



RI-STRUTTURA MASONRY REINFORCEMENT SYSTEM TECHNICAL DATA SHEET

RI-STRUTTURA System (C.R.M.) is qualified with CE marking according to EAD 340392-00-0104 – CRM (Composite Reinforced Mortar) Systems for strengthening concrete and masonry structures.

RI-STRUTTURA is the reinforcement system by Fibre Net composed of preformed GFRP meshes, angles and connectors made by alkali-resistant glass fibers and thermosetting resins, combined with structural mortars, also NHL lime based. This system guarantees important, uniform and widespread structural improvement of the mechanical and ductility properties with a low increase in terms of stiffness of the GFRP elements. **RI-STRUTTURA** guarantees high durability thanks to the absence of corrosion. The system is reversible and improves the shear and flexural resistance of the walls.

RI-STRUTTURA MASONRY REINFORCEMENT SYSTEM

APPLICATION FIELD

The masonry buildings, normally characterized by poor mechanical properties of the materials, present often weak building systems (e.g. multiple leaves, absence of diatons, etc) that under seismic actions, can suffer high horizontal actions in the plane (shear), out of plane (bending) and vertical (compression), which can not be supported by masonry itself. The confinement effect given by the plating of masonry with C.R.M. reinforced coating ensures adequate increases in the mechanical properties of the masonry. The intervention with the **RI-STRUTTURA** System requires the realization on both faces of a layer of thin mortar coating (about 30 mm) with pre-mixed mortar for structural applications, reinforced with GFRP meshes and preformed accessories.

Thus allows to obtain a homogeneous and widespread structural improvement of the mechanical and ductility properties with a low increase in terms of stiffness of the GFRP elements. **RI-STRUTTURA** System allows to increase the resistance of the wall both in gravitational and horizontal actions such as seismic and wind action. GFRP meshes and preformed components grant high durability effectiveness of the system, and also the reduction of heat bridges nearby the connection points. The thickness coating application limits the increase of masses concept linked to the increase of the seismic action.

SYSTEM COMPONENTS

FBMESH – GFRP MESH

GFRP mesh produced with Textursion™ technology, provided with CE marking, whose bars are made of long glass fibers, impregnated with epoxy-vinylester thermosetting resin.



Characteristics	FBMESH_T96	FBMESH_T192
Mesh dimension	33x33 / 66x66 / 99x99 mm	66x66 / 99x99 mm
Minimum wire section	8,9 mm ²	14,1 mm ²
Roll size (external)	Ø 50÷70 x 200 cm	Ø 50÷70 x 200 cm
Tensile resistance (wire) (characteristic) value ⁽²⁾	4,3 kN	5,5 kN
Young's modulus ⁽²⁾	25000 MPa	25500 MPa
Resistance at the mesh joint (characteristic) value ⁽²⁾	0,25 kN	0,43 kN
Wire failure strain ⁽²⁾	1,45 %	1,50 %
Wire tensile strength (characteristic) value ⁽²⁾	365 MPa	395 MPa
Reaction to fire ⁽³⁾	A2-s1, d0, Class B-s1, d0 Class	B-s1, d0 Class

FBANG – GFRP CORNER REINFORCEMENT

Preformed GFRP (Glass Fiber Reinforced Polymer) angle elements provided with CE marking, manufactured with Textursion™ technology. The bars are made of fiberglass impregnated with a thermosetting resin. Glass fibers and epoxy-vinylester thermosetting resin are worked and weaved orthogonally to obtain a monolithic square mesh.



