



C-MATRIX SYSTEM C-MATRIX C225C15-M

FRCM SYSTEM (FIBER REINFORCED CEMENTITIOUS MATRIX) FOR THE RESTORATION AND STRUCTURAL CONSOLIDATION OF HISTORIC AND MODERN MASONRY BUILDINGS

C-MATRIX G320C15-M is an FRCM reinforcement system that combines the effectiveness of a bidirectional high-tenacity carbon fiber mesh and an inorganic matrix based on lime and hydraulic binders, bonded together by a water-based adhesion promoter. The system offers excellent chemical-physical and elastomechanical properties, ensuring optimal compatibility with the support materials, even on heritage buildings subject to conservation or protection regulations.

System components:

- **FB-RC225-TH12-R16:** Bidirectional high-tenacity carbon fiber dry mesh, with a dry weight of 206 g/m², providing excellent tensile strength for the entire system and ensuring the proper distribution of static and seismic stresses.
- **MATERIA RINFORZA - RZ215:** Structural mortar based on lime and hydraulic binders, with a compressive strength ≥ 15 MPa, ensuring proper stress transfer through strong adhesion between the system and the substrate.
- **FB-IPN01:** A two-component water-based product made of resins supported by a microcrystalline inorganic matrix, used for impregnating fiberglass or carbon fiber reinforcements as an adhesion promoter.

The bidirectional high-tenacity carbon fiber mesh, known for its flexibility and adaptability to irregular surfaces, as well as its good mechanical strength, works synergistically with the inorganic matrix. This synergy, facilitated by the adhesion promoter, creates a homogeneous and low-thickness reinforcement that does not alter mass distribution or structural stiffness. The system integrates seamlessly with the existing masonry, enhancing both the resistance and ductility of the structure, even in areas prone to seismic risk.

C-MATRIX C225C15-M ensures excellent chemical and mechanical compatibility with traditional building materials, making it suitable for the consolidation of historically and artistically valuable buildings. Interventions using this reinforcement system are structurally effective while being minimally invasive, preserving the architectural value of the existing structures.

Compliant with the provisions of EAD 340275-00-0104 "Externally bonded Composite systems with inorganic matrix for strengthening of concrete and masonry structures," **C-MATRIX C225C15-M** is CE marked for structural consolidation interventions. The components of the system are certified with an Environmental Product Declaration (EPD) for CAM (Minimum Environmental Criteria) compliance.

C-MATRIX SYSTEM

C-MATRIX C225C15-M

APPLICATION FIELDS

- Structural reinforcement and seismic improvement of existing masonry with a high masonry quality index
- Increase of structural strength and ductility
- Prevention of local and/or global collapses
- Reinforcement of masonry arches and vaults, including those with reduced thickness
- Confinement and reinforcement of masonry columns
- Anti-overturning protection and reinforcement of non-structural elements (NSEs) (e.g., infill walls on framed structures)
- Reinforced masonry top courses (capping beams)

MAIN ADVANTAGES

1. **High performance:** the system improves the tensile strength of the masonry, ensuring structural safety even in seismic contexts and under high loads, without increasing the stiffness or mass of the structure.
2. **Durability and compatibility:** the matrix-reinforcement system ensures optimal chemical-physical compatibility with materials in historic masonry, resulting in the long-term durability of the intervention.
3. **Ease of application:** the bidirectional high-tenacity carbon fiber mesh is lightweight, flexible, manageable, and easy to install. The "fresh on fresh" application method, combined with the characteristics of the mesh, helps reduce reinforcement installation time.
4. **Environmental sustainability and living comfort:** the use of a lime-based matrix with hydraulic binders makes the system breathable, eco-friendly, and low in environmental impact (EPD certification available).
5. **Versatile solution:** suitable for both historic buildings and modern masonry structures, C-MATRIX C225C15-M is a thin, non-invasive reinforcement solution suitable for various substrates, including non-flat surfaces such as vaults, arches, columns, etc.
6. **Reversibility of the intervention:** The C-MATRIX C225C15-M system meets the reversibility criteria required for heritage architecture, ensuring non-invasive interventions that are easily removable.

