

PBO-MESH 70/18

FRCM system for concrete consisting of bidirectional PBO mesh weighing 70+18 g/m² and inorganic matrix

FIELDS OF APPLICATION

- Adapting and upgrading the static and anti-seismic behaviour of RC buildings.
- Adapting and upgrading the static and anti-seismic behaviour of RC infrastructure.
- Structurally strengthening beams against bending.
- Structurally strengthening columns against combined axial and flexural forces.
- Structurally strengthening reinforced concrete beams, columns, nodes and RC walls.
- Confinement of reinforced concrete columns subject to combined axial and flexural forces.

ADVANTAGES AND PROPERTIES OF THE SYSTEM

- Increasing the flexural strength capacity of reinforced concrete beams.
- Increasing the strength capacity against combined axial and flexural forces in reinforced concrete columns.
- Increasing the strength capacity against shear of structural elements such as beams, joists in clay/concrete composite slabs, columns, and beam/column nodes.
- Increasing the strength capacity and ductility of non-confined reinforced concrete nodes.
- Increasing the strength capacity of the extremities of reinforced concrete columns.
- High system reliability thanks to post-cracking behaviour in detachment conditions.
- High system ductility and energy dissipation capacity.
- The system is also resistant to high temperatures and to freeze-thaw cycles.
- The inorganic matrix has very good adhesion to the concrete support.
- Simple and reliable placement of the inorganic matrix, which is laid in the same way as a traditional premixed bagged cement mortar.
- The system can also be applied to damp supports without any need for special protection.
- The mesh is easy to place and handle.

METHOD OF USE

SUPPORT PREPARATION

The support must be suitably reinstated and prepared in accordance with the instructions given below, and with prior approval by the Director of Works:

- Remove any deteriorated substrate by hydro-demolition of the concrete cover and stripping the reinforcement until a concrete layer is reached that is well-compacted and not carbonated.
- Clean any incoherent materials, grease, or oil from the reinforcement and remove the rust layers by brushing (manually or mechanically). It is advisable to sandblast the reinforcement to bring it to white metal.
- Using a brush, apply two coats of **Ruregold Passivator** anticorrosion cementitious mortar (see technical data sheet at www.ruregold.com) until the reinforcement is completely covered.
- Using a trowel or spraying with a plastering machine, volumetrically reconstruct the concrete cover to a thickness of about 20/25 mm per layer, wet on wet, using **MX-R4 Repair** mortar (see technical data sheet at www.ruregold.com).
- Before applying the FRCM system, round off the sharp edges of the section.
- Wet the substrate to excess before applying the strengthening.

PREPARATION OF THE MX-PBO Concrete MATRIX

- A planetary mixer can be used to prepare the mixture but should not be loaded to more than 60% of its nominal capacity for the indicated mixing times.
- A rotary mixer can be used to prepare the mixture, but should not be loaded to more than 60% of its nominal capacity for the indicated mixing times.
- Manual mixing can be carried out by mixing part of the contents of the bag in a bucket using a drill fitted with a paddle mixer, and adding the

required amount of water in relation to the contents of the bag.

- Use the whole bag of pre-mixed **MX-PBO Concrete**, once the contents have been opened.
- Preparation using a **planetary mixer** (or a **rotary mixer**, or a **drill fitted with a mixer**):
1. Open the 25 kg bag of mortar.
 2. Pour the contents of the bag of premixed **MX-PBO Concrete** into the mixer and add approximately 90% of the prescribed water (6.5 - 7.0 litres of clean water).
 3. Mix continuously (without stopping so as to prevent clumping) for 3 - 4 minutes (4 - 5 minutes for a rotary mixer). Then add the remaining 10% of clean water and finish mixing continuously for approx. one more minute.
 4. Leave the mix to rest for approx. 1 - 2 minutes before application.
 5. Apply the material, if necessary giving it a final mix.

APPLICATION OF THE FRCM SYSTEM

Structural strengthening using **PBO-MESH 70/18** in combination with the special **MX-PBO Concrete** matrix is carried out in the following phases:

- Application of a first layer of **MX-PBO Concrete** matrix to a minimum thickness of 3 mm and a maximum of 5 mm.
- Application of the **PBO-MESH 70/18** by manually incorporating it into the first layer of the still-

fresh matrix using a **smooth metal trowel and/or a metal spatula** → to give a "see-through effect" to the PBO - MESH.

- Application of the second layer of **MX-PBO Concrete** matrix to a thickness of at least 3 mm and a maximum of 5 mm on top of the still-fresh first layer of matrix, exerting sufficient pressure and making sure that it comes through the mesh, thereby ensuring optimal adhesion between the first and second layers of matrix.
- Continue as previously described for any subsequent layers of matrix, being sure to apply the various layers whilst the previous layers are still fresh.
- At the lateral overlapping points of the meshes, and if a strip of mesh has to be resumed longitudinally, make an overlap of about 300 mm in the direction of stress.
- Cut the **PBO-MESH 70/18** with an **angle grinder** or use the special **Ruregold Scissors**.
- If applying the system for strengthening against combined axial and flexural forces to columns or in all cases in which a suitable anchorage length of 30 cm is not guaranteed, install suitable **PBO-JOINT** connectors beyond the extremity of the section to which the FRCM strengthening is applied, using an **MX-JOINT** inorganic matrix (see technical data sheet at www.ruregold.com).