Characteristics	FBANG_T96	FBANG_T192
Mesh dimension	33x33 / 66x66 / 99x99 mm	66x66 / 99x99 mm
Minimum wire section	8,9 mm ²	14,1 mm ²
Element dimension	33 x 33 x 200 cm	33 x 33 x 200 cm

RI-STRUTTURA MASONRY REINFORCEMENT SYSTEM

Angle ranges	90° ± 15°	90° ± 15°
Tensile resistance (wire) (characteristic) ⁽²⁾	4,3 kN	5,5 kN
Young's modulus ⁽²⁾	25000 MPa	25500 MPa
Resistance at the mesh joint (characteristic) ⁽²⁾	0,25 kN	0,43 kN
Wire failure strain	1,45 %	1,50 %
Wire tensile strength (characteristic) ⁽²⁾	365 MPa	395 MPa
Reaction to fire ⁽³⁾	A2-s1, d0 Class B-s1, d0 Class	B-s1, d0 Class

FBCON_L – GFRP “L-SHAPED” CONNECTOR



GFRP “L-shaped” connector, for the connection of FB MESH to the masonry, provided with CE marking, made of pre-stressed and impregnated glass fiber with epoxy-vinylester thermosetting resin.



Characteristics	FBCON_L
Connector dimensions	Long part: to 10 to 100 cm, short part 10 cm
Connector section	10.0 x 7.0 mm ²
Cross sectional area	78.9 mm ²
Connector tensile strength (characteristic)	380 MPa
Young's modulus ⁽²⁾	26500 MPa

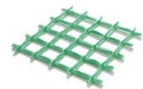
Properties	M.U.	Minimum value between the two directions		Test method Reference Regulation
		Average	Characteristic	
Connector extraction force (average value), F _{anc} on brick support	kN	17.0, 18.0, 21.3 (VINYL15) 17.5, 20.4, 22.5 (FB-RC30/3)		IT Qualification Guideline
Connector extraction force (average value), F _{anc} on tuff support	kN	4.9, 6.2, 6.8 (VINYL15) 8.0, 11.2, 12.5 (FB-RC30/3)		IT Qualification Guideline
Connector extraction force (average value), F _{anc} on stone support	kN	19.4, 22.0, 24.2 (VINYL15) 22.3, 24.0, 25.9 (FB-RC30/3)		IT Qualification Guideline
Crisis load of the junction for Overlap (average value), F _c	kN	14.0, 17.9, 22.5 (VINYL15) 21.1, 27.0, 36.6 (FB-RC30/3)		IT Qualification Guideline

Values with INTEGRA FIXA – VYNIL 15.

STRESS DISTRIBUTION ELEMENT - FB AREA MESH - FBFAZ33X33T96AR



GFRP mesh element provided with CE marking, produced with Textrusion™ technology, whose bars are made of long glass fibers, impregnated with epoxy-vinylester thermosetting resin.



Characteristics	FBFAZ33X33T96AR
Mesh dimension	33x33 mm

RI-STRUTTURA MASONRY REINFORCEMENT SYSTEM

Characteristics	FBFAZ33X33T96AR
Minimum wire section	8,9 mm ²
Element dimensions	150 x 150 mm
Tensile resistance (wire) (characteristic) value ⁽²⁾	4,3 kN
Young's modulus ⁽²⁾	25000 MPa
Resistance at the mesh joint (characterist) value ⁽²⁾	0,25 kN
Wire failure strain ⁽²⁾	1,45 %
Wire tensile strength (characteristic) value ⁽²⁾	365 MPa
Reaction to fire ⁽³⁾	B-s1, d0 Class

INTEGRA FIXA - VINYL15 Resin

Two-component, vinylester, styrene-free chemical anchor in cartridges for heavy and structural loads, for fixing reinforcing bars and reinforcing irons on concrete, reinforced concrete, solid masonry, hollow bricks and wood substrates.



Characteristics	INTEGRA FIXA - VINYL15								
	C16/20	C16/20	C20/25	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60
Design adhesion tensions according to EN 1992-1-1 [MPa]									
To $\Phi 8$ from $\Phi 14$	1.60	2.00	2.30	2.70	3.00	3.40	3.70	4.00	4.30
To $\Phi 16$ from $\Phi 20$	1.60	2.00	2.30	2.70	3.00	3.40	3.70	4.00	4.00
$\Phi 25$	1.60	2.00	2.30	2.70	3.00	3.40	3.40	3.40	3.40
$\Phi 28$	1.60	2.00	2.30	2.70	3.00	3.40	3.40	3.40	3.40
$\Phi 32$	1.60	2.00	2.30	2.70	2.70	2.70	2.70	2.70	2.70

PB-D_-G17/ PB-D_-G17AM Bars

GFRP (Glass Fiber Reinforced Polymer) smooth PB-D \emptyset or improved adhesion PB-D \emptyset AM preformed bars.



