CPC BELGELENDİRME MUAYENE VE DENEY HİZMETLERİ TİC. LTD. ŞTİ.
Çamlıca Mah. (Timko Eti) Anadolu Blv. No:20-R Blok No:4
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European Technical Assessment ETA-25/0247 of (17.04.2025)

Technical Assessment Body issuing the European Technical Assessment: CPC Belgelendirme Muayene ve Deney Hizmetleri Tic. Ltd. Şti.	
Trade name of the construction product	FRCM SYSTEM NET
Product family to which the construction product belongs	Product Area Code: 34 Building kits, units, prefabricated elements
Manufacturer	Seico Compositi S.r.l. Via G. Palatucci 5/int.6 – 47122 – Forli (FC), Italy
Manufacturing plant(s)	Plant 6
This European Technical Assessment contains	23 pages including 3 Annexes which forms an integral part of this assessment Annex may contain confidential information and is/are not included in the European Technical Assessment when that assessment is publicly disseminated
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	EAD 340275-00-0104 Externally bonded composite systems with inorganic matrix for strengthening of concrete and masonry structures

1. Technical description of the product

The Seico Compositi FRCM (Fiber Reinforced Cementitious Matrix) system is a structural reinforcement kit consisting of a bidirectional mesh and an inorganic matrix that serves as a bonding agent on masonry or concrete. The bidirectional reinforcing meshes are made of alkali-resistant (AR) glass, basalt, carbon and hybrid fibers. The mechanical and physical properties of products is detailed in Annex A. The list of reinforcement component of Seico Compositi FRCM System as follows,

Grid	Weight (g/m^2)	Aperture size (mm)
GLASSNET 230-28	230	24,2 x 23,4
BASALNET L130	130	22,7 x 20,8
BASALNET L200	304	15,0 x 14,0
BASALNET L400	568	14,2 x 12,9
BASALNET STEEL 300	305	13,6 x 14,2
BASALNET STEEL 500	535	12,7 x 13,9
CARBONET 250-15	242	13,9 x 13,1

All mortars were classified according to their strength and performance characteristics. Specifically, the hydraulic polymer-modified mortars were classified as M25, adhering to the EN 998-2 standard, which outlines the specifications for mortar for masonry. The cement-based mortars were categorized as R4, in accordance with the EN 1504-3 standard, which specifies the requirements for structural and non-structural repair mortars.

Mortar	Binder	Classification	Standard
BETONTIX 215	Hydraulic Polymer-Modified	M25	EN 998-2
BETONTIX 415	Cement	R4	EN 1504-3

Seico Compositi FRCM system consists of reinforcement mesh and hydraulic polymer-modified or cement-based bonding agent.
Additionally, a variety of materials, including stone, brick, tuff, and concrete, were utilized, each selected for its specific properties and suitability for different parts of the construction. Hydraulic polymer-modified mortars were used, tailored to meet the diverse requirements of the project.

The product description, with reference to its components, is detailed in Annex A.

2. Specification of the intended use(s) in accordance with the applicable European Assessment Document (hereinafter EAD)

Seico Compositi FRCM system is designed for use in specialized civil-engineering applications to reinforce masonry structures under various stresses, including flexure, shear, axial, and combined axial-bending. Its purpose is to increase load-bearing capacity, enhance the strength, stiffness, and ductility of undersized or damaged structural components, and minimize ultimate limit state deformations. The system is applicable for strengthening structural elements subjected to static, quasi-static, and dynamic loads. Regarding packaging, transport, and storage, the manufacturer is responsible for taking appropriate measures and advising clients on best practices to maintain declared performance levels. Installation instructions are provided in the technical documentation from the manufacturer, and it is expected that the product will be installed according to these guidelines or, in their absence, in line with standard building practices. Specifications and conditions set by the manufacturer are detailed in Annex B. The performance evaluations in this European Technical Assessment, according to the relevant EAD, assume an intended working life of at least 50 years, given that the conditions for installation, packaging, transport, storage, and proper use, maintenance, and repair are adhered to. The provided working life indication is not a guarantee from the manufacturer but is intended to help choose suitable products based on the expected economically reasonable lifespan of the works.

3. PERFORMANCE OF THE PRODUCT AND REFERENCES TO THE METHODS USED FOR ITS ASSESSMENT

The tests for performance assessment of FRCM System were carried out in compliance with EAD 340275-00-0104 according to the test methods reported herein, as well for what concerns sampling, conditioning and testing provisions.
The numbering (#) in the following tables corresponds to the numbering of Table 2.1, Table 2.2, Table 2.3 and Table 2.4 of EAD 340275-00-0104.

3.1 MECHANICAL RESISTANCE AND STABILITY (BWR 1)

3.1.1 FRCM System (Table 2.1 of EAD)

#	Essential characteristic	Performance
1	Tensile strength	See Annex C1, Table C1
2	Strain	See Annex C1, Table C1
3	Stress-strain curve	See Annex C1, Table C1
4	Interlaminar shear strength	NPA
5	Lap tensile strength	NPA
6	Bond strength on substrate (pull-off test)	NPA
7	Bond strength on substrate (single-lap shear test)	Ambient: see Annex C3, Tables C3 Water, saltwater and alkali conditioning: NPA
8	Pull-out from substrate	NPA
9	Freezing and Thawing	Direct tension: see Annex C4, Table C4 Lap tensile: NPA
10	Water resistance	Direct tension: see Annex C5 – C6, Table C5 and C6 Interlaminar shear: NPA Lap tensile: NPA
11	Saltwater resistance	Direct tension: see Annex C7 – C8, Table C7 and C8 Interlaminar shear: NPA Lap tensile: NPA
12	Alkali resistance	Direct tension: see Annex C9 – C10, Table C9 and C10 Interlaminar shear: NPA Lap tensile: NPA
13	Tensile Properties of dry fabric	Direct Tension: see Annex C11, Table C11
14	Conventional limit properties of composite system	Annex C12, Table C12

3.2 SAFETY IN CASE OF FIRE (BWR2)

3.2.1 FRCM kit (Table 2.1 of EAD)

#	Essential characteristic	Performance
1	Reaction to fire	No performance determined

4. Assessment and verification of constancy of performance (hereinafter AVCP) system applied, with reference to its legal base

In accordance with the European Assessment Document EAD No. 340275-00-0104, the applicable European legal act is: Decision 1999/0469/EC.

The AVCP system to be applied is: 2+

5. Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited by the Technical Assessment Body. The notified product certification body shall visit the factory at least once a year for surveillance of the manufacturer.

Issued in Ankara on 17.04.2025

by

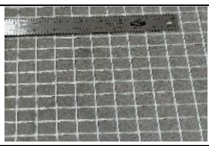
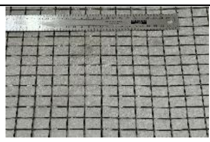
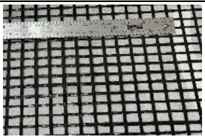
UĞUR GEDİK

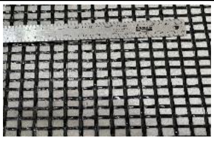
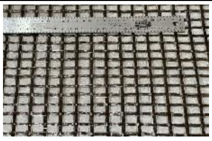
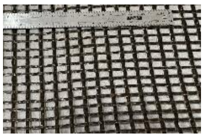
e-imzalıdır/e-signed

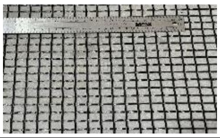
Uğur GEDİK

GENEL MÜDÜR/GENERAL MANAGER

Annex A

FRP MESH PROPERTIES								
	GLASSNET 230-28		**BASALNET L130**		**BASALNET L200**		Tolerance +/-	Testing method
Appereance							-	-
Finished weight (g/m²)	230		130		304		5%	EN 12127:1997
Coating (g/m²)	38		22		97		5%	ISO 1887:2014
	Warp	**Weft**	**Warp**	**Weft**	**Warp**	**Weft**		
Fibre type	AR-glass	AR-glass	Basalt	Basalt	Basalt	Basalt		
Aperture size (mm x mm)	24,20	23,40	22,70	20,80	15,00	14,00	5%	ETAG 0004 C.3.3

FRP MESH PROPERTIES								
	BASALNET L400		**BASALNET STEEL 300**		**BASALNET STEEL 500**		Tolerance +/-	Testing method
Appereance							-	-
Finished weight (g/m²)	568		305		535		5%	EN 12127:1997
Coating (g/m²)	181		65		115		5%	ISO 1887:2014
	Warp	**Weft**	**Warp**	**Weft**	**Warp**	**Weft**		
Fibre type	Basalt	Basalt	Basalt Steel	Basalt Steel	Basalt Steel	Basalt Steel		
Aperture size (mm x mm)	14,20	12,90	13,60	14,20	12,70	13,90	5,00%	ETAG 0004 C.3.3

FRP MESH PROPERTIES				
	CARBONET 250-15		Tolerance +/-	Testing method
Appereance			-	-
Finished weight (g/m²)	242		5%	EN 12127:1997
Coating (g/m²)	41		5%	ISO 1887:2014
	Warp	**Weft**		
Fibre type	Carbon	Carbon		
Aperture size (mm x mm)	13,90	13,10	5,00%	ETAG 0004 C.3.3

