FIBRE NET
composite engineering

C-MATRIX SYSTEM

C-MATRIX G320N15-M

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

C-MATRIX G320N15-M is an FRCM reinforcement system that combines the effectiveness of a bidirectional AR glass fiber mesh and an inorganic matrix based on natural hydraulic lime (NHL), bonded together by a water-based adhesion promoter. The system offers excellent chemical-physical and elasto-mechanical properties and ensures optimal compatibility with support materials, including architectural assets subject to protection or legal constraints.

System components:

- **FB-VAR320R12:** Bidirectional dry AR glass fiber mesh (alkali-resistant), with a dry weight of 300 g/m², providing good tensile strength for the entire system and ensuring correct distribution of static and seismic stresses.
- **EPOCA CALCE CNHL115**: Structural mortar based on natural hydraulic lime (NHL), with a compressive strength of ≥ 15 MPa, ensuring the correct transfer of stresses through good adhesion between the system and the support.
- **FB-IPN01:** A two-component, water-based product consisting of interpenetrating resins supported on a microcrystalline inorganic matrix, used for impregnating glass or carbon fiber reinforcements as an adhesion promoter.

The bidirectional dry 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, thanks to the presence of the adhesion promoter, to create a homogeneous and thin reinforcement that does not alter the distribution of mass or structural stiffness. The system integrates perfectly with the existing masonry, thereby improving the resistance and ductility of the structure, even in areas with potential seismic hazard.

C-MATRIX G320N15-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 carried out with this reinforcement system are structurally effective while being minimally impactful, allowing the preservation of the architectural value of the existing structures.
In accordance with the provisions of EAD 340275-00-0104 "Externally bonded Composite systems with inorganic matrix for strengthening of concrete and masonry structures," C-MATRIX G320N15-M is CE marked for structural consolidation interventions. The system components are provided with EPD certification for CAM contribution.

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

C-MATRIX G320N15-M

FIELDS OF APPLICATION

- Structural reinforcement and seismic improvement of existing masonry with a high masonry quality 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-overturning protection and reinforcement of non-structural elements (NSEs) (e.g., infill panels on framed structures)
- Reinforced masonry crowning beams

MAIN ADVANTAGES

1. **High performance**: The system improves the tensile strength of masonry, ensuring structural safety, even in seismic contexts and under high stress conditions, without increasing the stiffness or mass of the structure.
2. **Durability and compatibility**: The matrix-reinforcement system ensures optimal chemical-physical compatibility with materials used in historic masonry, resulting in 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, combined with the mesh's features, helps reduce the time needed to complete the reinforcement.
4. **Environmental sustainability and living comfort**: Thanks to the use of a matrix based on natural hydraulic lime, 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 G320N15-M is a thin, non-invasive reinforcement solution that can be applied to various types of supports, even irregular ones such as vaults, arches, columns, etc.
6. **Reversibility of the intervention**: The **C-MATRIX G320N15-M** system meets the reversibility criteria required for protected architectural heritage, ensuring non-invasive interventions that are easily removable.

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C-MATRIX G320N15-M

TECHNICAL DATA OF THE SYSTEM

	Description of the system
Commercial Name	**C-MATRIX G320N15-M**
Manufacturer	Fibre Net SpA
Type of reinforcement	FB-VAR320R12+IPN Bidirectional dry mesh made of AR glass fiber Water-based adhesion promoter
Type of matrix	EPOCA CALCE CNHL115 Lime-based mortar NHL
Nominal thickness of the reinforcement system	8 mm

MECHANICAL CHARACTERISTICS OF THE SYSTEM

Pull-off tests	**Average value**	**Characteristic value**	**U.M.**	**Ref.**
	Support: brick masonry			
Conventional limit stress $\sigma_{lim,conv}$	777	619	MPa	EAD 340275-00-0104
Conventional limit strain $\varepsilon_{lim,conv}$	1,25	-	%	
Tensile tests	**Average value**	**Characteristic value**	**U.M.**	
Ultimate tensile strength σ_u of the composite	942	827	MPa	
Ultimate strain ε_u of the composite	1,51	-	%	
Stiffness modulus E_I, in stage A	365,90	-	GPa	

