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DECLARATION OF PERFORMANCE No. 0483

1. Unique identification code of the product-type: **GeoSteel FRM**
(GeoSteel Grid 400 and Geocalce F Antisismico)
2. Intended use/es: **The FRM kit is suitable for strengthening and seismic upgrade of clay, tuff and natural stone masonry elements and structures.**
3. Manufacturer: **Kerakoll S.p.A Via dell'Artigianato, 9 - 41049 Sassuolo (MO) Italia**
4. System/s of AVCP: **System 2+**
5. European Assessment Document: **EAD 340275-00-0104, January 2018**
European Technical Assessment : **ETA-19/0326 of 13/07/2022**
Technical Assessment Body: **ITC CNR**
Notified body/ies: **ITC n°0970**
6. Declared performance/s:
 - Characteristic value for tensile strength and tensile strain
 - Average value for modulus of elasticity

Essential characteristics	Performance
Reaction to fire	Class A1
GeoSteel Grid 400 – Geocalce F Antisismico	See Annex A

The performance of the product identified above is in conformity with the set of declared performance/s. This declaration of performance is issued, in accordance with Regulation (EU) No 305/2011, under the sole responsibility of the manufacturer identified above.

Signed for and on behalf of the manufacturer by: **Romano Sghedoni (legal representative)**

At Sassuolo, on 29/07/2022

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Annex A – GeoSteel Grid 400-Geocalce F Antisismico

Essential characteristics			Performance	
			Average value	Characteristic value
Tensile strength (σ_u)	WEFT		1268 MPa	1160 MPa
Strain (ϵ_u)	WEFT		1,77 %	1,52 %
Stress-strain curve (E)	WEFT	Elastic modulus of stage A	870 GPa	196 GPa
		Stiffness modulus in stage C	67 GPa	54 GPa
Interlaminar shear strength (τ)			0.90 MPa	0.75 MPa
Lap tensile strength (σ_{lap})	Tested Overlap length $l_{lap}=300\text{ mm}$		1125 MPa	921 MPa
Bond strength on substrate CLAY: pull-off test	Ambient		0.80 MPa	-
	Water	1000 h	0.79 MPa	-
		3000 h	0.86 MPa	-
	saltwater	1000 h	1.02 MPa	-
		3000 h	0.96 MPa	-
	alkali	1000 h	0.81 MPa	-
3000 h		0.72 MPa	-	
Bond strength on substrate TUFF: pull-off test	Ambient		0.23 MPa	-
	Water	1000 h	0.20 MPa	-
		3000 h	0.23 MPa	-
	saltwater	1000 h	0.21 MPa	-
		3000 h	0.28 MPa	-
	alkali	1000 h	0.24 MPa	-
3000 h		0.20 MPa	-	
Bond strength on substrate CLAY: single-lap shear test (failure mode FR)	ambient		P_{max} 3004 N P_{deb} - ⁽¹⁾ $\sigma_{lim,conv}$ 1043 MPa	P_{max} 2461 N P_{deb} - ⁽¹⁾ $\sigma_{lim,conv}$ 854 MPa
	Water	1000 h	2990 N	-
		3000 h	2833 N	-
	saltwater	1000 h	2954 N	-
		3000 h	NPA	-
	alkali	1000 h	2601 N	-
3000 h		NPA	-	