PRODUCT DESCRIPTION

INORGANIC MATRIX PROPERTIES

Trade name	BETONTIX 215
Type of product	Hydraulic polymer-modified mortar, premixed, thixotropic, single-component, high-strength, containing polyacrylonitrile fibers
Appearance	Grey powder
Packaging	25 kg bags
Minimum thickness	~5 mm
Pot life	~90 min. (+20 °C and 50% RH)
Density of the powder	17,5 kg/m^2 for each cm of thickness
Compressive strength	≥ 25 MPa (28 days)
Young’s modulus	NPD
Strength class	M25
Bond strength	≥ 1,5 MPa
Reference Harmonized Standard	EN 998-1 EN 998-2 EN 1504-3

Seico Compositi FRCM Systems	**Annex A1** **of ETA N° 25/0247**
Product Description: Components - Inorganic matrix	

PRODUCT DESCRIPTION

INORGANIC MATRIX PROPERTIES	
Trade name	BETONTIX 415
Type of product	Premixed, single-component, thixotropic, shrinkage compensated shrinkage, bioreinforced, with high mechanical strength.
Appearance	Grey powder
Packaging	25 kg bags
Minimum thickness	~5 mm
Pot life	~60 min. (+20 °C and 50% RH)
Density of the powder	17,5 kg/m^2 for each cm of thickness
Compressive strength	≥45 MPa (28 days)
Young's modulus	≥20 GPa
Strength class	R4
Bond strength	≥ 2,0 MPa
Reference Harmonized Standard	EN 1504-3

SPECIFICATION OF INTENDED USE

- **INSTALLATION CONDITIONS**

Temperature: +5 °C / +35 °C

- **STORAGE CONDITIONS**

- Temperature: Both components must be stored at a temperature of at least +5 °C. Ensure storage areas are shielded from extreme summer heat and winter cold.

- Relative Humidity: Keep the product in a dry place and protected from water.

- Substrate Moisture: The gluing surface should be wet, achieving a saturated state without allowing liquid water to remain on the surface.

INSTALLATION INSTRUCTIONS

Substrate:

The Seico Compositi FRCM System can be applied on stone, brick, tuff and concrete surfaces.

Substrate Preparation:

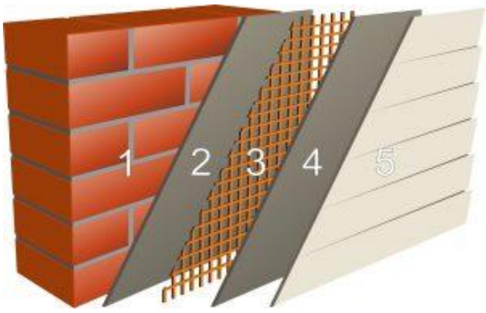
The Seico Compositi FRCM system is to be applied to substrates that are consistent, clean, and stable. Any loosened sections, partially detached components, dust, biological layers, or materials that might affect the matrix-substrate adhesion must be removed. If there are damaged masonry sections, they must be repaired prior to the application of the FRCM kits. The kits should be applied to substrates that have been saturated with clean water and have no excess water remaining on the surface.

Application Steps:

An initial layer of matrix, approximately 5 mm thick, is to be applied to the substrate. While this first layer of matrix is still wet, the mesh should be positioned and gently pressed into it to embed the mesh into the matrix. The mesh can be bent around corners and cut using regular scissors. In such cases, the mesh curvature radius should always be greater than 20 mm. Care must be taken to ensure the required overlap length between adjacent fabric slices. After the first layer has dried, a second layer of matrix should be applied to achieve an overall reinforcement thickness of approximately 10 mm.

Always refer to the technical data sheets for the kits and their components.

SEICO COMPOSITI FRCM SYSTEM



1. Masonry/Concrete Substrate
2. First layer of inorganic matrix
3. Reinforcement mesh
4. Second layer of inorganic matrix
5. Coating (if necessary)

Annex B

B.1 Mechanical Properties of the kit - Direct tension test

Tensile tests were performed to evaluate the tensile strength, the stiffness moduli, and the ultimate strain of the composite system, together with the stress-strain curve. The mechanical properties of the specimens were determined according to the procedure summarized in Annex B of EAD. Tests were conducted parallel to the primary direction of the reinforcement fabric, and in the secondary direction at the discretion of the manufacturer. Tests were conducted considering the number of layers proposed by the manufacturer in the instructions. In the case of multiple layers, the minimum and maximum numbers of layers were tested. If values of mechanical properties were significantly different, at least one intermediate value of layers was tested. Interpolation for intermediate sizes was used to determine the mechanical properties, with other tests conducted as necessary to confirm the assumed interpolation formula. A minimum number of twenty samples for each number of layers subjected to uniaxial tensile tests were prepared for each composite system configuration (i.e., weight per unit area), laid up according to the procedure indicated in Annex B of EAD and the manufacturer's instructions. Tests were performed at a temperature of 23±2°C and 50±5% relative humidity (RH), and, if specified by the manufacturer, at the maximum service temperature. The mechanical properties determined and reported in the ETA were: tensile elastic modulus of stage A, E1 (average value) [GPa]; failure stress σu (characteristic value) and strain εu [%]; and tensile stiffness modulus of phase C, E3 (average value) [GPa]. The relative testing conditions in terms of temperature (T) and relative humidity (RH) were also reported in the ETA. When properties were assessed under conditions different from the standard laboratory ones, the properties included the subscript corresponding to the testing temperature, e.g., σu,X, εu,X, E1,X, and E3,X, with X=testing temperature in °C. The characteristic value was determined by using the appropriate value of kn for unknown Vx reported in EN 1990, Annex D, Table D1.

B.2 Single-lap shear test

Tensile tests were performed to determine the shear bond strength of composite systems adhesively applied to a flat concrete or masonry substrate. A minimum of thirty-five composite specimens were prepared. One layer of composite was applied onto the substrate in accordance with the manufacturer's instructions. Five specimens were kept in standard laboratory conditions (23±2°C, 50±5% RH). The test followed the general procedure reported in Annex C of EAD. The conventional limit stress σlim,conv [MPa] was reported in the ETA, together with the compressive strength of the substrate fb [MPa] and the axial surface strength of the substrate fh,sub [MPa] according to EN 1542. The characteristic value was determined using the appropriate value of kn for unknown Vx as reported in EN 1990, Annex D, Table D1.

B.3 Freezing and thawing resistance

Tensile tests were performed to evaluate the influence of freeze-thaw cycles on the behavior of the composite system. Freezing and thawing conditioning was conducted on both tension composite panel specimens (Section 2.2.1 - minimum number of fabric layers) and interlaminar shear specimens (Section 2.2.2). The size of the specimens was the same as that required for tensile and interlaminar shear testing, as described in Sections 2.2.1 and 2.2.2. The samples were conditioned for one week in a humidity chamber with >95% relative humidity at 38±2°C. They were then subjected to twenty freeze-thaw cycles, each consisting of a minimum of four hours at -18±2°C, followed by twelve hours in a humidity chamber with >95% relative humidity at 38±2°C. The conditioned specimens were then tested in direct tension according to Section 2.2.1 and for interlaminar shear strength according to the test described in Section 2.2.2. A summary of the minimum number of specimens tested is reported in Annex A of EAD. Prior to testing, conditioned specimens were visually examined using 5× magnification to describe surface changes such as erosion, cracking, crazing, checking, and chalking. The average (arithmetic mean) and characteristic value of the tensile strength σu,FT [MPa], stiffness moduli E1,FT and E3,FT [GPa], strain εu,FT [%], and interlaminar shear strength τFT [MPa] were determined. The characteristic value was determined using the appropriate value of kn for unknown Vx as reported in EN 1990, Annex D, Table D1. The percentage of mechanical properties (σu,FT,ret [%], E1,FT,ret, and E3,FT,ret [%]) and interlaminar shear strength τFT,ret [%] retained by exposed specimens with respect to the value recorded for unconditioned specimens were also reported in the ETA.

B.4 Water resistance

Tensile tests were performed to evaluate the influence of water on the behavior of the composite system. Conditioning was conducted on tension composite panel specimens (Section 2.2.1 - minimum number of fabric layers), interlaminar shear specimens (Section 2.2.2), and lap tensile specimens (Section 2.2.3) according to ASTM D 2247-11 and ASTM E104-02 for 1,000 and 3,000 hours at a temperature of 38±2°C and relative humidity >95%. Conditioned specimens were then tested in direct tension according to Section 2.2.1, for interlaminar shear strength according to the procedure described in Section 2.2.2, and for lap tensile strength according to Section 2.2.3. A summary of the minimum number of specimens tested is reported in Annex A of EAD. Prior to testing, conditioned specimens were visually examined using 5× magnification to describe surface changes such as erosion, cracking, crazing, checking, and chalking. The average (arithmetic mean) and characteristic value of the tensile strength $\sigma_{u,w}$ [MPa], stiffness moduli $E_{1,w}$ and $E_{3,w}$ [GPa], strain $\varepsilon_{u,w}$ [%], interlaminar shear strength τ_w [MPa], and lap tensile strength $\sigma_{lap,w}$ [MPa] were determined. The characteristic value was determined using the appropriate value of k_n for unknown V_x as reported in EN 1990, Annex D, Table D1. The percentage of average mechanical properties ($\sigma_{u,w,ret}$ [%], $E_{1,w,ret}$ and $E_{3,w,ret}$ [%]), interlaminar shear strength $\tau_{w,ret}$ [%], and lap tensile strength $\sigma_{lap,w,ret}$ [%] retained by exposed specimens with respect to the value recorded for unconditioned specimens (Sections 2.2.1, 2.2.2, and 2.2.3) and the exposure conditions were also reported in the ETA.

