C-MATRIX SYSTEM

C-MATRIX C225C40-H

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

C-MATRIX C225C40-H is an FRCM (Fiber Reinforced Cementitious Matrix) reinforcement system that combines the effectiveness of a high-strength bidirectional carbon fiber mesh impregnated with an organic matrix and an inorganic cement-based matrix. The system offers excellent chemical-physical and elasto-mechanical properties.

System components:

- **FB-RC225-TH12S**: A bidirectional high-strength carbon fiber mesh impregnated with an organic matrix, with a dry weight of 206 g/m². This component provides excellent tensile strength to the entire system and ensures proper distribution of static and seismic loads.
- **STRUTTURA RASO FINO – RF248:** A premixed, single-component, thixotropic, polymer-modified cement mortar of the PCC type, reinforced with synthetic fibers, normal setting time, and fine grain, with a compressive strength of ≥ 40 MPa. This ensures efficient transfer of stresses through strong adhesion between the system and the substrate.

The bidirectional high-strength carbon fiber mesh, characterized by flexibility and adaptability to even irregular surfaces, along with good mechanical resistance, works in synergy with the inorganic matrix to create a homogeneous, thin reinforcement that does not alter mass distribution or structural stiffness. The system integrates seamlessly with the existing masonry, enhancing the structure's strength and ductility, particularly in seismically hazardous environments.

C-MATRIX C225C40-H ensures excellent chemical and mechanical compatibility with traditional building materials. Interventions performed with this reinforcement system are structurally effective while being minimally invasive, preserving the architectural value of existing structures.
In compliance with the EAD 340275-00-0104 "Externally Bonded Composite Systems with Inorganic Matrix for Strengthening Concrete and Masonry Structures," **C-MATRIX C225C40-H** is CE marked for structural strengthening applications.

CE
EAD 340275-00-0104
ETA - 22/0865

AVCP 2+

C-MATRIX C225C40-H

APPLICATION FIELDS

- Structural reinforcement and seismic improvement of existing masonry with a high quality masonry index
- Increased 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-tipping protection and reinforcement of non-structural elements (NSEs) (e.g., infill walls on framed structures)
- Reinforced masonry parapets

MAIN ADVANTAGES

1. **High performance**: the system enhances the tensile strength of masonry, ensuring structural safety even in seismic contexts or 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 masonry, resulting in long-lasting interventions.
3. **Ease of application**: the bidirectional high-strength carbon fiber mesh is lightweight, flexible, manageable, and easy to install. The "wet-on-wet" application, combined with the mesh's characteristics, reduces the time required to complete the reinforcement.
4. **Environmental sustainability and living comfort**: thanks to the use of a cement-based matrix, the system is eco-friendly with a low environmental impact.
5. **Versatile solution**: suitable for both historic buildings (not protected) and modern masonry structures, **C-MATRIX C225C40-H** is a thin, non-invasive reinforcement solution ideal for applications on various substrates, including non-flat surfaces such as vaults, arches, and columns.
6. **Reversibility of the intervention**: The **C-MATRIX C225C40-H** system meets reversibility criteria, ensuring non-invasive interventions that are easy to remove if necessary.

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C-MATRIX C225C40-H

TECHNICAL DATA OF THE SYSTEM

	Description of the system
Commercial Name	**C-MATRIX C225C40-H**
Manufacturer	Fibre Net SpA
Type of reinforcement	FB-RC225-TH12S High-strength carbon fiber bidirectional mesh impregnated
Type of matrix	STRUTTURA RASO FINO - RF248 Single-component PCC mortar
Nominal thickness of the reinforcement system	8 mm