GEOMETRIC, MECHANICAL AND PHYSICAL DATA OF THE REINFORCEMENT

Properties	**Description**	**Ref.**
Commercial name	**FB-VAR320R16S**	
Weight of the mesh (dry) in warp	150 g/m^2	ISO 11667:1997
Weight of the mesh (dry) in weft	150 g/m^2	
Equivalent thickness of the reinforcement mesh in both directions	0.057 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 tension σ_{uf} of the mesh	823	726	MPa	EAD 340275-00-0104
Elastic modulus E_f of the mesh	62,02	55	GPa	
Ultimate strain in tension ε_{uf} of the mesh	1,33	-	%	

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MECHANICAL CHARACTERISTICS OF THE ADHESION PROMOTER

Properties	Description	Ref.
Commercial name	**FB-IPN01**	
Catalysis report 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 MORTAR

Properties	Description	Ref.
Commercial name	**EPOCA CALCE CNHL115**	
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

Qualified system with **CE Marking** with assessment and verification of performance consistency **AVCP 2+**

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C-MATRIX G320N15-M

APPLICATION GUIDELINES FOR THE SYSTEM

The application of the **C-MATRIX G320N15-M** system follows a process designed to ensure maximum performance in any application context, whether historic or modern, working on 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 ranging from +5°C to +35°C. Direct exposure to sunlight or excessive humidity should be avoided to ensure optimal curing of the mortar and proper adhesion of the mesh.

PREPARATION OF THE SUBSTRATE

Preparing the support substrate is essential to ensure the full effectiveness of the C-MATRIX G320N15-M system. It is necessary to work on a sound, compact, and mechanically resistant surface to ensure perfect adhesion of the mortar and reinforcement.

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 detached parts should be removed until sound masonry is reached.
If possible, the scarification should also be applied to mortar joints to a depth of ≥5 mm. In the case of tenacious or highly cohesive surface coatings or plasters that would compromise the integrity of the support upon removal, affecting the subsequent application of reinforcement, it is advised to consult with Fibre Net technicians for a specific evaluation.

In the case of interventions on vaults, mechanically remove the existing plaster until the masonry is reached. For reinforcement on the exterior surface, verify the consistency of the infill before removal and follow the phases outlined in the project.
In the presence of large voids or cracks, the support should be repaired using materials compatible with the original ones, 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 the removal and the above operations, carefully clean the surface of dust, grease, efflorescences, and other substances using low-pressure water washing. Allow excess water to evaporate, ensuring the support is saturated but the surface is dry (d.s.a.) before applying the mortar.
The prepared surface should be flat, not smooth but rough, with a roughness index ≥ 1 mm sufficient to ensure proper adhesion for the subsequent mortar layer.
For highly absorbent or mechanically weak masonry, it is advisable to apply a consolidating primer to improve the adhesion of the mortar. This operation is particularly recommended for gypsum supports or substrates with low cohesion. For details on the most suitable consolidation materials, contact the company.

MORTRAR PREPARATION

The **EPOCA CALCE CNHL115** mortar should be prepared by adding clean water according to the specifications in the corresponding 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 washing, and with the support saturated but the surface dry (d.s.a.), 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 **EPOCA CALCE CNHL115** mortar using a trowel, spatula, or spray application. Allow this first layer to harden for 18-24 hours.
Subsequently, apply a uniform first layer of **EPOCA CALCE CNHL115** mortar with a thickness of 3 ÷ 5 mm, ensuring the material is evenly distributed across the entire surface to be treated.

