inorganic matrix for anchoring the anchor in the hole.

- Open the pack of **MX–JOINT** and add approx. 1.0 litres (0.26 gal) of clean water for every 5 kg (11 lb) of powder used (approx. 5.0 litres (1.32 gal) of clean water for every 25 kg (55 lb) of powder).
- Mix continuously for about 3 minutes, without interrupting, to obtain a smooth, homogeneous mix.
- Transfer the entire contents to the Ruregold **Applicator GUN**, complete with rigid nozzle extension and flexible coupling.

Preparing the inorganic matrix for impregnating the fibre anchor

- Open the pack of **MX–JOINT** and add approx. 1.0 litres (0.26 gal) of clean water for every 5 kg (11 lb) of powder used (approx. 5.0 litres (1.32 gal) of clean water for every 25 kg (55 lb) of powder).
- Mix continuously for about 3 minutes, without interrupting, to obtain a smooth, homogeneous mix.
- Add another 1.75 litres (0.46 gal) of clean water for every 5 kg (11 lb) of powder used and mix to obtain

a “fluid consistency” (approx. 8.75 litres (2.31 gal) of clean water for every 25 kg (55 lb) of powder). Impregnate the part of the fibre anchor that was prepared earlier.

APPLICATION

- Carefully wet the hole, ensuring that no excess water remains inside it.
- Cut the **PBO-JOINT** fibre anchor to the required length using an **angle grinder** or **Ruregold SCISSORS**.
- In the case of wall tie connections, the length of each individual anchor is equivalent to the thickness of the wall, plus approximately 30 cm (11.81 in) (to permit the **PBO-JOINT** to spread out onto the FRCM strengthening system by a radius of approx. 15 cm on either face).
- In the case of one side only connections, the length of each individual anchor is equivalent to about 3/5 of the depth of the hole, plus approximately 15 cm (5.90 in) (to permit the **PBO-JOINT** to spread out onto the FRCM strengthening system).
- Slide the tubular elastic net off the portion of the **PBO-JOINT** anchor to be inserted into the masonry.
- Having removed the fibre bundle from the tubular elastic net, spread it out so that the fibre anchor is ready to be impregnated.
- Impregnate the exposed portion with **MX-JOINT** matrix in a semi-fluid state.
- Allow the impregnated portion of the fibre anchor to harden (approx. 5-7 hours).
- Fill the hole with **MX-JOINT** inorganic matrix in a dense state using the Ruregold **Applicator GUN**.
- Insert the section of the **PBO-JOINT** fibre anchor that was impregnated earlier into the hole, taking care to insert it to the correct depth (approx. 3/5 of the depth of the hole in the case of one side only connections).
- Remove the tubular elastic net containing the portion of the **PBO-JOINT** fibre anchor that is protruding from the hole.
- Once the FRCM system has been installed and allowed to harden, apply an initial layer (thickness approx. 3-5 mm (0.12 – 0.20 in)) of **MX-JOINT** matrix around the hole.
- Spread out the bundle of fibres of the part of the **PBO-JOINT** fibre anchor that is protruding from the hole and then, using a smooth metal spatula and applying light pressure, push it into the first layer of **MX-JOINT** matrix.
- Then apply a second layer of **MX-JOINT** inorganic matrix (approx. thickness 3-5 mm (0.12 – 0.20 in)) on to the spread-out fibres to completely cover the previously spread-out portion of the fibre anchor.
- The operations described above should be carried out wet on wet.

PROPERTIES OF PBO (polyparaphenylene benzobisoxazole) FIBRE

Toughness	5.8 GPa (841,21 ksi)
Modulus of elasticity	270 GPa (39160.1 ksi)
Maximum strain at rupture	2.5 %
Density	1.56 g/cm^3 (96.4 lb/ft^3)
Decomposition temperature	+ 650 °C (1202°F)
Compliant	ISO 16120 – 1/4

PROPERTIES OF THE PBO-JOINT FIBRE ANCHOR

Nominal diameter	3 mm (0.12 in)	6 mm (0.24 in)
Hole diameter	≥ 16 mm (0.63 in)	≥ 18 mm (0.71 in)
Resistant transverse cross-section of the anchor	8.80 mm^2 (0.0136 in^2)	17.61 mm^2 (0.0273 in^2)
Tensile strength (mean value)	2789 MPa (404510 psi)	2983 MPa (432647 psi)
Tensile strength (characteristic value)	2413 MPa (349976 psi)	1860 MPa (269770 psi)
Fracture strain (characteristic value)	2.14 %	1.95 %
Modulus of elasticity (mean value)	198 GPa (28717.5 ksi)	238 GPa (34519 ksi)
Extraction force from brickwork and tufa substrate (mean value)	12.7 kN (2855.1 lb)	-
Extraction force from concrete substrate (mean value)	19.2 kN (4316.3 lb)	17.3 kN (3889 lb)
Minimum anchorage length	150 mm (5.90 in)	-
Packaging	10 m (32.81 ft) dispenser	
Storage conditions	In original packaging, indoors, in a cool, dry, unventilated place.	
Compliant	ETA 25/0095 issued on 14/02/2025	

PROPERTIES OF THE MX-JOINT INORGANIC MATRIX

Density of fresh mortar (EN 1015-6)	approx. 2000 kg/m^3 (125 lb/ft^3)
Mixing water per 5 kg of powder	approx. 1.0 litres (0.26 gal) for anchoring the anchor in the hole
	approx. 2.75 litres (0.73 gal) for impregnating the fibre anchor
Mixing water per 25 kg of powder	approx. 5.0 litres (1.32 gal) for anchoring the anchor in the hole
	approx. 13.75 litres (3.63 gal) for impregnating the fibre anchor
Mix consistency	Dense when anchoring in the hole
	Fluid when impregnating the fibre anchor
Application time at 20°C	Densification begins after approx. 10-15 minutes. Mix again and use within a maximum of about 45 minutes
Application temperature	From +5°C (41°F) up to +35°C (95°F)
Compressive strength after 28 days	≥ 25 MPa (3625.9 psi)
Coverage	approx. 0.8 - 1 kg/m
Packaging	Disposable wooden pallet laden with 60 x 25 kg (55 lb) bags - total weight 1500 kg (3300 lb)
Storage conditions (Regulation (CE) No. 1907/2006 – Annex XVII point 47)	In original packaging, indoors, in a cool, dry, unventilated place.
Durability (Regulation (CE) No. 1907/2006 – Annex XVII point 47)	Not more than 12 months from packing date.
Compliant	EN 998-2

SPECIFICATION ITEM

Supply and application of an anchoring system for FRCM structural strengthening solutions, consisting of unidirectional PBO fibre, e.g. Ruregold **PBO-JOINT**, having a nominal diameter of 3 or 6 mm (0.12 or 0.24 in). The PBO fibre has a density of 1.56 g/cm^3 (96.4 lb/ft^3), toughness/tensile strength of approx. 5.8 GPa (841,21 ksi), maximum modulus of elasticity of 270 GPa (39160.1 ksi), and fracture strain 2.5%. The system is coupled to an inorganic matrix, e.g. Ruregold **MX-JOINT** specific for anchors, having compressive strength ≥ 25 MPa (3625.9 psi). The anchoring system in unidirectional PBO create the connection between the existing structures and the structural strengthening and allow to achieve the necessary continuity of the reinforcement, where necessary. The system meets the requirements of the FRCM Guidelines issued in March 2022. The substrate must be prepared and the system applied in accordance with the manufacturer's instructions.

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