

Standard Epoxy High Strength Anchoring Adhesive



1. Introduction

KEM ES is a standard epoxy anchoring adhesive for heavy-duty structural fixings.

The KEM ES epoxy provides high performances when anchoring threaded rods and rebar in cracked and uncracked concrete.

Working temperature: from -40 up to +70°C short period and from -40 up to +43°C long period.

Features:

- European Approval ETA-20/1282 for cracked concrete op.1 according to EAD 330499-01-0601
- European Approval ETA-20/1283 for post-installed rebar connection for static/quasi static load according to EAD 330087-00-0601
- Temperature range after curing: -40 / +43°C (max 70°C for short period)
- High chemical resistance of bonded resin
- Overhead installation

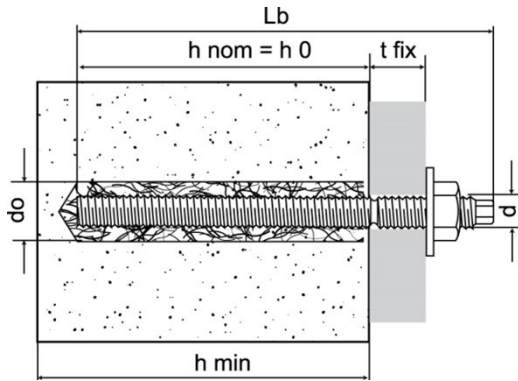
Safety data sheet available on web site www.strongtie.eu/sds

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2. Technical Data



- tfix = fixture thickness
- do = hole diameter
- h0 = minimum hole depth
- hnom = nominal embedment depth
- hmin = minimum support thickness
- Tmax = torque max
- Lb = threaded bar length
- d = threaded bar diameter
- Nr = approx. n° of trigger pulls per fixing

Resin range				
	Concrete	Post-installed Rebar	Diamond drilling	
KEM 935	CARTRIDGE – bi-component styrene free epoxy 585 ml			Cod. 9350100000

GUN - Injection gun	
Injection gun for 585 ml cartridge	Cod. 4993000000
Injection gun for 585 ml cartridge	Cod. 4993200000
MIX - Mixer nozzle	Cod. 9490400000
PUMP - Blow pump for hole cleaning	Cod. 4990500000
SPRAY TECNICO G82 - High pressure cleaner - 400ml	Cod. G8200

SCO - Brush for hole cleaning			
Brush Ø	For hole Ø	Total length	Cod.
14	10÷12	300	49999014300
20	14÷18	300	49999020300
30	20÷28	300	49999030300

BFK Threaded bar for solid materials							
Type d x L	tfix [mm]	Wrench - bar	Wrench - nut	Nr	Volume per fixing [ml]	Item code White zinc ptd.	Item code Stainless steel A4
M8x110	15	5	13	1	4	21911b08110	21911x08110
M10x130	25	7	17	2	6	21911b10130	21911x10130
M12x160	30	8	19	3	10	21911b12160	21911x12160
M16x190	40	12	24	5	18	21911b16190	21911x16190
M20x240*	45	13	30	10	45	21911b20240	
M20x260	65	13	30	10	45		21911x20260
M24x300	60	13	36	20	70	21911b24300	21911x24300
M30x380*	70	13	46	40	150	21911b30380	21911x30380 ¹⁾

*Threaded bar without external hexagon
¹⁾ Inox Stainless steel A4-50

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3. Base Materials

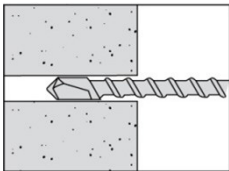
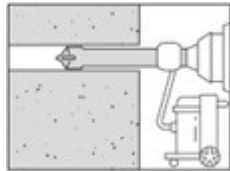
- Concrete
- Solid brick
- Honeycomb brick
- Cell like clay brick
- Light weight honeycomb brick
- Hollow dense aggregate block
- Hollow light aggregate block
- Aerated concrete
- Solid stone¹⁾
- Wood

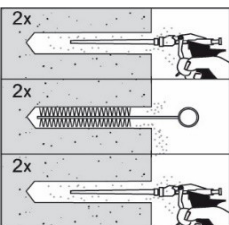
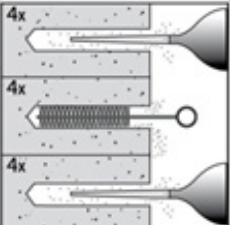
¹⁾ For application on natural stone or marble, carry out test and wait 24/48 hours for any reactions

- Suitable applications
- ◐ Partially suitable applications

4. Installation

Drilling methods	
HD	Hammer Drilling
HDB	Hollow Drill bit System
CD	Compressed air Drilling

1	Drilling (HD, HDB and CD methods)		
	<p>Drill using suitable drill bit</p>		<p>If hollow drill bit HDB according ETA is used no other borehole cleaning procedure is required</p>

2	Bore hole cleaning (HD and CD drilling methods) →		
	<p>COMPRESSED AIR 2x compressed air (min 6 bar) 2x brush 2x compressed air (min 6 bar)</p>		<p>MANUAL PUMP* 4x blows 4x brush 4x blows</p>

*only for uncracked concrete and for holes with diameter $d_b \leq 20\text{mm}$ e depth $h_b \leq 10d_{nom}$

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3	Resin injection and bar insertion
	<p>Pump resin to waste until the mix is an uniform colour before injecting resin.</p>
	<p>Insert threaded bar before the gel time stated on the packaging.</p>
	<p>Leave resin undisturbed for the curing time stated in the table on the packaging.</p>
	<p>Install the fixing and tighten.</p>

Base material °C	5°C	+ 10°C	+ 15°C	+ 20°C	+ 25°C	+ 35°C	+ 40°C
Gel time	80 min.	60 min.	40 min.	30 min.	12 min.	8 min.	8 min.
Curing time on dry base materials	60 h	48 h	24 h	12 h	10 h	7 h	4 h
Curing time on wet base materials	120 h	96 h	48 h	24 h	20 h	14 h	8 h

Cartridge temperature must be between +5°C and 40°C

5. Storage

- Store product in a cool and dry place at a temperature between +5°C and +35°C
- Simpson Strong-Tie guarantees the stability of the product in its unopened packaging for 24 months.

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6. