

## C-MATRIX SYSTEM C-MATRIX G220C15-S

**FRCM (FIBER REINFORCED CEMENTITIOUS MATRIX)  
REINFORCEMENT SYSTEM FOR THE RESTORATION AND  
STRUCTURAL STRENGTHENING OF HISTORIC AND MODERN  
MASONRY BUILDINGS.**



**C-MATRIX G220C15-S** is an FRCM reinforcement system that combines the effectiveness of a bidirectional dry AR glass fiber mesh with an inorganic matrix based on lime and hydraulic binders. The system offers excellent chemical-physical and elastomechanical properties while ensuring optimal compatibility with substrate materials, including those in architecturally protected or listed structures.

### System components:

- **FB-VAR220R12:** A bidirectional AR (Alkali-Resistant) glass fiber dry mesh, with a dry weight of 200 g/m<sup>2</sup>. It provides high tensile strength to the entire system and ensures the proper distribution of static and seismic stresses.
- **MATERIA RINFORZA - RZ215:** A structural mortar based on lime and hydraulic binders, with a compressive strength  $\geq 15$  MPa. This ensures efficient stress transfer and strong adhesion between the system and the substrate.

The AR glass fiber bidirectional dry mesh is characterized by its flexibility, adaptability to irregular surfaces, and mechanical strength. It works in synergy with the inorganic matrix to create a homogeneous, thin reinforcement layer that does not alter the mass distribution or structural rigidity. The system integrates seamlessly with existing masonry, enhancing both the strength and ductility of the structure, even in seismic-prone areas.

**C-MATRIX G220C15-S** ensures excellent chemical and mechanical compatibility with traditional construction materials, making it suitable for the consolidation of buildings of significant historical and artistic value. Reinforcements implemented with this system are structurally effective while being minimally invasive, thus preserving the architectural integrity of existing structures. The system complies with EAD 340275-00-0104 ("Externally bonded Composite systems with inorganic matrix for strengthening of concrete and masonry structures") and bears CE marking for structural consolidation applications. Its components are certified with EPD (Environmental Product Declaration), contributing to CAM (Minimum Environmental Criteria) compliance.

### APPLICATION FIELDS

- Structural reinforcement and seismic improvement of existing masonry with a high-quality masonry index.
- Enhancement 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 strengthening of masonry columns.
- Anti-overturning measures and reinforcement of non-structural elements (NSEs), such as infill panels in framed structures.
- Reinforced masonry top bands.

### MAIN ADVANTAGES

1. **High performance:** The system enhances the tensile strength of masonry, ensuring structural safety even in seismic conditions or under high-stress scenarios, without increasing the stiffness or mass of the structure.
2. **Durability and compatibility:** The matrix-reinforcement system ensures optimal chemical-physical compatibility with historic masonry materials, resulting in long-lasting interventions.
3. **Ease of application:** The dry, bidirectional alkali-resistant (AR) glass fiber mesh is lightweight, flexible, and easy to handle and install. The "wet-on-wet" application method, combined with the characteristics of the mesh, reduces reinforcement installation time.
4. **Environmental sustainability and living comfort:** Thanks to the use of a lime- and hydraulic binder-based matrix, the system is breathable, eco-friendly, and has a low environmental impact (EPD certification available).
5. **Versatile solution:** Suitable for both historic buildings and modern masonry structures, the **C-MATRIX G220C15-S** is a thin, non-invasive reinforcement solution that can be applied to various substrate types, including irregular surfaces such as vaults, arches, and columns.
6. **Reversibility of the intervention:** The **C-MATRIX G220C15-S** system meets reversibility criteria required for protected architectural heritage, ensuring non-invasive, easily removable interventions.

## TECHNICAL DATA OF THE SYSTEM

	System Description
Commercial Name	<b>C-MATRIX G220C15-S</b>
Manufacturer	Fibre Net SpA
Type of reinforcement	FB-VAR220R12 Bidirectional dry mesh made of AR glass fiber
Type of matrix	MATERIA RINFORZA – RZ 215 Lime-based mortar and hydraulic binders
Nominal thickness of the reinforcement system	8 mm

## MECHANICAL CHARACTERISTICS OF THE SYSTEM

Pull tests	Average value	Value characteristic	U.M.	Ref.
	Support: brick masonry			
Conventional limit stress $\sigma_{lim,conv}$	433	349	MPa	EAD 340275-00- 0104
Conventional limit deformation $\varepsilon_{lim,conv}$	0,55	-	%	
Tensile tests	Value average	Value characteristic	U.M.	
Ultimate tensile strength $\sigma_u$ of the composite	487	410	MPa	
Ultimate strain $\varepsilon_u$ of the composite	1,00	-	%	
Stiffness modulus $E_1$ , in stage A	105,60	-	GPa	

## GEOMETRIC, MECHANICAL AND PHYSICAL DATA OF THE REINFORCEMENT

Properties	Description	Ref.
Commercial name	<b>FB-VAR220R12</b>	
Grammage of the mesh (dry) in warp	100 g/m <sup>2</sup>	ISO 11667:1997
Grammage of the mesh (dry) in weft	100 g/m <sup>2</sup>	
Equivalent thickness of the reinforcement mesh in both directions	0.038 mm	EAD 340275-00-0104
Density of the material constituting the reinforcement mesh	2.65 g/cm <sup>3</sup>	
Mesh size	12x12 mm	Internal method

Tensile tests	Value average	Value characteristic	U.M.	Ref.
Ultimate tensile strength $\sigma_{uf}$ of the mesh	687	612	MPa	EAD 340275-00- 0104
Elastic modulus $E_f$ of the mesh	79,00	69,50	GPa	
Ultimate tensile strain $\varepsilon_{uf}$ of the mesh	0,87	-	%	

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## MECHANICAL CHARACTERISTICS OF THE MORTAR

Properties	Description	Ref.
Commercial name	<b>MATERIA RINFORZA- RZ215</b>	
Class	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 998-1
Percentage by weight of organic components	< 10 %	-
Vapor permeability	15 / 35	EN 998-2

Certified with CE Marking and compliant with AVCP System 2+ for the assessment and verification of constancy of performance.

## APPLICATION GUIDELINES FOR THE SYSTEM

The application of the **C-MATRIX G220C15-S** system follows a process designed to ensure maximum performance across all contexts, whether historic or modern, and on masonry with an adequate quality index. Proper execution of each operational phase is essential to achieving effective and durable reinforcement.

### ENVIRONMENTAL CONDITIONS

**Application temperature:** The system must be applied in environmental conditions ranging from +5°C to +35°C. To ensure optimal curing of the mortar and proper adhesion of the mesh, avoid exposure to direct sunlight or excessive humidity during application.

### SUBSTRATE PREPARATION

Proper substrate preparation is critical to ensuring the full effectiveness of the **C-MATRIX G220C15-S** system. Work must be carried out on a sound, compact, and mechanically robust surface to guarantee perfect adhesion of the mortar and reinforcement.

**Removal of surface layers and preparation of the support:** For interventions on load-bearing walls, arches, or vaults, it is recommended to completely remove the existing plaster and/or surface covering layers, either manually or using mechanical tools. All inconsistent or detached portions must be eliminated, proceeding until the sound masonry is exposed.

Where possible, joint raking should also be performed to a depth of ≥5 mm. In cases where surface coatings or plasters are firmly bonded and their removal would compromise the substrate's integrity for subsequent reinforcement applications, consulting Fibre Net technicians for a specific assessment is advised.

For interventions on vaults, mechanically remove the existing plaster until the masonry is reached. For extrados reinforcement, verify the consistency of the backfill before removing it and follow the phases outlined in the project.

In the presence of large voids or significant cracks, the substrate must be restored using materials compatible with the originals, such as stone, bricks, or tuff, to maintain structural coherence and compatibility with existing materials.

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

The prepared surface must be flat, not smooth but rough, with a roughness index ≥1 mm to ensure adequate adhesion for the subsequent mortar layer.

For highly absorbent or mechanically weak masonry, the application of a consolidating primer is recommended to enhance mortar adhesion. This operation is particularly advised for gypsum substrates or low-cohesion surfaces. For details on the most suitable consolidating materials, contact the Company.

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## **MORTAR PREPARATION**

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

## **APPLICATION OF THE FIRST LAYER OF MORTAR**

On the adequately roughened surface, thoroughly cleaned via low-pressure water jetting and with a saturated substrate but a dry surface (s.s.d.), proceed with the following steps.

Before applying the reinforcement system, and in the presence of irregular surfaces, the masonry can be leveled by applying a layer of **MATERIA RINFORZA - RZ215** mortar using a trowel, spatula, or spraying method. Allow this initial layer to cure for 18–24 hours.

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

## **INSTALLATION OF THE REINFORCEMENT MESH**

While the mortar is still fresh, proceed with the application of the **AR FB-VAR220R12** bidirectional fiberglass mesh. The mesh must be carefully positioned and gently pressed with a flat trowel to ensure it is fully embedded in the mortar layer.

At the junctions between the mesh sheets, both longitudinally and transversely, adequate overlap must be ensured as specified in CNR-DT 215/2018, thereby maintaining the continuity and effectiveness of the structural reinforcement. In the absence of laboratory tests, a minimum overlap of **300 mm** is required.

## **APPLICATION OF THE SECOND LAYER OF MORTAR**

Once the mesh has been positioned, apply a second layer of mortar, wet-on-wet, with a uniform thickness of approximately 3–5 mm, ensuring a total thickness of **8 mm**. This layer must fully cover the mesh, providing adequate protection for the reinforcement.

## **APPLICATION OF CONNECTORS (OPTIONAL)**

In specific situations requiring mechanical anchoring of the reinforcement to the load-bearing structure, high-strength fiberglass connectors, such as **FB-TUP10-VAR** or **FB-TUF\_VAR**, can be utilized. These connectors are inserted into pre-drilled holes within the masonry and embedded in the mortar layer, ensuring an effective bond 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. In particular, for extrados reinforcement of arches or vaults, it is recommended to install connectors on the reinforcement system turned back at the imposts over approximately 200 mm.

## **CURING AND PROTECTION**

After the reinforcement system has been applied, the surfaces must be adequately protected during the curing phase for at least **24 hours**. In particularly dry, hot, or windy climatic conditions, it is advisable to cover the surfaces with sheets or employ wet curing techniques, such as misting with water, to prevent overly rapid drying, which could compromise the quality of the reinforcement.

In aggressive environments or areas exposed to moisture or water, an additional protective layer with a suitable product is recommended to ensure greater system durability. In such cases, consulting the Technical Office is advised to define the most appropriate protective treatment for the specific conditions.

## **HANDLING AND STORAGE CONDITIONS**

The system is supplied in two separate components: the matrix (single-component mortar based on lime and hydraulic binders) and the reinforcement (AR bidirectional dry fiberglass mesh).

The **FB-VAR220R12** meshes are available in rolls with the following dimensions:

- 100 cm (H) x 50 – 100 (L) m

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

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

- 25 kg bag

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

**SAFETY INSTRUCTIONS**

During all phases of product preparation and application, operators must use the required Personal Protective Equipment (PPE) specific for handling meshes and mortars (workwear, protective goggles, gloves, and a dust mask). For detailed guidance, follow the instructions provided in the respective technical and safety data sheets.

Avoid contact with skin and eyes; in case of skin contact, wash with water and soap. If contact occurs with eyes, rinse thoroughly with water and seek medical advice.

When working in enclosed spaces, ensure adequate ventilation to provide proper air exchange.

**ENVIRONMENTAL DECLARATIONS**

The **FB-VAR220R12** mesh comes with an EPD (Environmental Product Declaration), contributing to compliance with CAM criteria.

Similarly, the **MATERIA RINFORZA - RZ215** mortar is certified by ICMQ for its minimum recycled content.

**CERTIFICATIONS**

The **C-MATRIX G220C15-S** system is CE marked according to ETA No. 22/0865

**SPECIFICATION VOICE**

Structural reinforcement intervention on existing brick masonry using the **FRCM C-MATRIX G220C15-S** system by Fibre Net SpA, compliant with EAD 340275-00-0104, CE marked with AVCP2+ control system, and meeting CAM criteria. The intervention includes the application of a first layer of **MATERIA RINFORZA - RZ215** mortar by Fibre Net, based on lime and hydraulic binders, with a compressive strength  $\geq 15$  MPa, followed by the application of **FB-VAR220R12** bidirectional dry fiberglass mesh by Fibre Net, with 12x12 mm mesh dimensions, 200 g/m<sup>2</sup> weight, equivalent thickness of 0.038 mm, characteristic composite ultimate tensile stress of 349 MPa, and average elastic modulus of 79 GPa. Subsequently, a second layer of **MATERIA RINFORZA - RZ215** mortar is applied to achieve a total intervention thickness of 8 mm.

Excluded from this clause are the removal of existing plasters, the remediation of degraded areas, the preparation of the substrate including washing and water saturation of application surfaces, the connectors (if required), finishing products, and acceptance tests on materials. All materials must comply with technical specifications and be certified in accordance with applicable regulations.

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