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Essential characteristics		Performance		
		Average value	Characteristic value	
Bond strength on substrate TUFF: single-lap shear test (failure mode FR)	ambient	P_{max} 3601 N P_{deb} - ⁽¹⁾ $\sigma_{lim,conv}$ 1250 MPa	P_{max} 3087 N P_{deb} - ⁽¹⁾ $\sigma_{lim,conv}$ 1071 MPa	
	Water, saltwater and alkali conditioning	NPA	NPA	
Bond strength on substrate NATURAL STONE: single-lap shear test (failure mode FR)	Ambient	P_{max} 2253 N P_{deb} - ⁽¹⁾ $\sigma_{lim,conv}$ 782 MPa	P_{max} 1933 N P_{deb} - ⁽¹⁾ $\sigma_{lim,conv}$ 670 MPa	
	Water, saltwater and alkali conditioning	NPA	NPA	
Freezing and Thawing	Direct tension	Tensile strength $\sigma_{u,FT}$ Strain $\epsilon_{u,FT}$ Stiffness moduli E_{1FT} Stiffness moduli E_{3FT} Inter. shear strength (τ_{FT})	1102 MPa 1.43 % 1332 GPa 69 GPa 0.93 MPa	932 MPa 0.97 % 739 GPa 66 GPa 0.71 MPa
	Retained properties	Tensile strength $\sigma_{u,FT,ret}$ Stiffness moduli $E_{1FT,ret}$ Stiffness moduli $E_{3FT,ret}$ Inter. shear strength ($\tau_{FT,ret}$)	87 % 153 % 104 % 104 %	-
Water resistance	Direct tension (1000 h)	Tensile strength $\sigma_{u,w}$ Strain $\epsilon_{u,w}$ Stiffness moduli E_{1w} Stiffness moduli E_{3w} Inter. shear strength (τ_w) Lap tensile ($\sigma_{lap,w}$)	1071 MPa 1.37 % 1197 GPa 71 GPa 0.80 MPa 995 MPa	924 MPa 1.01 % 479 GPa 68 GPa 0.71 MPa 851 MPa
	Direct tension (3000 h)	Tensile strength $\sigma_{u,w}$ Strain $\epsilon_{u,w}$ Stiffness moduli E_{1w} Stiffness moduli E_{3w} Inter. shear strength (τ_w) Lap tensile ($\sigma_{lap,w}$)	1075 MPa 1.34 % 1106 GPa 72 GPa 0.79 MPa 1005 MPa	843 MPa 0.82 % 567 GPa 69 GPa 0.70 MPa 815 MPa
	Retained properties (1000 h)	Tensile strength $\sigma_{u,w,ret}$ Stiffness moduli $E_{1w,ret}$ Stiffness moduli $E_{3w,ret}$ Inter. shear strength ($\tau_{w,ret}$) Lap tensile ($\sigma_{lap,w,ret}$)	85 % 138 % 105 % 89 % 88 %	-
	Retained properties (3000 h)	Tensile strength $\sigma_{u,w,ret}$ Stiffness moduli $E_{1w,ret}$ Stiffness moduli $E_{3w,ret}$ Inter. shear strength ($\tau_{w,ret}$) Lap tensile ($\sigma_{lap,w,ret}$)	85 % 127 % 106 % 87 % 109 %	-

(1) Rupture of fibres was observed outside the bonded length, therefore no value for the bond capacity is indicated

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Essential characteristics		Performance		
			Average value	Characteristic value
Saltwater resistance	Direct tension (1000 h)	Tensile strength $\sigma_{u,sw}$ Strain $\varepsilon_{u,sw}$ Stiffness moduli $E_{1,sw}$ Stiffness moduli $E_{3,sw}$ Inter. shear strength (τ_{sw})	929 MPa 1.16 % 1595 GPa 70 GPa 1.04 MPa	794 MPa 0.96 % 878 GPa 67 GPa 0.86 MPa
	Direct tension (3000 h)	Tensile strength $\sigma_{u,sw}$ Strain $\varepsilon_{u,sw}$ Stiffness moduli $E_{1,sw}$ Stiffness moduli $E_{3,sw}$ Inter. shear strength (τ_{sw})	895 MPa 1.12 % 1473 GPa 74 GPa 1.17 MPa	768 MPa 0.78 % 464 GPa 54 GPa 0.94 MPa
	Retained properties (1000 h)	Tensile strength $\sigma_{u,w,ret}$ Stiffness moduli $E_{1,w,ret}$ Stiffness moduli $E_{3,w,ret}$ Inter. shear strength ($\tau_{sw,ret}$)	73 % 183 % 104 % 115 %	-
	Retained properties (3000 h)	Tensile strength $\sigma_{u,sw,ret}$ Stiffness moduli $E_{1,sw,ret}$ Stiffness moduli $E_{3,sw,ret}$ Inter. shear strength ($\tau_{sw,ret}$)	71 % 169 % 109 % 130 %	-
	Lap Tensile		NPA	NPA
Alkali resistance	Direct tension (1000 h)	Tensile strength $\sigma_{u,alk}$ Strain $\varepsilon_{u,alk}$ Stiffness moduli $E_{1,alk}$ Stiffness moduli $E_{3,alk}$ Inter. shear strength (τ_{alk})	1127 MPa 1.52 % 1441 GPa 68 GPa 0.85 MPa	1072 MPa 1.49 % 788 GPa 66 GPa 0.49 MPa
	Direct tension (3000 h)	Tensile strength $\sigma_{u,alk}$ Strain $\varepsilon_{u,alk}$ Stiffness moduli $E_{1,alk}$ Stiffness moduli $E_{3,alk}$ Inter. shear strength (τ_{alk})	1063 MPa 1.41 % 1510 GPa 69 GPa 1.10 MPa	1013 MPa 1.24 % 679 GPa 65 GPa 0.83 MPa
	Retained properties (1000 h)	Tensile strength $\sigma_{u,alk,ret}$ Stiffness moduli $E_{1,alk,ret}$ Stiffness moduli $E_{3,alk,ret}$ Inter. shear strength ($\tau_{alk,ret}$)	89 % 166 % 101 % 95 %	-
	Retained properties (3000 h)	Tensile strength $\sigma_{u,alk,ret}$ Stiffness moduli $E_{1,alk,ret}$ Stiffness moduli $E_{3,alk,ret}$ Inter. shear strength ($\tau_{alk,ret}$)	84 % 173 % 102 % 122 %	-
	Lap Tensile		NPA	NPA
Alkali soil resistance	Direct tension (1000 h)	Tensile strength $\sigma_{u,soil}$ Strain $\varepsilon_{u,soil}$ Stiffness moduli $E_{1,soil}$ Stiffness moduli $E_{3,soil}$	985 MPa 1.15 % 1033 GPa; 69 GPa	840 MPa 1.00 % 863 GPa; 65 GPa
	Retained properties (1000 h)	Tensile strength $\sigma_{u,soil,ret}$ Stiffness moduli $E_{1,soil,ret}$ Stiffness moduli $E_{3,soil,ret}$	78 % 119 % 102 %	-

