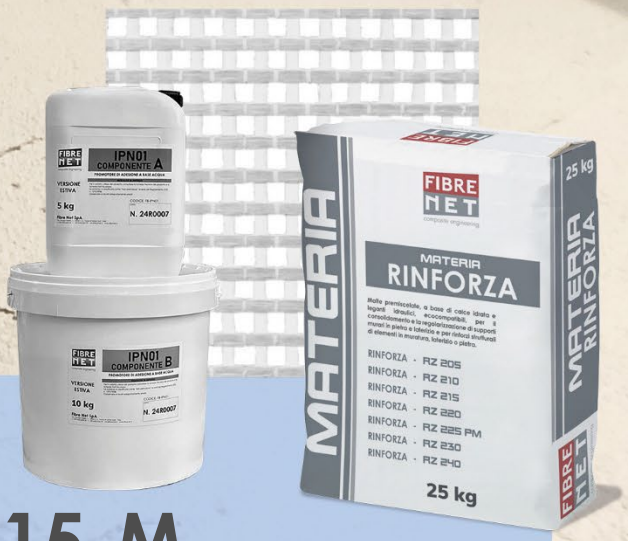
FIBRE NET
composite engineering



C-MATRIX SYSTEM

C-MATRIX G220C15-M

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

C-MATRIX G220C15-M is an FRCM reinforcement system that combines the effectiveness of a bidirectional AR glass fiber dry mesh and an inorganic matrix based on lime and hydraulic binders, bonded together by a water-based adhesion promoter. The system provides excellent chemical-physical and elasto-mechanical properties, ensuring optimal compatibility with supporting materials, even for architectural assets under conservation restrictions.

System components:

- **FB-VAR220R12:** Bidirectional dry mesh made of AR (Alkali-Resistant) glass fiber, with a dry weight of 200 g/m², offering good tensile strength for the entire system and ensuring proper distribution of static and seismic stresses.
- **MATERIA RINFORZA - RZ215:** A structural mortar based on lime and hydraulic binders, with a compressive strength ≥ 15 MPa, ensuring proper stress transfer through good adhesion between the system and the substrate.
- **FB-IPN01:** A two-component, water-based product made of interpenetrating resins supported by a microcrystalline inorganic matrix, used for impregnating glass or carbon fiber reinforcements as an adhesion promoter.

The bidirectional AR glass fiber mesh, characterized by flexibility and adaptability to even irregular surfaces, as well as good mechanical resistance, works in synergy with the inorganic matrix, aided by the adhesion promoter, to create a homogeneous and low-thickness reinforcement that does not alter the distribution of mass or structural stiffness. The system integrates seamlessly with existing masonry, improving the resistance and ductility of the structure, even in seismic hazard-prone areas.

C-MATRIX G220C15-M ensures excellent chemical and mechanical compatibility with traditional building materials, making the system suitable for the consolidation of buildings with high historical and artistic value. Interventions made with 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 G220C15-M** is CE marked for structural strengthening interventions. The system components are also EPD certified for CAM contribution purposes.

CE EAD 340275-00-0104 ETA - 22/0865 · EPD ITALY · CONFORMITÀ CAM · AVCP 2+

C-MATRIX SYSTEM

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APPLICATION FIELDS

- Structural reinforcement and seismic improvement of existing masonry with high masonry quality 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 reinforcement of masonry columns
- Anti-overturning protection and reinforcement of non-structural elements (NSEs) (e.g., infill walls on framed structures)
- Reinforcement of masonry crown beams

MAIN ADVANTAGES

1. **High performance**: The system enhances the tensile strength of masonry, ensuring structural safety even in seismic contexts and under high stress, without increasing the stiffness or mass of the structure.
2. **Durability and compatibility**: The matrix-reinforcement system ensures optimal chemical-physical compatibility with the materials of historic masonry, ensuring the durability of the intervention.
3. **Ease of application**: The bidirectional AR glass fiber mesh is lightweight, flexible, manageable, and easy to install. The "fresh-on-fresh" application method, combined with the mesh's characteristics, helps reduce the time required for reinforcement installation.
4. **Environmental sustainability and living comfort**: With its lime-based matrix and hydraulic binders, 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, **C-MATRIX G220C15-M** is a thin, non-invasive reinforcement solution ideal for application on various types of supports, including non-flat surfaces such as vaults, arches, columns, etc.
6. **Reversibility of the intervention**: The **C-MATRIX G220C15-M** system meets the reversibility criteria required for protected architectural heritage, ensuring non-invasive interventions that are easily removable.

TECHNICAL DATA

	System description
Commercial Name	**C-MATRIX G220C15-M**
Manufacturer	Fibre Net SpA
Type of reinforcement	FB-VAR220R12+IPN Bidirectional dry mesh made of AR glass 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

Peel tests	**Average value**	**Value Characteristic**	**U.M.**	**Ref.**
	Support: brick masonry			
Conventional limit stress $\sigma_{lim,conv}$	801	638	MPa	EAD 340275-00-0104
Conventional limit deformation $\varepsilon_{lim,conv}$	1,06	-	%	
Tensile tests	**Value average**	**Value Characteristic**	**U.M.**	
Ultimate stress σ_U of the composite	760	642	MPa	
Ultimate strain ε_U of the composite	0,82	-	%	
Stiffness module E_I, in stage A	170,3	-	GPa	

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C-MATRIX G220C15-M

GEOMETRIC, MECHANICAL AND PHYSICAL DATA OF THE REINFORCEMENT

Properties	Description	Ref.
Commercial name	**FB-VAR220R12**	
Weight of the mesh (dry) in warp	100 g/m^2	ISO 11667:1997
Weight of the mesh (dry) in weft	100 g/m^2	
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^3	
Mesh size	12x12 mm	Internal method

Tensile tests	Value average	Value Characteristic	U.M.	Ref.
Ultimate tensile strength σ_{uf} of the mesh	910	740	MPa	EAD 340275-00-0104
Elastic modulus E_f of the mesh	75,60	64,70	GPa	
Ultimate tensile strain ε_{uf} of the mesh	1,20	-	%	

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**	
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 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+**

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C-MATRIX G220C15-M

APPLICATION GUIDELINES FOR THE SYSTEM

The application of the **C-MATRIX G220C15-M** system follows a process designed to ensure maximum performance in any application context, whether historic or modern, on masonry with an appropriate quality index. Correct execution of all operational stages is essential to achieve an effective and durable reinforcement.

ENVIRONMENTAL CONDITIONS

Application temperatures: The system must be applied in environmental conditions ranging from +5°C to +35°C. Avoid exposure to direct sunlight or excessive humidity to ensure optimal mortar curing and proper mesh adhesion.

PREPARATION OF THE SUBSTRATE

Proper preparation of the support is crucial to guarantee the full effectiveness of the **C-MATRIX G220C15-M** system. The surface should be healthy, compact, and mechanically resistant to ensure perfect adhesion of the mortar and reinforcement.

Removal of surface layers and support preparation: For interventions on load-bearing masonry, arches, or vaults, it is recommended to completely remove the existing plaster and/or surface coatings, either manually or with mechanical tools. Any loose or detached material should be removed, continuing until a sound masonry substrate is reached.
Scarification, where possible, should also be carried out on mortar joints to a depth ≥5 mm. In the presence of particularly tenacious coatings or plasters strongly bonded to the masonry, whose removal would compromise the integrity of the substrate for the subsequent application of reinforcement, it is advisable to consult **Fibre Net** technicians for a specific evaluation.

For interventions on vaults, mechanically remove the existing plaster until reaching the masonry. In case of external reinforcement, verify the consistency of the backing before removal and follow the stages outlined in the project.
In the presence of large voids or significant cracks, the substrate should be restored using materials compatible with the original ones, such as stones, bricks, or tuff, to maintain structural coherence and compatibility with existing materials.
Any edges on which the system will be applied should be rounded with a curvature radius of at least 20 mm.
After removal and preparation, carefully clean the surface of dust, oils, efflorescence, and other substances using low-pressure water washing. Allow excess water to evaporate, ensuring that the substrate is saturated but the surface remains dry (SSD) before applying the mortar.
The prepared surface should be flat but not smooth, with a roughness index ≥1 mm, sufficient to ensure proper bonding of the subsequent mortar layer.
For highly absorbent or mechanically weak masonry, it is advisable to apply a consolidating primer to improve mortar adhesion. This step is particularly recommended for substrates made of gypsum or materials with low cohesion. For details on the most suitable consolidation materials, please contact the company.

MORTAR PREPARATION

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

APPLICATION OF THE FIRST LAYER OF MORTAR

On the adequately roughened surface, thoroughly cleaned through low-pressure water washing, and with the substrate saturated but the surface dry (SSD), proceed with the subsequent stages.
Before applying the reinforcement system, and in the presence of irregular surfaces, it is possible to level the masonry by applying a layer of **MATERIA RINFORZA - RZ215** mortar using a trowel, float, or spray method. Allow this first layer to cure for 18-24 hours.
Next, apply a uniform first layer of **MATERIA RINFORZA - RZ215** mortar, with a thickness of 3 ÷ 5 mm, ensuring that the material is evenly distributed across the entire surface to be treated.

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APPLICATION OF THE FIRST LAYER OF ADHESION PROMOTER

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 600 g/m² of surface to be treated. It is important to apply the adhesion promoter on the surface of the mortar while it is still damp but not within the water film.

