FORTIUS

Sistema C.R.M. (Composite Reinforced Mortar) system for the strengthening of reinforced concrete and masonry

TCS PASSIONE MATERICA

TECHNICAL MANUAL FOR THE PREPARATION AND INSTALLATION OF THE SYSTEM 07 | 2022

DURIOR
FORTIUS
IN TEMPORE

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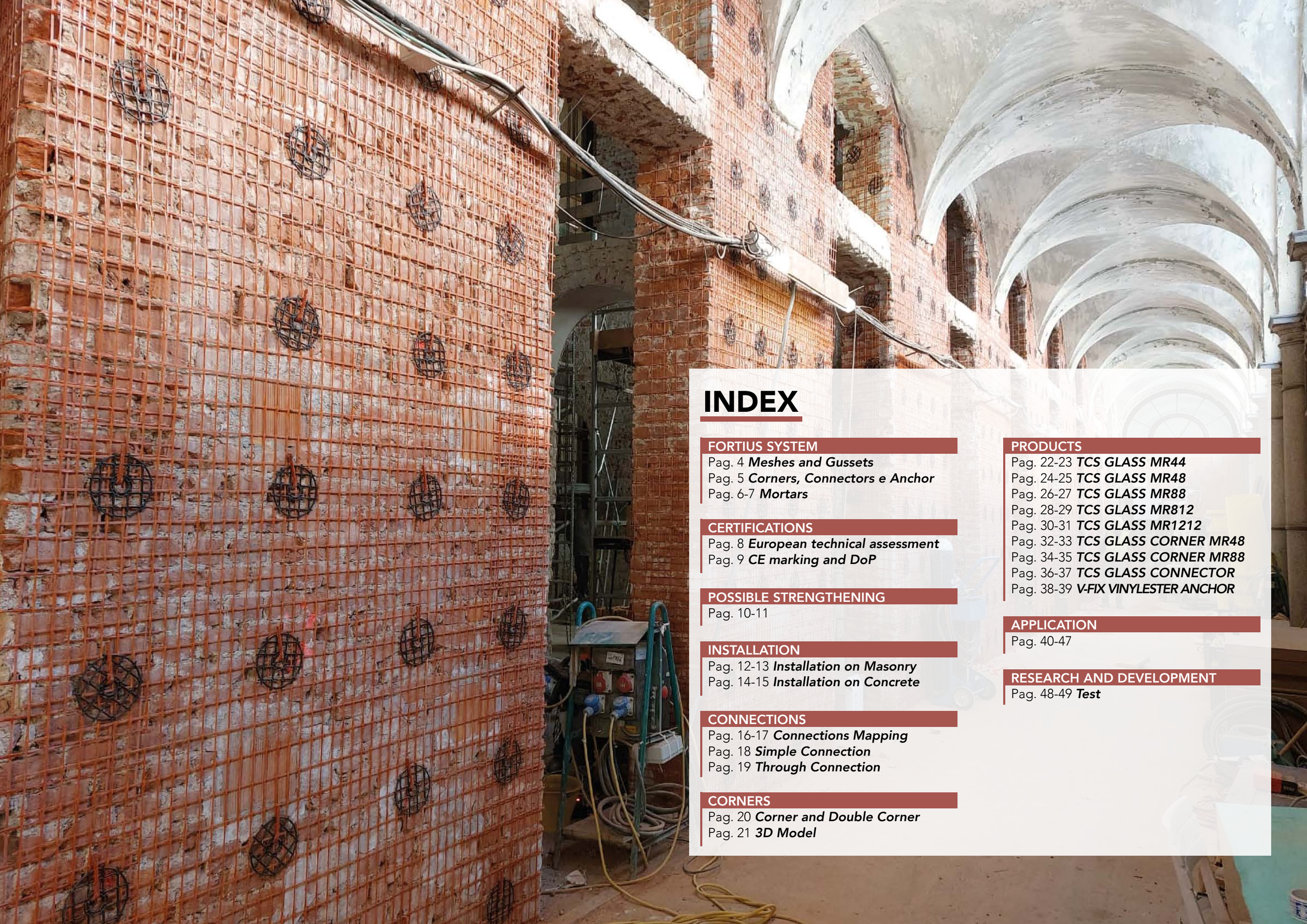

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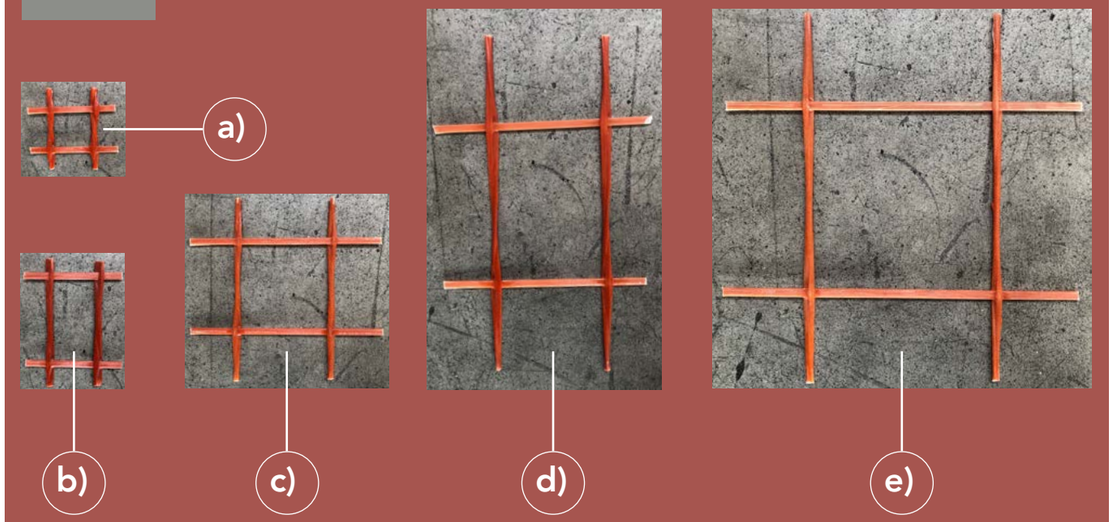
FORTIUS SYSTEM

CRM system "**FORTIUS**" consists of an alkali resistant glass fibre meshes, corners and connectors with an inorganic matrix.

FORTIUS is the ideal solution for securing masonry buildings. The base principle is the technique of the reinforced mortar but revisited in an innovative way with composite materials and lime-based mortars, ideals for restorations and refurbishments.

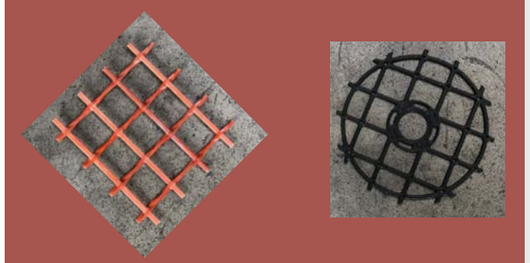
MESHES



a) Grid 4 x 4 b) Grid 4 x 8 c) Grid 8 x 8

d) Grid 8 x 12 e) Grid 12 x 12

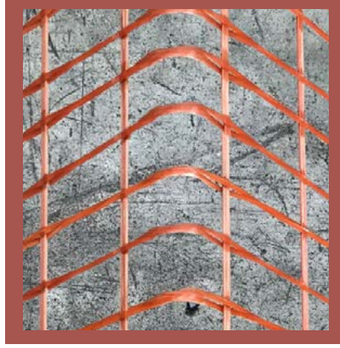
GUSSETS



Classic gusset **16 x 16 cm** with a square grid **4 x 4 cm** section obtained directly from the mesh.

Recycled PA gusset (**Ø 16 cm**) loaded with glass fibre.

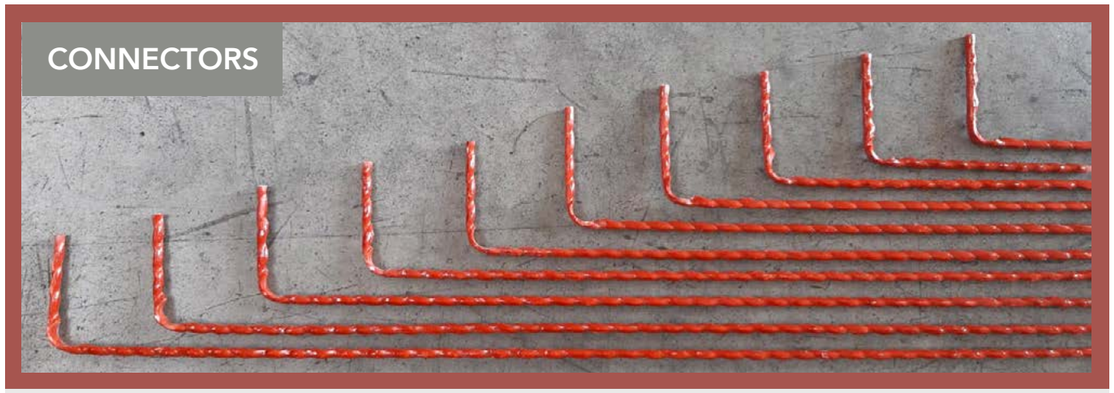
CORNERS



Corner
Grid
4 x 8 cm

Corner
Grid
8 x 8 cm

CONNECTORS



L-shaped connector with improved adherence in **GFRP** (Glass Fibre Reinforced Polymer) composite, alkali resistant in epoxy resin. Short side 10 cm - Long side 10, 15, 20, 30, 40, 50, 60, 70, 80, 90,100 cm. Custom length available on demand.

ANCHOR

Two-component vinylester anchor for installing connectors.
Also grips in wet or damp holes.

FORTIUS SYSTEM

System certified with various mortars with guarantee performance. For each and every need a specific mortar is available: structural or insulation, lime or cement based, dehumidifying or traditional.

Adaptable: apt to be applied with different inorganic **NHL 5** matrix or traditional matrix.

Restauration: combined with **B-STRUCTURA** (inorganic lime-based matrix) the system can be used to strengthen regulated building. The system can be used when it's required compatibility with the pre-existing materials and strengthening without modifying the breathability and the ambient weather equilibrium.

Reversible: the system is easily removed and the pre-strengthening conditions can be easily restored.

Resistant: high technical performance in terms of strength and elastic modulus.

Easy: very simple installation complying some easy steps.

Durability: high resistance to humid, alkaline and aggressive environment, thanks to the epoxy matrix.