TECHNICAL CHARACTERISTICS

PROPERTIES OF PBO FIBRE (POLYPARAPHENYLENEBENZOBISOXAZOLE)	
Tenacity	5.80 GPa (841.22 ksi)
Young's modulus of elasticity	270 GPa (39160.17 ksi)
Ultimate elongation	2.5 %
Density	1.56 g/cm ³ (97.39 lb/ft ³)
Decomposition temperature	+ 650 °C
Regulatory reference for the fibres	ISO 16120 – 1/4

PROPERTIES OF PBO-MESH 70/18	
Weight of the PBO fibres only	70 g/m ² (0.014 lb/ft ²) in warp and 18 g/m ² (0.004 lb/ft ²) in weft
Total mesh weight	approx. 126 g/m ² (0.026 lb/ft ²)
Equivalent thickness of the balanced mesh 0/90 ° (warp)	0.045 mm (0.00178 in)
Equivalent thickness of the balanced mesh 0/90 ° (weft)	0.012 mm (0.00005 in)
Young's modulus of elasticity E _f of the dry mesh	241 GPa (34954.08 ksi)
Coil width	50 cm/100 cm (19.69 in / 39.37 in)
Coil length	15 metres (590.55 in)
Storage	In a dry place away from heat sources
Packaging	15-metre coils h 50 and 100 cm

PROPERTIES OF MX-PBO CONCRETE INORGANIC MATRIX	
Density	approx. 1800 kg/m ³ (112.37 lb/ft ³)
Application time	After 10-15 minutes densification begins. Mix again and use within no more than approx. 45 minutes
Application temperature	from +5°C to +35°C
Compressive strength at 28 days	≥ 40 MPa (5801.51 psi)
Flexural strength at 28 days	≥ 4 MPa (580.15 psi)
Young's modulus of elasticity at 28 days	≥ 15 GPa (2175.57 ksi)
Consumption	1.41 kg/m ² per mm of application thickness 5.64 kg/m ² per 4 mm of application thickness
Reaction to fire (EN 13501-1)	Euroclass A2
Packaging	Disposable wooden pallets each with 40 no. 25 Kg bags, equivalent to 1000 kg of the loose product
Storage conditions	In original packaging, under cover, in a cool, dry, unventilated place
Shelf life (European Directive 2003/53/EC)	Not more than twenty-four (24) months from packing date
Safety data sheet	Available from www.ruregold.com
CE marking	EN 1504 – 3

PROPERTIES OF THE FRCM STRENGTHENING SYSTEM FOR CONCRETE (PBO-MESH 70/18 + MX-PBO CONCRETE)		
$\sigma_{lim,conv}$ (conventional limit stress according to CNR-DT 215/2018*)	Concrete support	1914 MPa (277.60 ksi)
$\epsilon_{lim,conv}$ (conventional limit strain according to CNR-DT 215/2018*)	Concrete support	0,79%
Matrix compressive strength	40 MPa (5801.51 psi)	
Ultimate tensile strength of FRCM system (CNR-DT 215/2018*)	2369 MPa (343.59 ksi)	
System-critical mechanism (CNR-DT 215/2018*)	Type D	
Operating temperature range (CNR-DT 215/2018*)	Max 100 °C	
Application thickness of MX-PBO Concrete matrix	3 – 5 mm per layer	
f_{tu} (ultimate tensile strength-according to ACI 549.4R-20 and AC434)	1532 MPa (222.20 ksi)	
ϵ_{tu} (ultimate tensile deformation-according to ACI 549.4R-20 and AC434)	1.63% reduced at 1.2% according to ACI 549.4R-20	
Young's modulus of elasticity of the composite (FRCM kit) in the cracked phase	128 a (18564.82 ksi)	

* CNR-DT 215/2018 - Guide for the Design and Construction of Externally Bonded Fibre Reinforced Inorganic Matrix Systems for Strengthening Existing Structures, issued by Italian national research council CNR - Advisory committee on technical recommendations for construction.

GENERAL NOTES/GUIDANCE

As instructed by the Designer, implement the **FRCM strengthening system for concrete** consisting of **PBO-MESH 70/18 + MX-PBO Concrete** mesh in relation to strip width, overlaps, and the positioning of any **PBO-JOINT** connectors + **MX-JOINT**. Any support preparation work, if required, should be carried out with particular care.

Store the material under cover in a dry place well away from substances that could compromise the integrity and adhesion of the selected matrix. Appropriate site PPE must be worn when installing the FRCM system

For further technical information, contact Ruregold Technical Support on +39 02.48011962 – info@ruregold.it.

SPECIFICATION ITEM

Supply and installation of FRCM structural strengthening system consisting of Ruregold **PBO-MESH 70/18** unbalanced bidirectional PBO fibre mesh. The PBO fibre has a density of 1.56 g/cm³, traction/tenacity strength of approx. 5.8 GPa, maximum Young's modulus of elasticity 270 GPa, and ultimate elongation 2.5%. The system is coupled with Ruregold **MX-PBO Concrete** inorganic matrix specific for concrete supports, of compressive strength ≥ 40

MPa, flexural strength ≥ 4 MPa, and Young's modulus of elasticity ≥ 15 GPa. The dry mesh included in the system has a grammage (0/90°) of 88 g/m² and an equivalent thickness (0/90°) of 0.057 mm. The PBO fibre FRCM system makes it possible to increase the resistance to bending, shear, and confinement in columns; bending and shear in beams and slab joists; and to locally strengthen beam - column nodes. Increased ductility of one-dimensional elements such as reinforced concrete beams and columns. The system meets the requirements of CNR-DT 215/2018 (Guide for the Design and Construction of Externally Bonded Fibre Reinforced Inorganic Matrix Systems for Strengthening Existing Structures, issued by Italian national research council CNR - Advisory committee on technical recommendations for construction) and it is approved by the International Code Council ICC-ES with Evaluation Service Report ESR-3265 according to AC434. The fire reaction classification of the system meets the requirements of EN 13501-1: A2 – s1, d0. Preparation of the surfaces and installation of the system must follow the manufacturer's instructions.

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This technical data sheet is not a specification.

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