TECHNICAL DATA OF THE SYSTEM

	Description of the system
Commercial Name	C-MATRIX C225C15-M
Manufacturer	Fibre Net SpA
Type of reinforcement	FB-RC225-TH12-R16 +IPN Bidirectional dry mesh made of high tensile carbon fiber Water-based adhesion promoter
Type of matrix	MATERIA RINFORZA- RZ215 Lime-based mortar and hydraulic binders
Nominal thickness of the reinforcement system	8 mm

MECHANICAL CHARACTERISTICS OF THE SYSTEM

Detachment tests	Average value	Value characteristic	U.M.	Ref.
	Support: brick masonry			
Conventional limit tension $\sigma_{lim,conv}$	838	672	MPa	EAD 340275-00- 0104
Conventional limit strain $\varepsilon_{lim,conv}$	0,43	-	%	
Tensile tests	Value average	Value characteristic	U.M.	
Ultimate tension σ_u of the composite	1860	1717	MPa	
Ultimate strain ε_u of the composite	1,07	-	%	
Stiffness modulus E_1 , in stage A	596,80	-	GPa	

GEOMETRIC, MECHANICAL AND PHYSICAL DATA OF THE REINFORCEMENT

Properties	Description	Ref.
Commercial name	FB-RC225-TH12-R16	
Weight of the mesh (dry) in warp	103 g/m ²	ISO 11667:1997
Weight of the mesh (dry) in weft	103 g/m ²	
Equivalent thickness of the reinforcement mesh in both directions	0.058 mm	EAD 340275-00-0104
Density of the material constituting the reinforcement mesh	1.78 g/cm ³	
Mesh size	16 x16 mm	Internal method

Tensile tests	Value average	Value characteristic	U.M.	Ref.
Ultimate tensile strength σ_{uf} of the mesh	1964	1793	MPa	EAD 340275-00- 0104
Elastic modulus E_f of the mesh	195,31	173,90	GPa	
Ultimate tensile strain ϵ_{uf} of the mesh	1,01	-	%	

MECHANICAL CHARACTERISTICS OF THE ADHESION PROMOTER

Properties	Description	Ref.
Commercial name	FB-IPN01	
Catalysis ratio components A / B	0.5 : 1	-
Compressive strength at 28 days	> 15 MPa	EN 1542
Flexural strength at 28 days	> 5 MPa	EN 1015-11

MECHANICAL CHARACTERISTICS OF THE MORTAR

Properties	Description	Ref.
Commercial name	MATERIA RINFORZA- RZ215	
Classe	M15	EN 998-2
Compressive strength at 28 days	≥ 15 MPa	EAD 340275-00-0104
Elastic modulus at 28 days	≥ 10 GPa	
Adhesion to the brick support	≥ 0.5 MPa (FP: A)	EN 1015-12
Percentage by weight of organic components	< 10 %	-
Vapor permeability	15 / 35	EN 998-2

System qualified with **CE Marking** with assessment and verification of performance consistency **AVCP 2+**

APPLICATION GUIDELINES FOR THE SYSTEM

The application of the **C-MATRIX C225C15-M** system follows a process designed to ensure maximum performance in any application context, whether historical or modern, and on masonry with an appropriate quality index. The correct execution of all operational stages is crucial to achieve an effective and durable reinforcement.

ENVIRONMENTAL CONDITIONS

Application temperature: The system should be applied in environmental conditions ranging from +5°C to +35°C. Exposure to direct sunlight or excessive moisture should be avoided to ensure optimal curing of the mortar and proper adhesion of the mesh.

PREPARATION OF THE SUBSTRATE

Proper substrate preparation is essential to ensure the full effectiveness of the **C-MATRIX G320C15-M** system. The surface must be sound, compact, and mechanically stable to ensure perfect adhesion of the mortar and reinforcement.

Removal of surface layers and preparation of the support: For interventions on load-bearing masonry, arches, or vaults, it is recommended to completely remove the existing plaster and/or surface coating layers, either manually or with mechanical tools. All loose or detached parts must be removed until the sound masonry is reached.

Where possible, scarification should also be performed on mortar joints to a depth of ≥ 5 mm. In the presence of strong and well-bonded surface coatings or plasters, whose removal would compromise the integrity of the substrate for subsequent reinforcement application, it is advisable to consult Fibre Net technicians for a specific evaluation.

In the case of vault interventions, mechanically remove the existing plaster until the masonry is exposed. For external reinforcement, check the consistency of the infill before removal and follow the stages outlined in the project.

In the presence of large voids or cracks, the substrate must be repaired using materials compatible with the original ones, such as stone, bricks, or tuff, to maintain structural integrity and compatibility with the existing materials.

Any edges where the system will be applied should be rounded with a radius of curvature of at least 20 mm. After removal and the aforementioned operations, carefully clean the surface of dust, grease, efflorescence, and other substances using low-pressure water washing. Allow excess water to evaporate, ensuring the substrate is saturated but the surface is dry (SSA) before applying the mortar.

The prepared surface should be flat, rough (not smooth), with a roughness index ≥ 1 mm, sufficient to ensure the proper bonding of the subsequent mortar.

For highly absorbent or mechanically weak masonry, it is recommended to apply a consolidating primer to improve mortar adhesion. This is particularly advised for gypsum-based supports or substrates with low cohesion. For recommendations on the most suitable consolidation materials, please contact the company.

MORTAR PREPARATION

The **MATERIA RINFORZA - RZ215** mortar must be prepared by adding clean water in accordance with the specifications provided in the relevant technical data sheet. The mixing and preparation of the mortar must be carried out using the appropriate tools and methods, as outlined in the same technical data sheet.

APPLICATION OF THE FIRST LAYER OF MORTAR

On the properly roughened surface, thoroughly washed with low-pressure water cleaning, and with the substrate saturated but the surface dry (SSA), proceed with the following steps.

Before applying the reinforcement system, and in the case of irregular surfaces, it is possible to level the masonry by applying a layer of **MATERIA RINFORZA - RZ215** mortar using a trowel, plastering tool, or spray application. Allow this first layer to harden for 18-24 hours.

Then, apply a uniform first layer of **MATERIA RINFORZA - RZ215** mortar with a thickness of 3 to 5 mm, ensuring the material is evenly distributed across the entire surface to be treated.

APPLICATION OF THE FIRST ADHESION PROMOTER LAYER

While the mortar is still damp, approximately 15-20 minutes after its application, proceed with the application of the first layer of adhesion promoter **FB-IPN01** using a brush or roller, at a rate of approximately 600g/m² of the surface to be treated.

It is important to apply the adhesion promoter to the surface of the mortar while it is still damp, but before the formation of any water film.

INSTALLATION OF THE REINFORCEMENT MESH

While the adhesion promoter is still fresh, proceed with the application of the bidirectional high-tenacity carbon fiber mesh **FB-RC225-TH12-R16**. The mesh should be carefully positioned and gently pressed with a flat trowel to ensure it is fully embedded in the mortar and adhesion promoter layer. At the junctions between mesh sheets, both longitudinally and transversally, proper overlap must be ensured as per the guidelines of **CNR-DT 215/2018**, ensuring continuity and effectiveness of the structural reinforcement. In the absence of laboratory testing, a minimum overlap of **300 mm** is required.

APPLICATION OF SECOND ADHESION PROMOTER LAYER

Once the mesh is positioned, apply the second layer of adhesion promoter FB-IPN01 on the still-wet reinforcement using a brush or roller, at a rate of 400g/m² of the surface to be treated. Be sure to use a special grooved steel roller to remove any air from the fabric, allowing for proper impregnation of the fibers.

APPLICATION OF THE SECOND MORTAR LAYER

Apply a second layer of mortar over the final layer of adhesion promoter, using a "fresh on fresh" technique, with a uniform thickness of approximately 3 to 5 mm, ensuring a total thickness of up to **8 mm**. This layer must fully cover the mesh and provide adequate protection to the reinforcement.

APPLICATION OF CONNECTORS OPTIONAL

In specific situations, where a mechanical connection between the reinforcement and the supporting structure is required, high-tenacity carbon fiber connectors such as **FB-TUP10-CHT** or **FB-TUF_CHT** may be used. These connectors are inserted into pre-drilled holes in the masonry and embedded within the mortar layer, ensuring an effective connection between the reinforcement system and the existing structure. The installation of connectors must follow the project's technical specifications and the guidelines provided by the company. Specifically, for external reinforcement of arches or vaults, it is recommended to use connection systems on the reinforcement system folded at the springlines for approximately **200 mm**.