Thermal and dehumidifying mortars:
CLIMATHERM AR and **INTOPORE AR**

Lime based structural mortars:
B-STRUCTURA and **B-STRUCTURA G**

High performance mortars:
MATERICA, B-STRUCTURA 10F and **15F**

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European Technical Assessment ETA 21/0524 of 14/07/2021

GENERAL PART

Trade name of the construction product	**FORTIUS made of:** FRP mesh TCS Glass MR44, TCS Glass MR48, TCS Glass MR88, TCS Glass MR812, TCS Glass MR1212 FRP mesh corner element TCS Glass Corner MR48, TCS Glass Corner MR88 FRP connectors TCS Glass Connector
Product family to which the construction product belongs	**PAC 34: BUILDING KITS, UNITS, AND PREFABRICATED ELEMENTS.** **CRM (Composite Reinforced Mortar) systems for strengthening concrete and masonry structures**
Manufacturer	**T.C.S. s.r.l.u.** **Via Sigalina a Mattina, 8/c** **I - 25018 Montichiari (BS)**
Manufacturing plant	**T.C.S. s.r.l.u.** **Via del Gavardello, 15** **I - 25018 Montichiari (BS)**
This European Technical Assessment contains:	**20 pages, including 16 annexes which form an integral part of this assessment**
This European Technical Assessment is issued in accordance with Regulation (EU) n° 305/2011, on the basis of	**EAD 340392-00-0104 ed. November 2018 – CRM (Composite Reinforced Mortar) systems for strengthening concrete and masonry structures**

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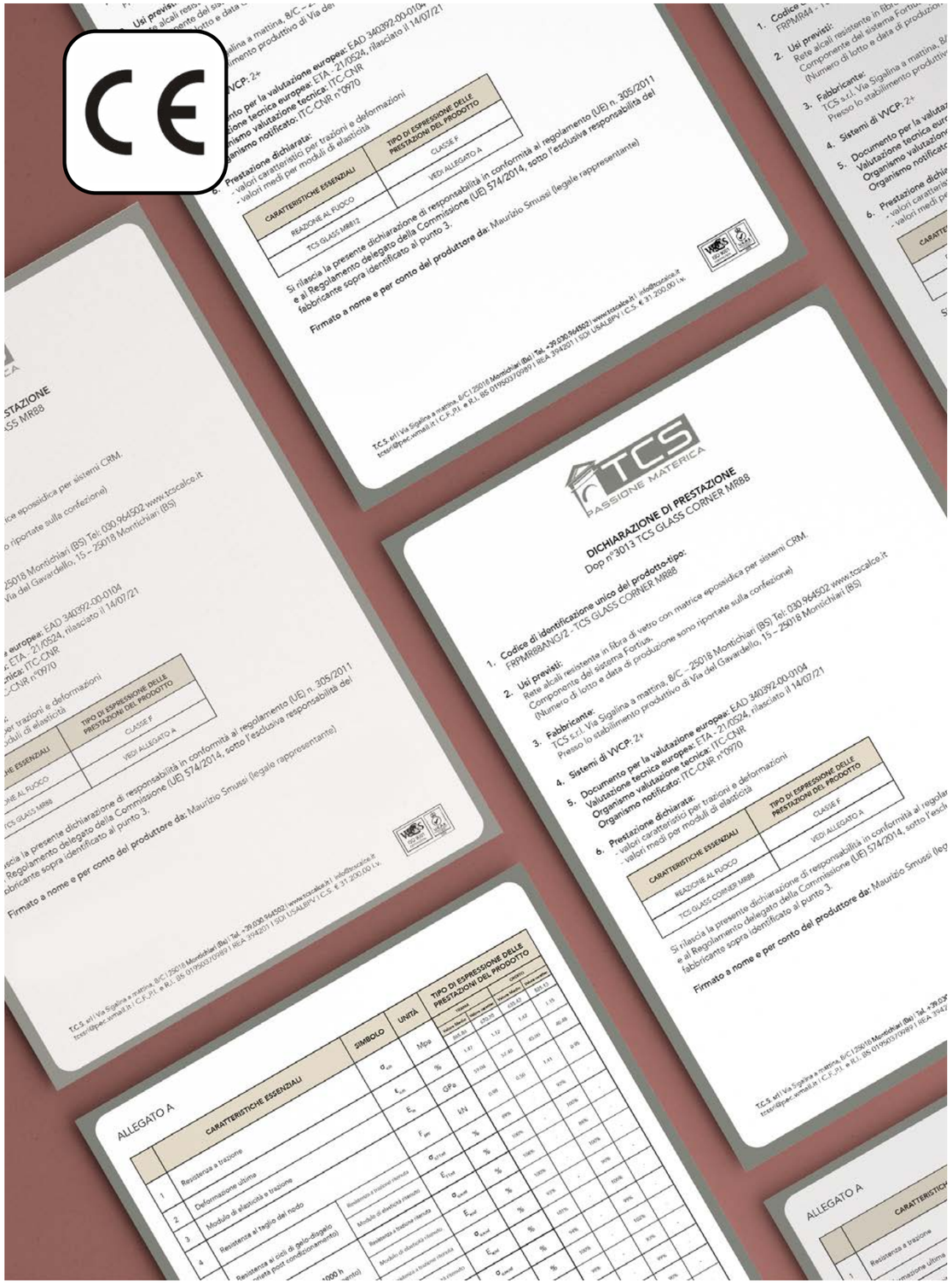


POSSIBLE STRENGTHENING

COLUMNS

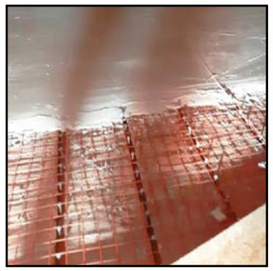
ARCS

VAULT SIDE

RING CURB BEAMS

EXTRADOS VAULTS (EXTENDED)

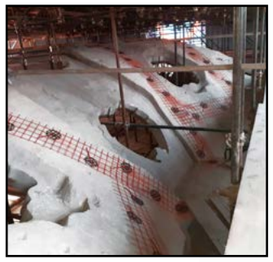
PEDIMENTS

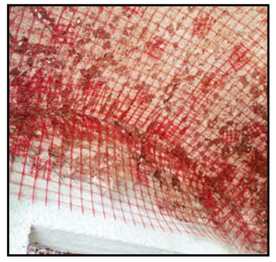

COLLABORATING SLABS

ROOF SLABS

ANTI-DEBONDING

CORNERS


(IRREGULAR) VAULTS


INTRADOS VAULTS (EXTENDED)

REINFORCED MORTARS

OPENING

RESTRAINING

FLOORING

FOUNDATIONS

INSTALLATION ON MASONRY

Rough slab surfaces (solid bricks, rough walls, mixed walls, stones and tuff):

1. Dry positioning of the **TCS GLASS MR48/88/812/1212.** Connectors or temporary fixing systems can be used in order to momentary maintain the mesh in positions;

2. Dry positioning of the **TCS GLASS CORNER MR48/MR88** or double **MR88** with an appropriate overlapping (Total overlap of the L-element is recommended, but not less than 15 cm.);

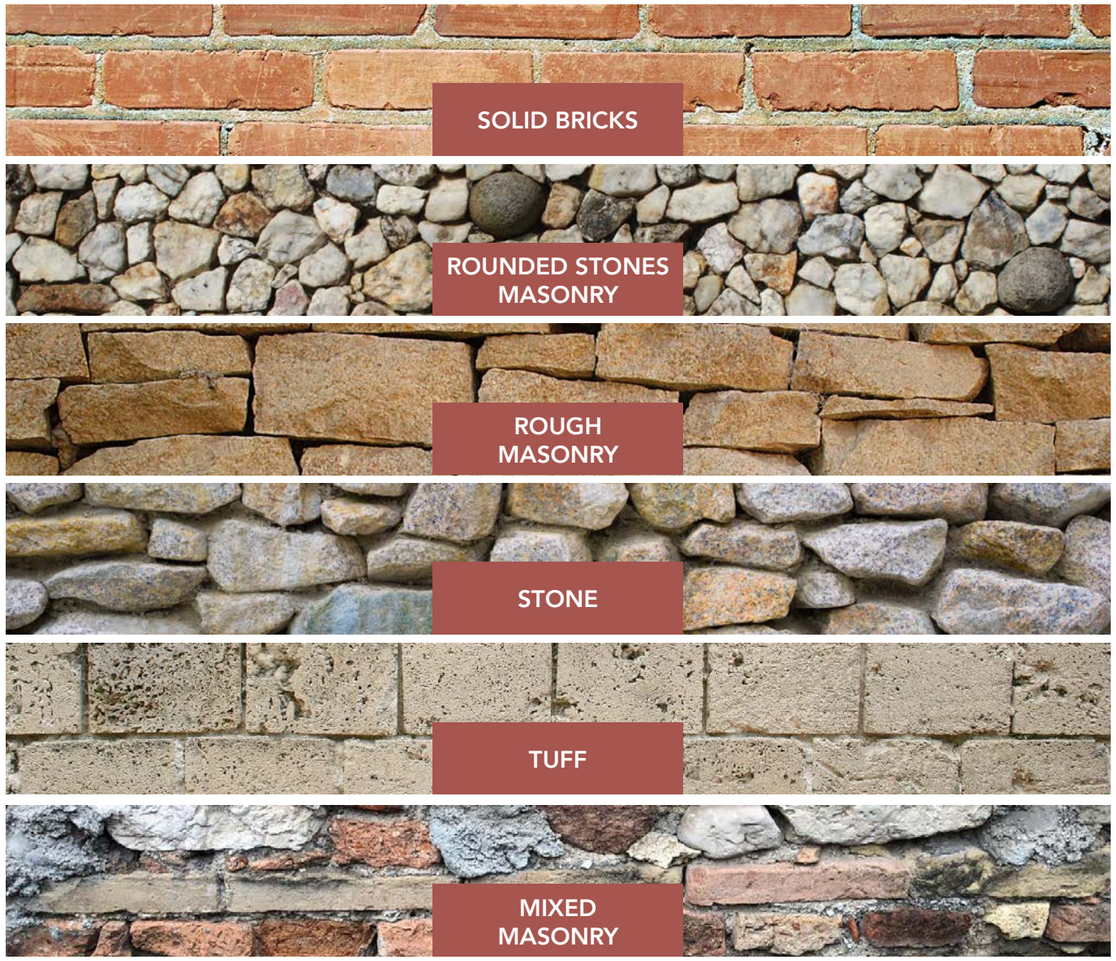
3. Drill ø 12 mm holes for the connectors;

4. Cleaning of the holes;

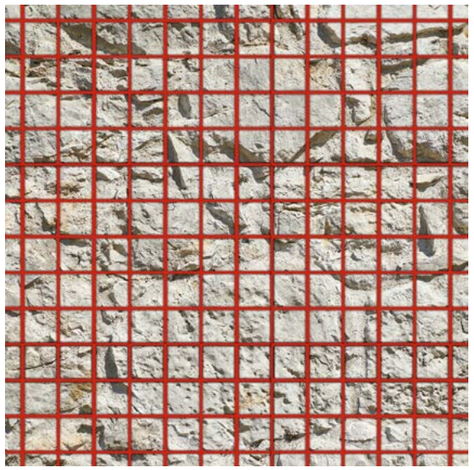
5. Saturation of the holes with structural anchor **V-FIX** or inorganic matrix;

6. Insertion of the **TCS GLASS CONNECTOR** with a 45° grid-mounted partitioning gusset or **GUSSET MR44 PA.**

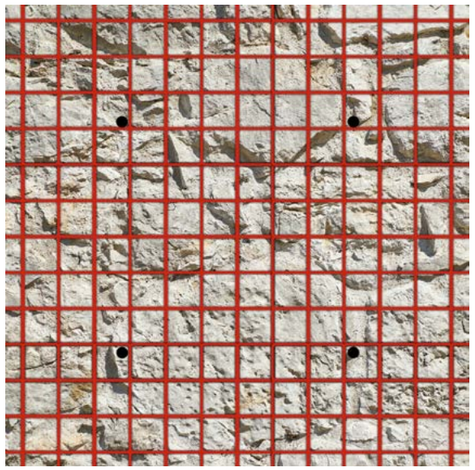
7. Application of the inorganic matrix to completely cover the mesh, gusset and connectors. **B-STRUCTURA** product line for a lime based application or **MATERICA** for a concrete masonry.