B.5 Saltwater resistance

Tensile tests were performed to evaluate the influence of saltwater on the efficiency of the composite system. Conditioning was conducted on tension composite panel specimens (Section 2.2.1 - minimum number of fabric layers), interlaminar shear specimens (Section 2.2.2), and lap tensile specimens (Section 2.2.3) by immersing the specimens in saltwater according to ASTM D1141-98 and ASTM C581-03 for 1,000 and 3,000 hours at a temperature of 23±2°C. Conditioned specimens were then tested in direct tension according to Section 2.2.1, for interlaminar shear strength according to the procedure described in Section 2.2.2, and for lap tensile strength according to Section 2.2.3. A summary of the number of specimens tested is reported in Annex A of EAD. Prior to testing, conditioned specimens were visually examined using 5× magnification to describe surface changes such as erosion, cracking, crazing, checking, and chalking. The average (arithmetic mean) and characteristic value of the tensile strength $\sigma_{u,sw}$ [MPa], stiffness moduli $E_{1,sw}$ and $E_{3,sw}$ [GPa], strain $\varepsilon_{u,sw}$ [%], interlaminar shear strength τ_{sw} [MPa], and lap tensile strength $\sigma_{lap,sw}$ [MPa] were determined. The characteristic value was determined using the appropriate value of k_n for unknown V_x as reported in EN 1990, Annex D, Table D1. The percentage of average mechanical properties ($\sigma_{u,sw,ret}$ [%], $E_{1,sw,ret}$, and $E_{3,sw,ret}$ [%]), interlaminar shear strength $\tau_{sw,ret}$ [%], and lap tensile strength $\sigma_{lap,sw,ret}$ [%] retained by exposed specimens with respect to the value recorded for unconditioned specimens (Sections 2.2.1, 2.2.2, and 2.2.3) and the exposure conditions were also reported in the ETA.

B.6 Alkali resistance

Tensile tests were performed to evaluate the influence of alkali attack on the efficiency of the composite system. Conditioning was conducted on tension composite panel specimens (Section 2.2.1 - minimum number of fabric layers), interlaminar shear specimens (Section 2.2.2), and lap tensile specimens (Section 2.2.3) by immersing the specimens in a liquid with pH ≥ 9.5 for 1,000 and 3,000 hours at a temperature of 23±2°C. Conditioned specimens were then tested in direct tension according to Section 2.2.1, for interlaminar shear strength according to the procedure described in Section 2.2.2, and for lap tensile strength according to Section 2.2.3. A summary of the number of specimens tested is reported in Annex A of EAD. Prior to testing, conditioned specimens were visually examined using 5× magnification to describe surface changes such as erosion, cracking, crazing, checking, and chalking. The average (arithmetic mean) and characteristic value of the tensile strength $\sigma_{u,alk}$ [MPa], stiffness moduli $E_{1,alk}$ and $E_{3,alk}$ [GPa], strain $\varepsilon_{u,alk}$ [%], interlaminar shear strength τ_{alk} [MPa], and lap tensile strength $\sigma_{lap,alk}$ [MPa] were determined. The characteristic value was determined using the appropriate value of k_n for unknown V_x as reported in EN 1990, Annex D, Table D1. The percentage of average mechanical properties ($\sigma_{u,alk,ret}$ [%], $E_{1,alk,ret}$ and $E_{3,alk,ret}$ [%]), interlaminar shear strength $\tau_{alk,ret}$ [%], and lap tensile strength $\sigma_{lap,alk,ret}$ [%] retained by exposed specimens with respect to the values recorded for unconditioned specimens (Sections 2.2.1, 2.2.2, and 2.2.3) and the exposure conditions were also reported in the ETA.

B.7 Conventional limit properties of composite system

Tensile tests were performed on dry fabric samples to define the conventional limit properties of the composite system. The tests were conducted on at least five specimens according to the procedure indicated in Annex E of EAD at standard laboratory conditions (23±2°C, 50±5% RH). Test specimens were cut from the fabric roll supplied by the manufacturer in the warp direction. The stress-strain curve was determined, and the characteristic value of the ultimate stress $\sigma_{u,f}$ [MPa], the ultimate strain $\varepsilon_{u,f}$ [%], the average elastic modulus E_f [GPa], and the conventional limit strain $\varepsilon_{lim,conv}$ [%] (Annex E of EAD) were reported in the ETA. The characteristic value was determined using the appropriate value of k_n for unknown V_x as reported in EN 1990, Annex D, Table D1.

Annex C

Table C1: Mechanical properties – Direct tension test

Direct tension test (Ambient: T=23±2°C , 50±5% RH)					
System	**Mechanical Properties**	**Symbol**	**Units**	**Average**	**Characteristic**
GLASSNET 230-28 + BETONTIX 215 (G-NET-230/2)	Tensile strength	σ_u	[MPa]	1236	1031
	Tensile strain	ε_u	[%]	1,36	0,95
	Elastic modulus of stage A	E_1	[GPa]	1145	-
	Stiffness modulus of phase C	E_3	[GPa]	65	-
GLASSNET 230-28 + BETONTIX 415 (G-NET-230/4)	Tensile strength	σ_u	[MPa]	1386	1156
	Tensile strain	ε_u	[%]	1,52	1,06
	Elastic modulus of stage A	E_1	[GPa]	1284	-
	Stiffness modulus of phase C	E_3	[GPa]	73	-
BASALNET L130 + BETONTIX 215 (B-NET-130/2)	Tensile strength	σ_u	[MPa]	1382	1154
	Tensile strain	ε_u	[%]	1,34	0,93
	Elastic modulus of stage A	E_1	[GPa]	1231	-
	Stiffness modulus of phase C	E_3	[GPa]	65	-
BASALNET L130 + BETONTIX 415 (B-NET-130/4)	Tensile strength	σ_u	[MPa]	1563	1305
	Tensile strain	ε_u	[%]	1,50	1,04
	Elastic modulus of stage A	E_1	[GPa]	1392	-
	Stiffness modulus of phase C	E_3	[GPa]	74	-
BASALNET L200 + BETONTIX 215 (B-NET-200/2)	Tensile strength	σ_u	[MPa]	1228	1079
	Tensile strain	ε_u	[%]	1,81	1,36
	Elastic modulus of stage A	E_1	[GPa]	1325	-
	Stiffness modulus of phase C	E_3	[GPa]	72	
BASALNET L200 + BETONTIX 415 (B-NET-200/4)	Tensile strength	σ_u	[MPa]	1375	1208
	Tensile strain	ε_u	[%]	1,98	1,49
	Elastic modulus of stage A	E_1	[GPa]	1483	-
	Stiffness modulus of phase C	E_3	[GPa]	81	-
BASALNET L400 + BETONTIX 215 (B-NET-400/2)	Tensile strength	σ_u	[MPa]	1161	911
	Tensile strain	ε_u	[%]	1,74	1,28
	Elastic modulus of stage A	E_1	[GPa]	1018	-
	Stiffness modulus of phase C	E_3	[GPa]	69	-
BASALNET L400 + BETONTIX 415 (B-NET-400/4)	Tensile strength	σ_u	[MPa]	1304	1023
	Tensile strain	ε_u	[%]	1,95	1,44
	Elastic modulus of stage A	E_1	[GPa]	1143	-
	Stiffness modulus of phase C	E_3	[GPa]	77	-
BASALNET STEEL 300 + BETONTIX 215 (B-STEEL-300/2)	Tensile strength	σ_u	[MPa]	1438	1217
	Tensile strain	ε_u	[%]	1,73	1,36
	Elastic modulus of stage A	E_1	[GPa]	1428	-
	Stiffness modulus of phase C	E_3	[GPa]	76	
BASALNET STEEL 300 + BETONTIX 415 (B-STEEL-300/4)	Tensile strength	σ_u	[MPa]	1610	1363
	Tensile strain	ε_u	[%]	1,96	1,54
	Elastic modulus of stage A	E_1	[GPa]	1599	-
	Stiffness modulus of phase C	E_3	[GPa]	85	-
BASALNET STEEL 500 + BETONTIX 215 (B-STEEL-500/2)	Tensile strength	σ_u	[MPa]	1407	1232
	Tensile strain	ε_u	[%]	1,61	1,35
	Elastic modulus of stage A	E_1	[GPa]	1685	-
	Stiffness modulus of phase C	E_3	[GPa]	81	-
BASALNET STEEL 500 + BETONTIX 415 (B-STEEL-500/4)	Tensile strength	σ_u	[MPa]	1592	1394
	Tensile strain	ε_u	[%]	1,81	1,51
	Elastic modulus of stage A	E_1	[GPa]	1906	-
	Stiffness modulus of phase C	E_3	[GPa]	92	-
CARBONET 250-15 + BETONTIX 215 (C-NET-250/2)	Tensile strength	σ_u	[MPa]	2822	2652
	Tensile strain	ε_u	[%]	1,75	1,62
	Elastic modulus of stage A	E_1	[GPa]	2148	-
	Stiffness modulus of phase C	E_3	[GPa]	182	-
CARBONET 250-15 + BETONTIX 415 (C-NET-250/4)	Tensile strength	σ_u	[MPa]	3432	3196
	Tensile strain	ε_u	[%]	1,96	1,81
	Elastic modulus of stage A	E_1	[GPa]	2453	-
	Stiffness modulus of phase C	E_3	[GPa]	197	-

