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## DECLARATION OF PERFORMANCE No. 0482

1. Unique identification code of the product-type: **GeoSteel FRM (GeoSteel Grid 200 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 Grid200 – 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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KERAKOLL Spa - Società con unico socio Fin Firel Spa - Soggetta a direzione e coordinamento di Fin-Firel Spa  
via dell'Artigianato, 9 - 41049 Sassuolo (MO) Italia - Tel +39 0536 816 511 - Fax +39 0536 816 581 - e-mail: info@kerakoll.com  
Rea MO n. 231812 - Reg. Imp. / Cod. Fisc. / P. Iva IT 01174510360 - Cap. Soc. € 2.000.000,00 i.v.



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## Annex A – GeoSteel Grid 200-Geocalce F Antisismico

Essential characteristics			Performance	
			Average value	Characteristic value
Tensile strength ( $\sigma_u$ )	WEFT		NPA	NPA
Strain ( $\epsilon_u$ )	WEFT		NPA	NPA
Stress-strain curve (E)	WEFT	Elastic modulus of stage A	6073 GPa	4049 GPa
		Stiffness modulus in stage C	NPA	NPA
Interlaminar shear strength ( $\tau$ )			0.24 MPa	0.12 MPa
Lap tensile strength ( $f_{lap}$ )	Tested Overlap length $l_{lap}=300$ mm		969 MPa	829 MPa
Bond strength on substrate CLAY: pull-off test	Ambient		1.70 MPa	-
	Water	1000 h	$f_h$ 1.59 MPa	-
		3000 h	$f_h$ 1.86 MPa	-
	saltwater	1000 h	$f_h$ 2.13 MPa	-
		3000 h	$f_h$ 2.18 MPa	-
	alkali	1000 h	$f_h$ 1.82 MPa	-
3000 h		$f_h$ 2.02 MPa	-	
Bond strength on substrate TUFF: pull-off test	Ambient		0.40 MPa	-
	Water	1000 h	$f_h$ 0.51 MPa	-
		3000 h	$f_h$ 0.46 MPa	-
	saltwater	1000 h	$f_h$ 0.46 MPa	-
		3000 h	$f_h$ 0.54 MPa	-
	alkali	1000 h	$f_h$ 0.44 MPa	-
3000 h		$f_h$ 0.49 MPa	NPA	
Bond strength on substrate CLAY: single-lap shear test (failure mode FR)	ambient		$P_{max}$ 1799 N $P_{deb}$ - (1) $\sigma_{lim,conv}$ 1102 MPa	$P_{max}$ 1543 N $P_{deb}$ - (1) $\sigma_{lim,conv}$ 945 MPa
	Water	1000 h	NPA	-
		3000 h	$P_{max}$ 1377 N	-
	saltwater	1000 h	NPA	-
		3000 h	NPA	-
	alkali	1000 h	NPA	-
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		$P_{max}$ 1641 N $P_{deb}^{-(1)}$ $\sigma_{lim,conv}$ 1005 MPa	$P_{max}$ 1498 N $P_{deb}^{-(1)}$ $\sigma_{lim,conv}$ 917 MPa	
	Water	1000 h	$P_{max}$ 1369 N	-	
		3000 h	$P_{max}$ 1498 N	-	
	saltwater	1000 h	NPA	-	
		3000 h	NPA	-	
	alkali	1000 h	NPA	-	
		3000 h	NPA	-	
Bond strength on substrate NATURAL STONE: single-lap shear test (failure mode FR)	ambient		$P_{max}$ 1537 N $P_{deb}^{-(1)}$ $\sigma_{lim,conv}$ 942 MPa	$P_{max}$ 1421 N $P_{deb}^{-(1)}$ $\sigma_{lim,conv}$ 871 MPa	
	Water, saltwater and alkali conditioning		NPA	NPA	
Pull out from substrate			NPA	NPA	
Freezing and Thawing	Direct tension		Tensile strength $\sigma_{u,FT}$ Strain $\epsilon_{u,FT}$ Stiffness moduli $E_{1FT}; E_{3FT}$ Inter. shear strength ( $\tau_{FT}$ )	641 MPa NPA NPA 0.98 MPa	209 MPa NPA NPA 0.58 MPa
	Retained properties		Tensile strength $\sigma_{u,FT,ret}$ Stiffness moduli $E_{1FT,ret}; E_{3FT,ret}$ Inter. shear strength ( $\tau_{FT,ret}$ )	106 % NPA 408 %	-
Water resistance	Direct tension (1000 h)		Tensile strength $\sigma_{u,w}$ Strain $\epsilon_{u,w}$ Stiffness moduli $E_{1w}; E_{3w}$ Inter. shear strength ( $\tau_w$ )	565 MPa NPA NPA 0.29 MPa	333 MPa NPA NPA 0.24 MPa
	Direct tension (3000 h)		Tensile strength $\sigma_{u,w}$ Strain $\epsilon_{u,w}$ Stiffness moduli $E_{1w}; E_{3w}$ Inter. shear strength ( $\tau_w$ )	696 MPa NPA NPA 1.24 MPa	319 MPa NPA NPA 0.82 MPa
	Retained properties (1000 h)		Tensile strength $\sigma_{u,w,ret}$ Stiffness moduli $E_{1w,ret}; E_{3w,ret}$ Inter. shear strength ( $\tau_{w,ret}$ )	93 % NPA 122 %	-
	Retained properties (3000 h)		Tensile strength $\sigma_{u,w,ret}$ Stiffness moduli $E_{1w,ret}; E_{3w,ret}$ Inter. shear strength ( $\tau_{w,ret}$ )	115 % NPA 520 %	-