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APPLICATION OF THE FIRST COAT OF ADHESION PROMOTER

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

APPLICATION OF THE REINFORCING MESH

While the adhesion promoter is still fresh, proceed with the application of the bidirectional AR glass fiber mesh **FB-VAR320R12**. The mesh must be carefully positioned and gently pressed with a flat spatula to ensure it is fully embedded within the mortar and adhesion promoter layer. At the joints between mesh sheets, both longitudinally and transversely, adequate overlap must be ensured in accordance with **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 LAYER OF ADHESION PROMOTER

Once the mesh is in place, apply the second layer of adhesion promoter FB-IPN01 to the still-damp reinforcement, using a brush or roller, at a rate of 400g/m² of surface to be treated. Be sure to use a special grooved steel roller to expel any air from the fabric and ensure good impregnation of the fiber.

APPLICATION OF THE SECOND LAYER OF MORTAR

Once the mesh is positioned, apply a second layer of mortar, "fresh on fresh," with an even thickness of about 3 ÷ 5 mm, ensuring a total thickness of 8 mm. This layer must fully cover the mesh and provide adequate protection for the reinforcement.

APPLICATION OF CONNECTIONS (OPTIONAL)

In specific situations where mechanical connection of the reinforcement to the load-bearing structure is required, high-strength fiberglass connectors such as **FB-TUP10-VAR** or **FB-TUF_VAR can be used.** These 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. Connector installation must follow the project's technical specifications and the guidelines provided by the company. In particular, for external reinforcement of arches or vaults, it is recommended to use connection systems at the reinforcement system turned around the springing for approximately **200 mm**.

CURING AND PROTECTION

Once the reinforcement system application is complete, the surfaces must be properly protected during the curing phase for at least 24 hours. In particularly dry, hot, or windy climatic conditions, it is advised to cover the surfaces with tarps or use wet curing techniques, such as spraying water, to prevent overly rapid drying that 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 with an appropriate product to ensure the system's greater durability. 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 (monocomponent mortar based on NHL hydraulic lime) and the reinforcement (bidirectional AR glass fiber mesh).

The **FB-VAR320R12** 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 environment. Direct exposure to light and heat sources should be avoided.

The **EPOCA CALCE CNHL115** mortar is supplied in the following packaging:

- 25 kg bag

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

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SAFETY INSTRUCTIONS

During all phases of preparation and application of the products, the operator must use the appropriate Personal Protective Equipment (PPE) as required for the specific use of the meshes and mortars (work clothing, protective goggles, gloves, and dust mask). For specific instructions, refer to the respective technical and safety data sheets. Avoid contact with skin and eyes; in case of contact with skin, wash with soap and water; in case of contact with eyes, rinse with water and consult a doctor.
If applying in enclosed spaces, ensure sufficient ventilation to guarantee proper air exchange.

ENVIRONMENTAL DECLARATIONS

The **FB-VAR320R12** mesh is equipped with an EPD "Environmental Product Declaration" for contribution to CAM criteria.
Similarly, the **EPOCA CALCE CNHL115** mortar is provided with a minimum recycled content certificate issued by ICMQ.

CERTIFICATIONS

The C-MATRIX G320N15-M system is CE marked in accordance with ETA No. 22/0865

SPECIFICATION

Structural reinforcement of existing brick masonry using the **FRCM C-MATRIX G320N15-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 includes the application of a first layer of EPOCA CALCE CNHL115 mortar by Fibre Net, based on natural hydraulic lime (NHL), with a compressive strength ≥ 15 MPa; while the mortar is still damp, the first layer of **FB-IPN01** adhesion promoter is applied, which is water-based and composed of interpenetrated resins. This is followed by the placement of the bidirectional AR glass fiber mesh FB-VAR320R12 by Fibre Net, with a mesh size of 12x12 mm, grammage of 300 g/m², equivalent mesh thickness of 0.057 mm, characteristic conventional tensile strength of the composite of 619 MPa, and average elastic modulus of the mesh of 62.02 GPa. The second layer of adhesion promoter FB-IPN01 is applied, followed by the second layer of **EPOCA CALCE CNHL115** mortar, until the total intervention thickness reaches 8 mm.
Excluded from this specification: removal of existing plasters, remediation of degraded areas, surface preparation through washing and saturation with water of the application surfaces, connectors (if required), any finishing products, and material acceptance testing.
All materials must comply with the technical specifications and be certified in accordance with current regulations.

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