Seico Compositi FRCM Systems	**Annex C1** **of ETA N° 25/0247**
Performances: Mechanical properties under direct tension	

Table C2: Interaction with substrate – Properties of substrate

Properties of substrates		
Substrate	Axial Surface Strenght fh,sub (Mpa)	fb (MPa)
Brick	1,82	23,40
Limestone (Stone)	1,45	119,70
Tuff	1,18	6,92
Concrete	1,89	25,20

Table C3: Interaction with substrate – Bond strength on substrate (single-lap shear test)							
Single-lap shear test (Ambient: T=23±2°C , 50±5% RH)							
System	Substrate	Failure Mode	Mechanical Properties	Symbol	Units	Average	Characteristic
GLASSNET 230-28 + BETONTIX 215 (G-NET-230/2)	Stone	FR	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	1046	876
	Brick	FR	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	1201	996
	Tuff	FR	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	1104	920
GLASSNET 230-28 + BETONTIX 415 (G-NET-230/4)	Stone	FR	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	1183	991
	Brick	FR	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	1344	1115
	Tuff	FR	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	1249	1041
BASALNET L130 + BETONTIX 215 (B-NET-130/2)	Stone	FR	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	1148	989
	Brick	FR	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	1336	1108
	Tuff	FR	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	1208	1029
BASALNET L130 + BETONTIX 415 (B-NET-130/4)	Stone	FR	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	1289	1111
	Brick	FR	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	1498	1242
	Tuff	FR	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	1357	1156
BASALNET L200 + BETONTIX 215 (B-NET-200/2)	Stone	FR	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	1021	779
	Brick	FR	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	1185	1006
	Tuff	FR	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	1066	904
BASALNET L200 + BETONTIX 415 (B-NET-200/4)	Stone	FR	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	1145	874
	Brick	FR	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	1340	1138
	Tuff	FR	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	1206	1023
BASALNET L400 + BETONTIX 215 (B-NET-400/2)	Stone	FR	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	884	692
	Brick	FR	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	1131	913
	Tuff	FR	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	1049	846
BASALNET L400 + BETONTIX 415 (B-NET-400/4)	Stone	FR	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	990	783
	Brick	FR	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	1266	1022
	Tuff	FR	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	1187	957
BASALNET STEEL 300 + BETONTIX 215 (B-STEEL-300/2)	Stone	FR	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	1114	996
	Brick	FR	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	1169	1108
	Tuff	FR	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	1332	1159
BASALNET STEEL 300 + BETONTIX 415 (B-STEEL-300/4)	Stone	FR	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	1249	1117
	Brick	FR	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	1307	1239
	Tuff	FR	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	1494	1300
BASALNET STEEL 500 + BETONTIX 215 (B-STEEL-500/2)	Stone	FR	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	1011	902
	Brick	FR	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	1292	1234
	Tuff	FR	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	1227	1123
BASALNET STEEL 500 + BETONTIX 415 (B-STEEL-500/4)	Stone	FR	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	1144	1021
	Brick	FR	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	1447	1382
	Tuff	FR	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	1374	1258
CARBONET 250-15 + BETONTIX 215 (C-NET-250/2)	Stone	FR	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	2182	1987
	Brick	FR	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	2587	2352
	Tuff	FR	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	2253	2014
CARBONET 250-15 + BETONTIX 415 (C-NET-250/4)	Stone	-	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	NPA	NPA
	Brick	-	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	NPA	NPA
	Tuff	-	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	NPA	NPA
	Concrete	FR	Conventional limit stress	$\sigma_{lim,conv}$	[MPa]	2991	2683

Seico Compositi FRCM Systems	Annex C3 of ETA N° 25/0247
Performances: Mechanical properties under direct tension and bond strength on substrates (single lap shear test)	

Table C4: Aging – Freezing and Thawing

Assessment of Surface Changes: No signs of surface changes, including erosion, cracking, crazing, checking, or chalking, were observed.

System	Mechanical Properties	Symbol	Units	Average	Characteristic	Retained (%) -Avr.
Freezing and Thawing						
GLASSNET 230-28 + BETONTIX 215 (G-NET-230/2)	Tensile strength	σ_u	[MPa]	1174	845	95
	Tensile strain	ε_u	[%]	1,25	0,85	-
	Elastic modulus of stage A	E_1	[GPa]	1168	919	102
	Stiffness modulus of phase C	E_3	[GPa]	64	45	99
GLASSNET 230-28 + BETONTIX 415 (G-NET-230/4)	Tensile strength	σ_u	[MPa]	1358	1112	98
	Tensile strain	ε_u	[%]	1,41	0,95	-
	Elastic modulus of stage A	E_1	[GPa]	1297	1075	101
	Stiffness modulus of phase C	E_3	[GPa]	73	57	100
BASALNET L130 + BETONTIX 215 (B-NET-130/2)	Tensile strength	σ_u	[MPa]	1313	957	95
	Tensile strain	ε_u	[%]	1,38	1,07	-
	Elastic modulus of stage A	E_1	[GPa]	1219	925	99
	Stiffness modulus of phase C	E_3	[GPa]	64	48	98
BASALNET L130 + BETONTIX 415 (B-NET-130/4)	Tensile strength	σ_u	[MPa]	1501	1185	96
	Tensile strain	ε_u	[%]	1,55	1,20	-
	Elastic modulus of stage A	E_1	[GPa]	1365	1107	98
	Stiffness modulus of phase C	E_3	[GPa]	71	57	97
BASALNET L200 + BETONTIX 215 (B-NET-200/2)	Tensile strength	σ_u	[MPa]	1154	812	94
	Tensile strain	ε_u	[%]	1,89	1,41	-
	Elastic modulus of stage A	E_1	[GPa]	1312	1072	99
	Stiffness modulus of phase C	E_3	[GPa]	71	56	98
BASALNET L200 + BETONTIX 415 (B-NET-200/4)	Tensile strength	σ_u	[MPa]	1278	920	93
	Tensile strain	ε_u	[%]	2,03	1,58	-
	Elastic modulus of stage A	E_1	[GPa]	1498	1179	101
	Stiffness modulus of phase C	E_3	[GPa]	79	56	98
BASALNET L400 + BETONTIX 215 (B-NET-400/2)	Tensile strength	σ_u	[MPa]	1115	786	96
	Tensile strain	ε_u	[%]	1,87	1,45	-
	Elastic modulus of stage A	E_1	[GPa]	1008	807	99
	Stiffness modulus of phase C	E_3	[GPa]	67	53	97
BASALNET L400 + BETONTIX 415 (B-NET-400/4)	Tensile strength	σ_u	[MPa]	1291	941	99
	Tensile strain	ε_u	[%]	2,11	1,62	-
	Elastic modulus of stage A	E_1	[GPa]	1143	867	100
	Stiffness modulus of phase C	E_3	[GPa]	76	58	98
BASALNET STEEL 300 + BETONTIX 215 (B-STEEL-300/2)	Tensile strength	σ_u	[MPa]	1323	1044	92
	Tensile strain	ε_u	[%]	1,91	1,42	-
	Elastic modulus of stage A	E_1	[GPa]	1414	1147	99
	Stiffness modulus of phase C	E_3	[GPa]	72	58	95
BASALNET STEEL 300 + BETONTIX 415 (B-STEEL-300/4)	Tensile strength	σ_u	[MPa]	1562	1163	97
	Tensile strain	ε_u	[%]	2,16	1,59	-
	Elastic modulus of stage A	E_1	[GPa]	1631	1239	102
	Stiffness modulus of phase C	E_3	[GPa]	84	65	99
BASALNET STEEL 500 + BETONTIX 215 (B-STEEL-500/2)	Tensile strength	σ_u	[MPa]	1337	1095	95
	Tensile strain	ε_u	[%]	1,75	1,38	-
	Elastic modulus of stage A	E_1	[GPa]	1651	1369	98
	Stiffness modulus of phase C	E_3	[GPa]	80	63	99
BASALNET STEEL 500 + BETONTIX 415 (B-STEEL-500/4)	Tensile strength	σ_u	[MPa]	1528	1206	96
	Tensile strain	ε_u	[%]	1,96	1,56	-
	Elastic modulus of stage A	E_1	[GPa]	1887	1530	99
	Stiffness modulus of phase C	E_3	[GPa]	89	71	97
CARBONET 250-15 + BETONTIX 215 (C-NET-250/2)	Tensile strength	σ_u	[MPa]	2766	2545	98
	Tensile strain	ε_u	[%]	1,55	1,15	-
	Elastic modulus of stage A	E_1	[GPa]	2169	1959	101
	Stiffness modulus of phase C	E_3	[GPa]	182	171	100
CARBONET 250-15 + BETONTIX 415 (C-NET-250/4)	Tensile strength	σ_u	[MPa]	3398	3130	99
	Tensile strain	ε_u	[%]	1,71	1,21	-
	Elastic modulus of stage A	E_1	[GPa]	2478	2216	101
	Stiffness modulus of phase C	E_3	[GPa]	193	178	98

Table C5: Aging – Water resistance

Assessment of Surface Changes: No signs of surface changes, including erosion, cracking, crazing, checking, or chalking, were observed.

Water resistance					
System	**Mechanical Properties**	**Symbol**	**Units**	**1000h**	**3000 h**
				Average	**Average**
GLASSNET 230-28 + BETONTIX 215 (G-NET-230/2)	Tensile strength	σ_u	[MPa]	1112	1174
	Tensile strain	ε_u	[%]	1,15	1,01
	Elastic modulus of stage A	E_1	[GPa]	1156	1179
	Stiffness modulus of phase C	E_3	[GPa]	56	59
GLASSNET 230-28 + BETONTIX 415 (G-NET-230/4)	Tensile strength	σ_u	[MPa]	1289	1317
	Tensile strain	ε_u	[%]	1,29	1,14
	Elastic modulus of stage A	E_1	[GPa]	1310	1361
	Stiffness modulus of phase C	E_3	[GPa]	65	68
BASALNET L130 + BETONTIX 215 (B-NET-130/2)	Tensile strength	σ_u	[MPa]	1341	1285
	Tensile strain	ε_u	[%]	1,12	0,93
	Elastic modulus of stage A	E_1	[GPa]	1268	1305
	Stiffness modulus of phase C	E_3	[GPa]	57	58
BASALNET L130 + BETONTIX 415 (B-NET-130/4)	Tensile strength	σ_u	[MPa]	1516	1485
	Tensile strain	ε_u	[%]	1,26	1,04
	Elastic modulus of stage A	E_1	[GPa]	1448	1476
	Stiffness modulus of phase C	E_3	[GPa]	68	69
BASALNET L200 + BETONTIX 215 (B-NET-200/2)	Tensile strength	σ_u	[MPa]	1167	1130
	Tensile strain	ε_u	[%]	1,47	1,09
	Elastic modulus of stage A	E_1	[GPa]	1391	1418
	Stiffness modulus of phase C	E_3	[GPa]	66	67
BASALNET L200 + BETONTIX 415 (B-NET-200/4)	Tensile strength	σ_u	[MPa]	1292	1361
	Tensile strain	ε_u	[%]	1,66	1,22
	Elastic modulus of stage A	E_1	[GPa]	1528	1602
	Stiffness modulus of phase C	E_3	[GPa]	77	81
BASALNET L400 + BETONTIX 215 (B-NET-400/2)	Tensile strength	σ_u	[MPa]	1138	1103
	Tensile strain	ε_u	[%]	1,38	1,07
	Elastic modulus of stage A	E_1	[GPa]	1089	1120
	Stiffness modulus of phase C	E_3	[GPa]	59	57
BASALNET L400 + BETONTIX 415 (B-NET-400/4)	Tensile strength	σ_u	[MPa]	1252	1317
	Tensile strain	ε_u	[%]	1,56	1,20
	Elastic modulus of stage A	E_1	[GPa]	1200	1223
	Stiffness modulus of phase C	E_3	[GPa]	68	71
BASALNET STEEL 300 + BETONTIX 215 (B-STEEL-300/2)	Tensile strength	σ_u	[MPa]	1265	1222
	Tensile strain	ε_u	[%]	1,31	0,97
	Elastic modulus of stage A	E_1	[GPa]	1457	1485
	Stiffness modulus of phase C	E_3	[GPa]	73	71
BASALNET STEEL 300 + BETONTIX 415 (B-STEEL-300/4)	Tensile strength	σ_u	[MPa]	1482	1433
	Tensile strain	ε_u	[%]	1,47	1,08
	Elastic modulus of stage A	E_1	[GPa]	1679	1727
	Stiffness modulus of phase C	E_3	[GPa]	84	80
BASALNET STEEL 500 + BETONTIX 215 (B-STEEL-500/2)	Tensile strength	σ_u	[MPa]	1182	1140
	Tensile strain	ε_u	[%]	1,47	1,12
	Elastic modulus of stage A	E_1	[GPa]	1803	1820
	Stiffness modulus of phase C	E_3	[GPa]	76	78
BASALNET STEEL 500 + BETONTIX 415 (B-STEEL-500/4)	Tensile strength	σ_u	[MPa]	1385	1432
	Tensile strain	ε_u	[%]	1,66	1,25
	Elastic modulus of stage A	E_1	[GPa]	2020	2097
	Stiffness modulus of phase C	E_3	[GPa]	84	86
CARBONET 250-15 + BETONTIX 215 (C-NET-250/2)	Tensile strength	σ_u	[MPa]	2568	2483
	Tensile strain	ε_u	[%]	1,54	1,17
	Elastic modulus of stage A	E_1	[GPa]	2277	2320
	Stiffness modulus of phase C	E_3	[GPa]	167	162
CARBONET 250-15 + BETONTIX 415 (C-NET-250/4)	Tensile strength	σ_u	[MPa]	3329	3398
	Tensile strain	ε_u	[%]	1,69	1,19
	Elastic modulus of stage A	E_1	[GPa]	2551	2625
	Stiffness modulus of phase C	E_3	[GPa]	185	189

Table C6: Aging – Water resistance					
Retained properties					
System	Mechanical Properties	Symbol	Units	1000h Average	3000 h Average
GLASSNET 230-28 + BETONTIX 215 (G-NET-230/2)	Retained tensile strength	$\sigma_{u,w,ret}$	[%]	90	95
	Retained elastic modulus of stage A	$E_{1,w,ret}$	[%]	101	103
	Retained stiffness modulus of phase C	$E_{3,w,ret}$	[%]	86	90
GLASSNET 230-28 + BETONTIX 415 (G-NET-230/4)	Retained tensile strength	$\sigma_{u,w,ret}$	[%]	93	95
	Retained elastic modulus of stage A	$E_{1,w,ret}$	[%]	102	106
	Retained stiffness modulus of phase C	$E_{3,w,ret}$	[%]	89	93
BASALNET L130 + BETONTIX 215 (B-NET-130/2)	Retained tensile strength	$\sigma_{u,w,ret}$	[%]	97	93
	Retained elastic modulus of stage A	$E_{1,w,ret}$	[%]	103	106
	Retained stiffness modulus of phase C	$E_{3,w,ret}$	[%]	88	89
BASALNET L130 + BETONTIX 415 (B-NET-130/4)	Retained tensile strength	$\sigma_{u,w,ret}$	[%]	97	95
	Retained elastic modulus of stage A	$E_{1,w,ret}$	[%]	104	106
	Retained stiffness modulus of phase C	$E_{3,w,ret}$	[%]	93	94
BASALNET L200 + BETONTIX 215 (B-NET-200/2)	Retained tensile strength	$\sigma_{u,w,ret}$	[%]	95	92
	Retained elastic modulus of stage A	$E_{1,w,ret}$	[%]	105	107
	Retained stiffness modulus of phase C	$E_{3,w,ret}$	[%]	91	93
BASALNET L200 + BETONTIX 415 (B-NET-200/4)	Retained tensile strength	$\sigma_{u,w,ret}$	[%]	94	99
	Retained elastic modulus of stage A	$E_{1,w,ret}$	[%]	103	108
	Retained stiffness modulus of phase C	$E_{3,w,ret}$	[%]	95	100
BASALNET L400 + BETONTIX 215 (B-NET-400/2)	Retained tensile strength	$\sigma_{u,w,ret}$	[%]	98	95
	Retained elastic modulus of stage A	$E_{1,w,ret}$	[%]	107	110
	Retained stiffness modulus of phase C	$E_{3,w,ret}$	[%]	85	82
BASALNET L400 + BETONTIX 415 (B-NET-400/4)	Retained tensile strength	$\sigma_{u,w,ret}$	[%]	96	101
	Retained elastic modulus of stage A	$E_{1,w,ret}$	[%]	105	107
	Retained stiffness modulus of phase C	$E_{3,w,ret}$	[%]	88	92
BASALNET STEEL 300 + BETONTIX 215 (B-STEEL-300/2)	Retained tensile strength	$\sigma_{u,w,ret}$	[%]	88	85
	Retained elastic modulus of stage A	$E_{1,w,ret}$	[%]	102	104
	Retained stiffness modulus of phase C	$E_{3,w,ret}$	[%]	96	93
BASALNET STEEL 300 + BETONTIX 415 (B-STEEL-300/4)	Retained tensile strength	$\sigma_{u,w,ret}$	[%]	92	89
	Retained elastic modulus of stage A	$E_{1,w,ret}$	[%]	105	108
	Retained stiffness modulus of phase C	$E_{3,w,ret}$	[%]	99	94
BASALNET STEEL 500 + BETONTIX 215 (B-STEEL-500/2)	Retained tensile strength	$\sigma_{u,w,ret}$	[%]	84	81
	Retained elastic modulus of stage A	$E_{1,w,ret}$	[%]	107	108
	Retained stiffness modulus of phase C	$E_{3,w,ret}$	[%]	94	96
BASALNET STEEL 500 + BETONTIX 415 (B-STEEL-500/4)	Retained tensile strength	$\sigma_{u,w,ret}$	[%]	87	90
	Retained elastic modulus of stage A	$E_{1,w,ret}$	[%]	106	110
	Retained stiffness modulus of phase C	$E_{3,w,ret}$	[%]	92	94
CARBONET 250-15 + BETONTIX 215 (C-NET-250/2)	Retained tensile strength	$\sigma_{u,w,ret}$	[%]	91	88
	Retained elastic modulus of stage A	$E_{1,w,ret}$	[%]	106	108
	Retained stiffness modulus of phase C	$E_{3,w,ret}$	[%]	92	89
CARBONET 250-15 + BETONTIX 415 (C-NET-250/4)	Retained tensile strength	$\sigma_{u,w,ret}$	[%]	97	99
	Retained elastic modulus of stage A	$E_{1,w,ret}$	[%]	104	107
	Retained stiffness modulus of phase C	$E_{3,w,ret}$	[%]	94	96