Characteristics	PB-D_-G17	PB-D_-G17AM
Bar diameter (mm)	4 / 6 / 8 / 10 / 12 / 16 / 20 / 26	4 / 6 / 8 / 10 / 12 / 16 / 20 / 26
Bar section (mm ²)	13 / 28 / 50 / 79 / 113 / 201 / 314 / 531	13 / 28 / 50 / 79 / 113 / 201 / 314 / 531
Weight	37 / 56 / 91 / 157 / 214 / 404 / 505 / 656	37 / 56 / 91 / 157 / 214 / 404 / 505 / 656
Bar surface	Smooth	Improved adhesion
Tensile strength mean value (MPa)	800	800
Tensile strength characteristic value (MPa)	560	560
Young's modulus (GPa)	350	350

RI-STRUTTURA MASONRY REINFORCEMENT SYSTEM

Mortars based on NHL hydraulic lime and lime and hydraulic binders



Characteristics of EPOCA Mortars	RASO NHL RNHL 105	CALCE NHL 105	CALCE NHL 110	CALCE NHL 115	CALCE NHL THERMIC 800
Binder type	NHL hydraulic lime	NHL hydraulic lime	NHL hydraulic lime	NHL hydraulic lime	NHL hydraulic lime
Compression strength -28 days (MPa)	-	≥ 5	≥ 10	≥ 15	≥ 8
Young's modulus (GPa)	-	≤ 7	≤ 8	≤ 10	≤ 5
Class and typology	CS I	CS III - M5	CS IV - M10	CS IV - M15	CS III - M5
Bending strength - 28 days (MPa)	-	≥ 1	≥ 1,5	≥ 4	≥ 2
Adhesion to the brick support (MPa)	-	≥ 0,5	≥ 0,5	≥ 0,5	≥ 0,5
Adhesion to the concrete support (MPa)	-	≥ 0,5	≥ 1	≥ 1	≥ 1

Characteristics of MATERIA Mortars	RASO LEGO RL 103	RINFORZA RZ 205	RINFORZA RZ 210	RINFORZA RZ 215	RINFORZA RZ 220
Binder type	Lyme and hydraulic binders	Lyme and hydraulic binders	Lyme and hydraulic binders	Lyme and hydraulic binders	Lyme and hydraulic binders
Compression strength -28 days (MPa)	-	≥ 5	≥ 10	≥ 15	≥ 20
Young's modulus (GPa)	-	≥ 6	≤ 8	≤ 10	≤ 15
Class and typology	CS IV	CS III - GP - M5	CS IV - GP - M10	CS IV - GP - M15	CS IV - GP - M20
Bending strength - at 28 giorni (MPa)	-	≥ 1	≥ 1,5	≥ 1,5	≥ 4
Adhesion to the brick support (MPa)	-	≥ 0,2	≥ 0,5	≥ 0,5	≥ 0,5
Adhesion to the concrete support (MPa)	-	≥ 0,5	≥ 1	≥ 1	≥ 1

CHARACTERISTICS

- Excellent mechanical characteristics
- Lightness e low thickness
- High corrosion resistance
- Different mortars compatibility
- Non-magnetic, radiotransparent, dielectric

ADVANTAGES

- Durability
- Widespread and homogeneous mechanical improvement
- Masonry breathability
- Ease and speed of application, worksite safety
- Reversibility
- Reduction of costs and time for handling and installation
- Reduction in overall intervention costs
- Reduction of heat bridges at connection points