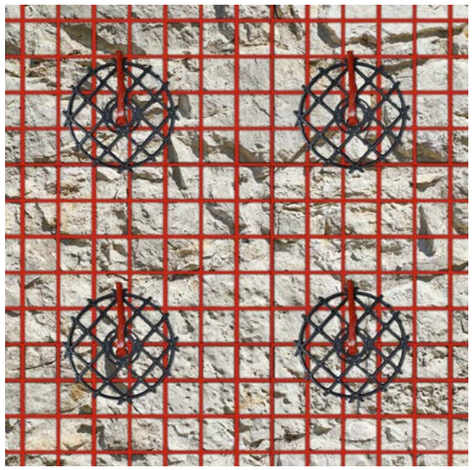
Substrate preparation



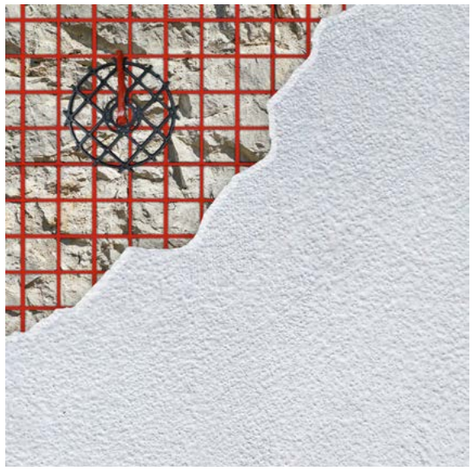
Mesh positioning



Holes for connectors and cleaning



Connectors and gussets installation



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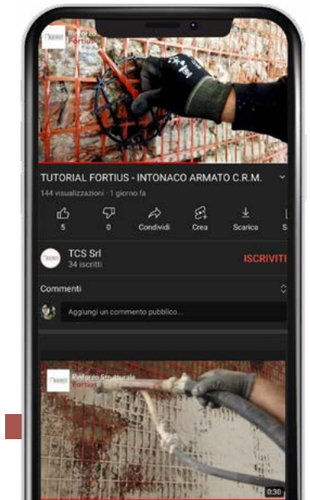
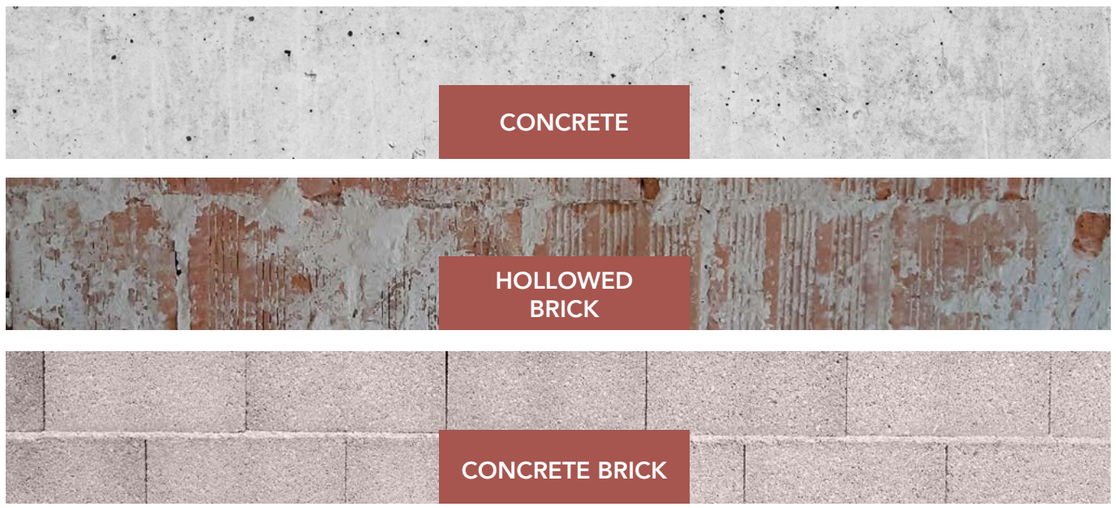
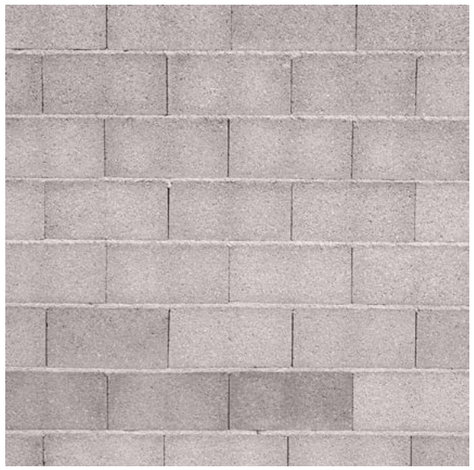


INSTALLATION ON CONCRETE

Smooth surfaces (concrete, brick masonry or very planar structural masonry):

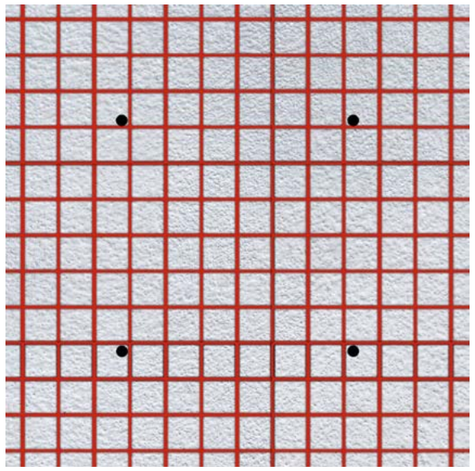
1. Priming coat of inorganic matrix for rough casting. **B-STRUCTURA** product line for lime-based applications or **MATERICA** for concrete based;
2. Dry positioning of the **TCS GLASS MR44/MR48/88/812/1212**. Connectors or temporary fixing systems can be used in order to momentary maintain the mesh in positions;
3. Dry positioning of the **TCS GLASS CORNER MR48/MR88** or double **MR88** with an appropriate overlapping (Total overlap of the L-element is recommended, but not less than 15 cm.);
4. Drill ø 12 mm holes for the connectors;
5. Cleaning of the holes;
6. Saturation of the holes with structural anchor **V-FIX** or inorganic matrix;
7. Insertion of the **TCS GLASS CONNECTOR** with a 45° grid-mounted partitioning gusset or **GUSSET MR44 PA**;
8. Second hand with inorganic matrix to completely cover the mesh, the gusset and the connectors.
B-STRUCTURA product line for lime-based applications or **MATERICA** for concrete based.



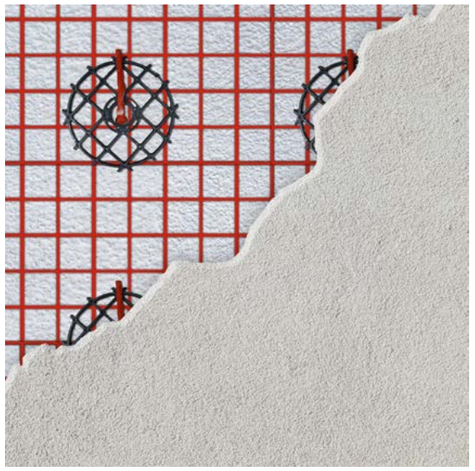


Substrate preparation

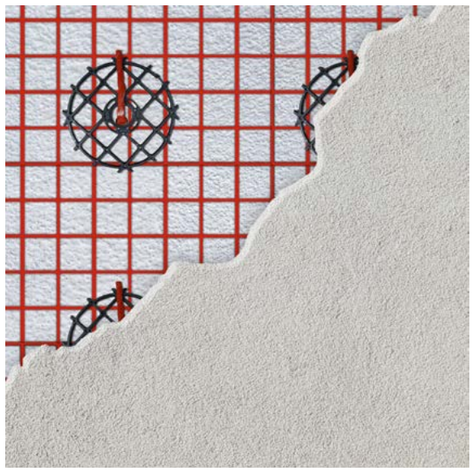
Priming coat



Mesh and holes



Connectors and gussets installation



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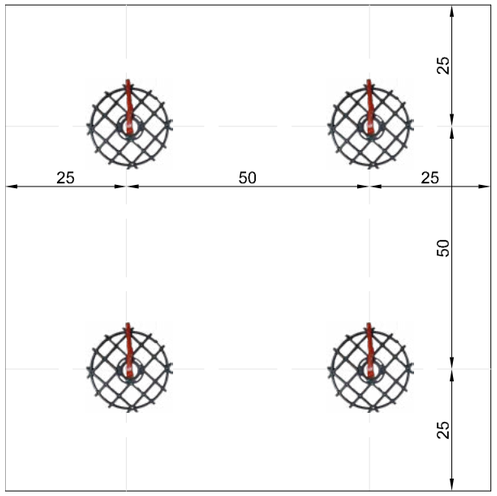
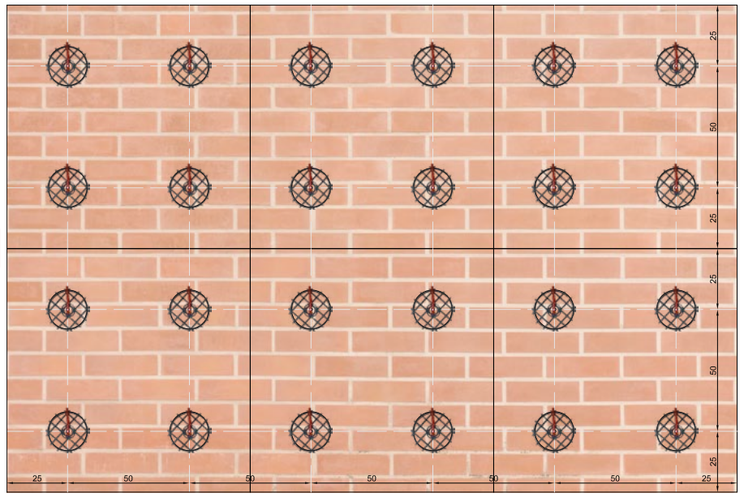
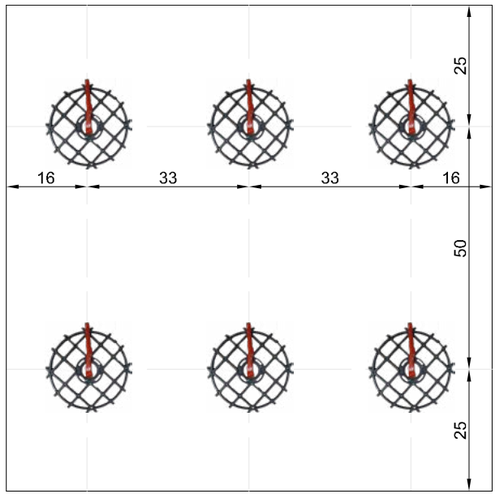
CONNECTIONS MAPPING