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Performances: Aging - Water Resistance	

Table C7: Aging – Saltwater resistance

Assessment of Surface Changes: No signs of surface changes, including erosion, cracking, crazing, checking, or chalking, were observed.

System	Mechanical Properties	Symbol	Units	1000h Average	3000 h Average
Saltswater resistance					
GLASSNET 230-28 + BETONTIX 215 (G-NET-230/2)	Tensile strength	σ_u	[MPa]	1162	1137
	Tensile strain	ε_u	[%]	1,10	0,96
	Elastic modulus of stage A	E_1	[GPa]	1179	1156
	Stiffness modulus of phase C	E_3	[GPa]	66	64
GLASSNET 230-28 + BETONTIX 415 (G-NET-230/4)	Tensile strength	σ_u	[MPa]	1275	1233
	Tensile strain	ε_u	[%]	1,24	1,07
	Elastic modulus of stage A	E_1	[GPa]	1374	1322
	Stiffness modulus of phase C	E_3	[GPa]	74	73
BASALNET L130 + BETONTIX 215 (B-NET-130/2)	Tensile strength	σ_u	[MPa]	1313	1299
	Tensile strain	ε_u	[%]	1,12	0,98
	Elastic modulus of stage A	E_1	[GPa]	1293	1256
	Stiffness modulus of phase C	E_3	[GPa]	59	57
BASALNET L130 + BETONTIX 415 (B-NET-130/4)	Tensile strength	σ_u	[MPa]	1454	1438
	Tensile strain	ε_u	[%]	1,26	1,10
	Elastic modulus of stage A	E_1	[GPa]	1406	1351
	Stiffness modulus of phase C	E_3	[GPa]	75	73
BASALNET L200 + BETONTIX 215 (B-NET-200/2)	Tensile strength	σ_u	[MPa]	1117	1068
	Tensile strain	ε_u	[%]	1,51	1,19
	Elastic modulus of stage A	E_1	[GPa]	1352	1325
	Stiffness modulus of phase C	E_3	[GPa]	68	66
BASALNET L200 + BETONTIX 415 (B-NET-200/4)	Tensile strength	σ_u	[MPa]	1306	1237
	Tensile strain	ε_u	[%]	1,71	1,33
	Elastic modulus of stage A	E_1	[GPa]	1557	1498
	Stiffness modulus of phase C	E_3	[GPa]	77	75
BASALNET L400 + BETONTIX 215 (B-NET-400/2)	Tensile strength	σ_u	[MPa]	1091	1068
	Tensile strain	ε_u	[%]	1,40	1,17
	Elastic modulus of stage A	E_1	[GPa]	1099	1069
	Stiffness modulus of phase C	E_3	[GPa]	59	58
BASALNET L400 + BETONTIX 415 (B-NET-400/4)	Tensile strength	σ_u	[MPa]	1200	1187
	Tensile strain	ε_u	[%]	1,57	1,31
	Elastic modulus of stage A	E_1	[GPa]	1178	1132
	Stiffness modulus of phase C	E_3	[GPa]	79	76
BASALNET STEEL 300 + BETONTIX 215 (B-STEEL-300/2)	Tensile strength	σ_u	[MPa]	1337	1309
	Tensile strain	ε_u	[%]	1,59	1,23
	Elastic modulus of stage A	E_1	[GPa]	1399	1357
	Stiffness modulus of phase C	E_3	[GPa]	69	68
BASALNET STEEL 300 + BETONTIX 415 (B-STEEL-300/4)	Tensile strength	σ_u	[MPa]	1433	1385
	Tensile strain	ε_u	[%]	1,78	1,39
	Elastic modulus of stage A	E_1	[GPa]	1631	1599
	Stiffness modulus of phase C	E_3	[GPa]	71	70
BASALNET STEEL 500 + BETONTIX 215 (B-STEEL-500/2)	Tensile strength	σ_u	[MPa]	1238	1196
	Tensile strain	ε_u	[%]	1,45	1,13
	Elastic modulus of stage A	E_1	[GPa]	1837	1803
	Stiffness modulus of phase C	E_3	[GPa]	74	72
BASALNET STEEL 500 + BETONTIX 415 (B-STEEL-500/4)	Tensile strength	σ_u	[MPa]	1512	1464
	Tensile strain	ε_u	[%]	1,64	1,26
	Elastic modulus of stage A	E_1	[GPa]	2020	1963
	Stiffness modulus of phase C	E_3	[GPa]	84	82
CARBONET 250-15 + BETONTIX 215 (C-NET-250/2)	Tensile strength	σ_u	[MPa]	2709	2653
	Tensile strain	ε_u	[%]	1,48	1,11
	Elastic modulus of stage A	E_1	[GPa]	2234	2169
	Stiffness modulus of phase C	E_3	[GPa]	175	167
CARBONET 250-15 + BETONTIX 415 (C-NET-250/4)	Tensile strength	σ_u	[MPa]	3329	3226
	Tensile strain	ε_u	[%]	1,57	1,14
	Elastic modulus of stage A	E_1	[GPa]	2502	2453
	Stiffness modulus of phase C	E_3	[GPa]	185	179

Table C8: Aging – Saltswater resistance					
Retained properties					
System	Mechanical Properties	Symbol	Units	1000h Average	3000 h Average
GLASSNET 230-28 + BETONTIX 215 (G-NET-230/2)	Retained tensile strength	σu,sw,ret	[%]	94	92
	Retained elastic modulus of stage A	E1,sw,ret	[%]	103	101
	Retained stiffness modulus of phase C	E3,sw,ret	[%]	101	99
GLASSNET 230-28 + BETONTIX 415 (G-NET-230/4)	Retained tensile strength	σu,sw,ret	[%]	92	89
	Retained elastic modulus of stage A	E1,sw,ret	[%]	107	103
	Retained stiffness modulus of phase C	E3,sw,ret	[%]	102	100
BASALNET L130 + BETONTIX 215 (B-NET-130/2)	Retained tensile strength	σu,sw,ret	[%]	95	94
	Retained elastic modulus of stage A	E1,sw,ret	[%]	105	102
	Retained stiffness modulus of phase C	E3,sw,ret	[%]	90	87
BASALNET L130 + BETONTIX 415 (B-NET-130/4)	Retained tensile strength	σu,sw,ret	[%]	93	92
	Retained elastic modulus of stage A	E1,sw,ret	[%]	101	97
	Retained stiffness modulus of phase C	E3,sw,ret	[%]	102	99
BASALNET L200 + BETONTIX 215 (B-NET-200/2)	Retained tensile strength	σu,sw,ret	[%]	91	87
	Retained elastic modulus of stage A	E1,sw,ret	[%]	102	100
	Retained stiffness modulus of phase C	E3,sw,ret	[%]	94	91
BASALNET L200 + BETONTIX 415 (B-NET-200/4)	Retained tensile strength	σu,sw,ret	[%]	95	90
	Retained elastic modulus of stage A	E1,sw,ret	[%]	105	101
	Retained stiffness modulus of phase C	E3,sw,ret	[%]	96	93
BASALNET L400 + BETONTIX 215 (B-NET-400/2)	Retained tensile strength	σu,sw,ret	[%]	94	92
	Retained elastic modulus of stage A	E1,sw,ret	[%]	108	105
	Retained stiffness modulus of phase C	E3,sw,ret	[%]	86	84
BASALNET L400 + BETONTIX 415 (B-NET-400/4)	Retained tensile strength	σu,sw,ret	[%]	92	91
	Retained elastic modulus of stage A	E1,sw,ret	[%]	103	99
	Retained stiffness modulus of phase C	E3,sw,ret	[%]	102	98
BASALNET STEEL 300 + BETONTIX 215 (B-STEEL-300/2)	Retained tensile strength	σu,sw,ret	[%]	93	91
	Retained elastic modulus of stage A	E1,sw,ret	[%]	98	95
	Retained stiffness modulus of phase C	E3,sw,ret	[%]	91	89
BASALNET STEEL 300 + BETONTIX 415 (B-STEEL-300/4)	Retained tensile strength	σu,sw,ret	[%]	89	86
	Retained elastic modulus of stage A	E1,sw,ret	[%]	102	100
	Retained stiffness modulus of phase C	E3,sw,ret	[%]	84	82
BASALNET STEEL 500 + BETONTIX 215 (B-STEEL-500/2)	Retained tensile strength	σu,sw,ret	[%]	88	85
	Retained elastic modulus of stage A	E1,sw,ret	[%]	109	107
	Retained stiffness modulus of phase C	E3,sw,ret	[%]	91	89
BASALNET STEEL 500 + BETONTIX 415 (B-STEEL-500/4)	Retained tensile strength	σu,sw,ret	[%]	95	92
	Retained elastic modulus of stage A	E1,sw,ret	[%]	106	103
	Retained stiffness modulus of phase C	E3,sw,ret	[%]	92	90
CARBONET 250-15 + BETONTIX 215 (C-NET-250/2)	Retained tensile strength	σu,sw,ret	[%]	96	94
	Retained elastic modulus of stage A	E1,sw,ret	[%]	104	101
	Retained stiffness modulus of phase C	E3,sw,ret	[%]	96	92
CARBONET 250-15 + BETONTIX 415 (C-NET-250/4)	Retained tensile strength	σu,sw,ret	[%]	97	94
	Retained elastic modulus of stage A	E1,sw,ret	[%]	102	100
	Retained stiffness modulus of phase C	E3,sw,ret	[%]	94	91