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Essential characteristics		Performance		
			Average value	Characteristic value
Dry heat resistance	Direct tension (1000 h)	Tensile strength $\sigma_{u, heat}$ Strain $\epsilon_{u, heat}$ Stiffness moduli $E_{1, heat}$ Stiffness moduli $E_{3, heat}$	1073 MPa 1.29 % 1683 GPa; 72 GPa	808 MPa 0.80 % 1082 GPa; 65 GPa
	Retained properties (1000 h)	Tensile strength $\sigma_{u, heat, ret}$ Stiffness moduli $E_{1, heat, ret}$ Stiffness moduli $E_{3, heat, ret}$	85 % 193 % 107 %	-
	Direct tension (3000 h)	Tensile strength $\sigma_{u, heat}$ Strain $\epsilon_{u, heat}$ Stiffness moduli $E_{1, heat}$ Stiffness moduli $E_{3, heat}$	NPA	NPA
	Retained properties (3000 h)	Tensile strength $\sigma_{u, heat, ret}$ Stiffness moduli $E_{1, heat, ret}$ Stiffness moduli $E_{3, heat, ret}$	NPA	NPA
Fuel resistance	Direct tension	Tensile strength $\sigma_{u, fuel}$ Strain $\epsilon_{u, fuel}$ Stiffness moduli $E_{1, fuel}$ Stiffness moduli $E_{3, fuel}$	1233 MPa, 1.74 % 1213 GPa, 69 GPa;	1125 MPa, 1.41 % 571 GPa, 62 GPa;
	Retained properties	Tensile strength $\sigma_{u, fuel, ret}$ Stiffness moduli $E_{1, fuel, ret}$ Stiffness moduli $E_{3, fuel, ret}$	97% 66% 92 %	-
Creep behaviour related to the adhesion on substrate	Substrate: clay	Displacement vs time (tabular) Maximum load $P_{max, creep}$ Bond capacity $P_{deb, creep}$	0.047 mm 3094 N (1)	- 1528 N (1)
	Substrate: tuff	Displacement vs time (tabular) Maximum load $P_{max, creep}$ Bond capacity $P_{deb, creep}$	0.030 mm 3364 N (1)	- 2808 N (1)
Tensile strength after long term actions (creep)			NPA	NPA
Tensile strength after low number of cycles (seismic behaviour) - WEFT			NPA	NPA
Tensile strength after high number of cycles (fatigue actions)			NPA	NPA
Mechanical properties of fabric		Ultimate stress $\sigma_{u, f}$ Ultimate strain $\epsilon_{u, f}$ Mean elastic modulus E_f	1479 MPa 2,17 % 67 GPa	1280 MPa 1,74 % 55 GPa
	Substrate: clay	Conventional limit strain $\epsilon_{lim, conv}$	1,55 %	1,27 %
	Substrate: tuff	Conventional limit strain $\epsilon_{lim, conv}$	1,85 %	1,59 %
	Substrate: Natural Stone	Conventional limit strain $\epsilon_{lim, conv}$	1,16 %	0,99 %
Tensile strength on bent fabric (for steel fabrics)			Not applicable	Not applicable

(1) Rupture of fibres was observed outside the bonded length, therefore no value for the bond capacity is indicated

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