(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 $\epsilon_{u,sw}$ Stiffness moduli $E_{1,sw}; E_{3,sw}$ Inter. shear strength ( $\tau_{sw}$ )	662 MPa NPA NPA 0.45 MPa	335 MPa NPA NPA 0.30 MPa
	Direct tension (3000 h)	Tensile strength $\sigma_{u,sw}$ Strain $\epsilon_{u,sw}$ Stiffness moduli $E_{1,sw}; E_{3,sw}$ Inter. shear strength ( $\tau_{sw}$ )	749 MPa NPA NPA 1.01 MPa	225 MPa NPA NPA 0.68 MPa
	Retained properties (1000 h)	Tensile strength $\sigma_{u,w,ret}$ Stiffness moduli $E_{1,w,ret}; E_{3,w,ret}$ Inter. shear strength ( $\tau_{sw,ret}$ )	109 % NPA 188 %	-
	Retained properties (3000 h)	Tensile strength $\sigma_{u,sw,ret}$ Stiffness moduli $E_{1,sw,ret}; E_{3,sw,ret}$ Inter. shear strength ( $\tau_{sw,ret}$ )	123 % NPA 422 %	-
Alkali resistance	Direct tension (1000 h)	Tensile strength $\sigma_{u,alk}$ Strain $\epsilon_{u,alk}$ Stiffness moduli $E_{1,alk}; E_{3,alk}$ Inter. shear strength ( $\tau_{alk}$ )	650 MPa NPA NPA 0.41 MPa	300 MPa NPA NPA 0.35 MPa
	Direct tension (3000 h)	Tensile strength $\sigma_{u,alk}$ Strain $\epsilon_{u,alk}$ Stiffness moduli $E_{1,alk}; E_{3,alk}$ Inter. shear strength ( $\tau_{alk}$ )	755 MPa NPA NPA 0.96 MPa	394 MPa NPA NPA 0.84 MPa
	Retained properties (1000 h)	Tensile strength $\sigma_{u,alk,ret}$ Stiffness moduli $E_{1,alk,ret}; E_{3,alk,ret}$ Inter. shear strength ( $\tau_{alk,ret}$ )	107 % NPA 170 %	-
	Retained properties (3000 h)	Tensile strength $\sigma_{u,alk,ret}$ Stiffness moduli $E_{1,alk,ret}; E_{3,alk,ret}$ Inter. shear strength ( $\tau_{alk,ret}$ )	124 % NPA 399 %	-
Alkali soil resistance	Direct tension (1000 h)	Tensile strength $\sigma_{u,soil}$ Strain $\epsilon_{u,soil}$ Stiffness moduli $E_{1,soil}$ Stiffness moduli $E_{3,soil}$	931 MPa 0.96 % 6147 GPa 73 GPa	582 MPa NPA 5134 GPa NPA
	Retained properties (1000 h)	Tensile strength $\sigma_{u,soil,ret}$ Stiffness moduli $E_{1,soil,ret}$ Stiffness moduli $E_{3,soil,ret}$	153 % 101 % 131 %	-
Dry heat resistance	Direct tension (1000 h)	Tensile strength $\sigma_{u,heat}$ Strain $\epsilon_{u,heat}$ Stiffness moduli $E_{1,heat}$ Stiffness moduli $E_{3,heat}$	778 MPa NPA 6795 GPa NPA	639 MPa NPA 5942 GPa NPA
	Retained properties (1000 h)	Tensile strength $\sigma_{u,heat,ret}$ Stiffness moduli $E_{1,heat,ret}$ Stiffness moduli $E_{3,heat,ret}$	128 % 112 % NPA	-
	Direct tension (3000 h)	Tensile strength $\sigma_{u,heat}$ Strain $\epsilon_{u,heat}$ Stiffness moduli $E_{1,heat}$ Stiffness moduli $E_{3,heat}$	866 MPa 1.08 % 5615 GPa; 56 GPa	593 MPa NPA 5150 GPa; NPA
	Retained properties (3000 h)	Tensile strength $\sigma_{u,heat,ret}$ Stiffness moduli $E_{1,heat,ret}$ Stiffness moduli $E_{3,heat,ret}$	143 % 92 % 101 %	-