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Performances: Aging - Saltwater Resistance	

Table C9: Aging – Alkali resistance

Assessment of Surface Changes: No signs of surface changes, including erosion, cracking, crazing, checking, or chalking, were observed.

System	Mechanical Properties	Symbol	Units	1000h	3000 h
				Average	Average
Alkali resistance					
GLASSNET 230-28 + BETONTIX 215 (G-NET-230/2)	Tensile strength	σ_u	[MPa]	1075	1001
	Tensile strain	ε_u	[%]	1,05	0,98
	Elastic modulus of stage A	E_1	[GPa]	1523	1466
	Stiffness modulus of phase C	E_3	[GPa]	83	80
GLASSNET 230-28 + BETONTIX 415 (G-NET-230/4)	Tensile strength	σ_u	[MPa]	1220	1164
	Tensile strain	ε_u	[%]	1,18	1,11
	Elastic modulus of stage A	E_1	[GPa]	1412	1361
	Stiffness modulus of phase C	E_3	[GPa]	88	85
BASALNET L130 + BETONTIX 215 (B-NET-130/2)	Tensile strength	σ_u	[MPa]	1189	1106
	Tensile strain	ε_u	[%]	1,08	0,96
	Elastic modulus of stage A	E_1	[GPa]	1613	1539
	Stiffness modulus of phase C	E_3	[GPa]	80	74
BASALNET L130 + BETONTIX 415 (B-NET-130/4)	Tensile strength	σ_u	[MPa]	1438	1360
	Tensile strain	ε_u	[%]	1,22	1,07
	Elastic modulus of stage A	E_1	[GPa]	1935	1852
	Stiffness modulus of phase C	E_3	[GPa]	93	87
BASALNET L200 + BETONTIX 215 (B-NET-200/2)	Tensile strength	σ_u	[MPa]	1130	1081
	Tensile strain	ε_u	[%]	1,46	1,17
	Elastic modulus of stage A	E_1	[GPa]	1895	1815
	Stiffness modulus of phase C	E_3	[GPa]	99	96
BASALNET L200 + BETONTIX 415 (B-NET-200/4)	Tensile strength	σ_u	[MPa]	1333	1251
	Tensile strain	ε_u	[%]	1,64	1,31
	Elastic modulus of stage A	E_1	[GPa]	2017	1958
	Stiffness modulus of phase C	E_3	[GPa]	104	100
BASALNET L400 + BETONTIX 215 (B-NET-400/2)	Tensile strength	σ_u	[MPa]	1091	1045
	Tensile strain	ε_u	[%]	1,37	1,14
	Elastic modulus of stage A	E_1	[GPa]	1435	1364
	Stiffness modulus of phase C	E_3	[GPa]	88	85
BASALNET L400 + BETONTIX 415 (B-NET-400/4)	Tensile strength	σ_u	[MPa]	1213	1147
	Tensile strain	ε_u	[%]	1,55	1,28
	Elastic modulus of stage A	E_1	[GPa]	1543	1463
	Stiffness modulus of phase C	E_3	[GPa]	95	91
BASALNET STEEL 300 + BETONTIX 215 (B-STEEL-300/2)	Tensile strength	σ_u	[MPa]	1280	1194
	Tensile strain	ε_u	[%]	1,35	1,09
	Elastic modulus of stage A	E_1	[GPa]	1814	1714
	Stiffness modulus of phase C	E_3	[GPa]	90	84
BASALNET STEEL 300 + BETONTIX 415 (B-STEEL-300/4)	Tensile strength	σ_u	[MPa]	1530	1465
	Tensile strain	ε_u	[%]	1,53	1,22
	Elastic modulus of stage A	E_1	[GPa]	2095	1999
	Stiffness modulus of phase C	E_3	[GPa]	107	100
BASALNET STEEL 500 + BETONTIX 215 (B-STEEL-500/2)	Tensile strength	σ_u	[MPa]	1294	1196
	Tensile strain	ε_u	[%]	1,28	1,04
	Elastic modulus of stage A	E_1	[GPa]	2174	2056
	Stiffness modulus of phase C	E_3	[GPa]	96	91
BASALNET STEEL 500 + BETONTIX 415 (B-STEEL-500/4)	Tensile strength	σ_u	[MPa]	1480	1401
	Tensile strain	ε_u	[%]	1,44	1,17
	Elastic modulus of stage A	E_1	[GPa]	2402	2306
	Stiffness modulus of phase C	E_3	[GPa]	112	106
CARBONET 250-15 + BETONTIX 215 (C-NET-250/2)	Tensile strength	σ_u	[MPa]	2568	2512
	Tensile strain	ε_u	[%]	1,43	1,12
	Elastic modulus of stage A	E_1	[GPa]	2363	2234
	Stiffness modulus of phase C	E_3	[GPa]	191	182
CARBONET 250-15 + BETONTIX 415 (C-NET-250/4)	Tensile strength	σ_u	[MPa]	3260	3089
	Tensile strain	ε_u	[%]	1,54	1,15
	Elastic modulus of stage A	E_1	[GPa]	2993	2870
	Stiffness modulus of phase C	E_3	[GPa]	232	219

Seico Compositi FRCM Systems	**Annex C9** **of ETA N° 25/0247**
Performances: Aging - Alkali Resistance	