MECHANICAL CHARACTERISTICS OF THE SYSTEM

Peel tests	**Support: brick masonry**		**U.M.**	**Ref.**
	Value average	**Value characteristic**		
conventional limit stress $\sigma_{lim,conv}$	2283	1725	MPa	EAD 340275-00-0104
conventional limit deformation $\varepsilon_{lim,conv}$	1,14	-	%	
	Support: stone masonry			
conventional limit stress $\sigma_{lim,conv}$	1419	1068	MPa	
conventional limit deformation $\varepsilon_{lim,conv}$	0,71	-	%	
	Support: tuff masonry			
(*) conventional limit stress $\sigma_{lim,conv}$	1831	1561	MPa	
(*) conventional limit deformation $\varepsilon_{lim,conv}$	0,92	-	%	
	Support: concrete			
conventional limit stress $\sigma_{lim,conv}$	2111	1681	MPa	
conventional limit deformation $\varepsilon_{lim,conv}$	1,06	-	%	
Tensile tests	**Value average**	**Value characteristic**	**U.M.**	
ultimate stress σ_u of the composite	2289	1367	MPa	
ultimate deformation ε_u of the composite	1,23	-	%	
Stiffness modulus E_I, in stage A	982	-	GPa	
Effective lap tension (l=150mm) σ_{lap}	-	> 90% $\sigma_{u,k}$	-	LG 2022 FRCM qualification
Effective lap tension (l=200mm) σ_{lap}	-	> 90% $\sigma_{u,k}$	-	

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GEOMETRIC, MECHANICAL AND PHYSICAL DATA OF THE REINFORCEMENT

Properties	Description	Ref.
Commercial name	**FB-RC225-TH12**	
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 stress σ_{uf} of the mesh	2386	1444	MPa	EAD 340275-00-0104
Elastic modulus E_f of the mesh	200	160	GPa	
Ultimate tensile strain ε_{uf} of the mesh	1,20	-	%	

MECHANICAL PROPERTIES OF MORTAR

Properties	Description	Ref.
Commercial name	**STRUTTURA RASO FINO –RF248**	
Classe	R3	EN 1504-3
Compressive strength at 28 days	≥ 40 MPa	EAD 340275-00-0104
Elastic modulus at 28 days	≥ 20 GPa	
Adhesion to the brick support	≥ 0.5 MPa (FP:A)	EN 1015-12
Weight percentage of organic components	< 10 %	-
Vapor permeability		

(*) The values of conventional stress and strain limits are also valid for an effective anchorage length of 250 mm.
The system is CE marked with performance evaluation and verification under AVCP 2+.

APPLICATION GUIDELINES FOR THE SYSTEM

The application of the **C-MATRIX C225C40-H** system follows a process designed to ensure maximum performance in any application context, whether historical or modern, and is suitable for masonry with an adequate quality index. Proper execution of all operational phases is crucial for achieving effective and durable reinforcement.

ENVIRONMENTAL CONDITIONS

Application temperature: The system should be applied in environmental conditions between +5°C and +35°C. Direct exposure to solar radiation or excessive humidity should be avoided to ensure optimal curing of the mortar and proper adhesion of the mesh.

PREPARATION OF THE SUBSTRATE

Substrate preparation is essential to guarantee the full effectiveness of the **C-MATRIX C225C40-H** system. It is necessary to work on a sound, compact, and mechanically resistant surface to ensure perfect adhesion of both the mortar and the reinforcement.

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Removal of surface layers and preparation of the substrate: 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 using mechanical tools. All inconsistent or delaminating parts must be removed, proceeding until a sound masonry substrate is reached.
Where possible, surface scarification should also be carried out on the mortar joints to a depth of ≥ 5 mm.
In the presence of resilient surface coatings or plasters that are strongly bonded to the masonry, whose removal could compromise the integrity of the substrate for the subsequent application of reinforcement, it is advisable to consult Fibre Net technicians for a specific assessment.

In the case of interventions on vaults, mechanically remove the existing plaster until reaching the masonry.
If the reinforcement is to be applied to the outer surface, verify the consistency of the backfill before removal and follow the procedures outlined in the project.
In the presence of large voids or cracks, the substrate must 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 corners where the system will be applied should be rounded with a curvature radius of at least 20 mm.
After the removal and the procedures mentioned above, thoroughly clean the surface from dust, grease, efflorescence, and other contaminants using low-pressure water cleaning. Allow any excess water to evaporate, ensuring that the substrate is saturated but the surface is dry (dry surface absorption) before applying the mortar.
The prepared surface must be flat, but not smooth; it should be rough enough, with a roughness index ≥ 1 mm, sufficient to ensure proper bonding of the subsequent mortar.
For highly absorbent or mechanically weak masonry, it is recommended to apply a consolidating primer to enhance the adhesion of the mortar. This operation is particularly advised for substrates made of plaster or weakly cohesive materials. For details on the most suitable consolidation materials, please contact the Company.