CURING AND PROTECTION

Once the reinforcement system application is completed, the surfaces must be adequately protected during the curing phase for at least **24 hours**. In particularly dry, hot, or ventilated conditions, it is recommended to cover the surfaces with tarps or use wet curing techniques, such as spraying water, to prevent too rapid drying, which could compromise the quality of the reinforcement. In aggressive environments or areas exposed to humidity or water, it is advisable to apply an additional protective layer with a suitable product to ensure greater durability of the system. In these cases, it is recommended to consult the Technical Department to determine the most appropriate protective treatment for the specific conditions.

C-MATRIX SYSTEM

C-MATRIX C225C15-M

HANDLING AND STORAGE CONDITIONS

The system is provided in two distinct phases: the matrix (a one-component mortar based on lime and hydraulic binders) and the reinforcement (bidirectional high-tenacity carbon fiber mesh).

The **FB-RC225-TH12-R16** mesh is available in rolls with the following dimensions:

- 100 - 125 cm (H) x 50 - 100 (L) m

The mesh must be stored in a dry, dust-free environment. Avoid direct exposure to light and heat sources.

The **MATERIA RINFORZA - RZ215** mortar is supplied in the following format:

- 25 kg bag

The mortar must be stored in its original, well-sealed packaging, in a dry location, and protected from freezing, high temperatures, excessive sunlight, and wind during the curing period.

SAFETY INSTRUCTIONS

During all stages of product preparation and application, the operator must use the required Personal Protective Equipment (PPE) specific to the handling of mesh and mortar (work clothing, protective goggles, gloves, and dust mask). For detailed instructions, refer to the respective technical and safety data sheets. Avoid contact with skin and eyes; in case of skin contact, wash thoroughly with water and soap; in case of eye contact, rinse with water and seek medical advice.

In confined spaces, ensure sufficient ventilation to guarantee proper air exchange.

ENVIRONMENTAL DECLARATIONS

The **FB-RC225-TH12-R16** mesh is equipped with an EPD (Environmental Product Declaration) for contributing to the CAM (Minimum Environmental Criteria) requirements.

Similarly, the **MATERIA RINFORZA - RZ215** mortar has a certificate of minimum recycled content issued by ICMQ.

CERTIFICATIONS

The **C-MATRIX C225C15-M** system is CE marked in accordance with ETA No. 22/0865.

SPECIFICATION VOICE

Structural reinforcement intervention on existing masonry using the **FRCM C-MATRIX C225C15-M** system by Fibre Net SpA, in accordance with EAD 340275-00-0104, CE marked with AVCP2+ control system, and compliant with CAM criteria. The intervention involves the application of an initial layer of **MATERIA RINFORZA - RZ215** mortar by Fibre Net, based on lime and hydraulic binders, with a compressive strength ≥ 15 MPa. While the mortar is still damp, the first layer of **FB-IPN01** adhesion promoter, water-based and consisting of interpenetrated resins, is applied. This is followed by the placement of the bidirectional high-tenacity carbon fiber mesh **FB-RC225-TH12-R16** by Fibre Net, with a mesh size of 16x16 mm, grammage of 206 g/m², equivalent mesh thickness of 0.058 mm, characteristic ultimate tensile strength of the composite of 672 MPa, and an average elastic modulus of the mesh of 195.31 GPa. Subsequently, a second layer of adhesion promoter **FB-IPN01** is applied, followed by a second layer of **MATERIA RINFORZA - RZ215** mortar, achieving a total intervention thickness of 8 mm. The following items are excluded: removal of existing plaster, remediation of degraded areas, preparation of the substrate via washing and saturation with water on the application surfaces, connectors (if specified), any finishing products, and material acceptance testing. All materials must comply with technical specifications and be certified according to current regulations.

The information provided in this data sheet, along with any technical advice given verbally or in writing regarding the usage methods and performance of our products, reflects the current state of scientific and practical knowledge. It does not imply any responsibility or warranty regarding the final outcome of works using our products. It is the responsibility of the Client to determine whether Fibre Net products are suitable for the intended use and purposes, and to ensure compliance with workplace conditions and disposal procedures in accordance with applicable laws and regulations. Fibre Net reserves the right to modify the technical characteristics, descriptions, and illustrations of the product in this data sheet at any time. The Client is responsible for verifying that this data sheet is not outdated, as it may have been replaced by subsequent editions and/or new products. For additional information, the Client is advised to contact the Fibre Net technical office in advance. This edition supersedes and replaces any previous versions.