Table C10: Aging – Alkali resistance					
Retained properties					
System	**Mechanical Properties**	**Symbol**	**Units**	**1000h Average**	**3000 h Average**
GLASSNET 230-28 + BETONTIX 215 (G-NET-230/2)	Retained tensile strength	σu,alk,ret	[%]	87	81
	Retained elastic modulus of stage A	E1,alk,ret	[%]	133	128
	Retained stiffness modulus of phase C	E3,alk,ret	[%]	128	123
GLASSNET 230-28 + BETONTIX 415 (G-NET-230/4)	Retained tensile strength	σu,alk,ret	[%]	88	84
	Retained elastic modulus of stage A	E1,alk,ret	[%]	110	106
	Retained stiffness modulus of phase C	E3,alk,ret	[%]	121	117
BASALNET L130 + BETONTIX 215 (B-NET-130/2)	Retained tensile strength	σu,alk,ret	[%]	86	80
	Retained elastic modulus of stage A	E1,alk,ret	[%]	131	125
	Retained stiffness modulus of phase C	E3,alk,ret	[%]	123	114
BASALNET L130 + BETONTIX 415 (B-NET-130/4)	Retained tensile strength	σu,alk,ret	[%]	92	87
	Retained elastic modulus of stage A	E1,alk,ret	[%]	139	133
	Retained stiffness modulus of phase C	E3,alk,ret	[%]	126	119
BASALNET L200 + BETONTIX 215 (B-NET-200/2)	Retained tensile strength	σu,alk,ret	[%]	92	88
	Retained elastic modulus of stage A	E1,alk,ret	[%]	143	137
	Retained stiffness modulus of phase C	E3,alk,ret	[%]	138	133
BASALNET L200 + BETONTIX 415 (B-NET-200/4)	Retained tensile strength	σu,alk,ret	[%]	97	91
	Retained elastic modulus of stage A	E1,alk,ret	[%]	136	132
	Retained stiffness modulus of phase C	E3,alk,ret	[%]	129	124
BASALNET L400 + BETONTIX 215 (B-NET-400/2)	Retained tensile strength	σu,alk,ret	[%]	94	90
	Retained elastic modulus of stage A	E1,alk,ret	[%]	141	134
	Retained stiffness modulus of phase C	E3,alk,ret	[%]	128	123
BASALNET L400 + BETONTIX 415 (B-NET-400/4)	Retained tensile strength	σu,alk,ret	[%]	93	88
	Retained elastic modulus of stage A	E1,alk,ret	[%]	135	128
	Retained stiffness modulus of phase C	E3,alk,ret	[%]	123	117
BASALNET STEEL 300 + BETONTIX 215 (B-STEEL-300/2)	Retained tensile strength	σu,alk,ret	[%]	89	83
	Retained elastic modulus of stage A	E1,alk,ret	[%]	127	120
	Retained stiffness modulus of phase C	E3,alk,ret	[%]	118	111
BASALNET STEEL 300 + BETONTIX 415 (B-STEEL-300/4)	Retained tensile strength	σu,alk,ret	[%]	95	91
	Retained elastic modulus of stage A	E1,alk,ret	[%]	131	125
	Retained stiffness modulus of phase C	E3,alk,ret	[%]	126	118
BASALNET STEEL 500 + BETONTIX 215 (B-STEEL-500/2)	Retained tensile strength	σu,alk,ret	[%]	92	85
	Retained elastic modulus of stage A	E1,alk,ret	[%]	129	122
	Retained stiffness modulus of phase C	E3,alk,ret	[%]	119	112
BASALNET STEEL 500 + BETONTIX 415 (B-STEEL-500/4)	Retained tensile strength	σu,alk,ret	[%]	93	88
	Retained elastic modulus of stage A	E1,alk,ret	[%]	126	121
	Retained stiffness modulus of phase C	E3,alk,ret	[%]	122	116
CARBONET 250-15 + BETONTIX 215 (C-NET-250/2)	Retained tensile strength	σu,alk,ret	[%]	91	89
	Retained elastic modulus of stage A	E1,alk,ret	[%]	110	104
	Retained stiffness modulus of phase C	E3,alk,ret	[%]	105	100
CARBONET 250-15 + BETONTIX 415 (C-NET-250/4)	Retained tensile strength	σu,alk,ret	[%]	95	90
	Retained elastic modulus of stage A	E1,alk,ret	[%]	122	117
	Retained stiffness modulus of phase C	E3,alk,ret	[%]	118	111

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Performances: Aging - Alkali Resistance	

Table C11: Mechanical properties of the fabric – Direct tension test

Direct tension test (Ambient: T=23±2°C , 50±5% RH)					
Product	**Mechanical Properties**	**Symbol**	**Units**	**Average**	**Characteristic**
GLASSNET 230-28	Ultimate Stress	$\sigma_{u,f}$	[MPa]	1318	1265
	Ultimate Strain	$\varepsilon_{u,f}$	[%]	1,93	1,72
	Average elastic modulus	E_f	[GPa]	89	-
BASALNET L130	Ultimate Stress	$\sigma_{u,f}$	[MPa]	1494	1352
	Ultimate Strain	$\varepsilon_{u,f}$	[%]	1,86	1,64
	Average elastic modulus	E_f	[GPa]	73	-
BASALNET L200	Ultimate Stress	$\sigma_{u,f}$	[MPa]	1396	1294
	Ultimate Strain	$\varepsilon_{u,f}$	[%]	1,82	1,54
	Average elastic modulus	E_f	[GPa]	75	-
BASALNET L400	Ultimate Stress	$\sigma_{u,f}$	[MPa]	1298	1159
	Ultimate Strain	$\varepsilon_{u,f}$	[%]	1,80	1,65
	Average elastic modulus	E_f	[GPa]	72	
BASALNET STEEL 300	Ultimate Stress	$\sigma_{u,f}$	[MPa]	1466	1327
	Ultimate Strain	$\varepsilon_{u,f}$	[%]	2,10	1,95
	Average elastic modulus	E_f	[GPa]	65	-
BASALNET STEEL 500	Ultimate Stress	$\sigma_{u,f}$	[MPa]	1446	1270
	Ultimate Strain	$\varepsilon_{u,f}$	[%]	2,26	2,05
	Average elastic modulus	E_f	[GPa]	73	-
CARBONET 250-15	Ultimate Stress	$\sigma_{u,f}$	[MPa]	3495	3240
	Ultimate Strain	$\varepsilon_{u,f}$	[%]	1,59	1,25
	Average elastic modulus	E_f	[GPa]	223	-

Table C12: Conventional limit strain						
Description	**Symbol**	**Unit**	**Substrate**	**System**	**Average value**	**Characteristic value**
Conventional limit strain	$\varepsilon_{lim,\ conv}$	[%]	**Brick**	**GLASSNET 230-28 + BETONTIX 215 (G-NET-230/2)**	1,61	1,30
				GLASSNET 230-28 + BETONTIX 415 (G-NET-230/4)	1,82	1,46
				BASALNET L130 + BETONTIX 215 (B-NET-130/2)	1,57	1,24
				BASALNET L130 + BETONTIX 415 (B-NET-130/4)	1,76	1,40
				BASALNET L200 + BETONTIX 215 (B-NET-200/2)	1,41	1,17
				BASALNET L200 + BETONTIX 415 (B-NET-200/4)	1,59	1,31
				BASALNET L400 + BETONTIX 215 (B-NET-400/2)	1,32	1,12
				BASALNET L400 + BETONTIX 415 (B-NET-400/4)	1,48	1,25
				BASALNET STEEL 300 + BETONTIX 215 (B-STEEL-300/2)	1,36	1,14
				BASALNET STEEL 300 + BETONTIX 415 (B-STEEL-300/4)	1,54	1,28
				BASALNET STEEL 500 + BETONTIX 215 (B-STEEL-500/2)	1,31	1,13
				BASALNET STEEL 500 + BETONTIX 415 (B-STEEL-500/4)	1,47	1,27
				CARBONET 250-15 + BETONTIX 215 (C-NET-250/2)	0,98	0,85
			Stone	**GLASSNET 230-28 + BETONTIX 215 (G-NET-230/2)**	1,59	1,28
				GLASSNET 230-28 + BETONTIX 415 (G-NET-230/4)	1,78	1,45
				BASALNET L130 + BETONTIX 215 (B-NET-130/2)	1,49	1,21
				BASALNET L130 + BETONTIX 415 (B-NET-130/4)	1,67	1,37
				BASALNET L200 + BETONTIX 215 (B-NET-200/2)	1,32	1,17
				BASALNET L200 + BETONTIX 415 (B-NET-200/4)	1,48	1,32
				BASALNET L400 + BETONTIX 215 (B-NET-400/2)	1,25	1,09
				BASALNET L400 + BETONTIX 415 (B-NET-400/4)	1,40	1,22
				BASALNET STEEL 300 + BETONTIX 215 (B-STEEL-300/2)	1,28	1,10
				BASALNET STEEL 300 + BETONTIX 415 (B-STEEL-300/4)	1,45	1,23
				BASALNET STEEL 500 + BETONTIX 215 (B-STEEL-500/2)	1,24	1,12
				BASALNET STEEL 500 + BETONTIX 415 (B-STEEL-500/4)	1,39	1,26
				CARBONET 250-15 + BETONTIX 215 (C-NET-250/2)	0,92	0,85
			Tuff	**GLASSNET 230-28 + BETONTIX 215 (G-NET-230/2)**	1,60	1,25
				GLASSNET 230-28 + BETONTIX 415 (G-NET-230/4)	1,81	1,40
				BASALNET L130 + BETONTIX 215 (B-NET-130/2)	1,53	1,29
				BASALNET L130 + BETONTIX 415 (B-NET-130/4)	1,73	1,45
				BASALNET L200 + BETONTIX 215 (B-NET-200/2)	1,35	1,31
				BASALNET L200 + BETONTIX 415 (B-NET-200/4)	1,53	1,47
				BASALNET L400 + BETONTIX 215 (B-NET-400/2)	1,28	1,10
				BASALNET L400 + BETONTIX 415 (B-NET-400/4)	1,43	1,24
				BASALNET STEEL 300 + BETONTIX 215 (B-STEEL-300/2)	1,30	1,05
				BASALNET STEEL 300 + BETONTIX 415 (B-STEEL-300/4)	1,46	1,18
				BASALNET STEEL 500 + BETONTIX 215 (B-STEEL-500/2)	1,26	1,01
				BASALNET STEEL 500 + BETONTIX 415 (B-STEEL-500/4)	1,41	1,13
				CARBONET 250-15 + BETONTIX 215 (C-NET-250/2)	0,75	0,60
			Concrete	**CARBONET 250-15 + BETONTIX 415 (C-NET-250/4)**	1,21	0,94

Seico Compositi FRCM Systems	**Annex C12 of ETA N° 25/0247**
Performances: Conventional limit properties of composite system	