

# C-MESH 84/84

**FRCM strengthening system for masonry consisting of a bi-axial carbon mesh weighing 84+84 g/m<sup>2</sup> (2.48+2.48 oz/yd<sup>2</sup>) and MX-C 25 Masonry inorganic matrix**



## FIELDS OF APPLICATION

- Retrofitting and upgrading the static and seismic behaviour of masonry buildings.
- Structural strengthening of load-bearing walls (piers) and perimeter strips (spandrels) in masonry buildings.
- Structural strengthening of masonry corners and floor edge beams.
- Structural strengthening of edge beams in masonry walls.
- Structural strengthening of masonry arches, vaults, and domes.
- Structural strengthening of masonry infrastructure.
- Increased ductility of masonry buildings.
- Overturn protection and structural strengthening for external infill walls in r.c. frame buildings.

## METHOD OF USE

### Preparing the substrate

Repair and prepare the substrate as necessary, in accordance with the following instructions, subject to prior approval of the Works Manager:

- Ensure the substrate is clean, consistent and free of loose parts, dust, or mould.
- If necessary, clean the surfaces by sandblasting or using low pressure water jets.
- Ensure the substrate is sufficiently moist and has been correctly prepared for the first layer of **MX-C 25 Masonry** mortar and the subsequent FRCM system application phases.

If the support is deteriorated, irregular, and/or damaged, proceed as follows, subject to prior approval of the Works Manager:

- Remove any inconsistent residual bedding mortar between the various stone elements, and any previous work that could compromise adhesion to the support - such as structural repairs on the masonry element, e.g. cut and plug brick replacement work and/or deep repointing of mortar joints.
- Remove any existing residual mortar, either mechanically or simply by raking out manually.
- Regularise the substrate and/or mortar joints as necessary using structural repair mortars such as **MX-RW High Performance**, **MX-CP Lime**, **MX-15 Plaster** and **MX-PVA Fibre-reinforced** (consult the technical data sheets available on the website [www.ruregold.com](http://www.ruregold.com)).
- Ensure the substrate is sufficiently moist and has been correctly prepared for the first layer of **MX-C 25 Masonry** mortar and the subsequent FRCM system application phases.

### Preparing the inorganic matrix

**MX-C 25 Masonry** does not require any additional material and may be prepared using:

- A planetary type mixer.
- A concrete mixer (do not exceed 60% of the nominal load limit and mix with the axis of rotation almost horizontal).
- A screw mixer (e.g. Gras Calce **Turbomalt** mixer).
- The product may also be mixed manually in a bucket using a paddle mixer, pouring in a part of the contents of the bag and adding the appropriate quantity of water.

Mix as follows:

1. Pour in the contents of the bag of MX-C 25 Masonry and add approx. 5.5-6.5 litres (1.45 – 1.72 gal) of clean water.
2. Mix for about 3-4 minutes (4-5 minutes when using a concrete mixer) so as to obtain a smooth, homogeneous mix.
3. Leave the mix to stand for about 1-2 minutes before use.

## APPLICATION

To apply the FRCM system, proceed as follows:

- Cut the **C-MESH 84/84** to the required dimensions using an **angle grinder** or **Ruregold SCISSORS**.
- Apply an initial layer of **MX-C 25 Masonry** matrix, between 3 mm (0.12 in) and 5 mm (0.20 in) thick.
- Apply the **C-MESH 84/84**, embedding it manually in the initial layer of matrix while still fresh using a **smooth metal float and/or spatula with rounded edges** to create a see-through effect.
- Apply a second layer of **MX-C 25 Masonry** matrix, between 3 mm (0.12 in) and 5 mm (0.20 in) thick, over the initial layer while it is still fresh, exerting sufficient pressure to guarantee optimal adhesion between the two layers.
- When applying two or more layers of carbon mesh, apply each layer on the previous one while still fresh as described above.
- Where they meet longitudinally, ensure the mesh strips overlap by approx. 300 mm (11.81 in) in the direction of the stress.
- see CNR-DT215/2018 | provide sufficient overlap splicing fabrics as determined according to test methods specified in ICC-ES AC434 (see ACI 549.6R-20 chapter 11).
- In the case of rubble-core masonry and/or unconnected cavity walls, use the appropriate **C-JOINT** face-to-face anchors, together with **MX-JOINT** inorganic matrix (consult the **C-JOINT + MX-JOINT** technical data sheets available on the web site [www.ruregold.com](http://www.ruregold.com)).
- When applying the strengthening system to one face of the load-bearing wall only, use the appropriate **C-JOINT** anchors together with the **MX-JOINT** inorganic matrix. The anchors should be long enough to penetrate into the outermost layer of the unstrengthened wall (consult the **C-JOINT + MX-JOINT** connection system technical data sheets available on the web site [Ruregold.com](http://Ruregold.com)).

## FINISHING

- Once the mortar is fully cured, apply the appropriate finishing, provided it does not contain chalk.

