RUREGOLD
INNOVATION & SAFETY FOR BUILDING

FRCM SYSTEM FOR CONNECTIONS

C-JOINT

Carbon fibre connector for FRCM system

Along with its **MX-JOINT inorganic matrix, the C-JOINT** connection system interconnects existing masonry and concrete structures by means of FRCM **Carbon** structural strengthening systems.
The fibre connector is prepared on site. It consists of a bundle of continuous parallel fibres or strands gathered within a tubular elastic net made of polyester, polyamide and latex fibres. The net can be extended both longitudinally and transversely and can be removed. The bundle of fibres becomes rigid when it is impregnated with the appropriate **MX-JOINT** inorganic matrix and is inserted into a specially made hole in the masonry and/or reinforced concrete structural element.

FIELDS OF APPLICATION

- Adapting and upgrading the static and anti-seismic behaviour of masonry and reinforced concrete buildings.
- Structural strengthening to loadbearing walls (piers) and spandrels of masonry buildings, when the FRCM system is applied to one face only of the wall
- Structural strengthening to loadbearing walls (piers) and spandrels of masonry buildings, when the FRCM system is applied to multiple-leaf and/or rubble core masonry.
- Structural strengthening to masonry corners and horizontal bandaging at floor levels.
- Structural strengthening to eaves ring beams in masonry walls.
- Structural strengthening to masonry arches, vaults, and domes.
- Structural strengthening to infrastructure works built from masonry.
- Shear strengthening to reinforced concrete beams.
- Strengthening to resist combined axial and flexural forces in reinforced concrete columns.
- Structural strengthening to infrastructure works in reinforced concrete.
- Anti-overturn systems for internal partitions and external walls.

ADVANTAGES AND PROPERTIES OF THE SYSTEM

- Increases the capacity of the Carbon-FRCM strengthening system to adhere to the existing support.
- Increases the capacity of the Carbon-FRCM system to adhere to the existing masonry support when it is applied to one face only.
- Application of the face-to-face Carbom fibre connector increases adhesion capacity to the masonry support in multi-leaf and/or rubble-core masonry.
- Increased adhesion capacity of the Carbon FRCM system to the concrete support when shear strengthening is applied to reinforced concrete beams.
- Increased adhesion capacity of the Carbon FRCM system to the concrete support when strengthening is applied to reinforced concrete walls.
- Continuous force transfer to the structure is created by the Carbon-FRCM strengthening system when it is applied to strengthening against combined axial and flexural forces in reinforced concrete columns.
- Creation of constraints when the Carbon fibre connector is inserted into masonry and reinforced concrete structures.
- The system can also be applied to damp supports without any need for special protection.
- The fibre bundle is easy to place and handle.

METHOD OF USE AND INSTALLATION

SUPPORT PREPARATION

- Prepare the support and install the FRCM system for masonry and concrete (see technical data sheet for the **C-MESH 84/84 + MX-C25 Masonry**, **C-MESH 182 + MX-C50 Concrete** systems).
- Drill holes in the masonry or concrete support of minimum diameter 16 mm for the **6 mm C-JOINT**, 20 mm for the **10 mm C-JOINT**, and 22 mm for the **12 mm C-JOINT**.

- The depth, inclination, and pitch of the connection systems must accord with the design requirements, and with prior approval by the Director of Works.
- It is recommended to use a drill whose technical characteristics are suitable for the consistency of the material to be drilled.
- Eliminate dust and incoherent parts (e.g. with compressed air) from inside the hole that were produced by drilling.
- The connection system must only be installed after the inorganic matrix of the previously installed FRCM reinforcement system has completely hardened.

PREPARATION OF THE MX-JOINT INORGANIC MATRIX

- Open the 5 kg bucket of **MX-JOINT** inorganic matrix.
- Pour in 90% of the required total water content (0.95 litres of clean water) and mix for approx. three minutes.
- Using a paddle mixer drill at low speed, mix without stopping until a homogeneous lump-free mixture is obtained.

GROUTING INTO THE HOLE

- Add the remainder of the water (0.10 litres of clean water) and continue until the mixture is homogeneous, free of lumps, and has a “pasty/creamy" consistency.
- Pour the contents into the Ruregold **GUN**.
- Using the Ruregold **GUN**, inject the **MX-JOINT** inorganic matrix into the hole.

IMPREGNATING THE FIBRE CONNECTOR

- Add the remainder of the water (0.35 litres of clean water) and continue mixing until a homogeneous and lump-free mixture of “fluid" consistency is obtained.
- Impregnate the part of the connector that was prepared previously.