PLACEMENT OF THE REINFORCING MESH

While the adhesion promoter is still fresh, proceed with the application of the bidirectional AR glass fiber dry mesh **FB-VAR220R12**. 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, ensure the required overlap as specified by **CNR-DT 215/2018**, ensuring the continuity and effectiveness of the structural reinforcement. In the absence of laboratory testing, a minimum overlap of 300 mm is required.

APPLICATION OF SECOND LAYER OF ADHESION PROMOTER

Once the mesh is positioned, apply the second layer of adhesion promoter **FB-IPN01** on the still-damp reinforcement using a brush or roller, at a rate of 400 g/m² of surface to be treated. Be sure to roll with a special corrugated steel roller to expel any air from the fabric and allow for proper impregnation of the fiber.

APPLICATION OF THE SECOND LAYER OF MORTAR

Apply a second layer of mortar onto the final layer of adhesion promoter, in a "fresh on fresh" manner, with a uniform thickness of approximately 3 ÷ 5 mm, ensuring a total thickness of about 8 mm. This layer must completely cover the mesh and provide adequate protection for the reinforcement.

APPLICATION OF CONNECTIONS (OPTIONAL)

In specific situations where a mechanical connection between the reinforcement and the load-bearing structure is required, high-strength fiberglass connectors such as **FB-TUP10-VAR** or **FB-TUF_VAR** can be used. These connectors are inserted into the masonry thickness through pre-drilled holes and embedded within the mortar layer, ensuring an effective connection between the reinforcement system and the existing structure. The installation of connectors should follow the technical specifications of the project and the guidelines provided by the company. In particular, for external reinforcement of arches or vaults, it is recommended to adopt connection systems on the reinforcement at the intrados, extending for approximately 200 mm at the imposts.

CURING AND PROTECTION

Once the reinforcement system application is completed, the surfaces must be properly protected during the curing phase for at least 24 hours. In particularly dry, hot, or ventilated climatic conditions, it is advised to cover the surfaces with tarps or employ wet curing techniques, such as misting water, to prevent overly rapid drying that could compromise the quality of the reinforcement. In highly aggressive environments or areas exposed to moisture or water, it is recommended to apply an additional protective layer with an appropriate product to ensure greater durability of the system. In such cases, it is advisable to consult the Technical Office to define the most suitable protective treatment for the specific conditions.

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STORAGE AND HANDLING CONDITIONS

The system is supplied in two distinct phases: the matrix (single-component lime-based and hydraulic binder mortar) and the reinforcement (bidirectional AR glass fiber mesh).

The **FB-VAR220R12** mesh is available in rolls with the following dimensions:

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

The mesh should 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 packaging:

- 25 kg bag

The mortar should be stored in its original, properly sealed packaging in a dry place, protected from frost, high temperatures, excessive sunlight, and wind during the curing period.

SAFETY INSTRUCTIONS

During all phases of preparation and application of the products, operators must use the appropriate Personal Protective Equipment (PPE) required for handling meshes and mortars (work clothing, protective glasses, gloves, and dust mask). For specific instructions, refer to the corresponding technical and safety data sheets. Avoid contact with skin and eyes; in case of skin contact, wash with water and soap; in case of eye contact, rinse with water and consult a doctor.

When applying in enclosed spaces, ensure adequate ventilation to guarantee proper air exchange.

ENVIRONMENTAL DECLARATIONS

The **FB-VAR220R12** mesh is equipped with an Environmental Product Declaration (EPD) for compliance with CAM criteria.
Similarly, the **MATERIA RINFORZA - RZ215** mortar holds a certificate of minimum recycled content issued by ICMQ.

CERTIFICATIONS

The C-MATRIX G220C15-M system is equipped with CE marking in accordance with ETA no. 22/0865.

SPECIFICATIONS

Structural reinforcement intervention on existing brick masonry using the FRCM **C-MATRIX G220C15-M** system by Fibre Net SpA, compliant with EAD 340275-00-0104, CE marked with AVCP2+ control system, and in accordance with 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 ≥ 15 MPa. While the mortar is still damp, the first layer of **FB-IPN01** adhesion promoter, water-based and composed of interpenetrating resins, is applied. This is followed by the placement of the bidirectional AR fiberglass mesh **FB-VAR220R12** by Fibre Net, with a mesh size of 12x12 mm, grammage of 200 g/m², equivalent mesh thickness of 0.038 mm, characteristic conventional tensile strength of the composite 638 MPa, and average elastic modulus of the mesh 75.60 GPa. A second layer of **FB-IPN01** adhesion promoter is applied, followed by a second layer of **MATERIA RINFORZA - RZ215** mortar to achieve a total thickness of 8 mm.
Excluded from the scope: removal of existing plaster, remediation of degraded areas, preparation of the support through washing and saturation with water of the application surfaces, connectors (if required), any finishing products, and material acceptance tests.
All materials must comply with the technical specifications and be certified according to current regulations.

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