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Essential characteristics	Performance				
			Average value	Characteristic value	
Fuel resistance			NPA	NPA	
Creep behaviour related to the adhesion on substrate	Substrate: clay	Displacement vs time (tabular) Maximum load $P_{max, creep}$ Bond capacity $P_{deb, creep}$	0.040 mm 1488 N - (1)	- 575 N -	
	Substrate: tuff	Displacement vs time (tabular) Maximum load $P_{max, creep}$ Bond capacity $P_{deb, creep}$	0.027 mm 1455 N - (1)	- 767 N -	
Tensile strength after long term actions (creep)	100 h	Direct tension	Tensile strength $\sigma_{u, creep}$ Strain $\epsilon_{u, creep}$ Stiffness moduli $E_{3, creep}$	903 MPa 1.02 % 76 GPa;	-
		Retained properties	Tensile strength $\sigma_{u, creep, ret}$ Stiffness moduli $E_{3, creep, ret}$	149 % NPA	-
	500 h	Direct tension	Tensile strength $\sigma_{u, creep}$ Strain $\epsilon_{u, creep}$ Stiffness moduli $E_{3, creep}$	862 MPa 1.23 % 70 GPa	-
		Retained properties	Tensile strength $\sigma_{u, creep, ret}$ Stiffness moduli $E_{3, creep, ret}$	142 % NPA	-
	1000 h	Direct tension	Tensile strength $\sigma_{u, creep} \geq$ Strain $\epsilon_{u, creep}$ Stiffness moduli $E_{3, creep}$	896 MPa 1.11 % 74 GPa	-
		Retained properties	Tensile strength $\sigma_{u, creep, ret}$ Stiffness moduli $E_{3, creep, ret}$	147 % NPA	-
	4000 h	Direct tension	Tensile strength $\sigma_{u, creep}$ Strain $\epsilon_{u, creep}$ Stiffness moduli $E_{3, creep}$	893 MPa 1.11 % 68 GPa	-
		Retained properties	Tensile strength $\sigma_{u, creep, ret}$ Stiffness moduli $E_{3, creep, ret}$	147 % NPA	-
Tensile strength after low number of cycles (seismic behaviour) - WEFT		Tensile strength $\sigma_{u, seismic}$ Strain $\epsilon_{u, seismic}$ Stiffness moduli $E_{1, seismic, ret}$ Stiffness moduli $E_{3, seismic, ret}$	1071 MPa 1.34 % 1104 GPa 71 GPa	948 MPa 1.11 % 391 GPa 61 GPa	
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 $E_r$	1341 MPa 2,22 % 62 GPa	1227 MPa 1,80 % 44 GPa	
	Substrate: clay	Conventional limit strain $\epsilon_{lim, conv}$	1,78 %	1,52 %	
	Substrate: tuff	Conventional limit strain $\epsilon_{lim, conv}$	1,62 %	1,48 %	
	Substrate: Natural Stone	Conventional limit strain $\epsilon_{lim, conv}$	1,52 %	1,40 %	
Tensile strength on bent fabric (for steel fabrics)			Not applicable	Not applicable	

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