### PROPERTIES OF CARBON FIBRE

<b>Toughness</b>	4.9 GPa (710.7 ksi)
<b>Modulus of elasticity</b>	250 GPa (3.62*10 <sup>4</sup> ksi)
<b>Maximum strain at rupture</b>	1.9 %
<b>Density</b>	1.81 g/cm <sup>3</sup> (0.065 lb/in <sup>3</sup> )
<b>Compliant</b>	EN 13002/ISO 13002

### PROPERTIES OF C-MESH 84/84

<b>Carbon fibre mesh weight</b>	84 g/m <sup>2</sup> (2.48 oz/yd <sup>2</sup> ) in warp and 84 g/m <sup>2</sup> (2.48 oz/yd <sup>2</sup> ) in weft
<b>Mesh total weight</b>	approx. 204 g/m <sup>2</sup> (6 oz/yd <sup>2</sup> )
<b>Equivalent thickness of the mesh in warp</b>	0.046 mm <sup>2</sup> /mm (0.002 in <sup>2</sup> /in)
<b>Equivalent thickness of the mesh in weft</b>	0.046 mm <sup>2</sup> /mm (0.002 in <sup>2</sup> /in)
<b>Strand pitch distance (yarn)</b>	9.5 mm (0.37 in)
<b>Area single thread (yarn)</b>	0.44 mm <sup>2</sup> (0.0007 in <sup>2</sup> )
<b>Dry mesh modulus of elasticity Ef</b>	239 GPa (34664 ksi)
<b>Width of mesh on the reel</b>	100 cm (39.37 in)
<b>Length of mesh on the reel</b>	15 m (49.21 ft)
<b>Storage conditions</b>	In the original packaging, indoors, in a cool, dry, unventilated place away from sources of heat.
<b>Packaging</b>	15 metre (49.21 ft) rolls, h 100 cm (39.37 in)

### PROPERTIES OF MX-C 25 MASONRY INORGANIC MATRIX

<b>Density of fresh mortar (EN 1015-6)</b>	Approx. 1750 kg/m <sup>3</sup> (109.2 lb/ft <sup>3</sup> )
<b>Application time at 20°C</b>	Densification begins after approx. 10-15 minutes. Mix again and use within a maximum of about 45 minutes
<b>Application temperature</b>	From +5°C (41°F) up to +35°C (95°F)
<b>Compressive strength after 28 days</b>	≥ 20 MPa (2900.7 psi)
<b>Coverage</b>	approx. 11.3 kg/m <sup>2</sup> (2.31 lb/ft <sup>2</sup> ) per strengthening layer (4+4 mm) approx. 17 kg/m <sup>2</sup> (3.48 lb/ft <sup>2</sup> ) per double strengthening layer (4+4+4 mm)
<b>Packaging</b>	Disposable wooden pallet laden with 60 x 25 kg (55 lb) bags - total weight 1500 kg (3300 lb)
<b>Storage conditions (Regulation (CE) No. 1907/2006 – Annex XVII point 47)</b>	In original packaging, indoors, in a cool, dry, unventilated place.
<b>Durability (Regulation (CE) No. 1907/2006 – Annex XVII point 47)</b>	Not more than 12 months from packing date.
<b>Compliant</b>	EN 998-2 / FRCM Guidelines 03/22
<b>Content of recovered, recycled and sub-product material</b>	≥ 15% Certificate available upon request on RureGold.com

### PROPERTIES OF THE MX-JOINT INORGANIC MATRIX

<b>Density of fresh mortar (EN 1015-6)</b>	Approx. 2000 kg/m <sup>3</sup> (124.9 lb/ft <sup>3</sup> )
<b>Application time at 20°C</b>	Densification begins after approx. 10-15 minutes. Mix again and use within a maximum of about 45 minutes
<b>Application temperature</b>	From +5°C (41°F) up to +35°C (95°F)
<b>Compressive strength after 28 days</b>	≥ 25 MPa (3625.9 psi)
<b>Coverage</b>	approx. 0.8 - 1 kg/m (0.54 – 0.67 lb/ft)
<b>Packaging</b>	Disposable wooden pallet laden with 60 x 25 kg (55 lb) bags - total weight 1500 kg (3300 lb)
<b>Storage conditions (Regulation (CE) No. 1907/2006 – Annex XVII point 47)</b>	In original packaging, indoors, in a cool, dry, unventilated place.
<b>Durability (Regulation (CE) No. 1907/2006 – Annex XVII point 47)</b>	Not more than 12 months from packing date.
<b>Compliant</b>	EN 998-2

## PROPERTIES OF THE C-MESH 84/84 + MX-C 25 Masonry STRENGTHENING SYSTEM

Certified in accordance with the “FRCM Guidelines 03/2022” - Designed in accordance with “CNR-DT215/2018” (National Research Council Technical Guidelines)