PREPARATION OF THE MORTAR

The **STRUTTURA RASO FINO - RF248** mortar must be prepared by adding clean water as specified in the relevant technical data sheet. The mixing and preparation of the mixture must be carried out using suitable 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 using low-pressure water cleaning, and with a saturated but dry (saturated surface dry - s.s.a.) substrate, proceed with the following steps.
Before applying the reinforcement system, and in the presence of irregular surfaces, it is possible to level the masonry by applying a layer of **STRUTTURA RASO FINO - RF248** mortar using a trowel, spatula, or spray application. Allow this first layer to harden for 18-24 hours (finish the surface with a rough coat).
Subsequently, apply a uniform first layer of **STRUTTURA RASO FINO - RF248** mortar, with a thickness of 3 to 5 mm, ensuring that the material is evenly distributed over the entire surface to be treated.

INSTALLATION OF THE REINFORCEMENT MESH

While the mortar is still fresh, proceed with the application of the bidirectional high-strength carbon fiber mesh **FB-RC225-TH12S**. The mesh must be carefully positioned and gently pressed with a flat trowel to ensure it is fully embedded within the mortar layer. At the mesh overlap points, both longitudinally and transversely, the proper overlap must be ensured as specified by CNR-DT 215/2018, ensuring continuity and effectiveness of the structural reinforcement. In the absence of laboratory tests, a minimum overlap of **300 mm** is required. In this specific case, the system is qualified for overlap lengths of **150 mm** and **200 mm**, respectively.

APPLICATION OF THE SECOND LAYER OF MORTAR

Once the mesh is in place, apply a second layer of mortar, "wet on wet," with a uniform thickness of approximately 3 to 5 mm, ensuring a total thickness of **8 mm**. This layer must completely cover the mesh and provide adequate protection to the reinforcement.

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APPLICATION OF CONNECTORS (OPTIONAL)

In particular situations where a mechanical connection of the reinforcement to the load-bearing structure is required, high-strength carbon fiber connectors such as **FB-TUP10-CHT** or **FB-TUF_CHT** can be used. These connectors are inserted into pre-drilled holes in the masonry thickness and embedded within the mortar layer, ensuring an effective connection between the reinforcement system and the existing structure. The installation of the connectors must be carried out according to the project's technical specifications and the guidelines provided by the Company. Specifically, for external reinforcement of arches or vaults, it is recommended to adopt connection systems on the reinforcement at the support points for approximately **200 mm.**

CURING AND PROTECTION

Once 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 conditions, it is recommended to cover the surfaces with tarps or use wet curing techniques, such as spraying water, to prevent the material from drying too quickly, which could compromise the quality of the reinforcement. In particularly aggressive environments or areas exposed to humidity or water, it is advisable to apply an additional protective layer using an appropriate product to ensure greater durability of the system. In these cases, it is recommended to consult the Technical Department to define the most suitable protective treatment for the specific conditions.

HANDLING AND STORAGE CONDITIONS

The system is supplied in two distinct phases: the matrix (cementitious mortar) and the reinforcement (bidirectional high-strength carbon fiber mesh).

The **FB-RC225-TH12S** meshes are available in rolls with the following dimensions:

- 100 – 150 – 200 cm (H) x 50 – 100 (L) m

The meshes must be stored in a dry, dust-free environment. Direct exposure to light and heat sources should be avoided.

The **STRUTTURA RASO FINO - RF248** mortar is supplied in the following packaging:

- 25 kg bag

The mortar should 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 preparation and application of the products, the operator must use the appropriate Personal Protective Equipment (PPE) for the specific use of meshes and mortars (workwear, protective goggles, gloves, and dust mask). For specific instructions, follow the indications provided in the respective technical and safety data sheets. Avoid contact with skin and eyes; in case of skin contact, wash with soap and water; in case of eye contact, rinse with water and consult a doctor.

In the case of application in enclosed spaces, ensure adequate ventilation to provide proper air exchange.

CERTIFICATIONS

The C-MATRIX C225C40-H system is CE marked in accordance with ETA no. 22/0865-

SPECIFICATION VOICE

BRICK SUPPORT

Structural reinforcement intervention on existing brick masonry using the **FRCM C-MATRIX C225C40-H** system by Fibre Net SpA, compliant with **EAD 340275-00-0104**, CE marked with AVCP2+ control system. The intervention includes the application of a first layer of **STRUTTURA RASO FINO - RF248** cementitious mortar by Fibre Net with a compressive strength of ≥ 40 MPa, followed by the application of the bidirectional high-strength carbon fiber mesh FB-RC225-TH12S by Fibre Net, with a mesh size of 16x16 mm, grammage of 206 g/m², equivalent mesh thickness of 0.058 mm, characteristic conventional limit stress of the composite 1725 MPa, and an average elastic modulus of the mesh of 200 GPa. Subsequently, a second layer of **STRUTTURA RASO FINO - RF248** mortar will be applied to achieve a total thickness of 8 mm.
This specification excludes the following work: removal of existing plasters, remediation of degraded areas, substrate preparation through washing and saturation of application surfaces with water, connectors (if required), any finishing products, and acceptance testing of the materials. All materials must comply with technical specifications and be certified in accordance with current regulations.

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STONE SUPPORT

Structural reinforcement intervention on existing stone masonry using the **FRCM C-MATRIX C225C40-H** system by Fibre Net SpA, compliant with **EAD 340275-00-0104**, CE marked with AVCP2+ control system. The intervention includes the application of a first layer of **STRUTTURA RASO FINO - RF248** cementitious mortar by Fibre Net with a compressive strength of ≥ 40 MPa, followed by the application of the bidirectional high-strength carbon fiber mesh **FB-RC225-TH12S** by Fibre Net, with a mesh size of 16x16 mm, grammage of 206 g/m², equivalent mesh thickness of 0.058 mm, characteristic conventional limit stress of the composite 1068 MPa, and an average elastic modulus of the mesh of 200 GPa. Subsequently, a second layer of STRUTTURA RASO FINO - RF248 mortar will be applied to achieve a total thickness of 8 mm.
This specification excludes the following work: removal of existing plasters, remediation of degraded areas, substrate preparation through washing and saturation of application surfaces with water, connectors (if required), any finishing products, and acceptance testing of the materials. All materials must comply with technical specifications and be certified in accordance with current regulations.

TUFF SUPPORT

Structural reinforcement intervention on existing tuff masonry using the **FRCM C-MATRIX C225C40-H** system by Fibre Net SpA, compliant with **EAD 340275-00-0104**, CE marked with AVCP2+ control system. The intervention includes the application of a first layer of **STRUTTURA RASO FINO - RF248** cementitious mortar by Fibre Net with a compressive strength of ≥ 40 MPa, followed by the application of the bidirectional high-strength carbon fiber mesh **FB-RC225-TH12S** by Fibre Net, with a mesh size of 16x16 mm, grammage of 206 g/m², equivalent mesh thickness of 0.058 mm, characteristic conventional limit stress of the composite 1561 MPa, and an average elastic modulus of the mesh of 200 GPa. Subsequently, a second layer of STRUTTURA RASO FINO - RF248 mortar will be applied to achieve a total thickness of 8 mm.
This specification excludes the following work: removal of existing plasters, remediation of degraded areas, substrate preparation through washing and saturation of application surfaces with water, connectors (if required), any finishing products, and acceptance testing of the materials. All materials must comply with technical specifications and be certified in accordance with current regulations.

CONCRETE SUPPORT

Structural reinforcement intervention on existing reinforced concrete structures using the **FRCM C-MATRIX C225C40-H** system by Fibre Net SpA, compliant with **EAD 340275-00-0104**, CE marked with AVCP2+ control system. The intervention includes the application of a first layer of STRUTTURA RASO FINO - RF248 cementitious mortar by Fibre Net with a compressive strength of ≥ 40 MPa, followed by the application of the bidirectional high-strength carbon fiber mesh **FB-RC225-TH12S** by Fibre Net, with a mesh size of 16x16 mm, grammage of 206 g/m², equivalent mesh thickness of 0.058 mm, characteristic conventional limit stress of the composite 1681 MPa, and an average elastic modulus of the mesh of 200 GPa. Subsequently, a second layer of **STRUTTURA RASO FINO - RF248** mortar will be applied to achieve a total thickness of 8 mm.
This specification excludes the following work: removal of existing plasters, remediation of degraded areas, substrate preparation through washing and saturation of application surfaces with water, connectors (if required), any finishing products, and acceptance testing of the materials. All materials must comply with technical specifications and be certified in accordance with current regulations.

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