FRCM SYSTEM FOR CONCRETE

PBO-MESH 105

FRCM system for concrete consisting of unidirectional PBO mesh weighing 105 g/m^2 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 hollowcore composite slabs against bending.
- Structurally strengthening columns against combined axial and flexural forces.
- Structurally strengthening reinforced concrete beams, slabs, columns, and nodes.
- 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 flexural strength capacity of the joists in clay/concrete composite slabs.
- 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 hydrodemolition of the concrete cover and stripping the reinforcement until a concrete layer is reached that is well-compacted and not carbonated.
- If strengthening against combined axial and flexural forces is to be applied to the joists in a hollowcore composite slab, remove the clay bottom tray.
- 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, rond 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 105** 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 105** 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 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 105** 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
Young's modulus of elasticity	270 GPa
Ultimate elongation	2.5 %
Density	1.56 g/cm^3
Decomposition temperature	+ 650 °C
Regulatory reference for the fibres	ISO 16120 – 1/4

PROPERTIES OF PBO-MESH 105	
Weight of the PBO fibres only	105 g/m^2
Total mesh weight	approx. 152 g/m^2
Equivalent thickness of the balanced mesh 0/90 ° (warp)	0.067 mm
Equivalent thickness of the balanced mesh 0/90 ° (weft)	0.00 mm
Young's modulus of elasticity E_f of the dry mesh	228 GPa
Coil width	10 cm/20 cm(**)/25 cm/50 cm(**)
Coil length	30 metres/15 metres
Storage	In a dry place away from heat sources
Packaging	30-metre coils h 10 cm 15-metre coils h 20 (**), 25 and 50(**) cm

(**) Contact the Ruregold sales office to check delivery times and minimum lots.

PROPERTIES OF MX-PBO CONCRETE INORGANIC MATRIX	
Density	approx. 1800 kg/m^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
Flexural strength at 28 days	≥ 4 MPa
Young's modulus of elasticity at 28 days	≥ 15 GPa
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 105+ MX-PBO CONCRETE)		
$\sigma_{lim,conv}$ (conventional limit stress according to CNR-DT 215/2018*)	Concrete support (single layer)	1770 MPa
	Concrete support (two or more layers)	1738 MPa
$\varepsilon_{lim,conv}$ (conventional limit strain according to CNR-DT 215/2018*)	Concrete support (single layer)	0.77 %
	Concrete support (two or more layers)	0.76 %
Matrix compressive strength	40 MPa	
Ultimate tensile strength of FRCM system (CNR-DT 215/2018*)	2670 MPa (1 layer) 2135 MPa (2 layers)	
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	

(*) 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 105 + MX-PBO Concrete** mesh in relation to strip width, overlaps, and the positioning of any **PBO-JOINT + MX-JOINT** connectors. 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 105** unidirectional PBO fibre mesh. The PBO fibre has a density of 1.56 g/cm^3, 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 of 105 g/m^2 and an equivalent thickness of 0.067 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). 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.

Edition 06/2021

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