Conventional limit stress (characteristic value)	$\sigma_{lim,conv}$	Brickwork	714 MPa (103557 psi)
		Tufa	884 MPa (128213 psi)
Conventional limit strain (characteristic value)	$\epsilon_{lim,conv}$	Brickwork	0.30 %
		Tufa	0.37 %
Ultimate tensile strength of the FRCM composite (Tensile failure) (characteristic value)	$\sigma_u$	728 MPa (105587 psi)	
Ultimate tensile strength of the dry fabric (Tensile failure) (characteristic value)	$\sigma_{u,f}$	1029 MPa (149244 psi)	
Dry fabric modulus of elasticity (mean value)	$E_f$	239 GPa (34664 ksi)	
Matrix compressive strength (characteristic value)	$f_{c,mat}$	20 MPa (2900.7 psi)	
Equivalent thickness of the mesh in warp	$t_f$	0.046 mm (0.002 in)	
Equivalent thickness of the mesh in weft	$t_f$	0.046 mm (0.002 in)	
System failure mechanism	-	Type D	
Serviceability temperature range	$T_{min} - T_{max}$	From -18°C (-0.4°F) to +100°C (212°F)	
Application thickness of the MX-C 25 Masonry matrix	-	3-5 mm (0.12-0.2 in) per layer	
Reaction to fire (EN 13501-1)	-	B-s1, d0	
Certification	-	CVT No. 285 of 28/06/2023 according to the 'Guidelines for the identification, qualification and acceptance control of fibre-reinforced inorganic matrix composites (FRCM) to be used for the structural consolidation of existing buildings'.	

## “ICC-ES” verification in accordance with “AC434” Acceptance Criteria

Designed in accordance with “ACI 549.4R-20” and “ACI 549.6R-20”

Ultimate tensile strength (characteristic value)	$f_{tu}$	686 MPa (99,50 ksi)
Ultimate tensile strain (characteristic value)	$\epsilon_{tu}$	0.86 %
Composite (FRCM kit) modulus of elasticity in cracked phase (mean value)	$E_f$	80 GPa (11603.01 ksi)
Matrix compressive strength (characteristic value)	$f_{c,mat}$	20 MPa (2900.75 psi)
Equivalent thickness of the mesh in warp	$t_f$	0.046 mm (0.0018 in)
Equivalent thickness of the mesh in weft	$t_f$	0.046 mm (0.0018 in)
Application thickness of the MX-C 25 Masonry matrix	-	3-5 mm (0.12-0.2 in) per layer
Certification	-	ESR-3265

## PROPERTIES OF THE C-JOINT FIBRE CONNECTOR

Nominal diameter	6 mm (0.24 in)	10 mm (0.40 in)
Hole diameter	≥ 16 mm (0.63 in)	≥ 20 mm (0.79 in)
Resistant transverse cross-section of the connector	15.43 mm <sup>2</sup> (0.024 in <sup>2</sup> )	25.77 mm <sup>2</sup> (0.04 in <sup>2</sup> )
Tensile strength (mean value)	1494 MPa (216686 psi)	1380 MPa (200152 psi)
Tensile strength (characteristic value)	1225 MPa (177671 psi)	1221 MPa (177091 psi)
Fracture strain (characteristic value)	0.68 %	0.49 %
Modulus of elasticity (mean value)	234 GPa (33939 ksi)	232 GPa (33649 ksi)
Extraction force from brickwork and tufa substrate (mean value)	5.1 kN (1147 lb)	-
Minimum anchorage length	150 mm (5.9 in)	-
Packaging	10 m (32.8 ft) dispenser	
Storage conditions	In the original packaging, indoors, in a cool, dry, unventilated place away from sources of heat.	
Compliant	ETA 19/0361 issued on 16/10/2019	

## SPECIFICATION ITEM

Supply and application of a CVT certified FRCM structural strengthening system, consisting of a balanced, bi-directional carbon fibre mesh, e.g. Ruregold **C-MESH 84/84** and **MX-C 25 Masonry** inorganic matrix. The carbon fibre has a density of 1.81 g/cm<sup>3</sup> (0.065 lb/in<sup>3</sup>), toughness/tensile strength of approx. 4.9 GPa (710.7 ksi), modulus of elasticity of 250 GPa (36259.4 ksi), and fracture strain 1.9%. The grammage of the dry mesh is 84 g/m<sup>2</sup> (2.48 oz/yd<sup>2</sup>) in warp and 84 g/m<sup>2</sup> (2.48 oz/yd<sup>2</sup>) in weft, while the equivalent thickness is 0.046 mm (0.002 in) in warp and 0.046 mm (0.002 in) in weft. The compressive strength of the inorganic matrix, which is specifically designed for masonry substrates, is  $\geq 20$  MPa (2900.7 psi). The FRCM systems in carbon fibre may be used to strengthen load-bearing walls (piers), spandrels and reinforce masonry corners, floor and ceiling edge beams, and the intrados and extrados of arch and vault structures. The system is resistant to high temperatures and freeze/thaw cycles and may be applied directly to moist substrates. The system is consistent with the March 2022 FRCM Guidelines and is recognised 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: B-s1, d0. The substrate must be prepared and the system applied in accordance with the manufacturer's instructions.

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