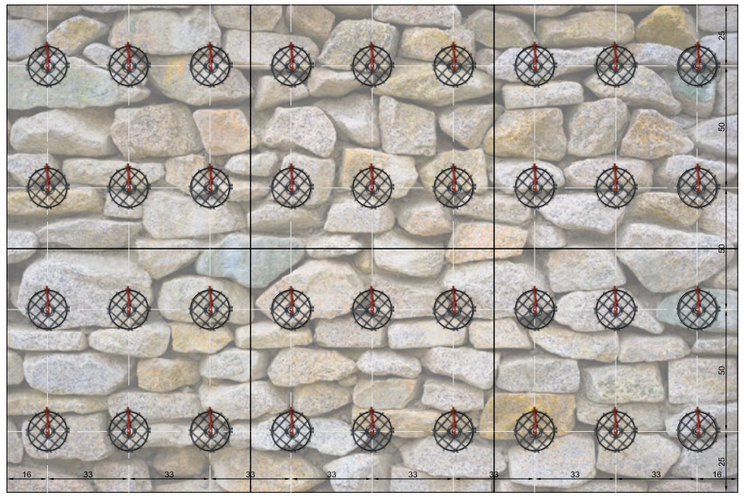


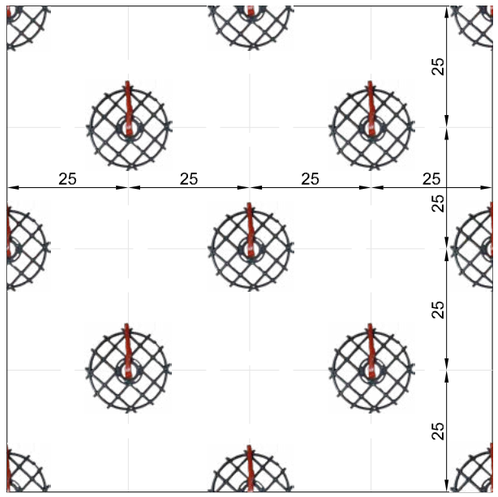
4 connection/m²



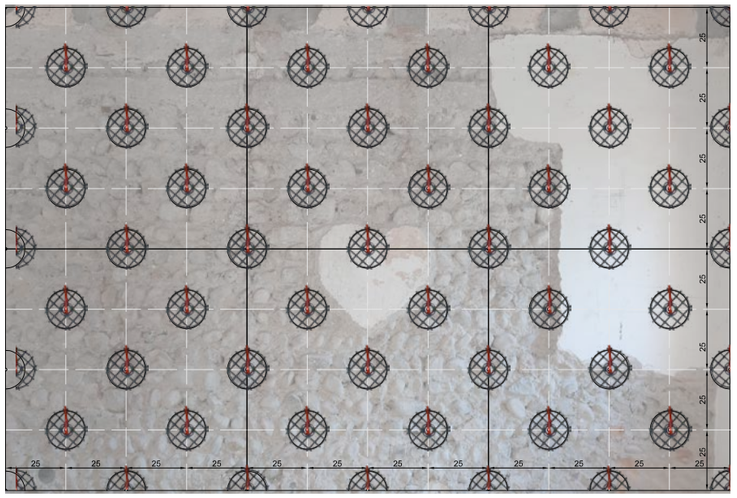


6 connection/m²



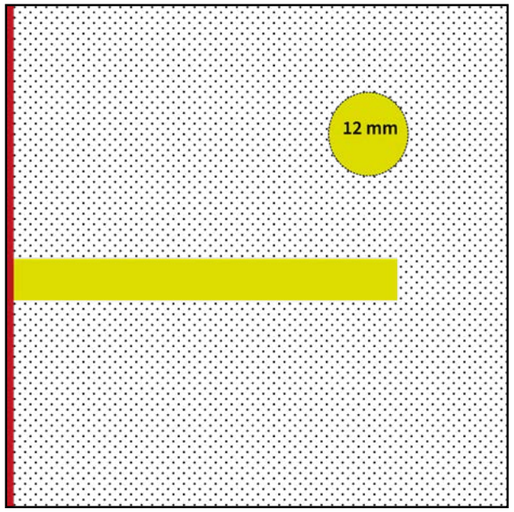


8 connection/m²



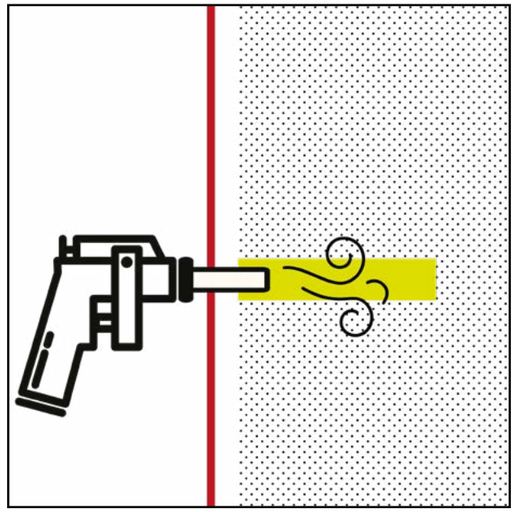
SIMPLE CONNECTION

1



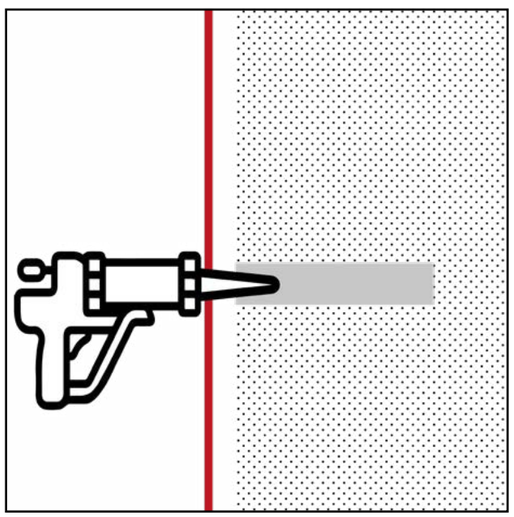
12 mm hole. Length as defined by the project. Recommended not less than 2/3 of the thickness.

2



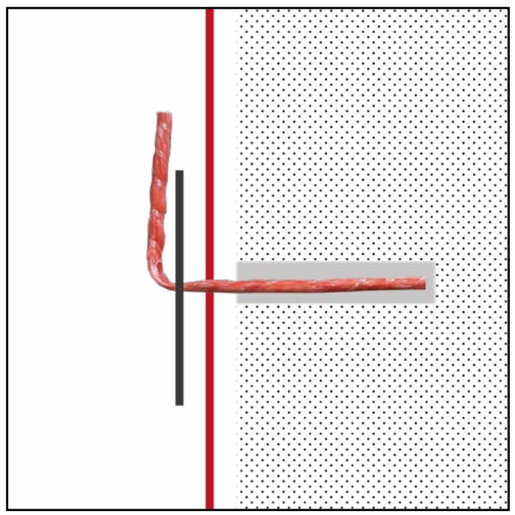
Blow the hole with compressed air or wash it.

3



Fill the hole with the structural anchor V-FIX.

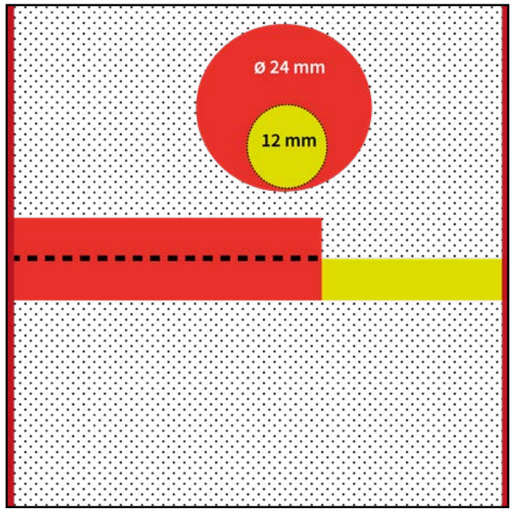
4



Place the gusset and insert the connector.

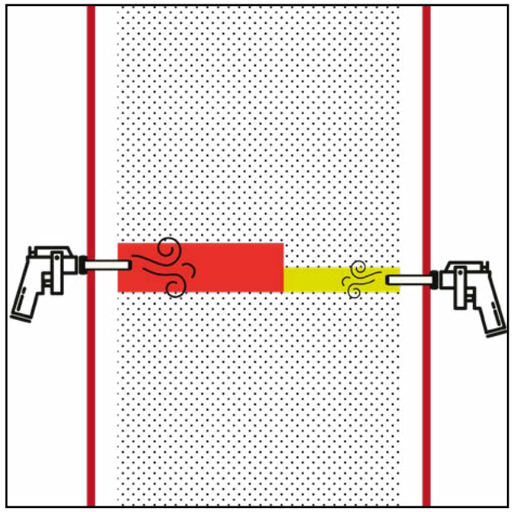
THROUGH CONNECTION

1



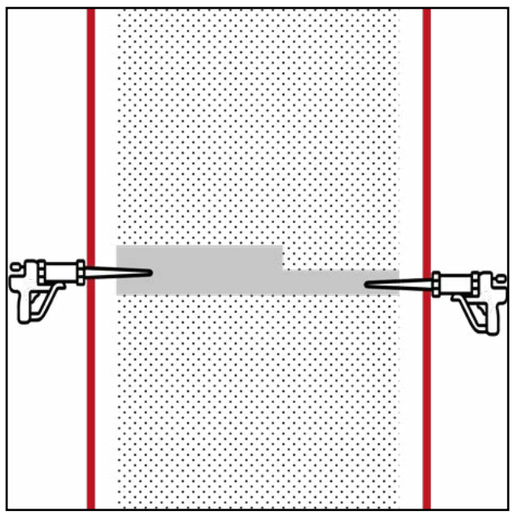
24 mm hole for a 200 mm depth.
12 mm through-hole tangent to the base.

2



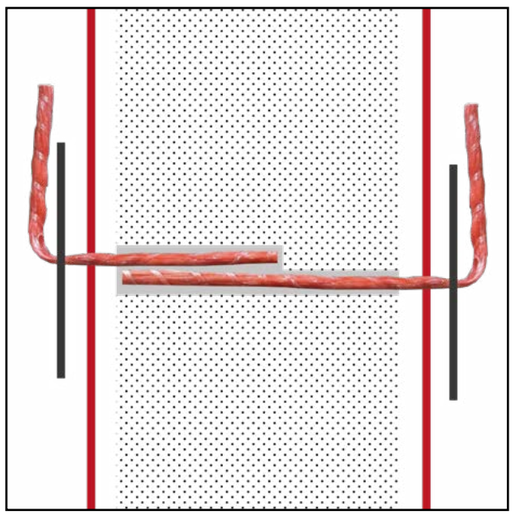
Blow the hole with compressed air or wash it.

3



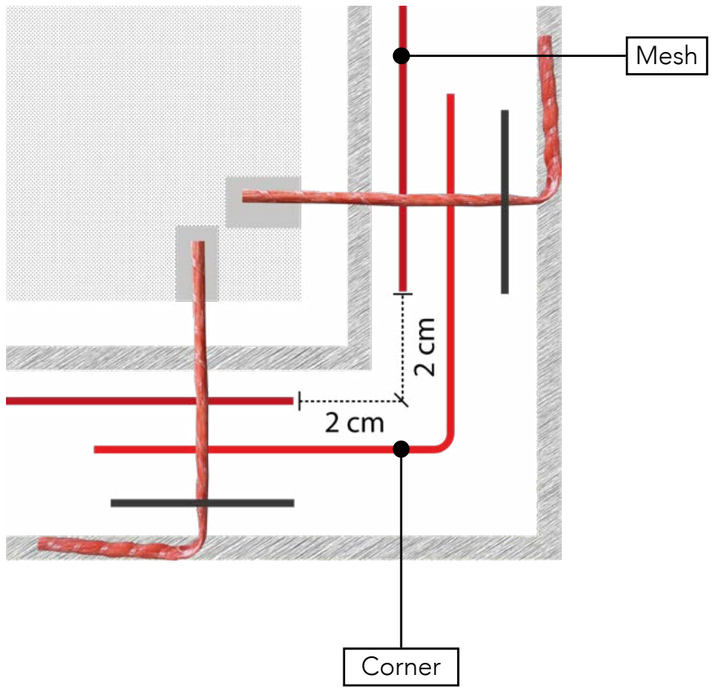
Fill the hole with the structural anchor V-FIX.

4

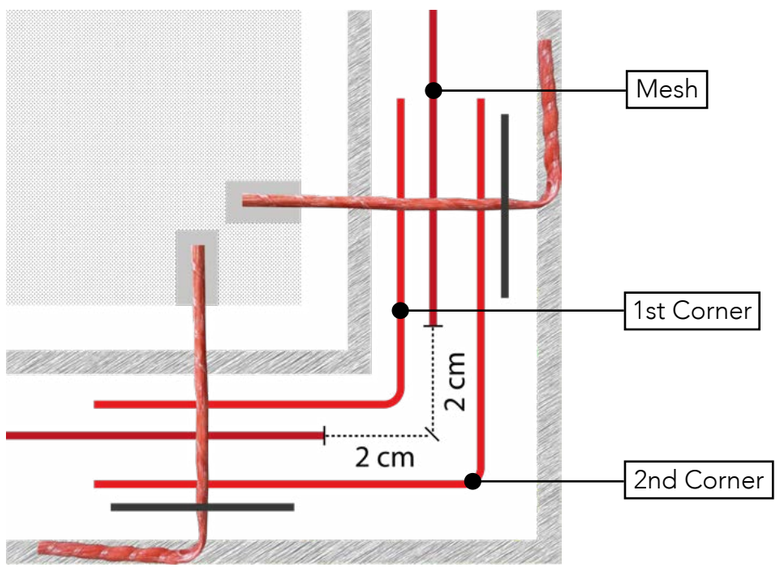


Place the gusset and insert the connector.

CORNER



DOUBLE CORNER

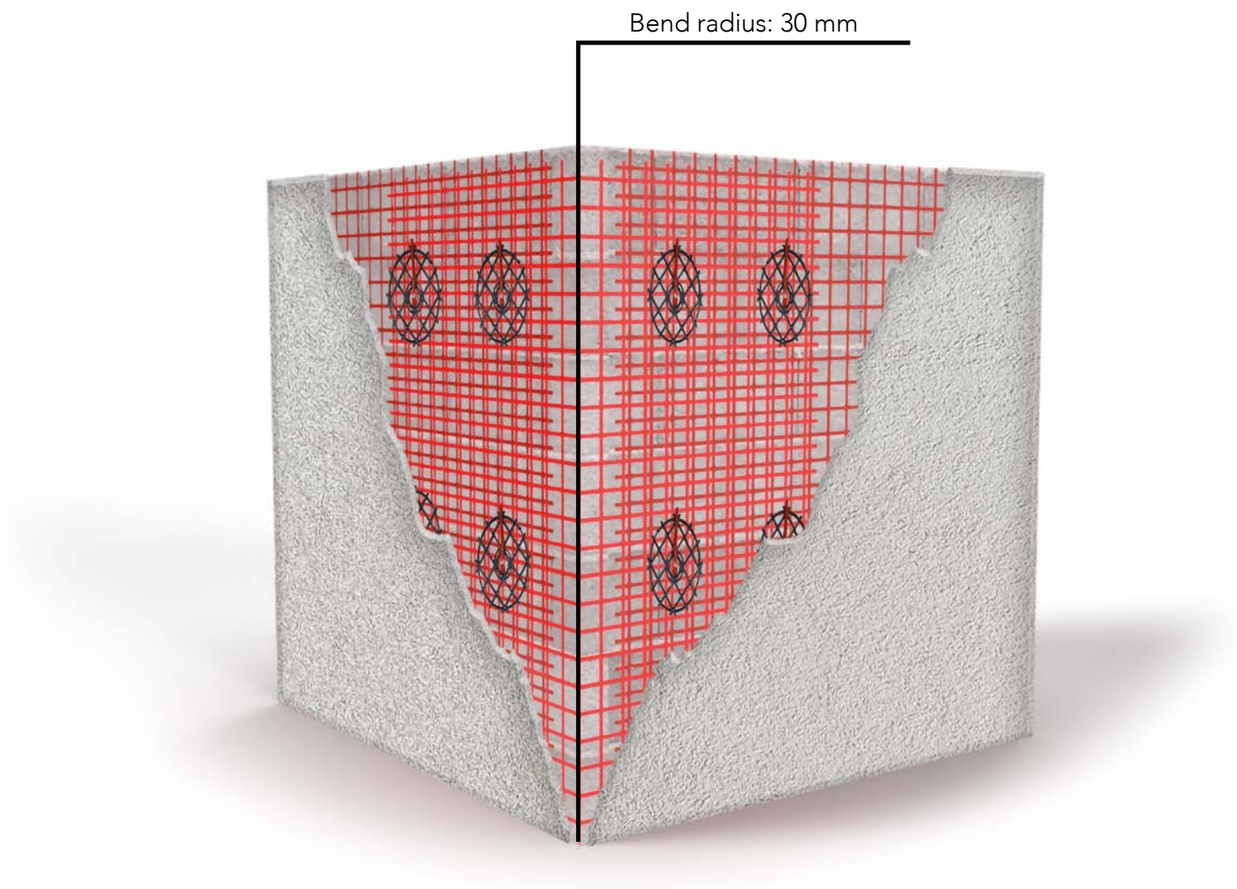


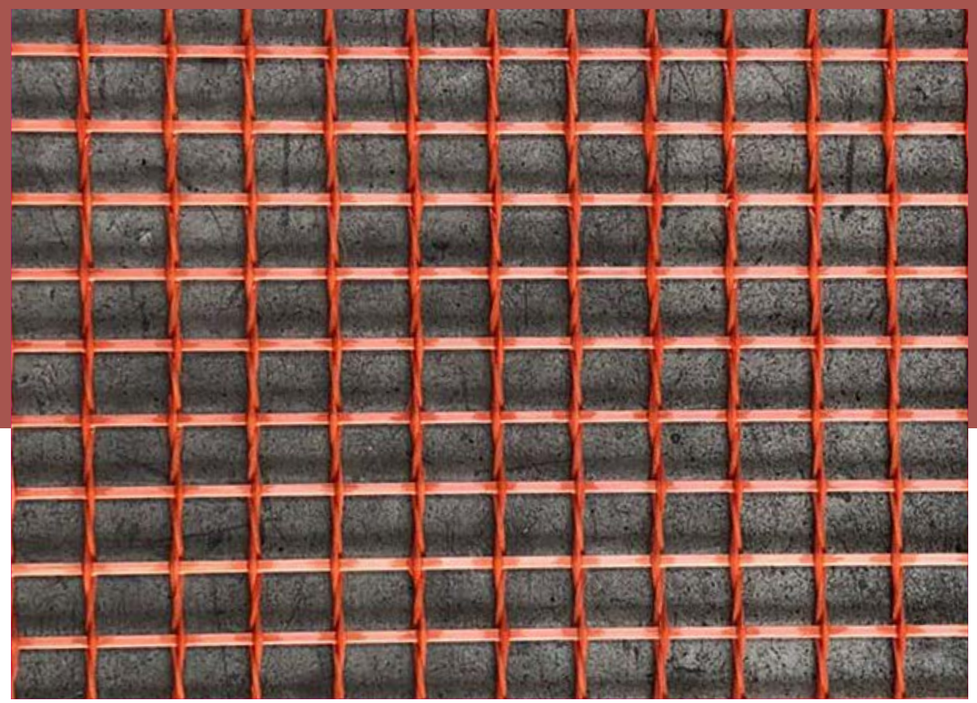
MORTARS

GUSSETS

MESH/CORNER

SUPPORT





TCS GLASS MR44

Alkali-resistant glass fibre mesh with epoxy matrix for **CRM** systems.
FORTIUS system component.
ETA - 21/0524 according to EAD 340392-00-0104
MESH GRID: 40 x 40 mm
GRAMMAGE: 1050 g/m²
HEIGHT: 2 m
LENGHT: 20 m
SURFACE: 40 m²
ROLL: 20 x 2 m

SCAN QR CODE
AND DOWNLOAD DATASHEET

GEOMETRICAL AND PHYSICAL CHARACTERISTICS		Value		
Property	**u.m.**	**Weave**	**Warp**	**Reference**
Nominal diameter	mm	-	3,6	ETA-21/0524
Nominal section	mm²	9,90	-	
Nominal section (graduated cylinder)	mm²	9, 60	10,00	
Nominal area referred to the fibre	mm²	7,20	5,70	CNR DT 203/2006
Rods per metre	n.	25	25	
Fibre contents in weight (average)	%	75		Internal method
Operating temperature limit	°C	from -15 to 70		ETA-21/0524
Glass tensile temperature of the composite	°C	70		
Fibre density	g/cm³	2,50 ÷ 2,60		
Matrix density	g/cm³	1,15 ÷ 1,25		
Flame Resistance	-	F		

MECHANICAL CHARACTERISTICS			
Property	**u.m.**	**Value**	**Reference**
Single rod tensile strength (average)	kN	4,78	ETA-21/0524
Single rod tensile strength (characteristic)	kN	3,90	
Single rod pulling force (average)	MPa	486	
Single rod pulling force (characteristic)	MPa	436	
Tensile strength per metre (average)	kN	119	
Tensile strength per metre (characteristic)	kN	97	
Elastic model (characteristic)	GPa	42	
Rupture distortion (characteristic)	%	0,96	
Tear resistance of the not (characteristic)	kN	0,50	

STORAGE AND PACKAGING	
Packaging	20 m roll, 2 m high, 1 m sheet, 2 m high, 5 roll each pallet, 100 x 120 x 215 cm.
Storage	Keep in dry place in the original package.

CE DoP n°3007 - FRPMR44

TCS GLASS MR48

Alkali-resistant glass fibre mesh with epoxy matrix for **CRM** systems.
FORTIUS system component.
ETA - 21/0524 according to EAD 340392-00-0104
MESH GRID: 40 x 80 mm
GRAMMAGE: 780 g/m^2
HEIGHT: 2 m
LENGHT: 20 m
SURFACE: 40 m^2
ROLL: 20 x 2 m

SCAN QR CODE
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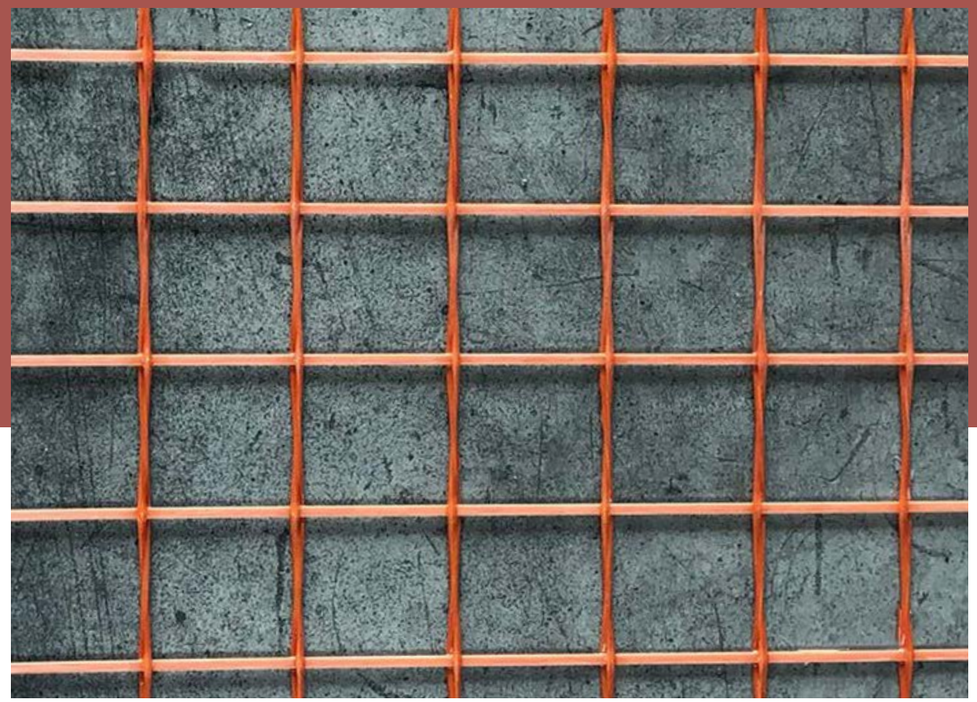
GEOMETRICAL AND PHYSICAL CHARACTERISTICS		Value		
Property	**u.m.**	**Weave**	**Warp**	**Reference**
Nominal diameter	mm	-	3,60	Internal method
Nominal section	mm²	9,90	-	ETA-21/0524
Nominal section (graduated cylinder)	mm²	9, 60	10,00	ETA-21/0525
Nominal area referred to the fibre	mm²	7,20	5,70	ETA-21/0526
Rods per metre	n.	12,5	25	ETA-21/0527
Fibre contents in weight (average)	%	75		Internal method
Operating temperature limit	°C	from -15 to 70		ETA-21/0524
Glass tensile temperature of the composite	°C	70		
Fibre density	g/cm^3	2,50 ÷ 2,60		
Matrix density	g/cm^3	1,15 ÷ 1,25		
Flame Resistance	-	F		

MECHANICAL CHARACTERISTICS		Value		
Property	**u.m.**	**Weave**	**Warp**	**Reference**
Single rod tensile strength (average)	kN	8,28	6,69	ETA-21/0524
Single rod tensile strength (characteristic)	kN	6,41	5,46	
Single rod pulling force (average)	MPa	865	635	
Single rod pulling force (characteristic)	MPa	670	525	
Tensile strength per metre (average)	kN	103	167	
Tensile strength per metre (characteristic)	kN	80	136	
Elastic model (characteristic)	GPa	57	40	
Rupture distortion (characteristic)	%	1,12	1,15	
Tear resistance of the not (characteristic)	kN	0,50		

STORAGE AND PACKAGING	
Packaging	20 m roll, 2 m high, 1 m sheet, 2 m high, 5 roll each pallet, 100 x 120 x 215 cm.
Storage	Keep in dry place in the original package.

CE DoP n°3008 - FRPMR48



TCS GLASS MR88

Alkali-resistant glass fibre mesh with epoxy matrix for **CRM** systems.
FORTIUS system component.
ETA - 21/0524 according to EAD 340392-00-0104
MESH GRID: 80 x 80 mm
GRAMMAGE: 550 g/m²
HEIGHT: 2 m
LENGHT: 20 m
SURFACE: 40 m²
ROLL: 20 x 2 m

SCAN QR CODE
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GEOMETRICAL AND PHYSICAL CHARACTERISTICS		Value		
Property	**u.m.**	**Weave**	**Warp**	**Reference**
Nominal diameter	mm	-	3,90	ETA-21/0524
Nominal section	mm²	9,90	-	
Nominal section (graduated cylinder)	mm²	9, 60	12,00	
Nominal area referred to the fibre	mm²	7,20	5,70	CNR DT 203/2006
Rods per metre	n.	12,5	12,5	
Fibre contents in weight (average)	%	75		Internal method
Operating temperature limit	°C	from -15 to 70		ETA-21/0524
Glass tensile temperature of the composite	°C	70		
Fibre density	g/cm³	2,50 ÷ 2,60		
Matrix density	g/cm³	1,15 ÷ 1,25		
Flame Resistance	-	F		

MECHANICAL CHARACTERISTICS			
Property	**u.m.**	**Value**	**Reference**
Single rod tensile strength (average)	kN	7,14	ETA-21/0524
Single rod tensile strength (characteristic)	kN	5,83	
Single rod pulling force (average)	MPa	572	
Single rod pulling force (characteristic)	MPa	496	
Tensile strength per metre (average)	kN	89	
Tensile strength per metre (characteristic)	kN	72	
Elastic model (characteristic)	GPa	34	
Rupture distortion (characteristic)	%	1,32	
Tear resistance of the not (characteristic)	kN	0,50	

STORAGE AND PACKAGING	
Packaging	20 m roll, 2 m high, 1 m sheet, 2 m high, 5 roll each pallet, 100 x 120 x 215 cm.
Storage	Keep in dry place in the original package.

CE DoP n°3009 - FRPMR88

TCS GLASS MR812

Alkali-resistant glass fibre mesh with epoxy matrix for **CRM** systems.
FORTIUS system component.
ETA - 21/0524 according to EAD 340392-00-0104
MESH GRID: 80 x 120 mm
GRAMMAGE: 440 g/m²
HEIGHT: 2 m
LENGHT: 20 m
SURFACE: 40 m²
ROLL: 20 x 2 m

SCAN QR CODE
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GEOMETRICAL AND PHYSICAL CHARACTERISTICS		Value		
Property	**u.m.**	**Weave**	**Warp**	**Reference**
Nominal diameter	mm	-	3,90	ETA-21/0524
Nominal section	mm²	9,90	-	
Nominal section (graduated cylinder)	mm²	9, 60	12,00	
Nominal area referred to the fibre	mm²	7,20	5,70	CNR DT 203/2006
Rods per metre	n.	8,3	12,5	
Fibre contents in weight (average)	%	75		Internal method
Operating temperature limit	°C	from -15 to 70		ETA-21/0524
Glass tensile temperature of the composite	°C	70		
Fibre density	g/cm³	2,50 ÷ 2,60		
Matrix density	g/cm³	1,15 ÷ 1,25		
Flame Resistance	-	F		

MECHANICAL CHARACTERISTICS		Value		
Property	**u.m.**	**Weave**	**Warp**	**Reference**
Single rod tensile strength (average)	kN	8,7	7,19	ETA-21/0524
Single rod tensile strength (characteristic)	kN	7,10	5,64	
Single rod pulling force (average)	MPa	929	596	
Single rod pulling force (characteristic)	MPa	764	468	
Tensile strength per metre (average)	kN	72	89	
Tensile strength per metre (characteristic)	kN	58	70	
Elastic model (characteristic)	GPa	58	36	
Rupture distortion (characteristic)	%	1,27	1,24	
Tear resistance of the not (characteristic)	kN	0,50		

STORAGE AND PACKAGING	
Packaging	20 m roll, 2 m high, 1 m sheet, 2 m high, 5 roll each pallet, 100 x 120 x 215 cm.
Storage	Keep in dry place in the original package.

CE DoP n°3010 - FRPMR812

TCS GLASS MR1212

Alkali-resistant glass fibre mesh with epoxy matrix for **CRM** systems.
FORTIUS system component.
ETA - 21/0524 according to EAD 340392-00-0104
MESH GRID: 120 x 120 mm
GRAMMAGE: 350 g/m²
HEIGHT: 2 m
LENGHT: 20 m
SURFACE: 40 m²
ROLL: 20 x 2 m

SCAN QR CODE
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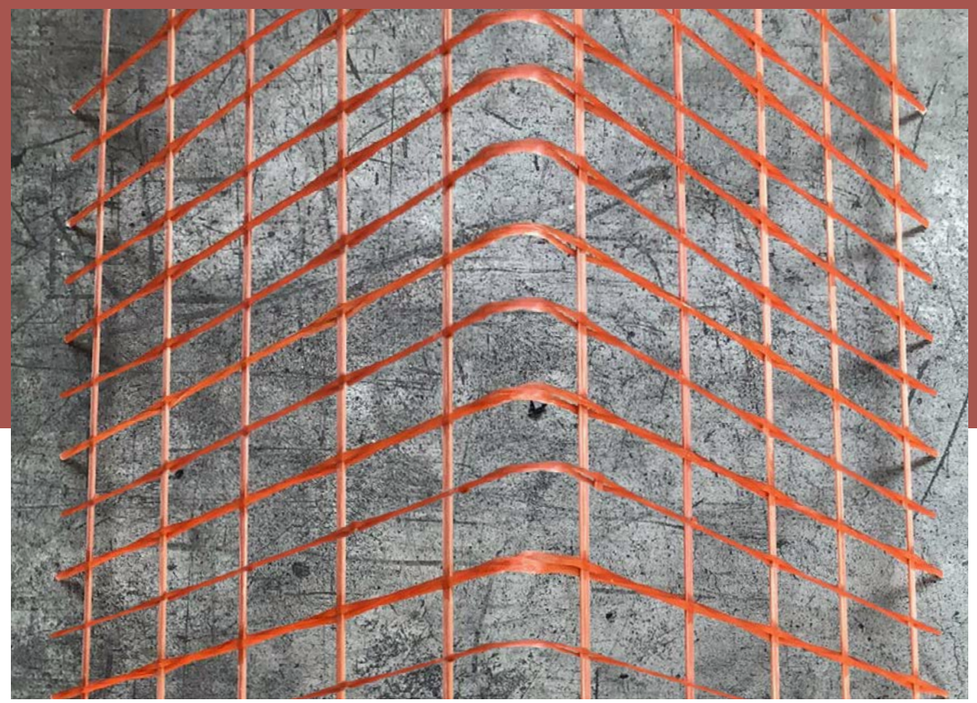
GEOMETRICAL AND PHYSICAL CHARACTERISTICS		Value		
Property	**u.m.**	**Weave**	**Warp**	**Reference**
Nominal diameter	mm	-	3,90	ETA-21/0524
Nominal section	mm²	9,90	-	
Nominal section (graduated cylinder)	mm²	9, 60	12,00	
Nominal area referred to the fibre	mm²	7,20	5,70	CNR DT 203/2006
Rods per metre	n.	8,3	8,3	
Fibre contents in weight (average)	%	75		Internal method
Operating temperature limit	°C	from -15 to 70		ETA-21/0524
Glass tensile temperature of the composite	°C	70		
Fibre density	g/cm³	2,50 ÷ 2,60		
Matrix density	g/cm³	1,15 ÷ 1,25		
Flame Resistance	-	F		

MECHANICAL CHARACTERISTICS			
Property	**u.m.**	**Value**	**Reference**
Single rod tensile strength (average)	kN	7,19	ETA-21/0524
Single rod tensile strength (characteristic)	kN	5,64	
Single rod pulling force (average)	MPa	596	
Single rod pulling force (characteristic)	MPa	468	
Tensile strength per metre (average)	kN	59	
Tensile strength per metre (characteristic)	kN	46	
Elastic model (characteristic)	GPa	36	
Rupture distortion (characteristic)	%	1,24	
Tear resistance of the not (characteristic)	kN	0,50	

STORAGE AND PACKAGING	
Packaging	20 m roll, 2 m high, 1 m sheet, 2 m high, 5 roll each pallet, 100 x 120 x 215 cm.
Storage	Keep in dry place in the original package.

CE DoP n°3011-FRPMR1212

CE



TCS GLASS CORNER MR48

Alkali-resistant glass fibre mesh with epoxy matrix for **CRM** systems.
FORTIUS system component.
ETA - 21/0524 according to EAD 340392-00-0104
MESH GRID: 40 x 80 mm
GRAMMAGE: 780 g/m²
CORNER SIDE: 40 cm
CORNER HEIGHT: 2 m
BEND RADIUS: 30 mm
CORNER: 40 x 2 m

SCAN QR CODE
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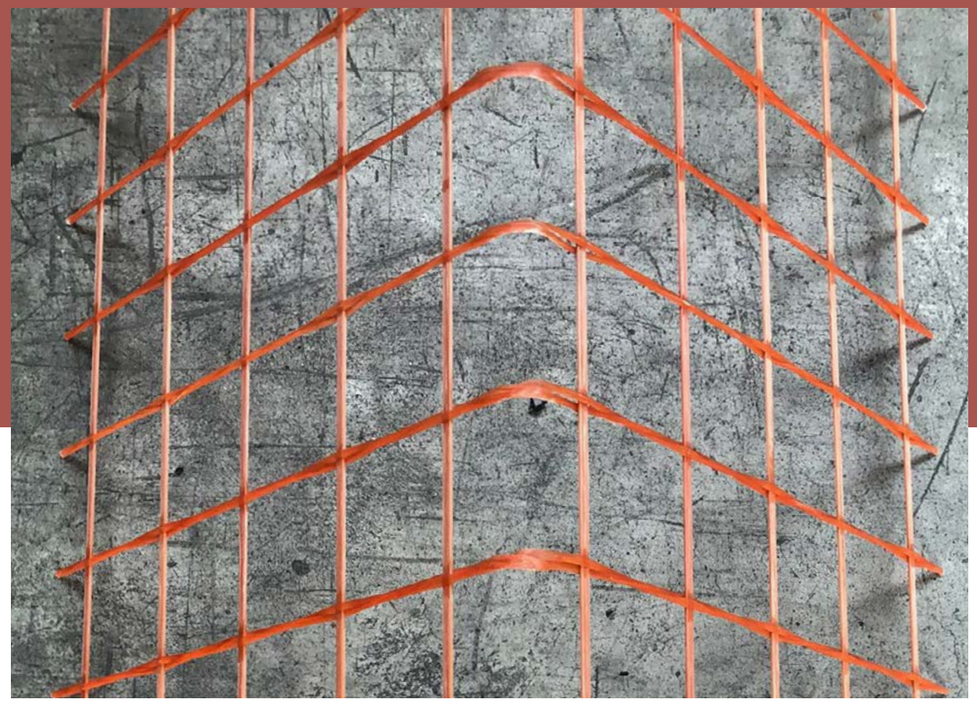
GEOMETRICAL AND PHYSICAL CHARACTERISTICS		Value		
Property	**u.m.**	**Weave**	**Warp**	**Reference**
Nominal diameter	mm	-	3,60	ETA-21/0524
Nominal section	mm²	9,90	-	
Nominal section (graduated cylinder)	mm²	9, 60	10,00	
Nominal area referred to the fibre	mm²	7,20	5,70	CNR DT 203/2006
Rods per metre	n.	12,5	25	
Fibre contents in weight (average)	%	75		Internal method
Operating temperature limit	°C	from -15 to 70		ETA-21/0524
Glass tensile temperature of the composite	°C	70		
Fibre density	g/cm³	2,50 ÷ 2,60		
Matrix density	g/cm³	1,15 ÷ 1,25		
Flame Resistance	-	F		

MECHANICAL CHARACTERISTICS			
Property	**u.m.**	**Value**	**Reference**
Perpendicular force of the angle (characteristic)	kN	4,01	ETA-21/0524
Corner force broke down at 90° (characteristic)	kN	2,84	
Maximum broke down resistance per metre (characteristic)	kN	71	
Elastic model (characteristic)	GPa	40	
Rupture distortion (characteristic)	%	1,32	
Tear resistance of the not (characteristic)	kN	0,50	

STORAGE AND PACKAGING	
Packaging	10 pcs/box, 2 m width, 40 cm side. 100 pcs/box, pallet, 200 x 120 x 60 cm.
Storage	Keep in dry place in the original package.

CE DoP n°3012 - FRPMR48ANG/2



TCS GLASS CORNER MR88

Alkali-resistant glass fibre mesh with epoxy matrix for **CRM** systems.
FORTIUS system component.
ETA - 21/0524 according to EAD 340392-00-0104
MESH GRID: 80 x 80 mm
GRAMMAGE: 550 g/m²
CORNER SIDE: 40 cm
CORNER HEIGHT: 2 m
BEND RADIUS: 30 mm
CORNER: 40 x 2 m

SCAN QR CODE
AND DOWNLOAD DATASHEET

GEOMETRICAL AND PHYSICAL CHARACTERISTICS		Value		
Property	**u.m.**	**Weave**	**Warp**	**Reference**
Nominal diameter	mm	-	3,90	ETA-21/0524
Nominal section	mm²	9,90	-	
Nominal section (graduated cylinder)	mm²	9, 60	12,00	
Nominal area referred to the fibre	mm²	7,20	5,70	CNR DT 203/2006
Rods per metre	n.	12,5	12,5	
Fibre contents in weight (average)	%	75		Internal method
Operating temperature limit	°C	from -15 to 70		ETA-21/0524
Glass tensile temperature of the composite	°C	70		
Fibre density	g/cm³	2,50 ÷ 2,60		
Matrix density	g/cm³	1,15 ÷ 1,25		
Flame Resistance	-	F		

MECHANICAL CHARACTERISTICS			
Property	**u.m.**	**Value**	**Reference**
Perpendicular force of the angle (characteristic)	kN	4,01	ETA-21/0524
Corner force broke down at 90° (characteristic)	kN	2,84	
Maximum broke down resistance per metre (characteristic)	kN	35	
Elastic model (characteristic)	GPa	34	
Rupture distortion (characteristic)	%	1,32	
Tear resistance of the not (characteristic)	kN	0,50	

STORAGE AND PACKAGING	
Packaging	10 pcs/box, 2 m width, 40 cm side. 100 pcs/box, pallet, 200 x 120 x 60 cm.
Storage	Keep in dry place in the original package.

CE DoP n°3013 - FRPMR88ANG/2

TCS GLASS CONNECTOR

Alkali resistant **GFRP** (Glass Fibre Reinforced Polymer) composite "L" connector made of epoxy resin.
FORTIUS system component.
ETA - 21/0524 according to EAD 340392-00-0104
TO USE WITH: chemical anchor V-FIX
GRAMMAGE: 103 g/m
LENGHT: short side 10 cm – long side 10, 15, 20, 30, 40, 50, 60, 70, 80, 90, 100 cm

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TECHNICAL DATA			
Property	**u.m.**	**Value**	**Reference**
Nominal diameter	mm	8,2	ETA-21/0524
Nominal section (graduated cylinder)	mm²	52,28	
Nominal area referred to the fibre	mm²	29,5	CNR DT 203/2006
Fibre contents	%	74 (weight), 53 (volume)	Internal method
Operating temperature limit	°C	from -15 to 70	ETA-21/0524
Glass tensile temperature of the composite	°C	70	
Fibre density	g/cm³	2,50 ÷ 2,60	
Matrix density	g/cm³	1,15 ÷ 1,25	
Flame Resistance	-	F	
Single rod tensile strength (average)	kN	30	
Single rod tensile strength (characteristic)	kN	28	
Single rod pulling force (average)	MPa	579,44	
Single rod pulling force (characteristic)	MPa	540,43	
Tensile stress referred to the fibre (average)	MPa	1016	
Tensile stress referred to the fibre (characteristic)	MPa	949	
Elastic model (characteristic)	GPa	38	
Length	cm	Short side 10 cm – Long side 10, 15, 20, 30, 40, 50, 60, 70, 80, 90,100 cm	

STORAGE AND PACKAGING	
Packaging	100 pcs/box
Storage	Keep in dry place in the original package.

CE DoP n°3006 - FRPCON7

V-FIX Ancorante Vinilestere

Bi-component vinylester styrene-free chemical anchor in cartridge for structural loads.
FORTIUS system component.
CARTRIDGE: 400 ml
APPLICATION: specific tools for chemical anchor
COMPATIBILITY: dry and wet walls

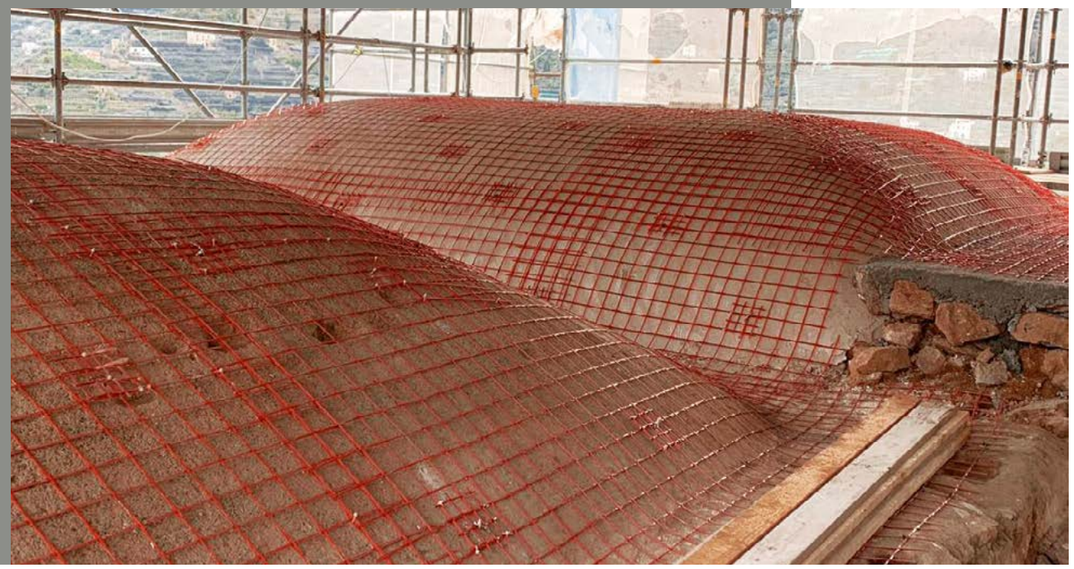
SCAN QR CODE
AND DOWNLOAD DATASHEET

TECHNICAL DATA			
Property	**u.m.**	**Value**	**Reference**
Workability at -10°C	min	105	ETA-09/0140 ETA-09/0246
Waiting for loading at -10°C	hours	24	
Workability at -5°C	min	65	
Waiting for loading at -5°C	hours	14	
Workability at 0°C	min	45	
Waiting for loading at 0°C	hours	7	
Workability at 5°C	min	25	
Waiting for loading at 5°C	hours/min	1 h 30 min	
Workability at 10°C	min	16	
Waiting for loading at 10°C	hour	1	
Workability at 20°C	min/sec	7 min 30 sec	
Waiting for loading at 20°C	min	40	
Workability at 25°C	min	5	
Waiting for loading at 25°C	min	35	
Workability at 30°C	min	3	
Waiting for loading at 30°C	min	30	
Workability at 40°C	min	1	
Waiting for loading at 40°C	min	20	
Consumption			
Connector diameter	mm	ø 8	Internal method
Hole diameter	mm	ø 12	
Hole depth	mm	100	
Application temperature	°C	from +5 to +30	
REACH classification	-	See ADS	
STORAGE AND PACKAGING			
Injection number	25/30 (cartridge 400 ml)		
Packaging	12 pcs/box		
Storage	Up until 16 months in the original packaging.		

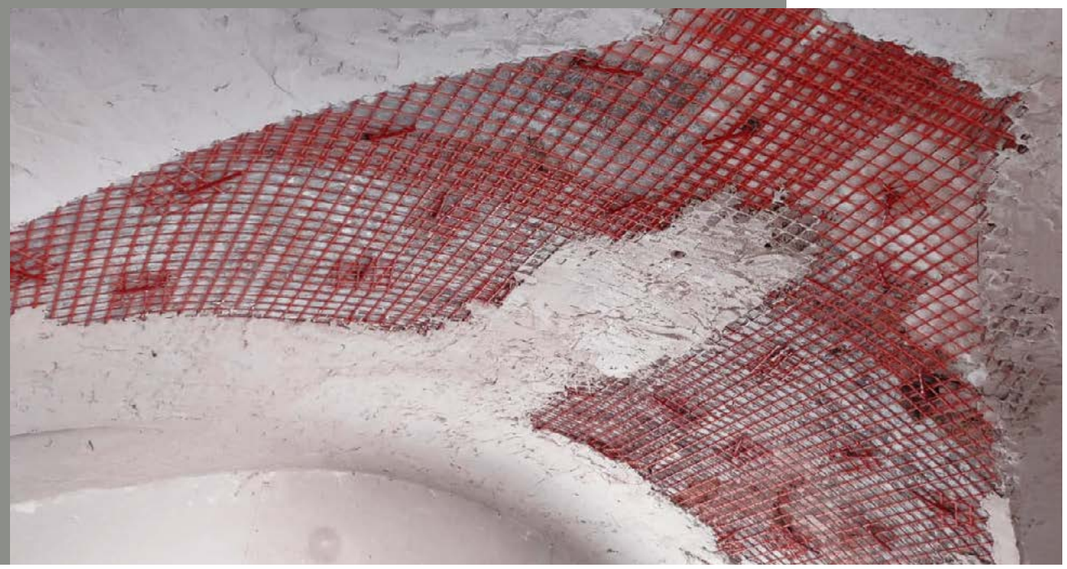
BRAKE

TIMBER VAULT

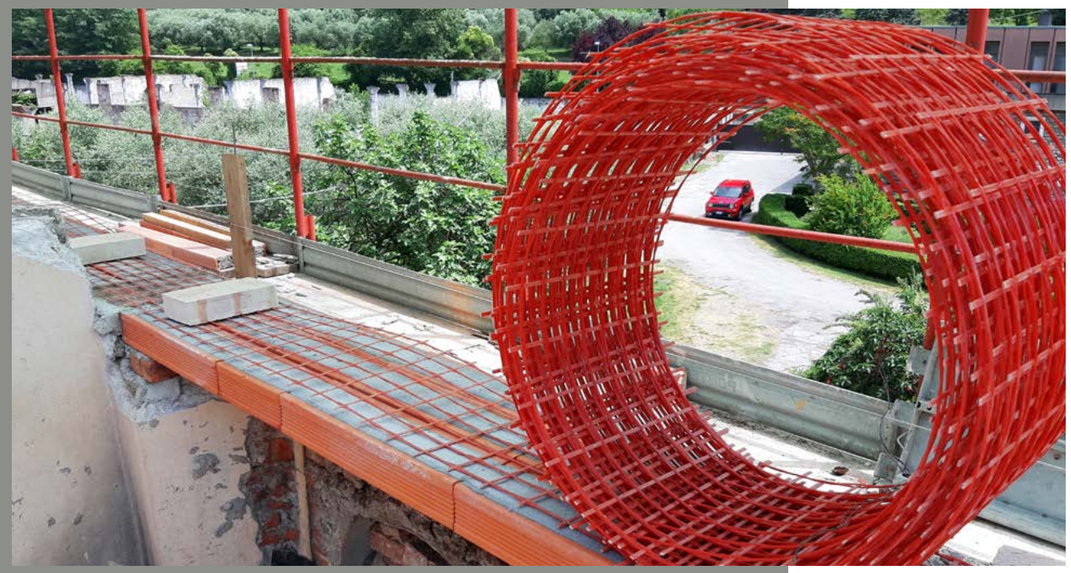
MASONRY VAULT (EXTRADOS)



MASONRY VAULT (INTRADOS)



RING CURB BEAMS



COLUMN

REINFORCED PLASTER

CORNER

ANTI-DEBONDING

SLIM ELEMENTS

FOUNDATION RECOVERY

HISTORICAL PAVEMENTS

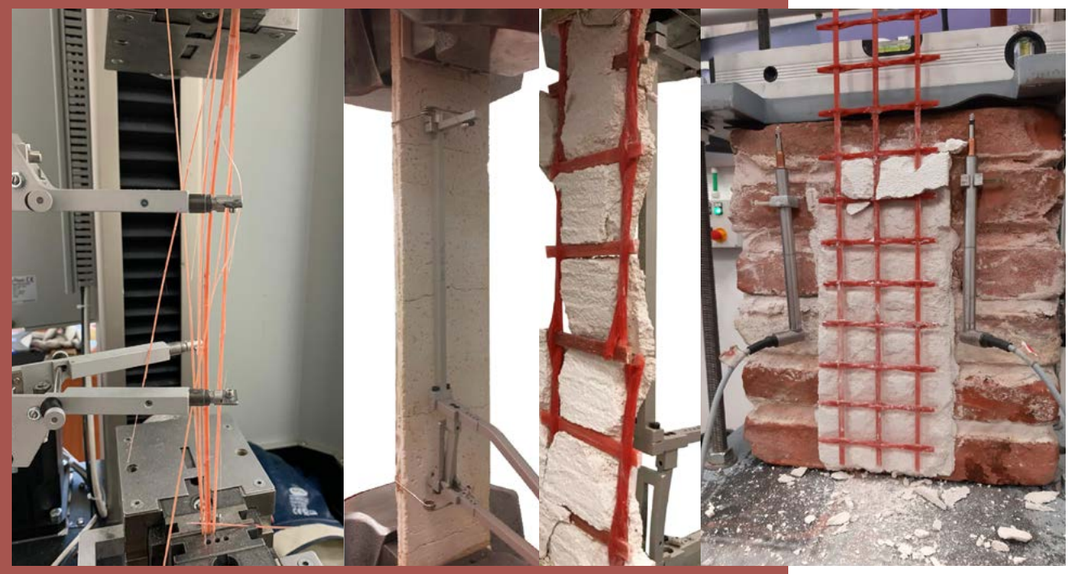
PERIMETER CONNECTIONS

RESTRAINING

NSM

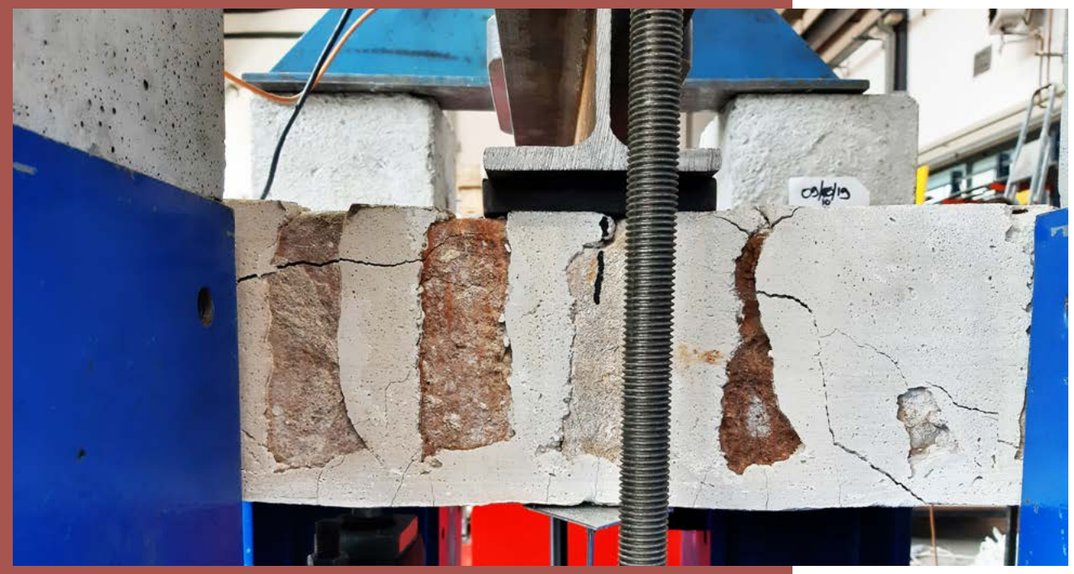
GUSSET CONNECTION

DEBONDING TEST



DIAGONAL COMPRESSION TESTS

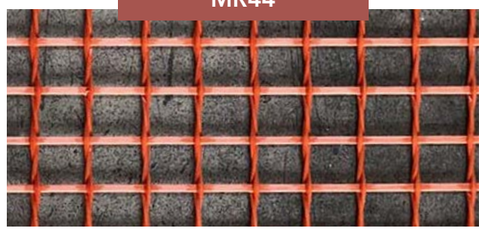
OUT-OF-PLANE BENDING TESTS



ANTI-DEBONDING

MASH AND GRID - ALKALI RESISTANT GFRP

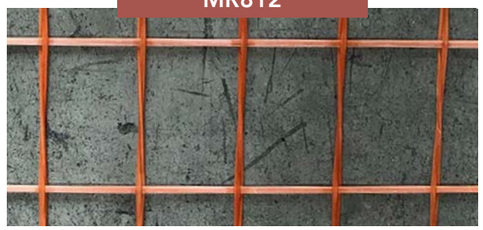
TCS GLASS
MR44



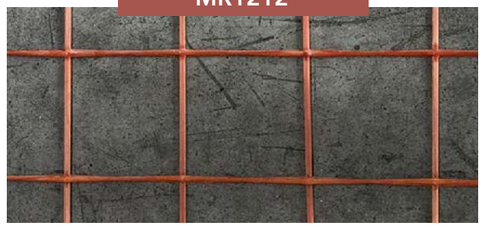
TCS GLASS
MR48

TCS GLASS
MR88

TCS GLASS
MR812



TCS GLASS
MR1212



TCS
PASSIONE MATERICA

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