RI-STRUTTURA MASONRY REINFORCEMENT SYSTEM

INSTALLATION PROCEDURE

1. Removal of the existing plaster and deteriorated parts and scarification of about 10 ± 15 mm of the bedding joints to facilitate the adherence of the mortar. Wash the external walls using a high-pressure water jet machine. Completely remove the dust still present on the masonry surface. Eventual reconstruction of missing or particularly damaged parts of masonry. In presence of carbonation and reinforcements oxidation phenomena on the concrete facings, it is necessary to make a preliminary protection intervention of the reinforcements with a suitable product.
2. Before applying the new coating, wet the masonry to refusal. The support must be saturated but without water surface stagnation.
3. In certain conditions it could be necessary to apply a layer of undercoat with a thickness of 5-10 mm to completely cover the support. Wait at least 24 hours of maturation before proceeding with the following operation.
4. Mark on the wall the connectors position in the quantity foreseen by the project (4/6 connections per m^2) and make the passing holes with a diameter of 12 mm for the insertion of the "long" FBCON_L transversal connectors (it is sufficient that the hole is not passing where the reinforcement is foreseen only on one side of the masonry). Enlarge the hole diameter of about two times on the other side of the parameter where the "short" transversal connectors will be inserted. The length of the second hole will have to guarantee in the following phase the overlap of at least 10 - 15 cm between the two transversal connectors. Drill the holes with a roto-percussion drill (in case of very deteriorated masonry, proceed with a simple rotation drilling). Clean the holes with compressed air to remove drilling dust.
5. Drilling of holes to make connections and reinforcement of the reinforced coating on the floors by means of PB-D_ or PB-D_AM preformed bars in GFRP in the number foreseen by the design. Drill the holes with a rotary drill. Drill a hole with a diameter equal to that of the bar increased by 2 mm. The drilling should provide an anchorage length of at least 50 times the maximum connector diameter. It is recommended to have a variable spacing between bars from 1 m to 0,67 m (corresponding to n°1 bar every meter or n°3 bars every 2 m).
6. Installation of the FBMESH on the face destined to the insertion of the "long" connectors and temporary fixing of the mesh to the masonry with carpentry nails to allow the correct positioning and cutting of the mesh in correspondence of the openings. The mesh is cut by means of shears and/or cutters or with an angle grinder. Overlap the mesh strips for about 15 cm in order to guarantee the mechanical continuity. Do not bend the mesh at a sharp angle in order to avoid possible breakage of the fibers. Mount FBANG in correspondence of the edges, overlapping them to the mesh for at least 15 cm.
7. Resin injection in the holes, previously cleaned with compressed air jet. The injection must guarantee the arrival of the resin in the deepest part of the perforation. Insertion of PB-D_ or PB-D_AM preformed bars by rotating them around their own axis so that a perfect distribution of the resin inside the hole takes place. The correct filling of the cavity is ensured when, with the insertion of the connector, a certain amount of resin is released on the surface.
8. Insertion of FBCON_L connectors of length equal to the thickness of the masonry. If necessary, cut the exceeding part of the connector. Where applicable, the insertion of the connector must be preceded by the positioning of the FBFAZ.
9. Eventual laying of FBMESH and FBANG on the other side of the wall face.
10. Proceed with the injection of vinylester and/or epoxy resin in the enlarged portion of the holes to solidify the two elements. Insert in the hole the second FBCON_L connector, creating an overlap of at least 10 - 15 cm. Where applicable, the insertion of the connector must be preceded by the positioning of the FBFAZ.
11. When the resin of the connectors is completely hardened, proceed with the application of the mortar coating with the design characteristics, with a minimum thickness of about 25 mm per side (thickness defined by the design).

The coating can be applied in a single layer (normal situation for thicknesses up to 30 mm) or in two or more successive layers. The mesh must be placed in the middle of the mortar thickness. Ensure wet curing of the coating by avoiding intense sunlight or ventilation and by wetting at least 2 times a day for 7 days, starting 24 - 48 hours after laying. Wait at least 10 days before laying any finishing skim coats. Paints or colored coatings can be applied only after the plaster has cured and not before 28 days from the installation.

Always refer to the design indications of the specific intervention.

RI-STRUTTURA MASONRY REINFORCEMENT SYSTEM

SPECIFICATION ITEM

RI-STRUTTURA is qualified with CE marking according to EAD 340392-00-0104 – CRM (Composite Reinforced Mortar) Systems for strengthening concrete and masonry structures.