APPLICATION OF THE CONNECTION SYSTEM

- Carefully wet the hole without allowing any excess water to stagnate.
- Cut the **C-JOINT** fibre connector to the required length. Take into consideration the portion that will be inserted into the hole (approx. 3/5 of the depth of the hole) increased as appropriate (about 15 - 30 cm), to account for the portion that will be spread out on the FRCM system. Cut the fibre connector to size.
- From the end of the **C-JOINT** fibre connector, pull out the fibres from the tubular elastic net that contains it, taking care not to extract the fibres completely, but only the length that is to be inserted into the hole. →Important: use one hand to hold the end of the part of the connector that is retained within the tubular elastic net.
- Open the bundle of fibres that are now free of the tubular net, ready to be impregnated with the **MX JOINT** matrix.
- Impregnate the part of the connector that has been pulled out, in the semi-fluid **MX-JOINT** matrix (the steps for preparing the **MX-JOINT** matrix are given below).
- Reposition the tubular elastic net on the portion of the connector that is now impregnated with the semi-fluid inorganic matrix.
- Wait for the now-impregnated part of the connector to harden **(the hardening phase must continue until the affected part of the fibre connector has become sufficiently maneuverable inside the hole, without waiting for the matrix gripping and hardening phase to complete).**
- Fill the hole with **MX-JOINT** inorganic matrix. If necessary use the special Ruregold **GUN**, which has a nozzle with a rigid extension and a flexible connection and is ideal even in the most difficult positions.
- Insert the portion of the **C-JOINT** connector, previously impregnated with **MX-JOINT** matrix, into the hole, being sure to insert it deeply (approx. 3/5 of the depth of the hole).
- Remove the elastic tubular net containing the portion of the **C-JOINT** connector that is protruding from the hole.
- When the FRCM strengthening system has been installed and has hardened, apply a first layer (approx. thickness 3- 5 mm) of **MX-JOINT** matrix around the hole into which the impregnated portion of the **C-JOINT** connector was inserted.
- Fan out the bundle of fibres of the part of the **C-JOINT** connector 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) on to the fanned-out fibres to completely cover the previously fanned-out portion of the connector.
- The operations just described should be carried out wet on wet.

TECHNICAL CHARACTERISTICS

PROPERTIES OF CARBON FIBRE	
Tenacity	4.90 GPa
Young's modulus of elasticity	250 GPa
Ultimate elongation	1.9 %
Density	1.81 g/cm^3
Regulatory reference for the fibres	UNI EN 13002-2 / ISO 13002

PROPERTIES OF THE C-JOINT FIBRE CONNECTOR			
Nominal diameter	6 mm	10 mm	12 mm
Resistant cross-section of the connector	15.43 mm^2	25.77 mm^2	31.08 mm^2
Tensile strength (average value)	1494 MPa	1380 MPa	1429 MPa
Tensile strength (characteristic value)	1225 MPa	1221 MPa	1263 MPa
Ultimate strain (characteristic value)	0.68 %	0.49 %	0.83 %
Young's modulus of elasticity (average value)	234 GPa	232 GPa	198 GPa
Packaging	10-metre dispenser		
Storage	In a dry place away from heat sources		
Certification	ETA 19/0361 dated 16/10/2019		

PROPERTIES OF MX-JOINT INORGANIC MATRIX	
Density	approx. 1800 kg/m^3
Application temperature	from +5°C to +35°C
Compressive strength at 28 days	≥ 40 MPa
Flexural strength at 28 days	≥ 3 MPa
Youngs modulus of elasticity at 28 days	≥ 18.50 GPa
Consumption	approx. 0.8 - 1.0 kg/m
Reaction to fire (EN 13501-1)	Euroclass A2
Packaging	Disposable wooden pallets with 72 buckets per 5 kg pallet = 360 kg of 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**

GENERAL NOTES/GUIDANCE

As directed by the Designer, install the **FRCM strengthening system for connections** consisting of the **C-JOINT** connector and the **MX-JOINT** inorganic matrix. One length of the fibre bundle will be impregnated and inserted into the hole, and the other length will be fanned out on to the FRCM connection after installation. Ensure that the support is prepared as necessary.
Store the material in a covered and dry place away from substances that could compromise its integrity and correct application. 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 a connection system to support the **FRCM structural strengthening** and consisting of Ruregold unidirectional **C-JOINT** carbon fibres of nominal diameter 6/10/12 mm. The carbon fibre has a density of 1.81 g/cm^3, tensile strength/toughness approx. 4.9 GPa, maximum Young's modulus of elasticity 250 GPa, and ultimate strain of 1.9%. The system is coupled to an inorganic matrix of type Ruregold **MX-JOINT** specific for connections, of compression strength> 40 MPa and flexural strength> 3 MPa. The connection system in unidirectional carbon fibres enables coupling connections to be created between the existing structures and the structural strengthening and to obtain, where required, the necessary continuity of the reinforcement. Creation of connection for anti-overturn protection. Face-to-face connections at corners and separated intersecting walls. Connection system consistent with 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). 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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