RI-STRUTTURA System provides the reinforcement of walls of any kind, even one-headed, by means of CRM (Composite Reinforced Mortar) technique with the application of a preformed mesh in G.F.R.P. (Glass Fiber Reinforced Polymer) composite material. (Glass Fiber Reinforced Polymer) mesh _____ mm, FBMESH_____ of Fibre Net, or equivalent, CE marked, consisting of glass fiber and vinylester-epoxy thermosetting resin, tensile strength characteristic of a single bar \geq _____ kN, minimum section _____ mm² and having n° _____ bars/meter/side, equivalent tensile modulus N/mm² _____, elongation at break _____, equivalent tensile modulus E _____ N/mm², characteristic knot tensile strength \geq _____ kN, with decay of tensile strength and elastic modulus for humid, alkaline and saline environments < 15%.

It also includes: the cleaning of the wall elements already scarified; the abundant washing of the wall surface; the execution of holes in number of _____/m² and the supply and insertion of preformed "L shaped" connectors in G.F.R.P. FBCON_L of Fibre Net, or equivalent, CE marked, consisting of glass fiber and vinylester-epoxy thermosetting resin, characteristic tensile strength \geq 26.6 kN, equivalent tensile elastic modulus E _____ N/mm², with sections 10 x 7 mm and suitable length in relation to the wall thickness, applied to the wall with overlapping between them of at least 10 cm and secured with chemical anchor vinylester VINYL15, styrene-free, complete with load distribution tissue FBFAZ33X33T96AR. The execution of holes and the supply and insertion of preformed bars PB_-G17 or PB_-G17AM of Fibre Net, or equivalent, consisting of glass fiber and thermosetting resin of vinylester-epoxy type, characteristic tensile strength _____ kN, average axial stiffness _____ kN, with diameter _____ mm and length equal to _____ and solidified by chemical anchor vinylester VINYL15, styrene-free, or lime grout to make connections and recovery of reinforced plaster counted in number of _____/m² compared to the total surface to be reinforced.

Including FBANG corner reinforcements in G.F.R.P. (Glass Fiber Reinforced Polymer) fiber-reinforced composite material. (Glass Fiber Reinforced Polymer), CE marked, with mesh _____ mm, FBANG _____ of Fibre Net, or equivalent, consisting of glass fiber and thermosetting resin of vinylester-epoxy type, tensile strength characteristic single bar \geq _____ kN, minimum section _____ mm² and having n° _____ bars/meter/side, tensile elastic modulus equivalent _____ N/mm² _____, elongation at break _____; characteristic tensile strength of the knot \geq _____ kN, with decay of tensile strength and elastic modulus for humid, alkaline and saline environments < 15%. and counted at a rate of _____ % with respect to the total surface to be reinforced.

Including the supply and application of EPOCA or MATERIA plaster, by Fibre Net or equivalent, pre-mixed for structural applications with a minimum thickness of 30 mm, compressive strength _____ MPa, with trowel finish. Recyclable materials in accordance with CSI protocols. The removal of the existing plaster has to be foreseen separately. It also includes everything else needed to finish the job, counted at actual size on the external wall.

Application on both faces or only one face of the wall and for wall thicknesses up to _____cm.

Note 1: Where applicable.

Note 2: The values of mechanical properties refer to the minimum value in the direction of weft (transverse flat yarns) and warp (longitudinal twisted yarns).

Note 3: The reaction-to-fire rating is determined according to EN 13501-1:2007 + A1 2009. The minimum fire response according to this classification depends on the type of mesh:

Mesh	Fire reaction class
FBMESH33x33T96AR	B-s1, d0
FBMESH66x66T96AR	A2-s1, d0
FBMESH99x99T96AR	A2-s1, d0
FBMESH66x66T192AR	B-s1, d0
FBMESH99x99T192AR	B-s1, d0

The purchaser is responsible for verifying the suitability of the products described in this document for its intended use and purposes. Fibre Net SpA assumes no responsibility for improper use of the material. The customer is required to verify that this sheet and the data reported therein are valid for the product batch of his interest and are not outdated as replaced by subsequent editions and / or new product formulations or certifications. The customer is invited to contact our Technical Department in advance. This edition cancels and replaces any previous one.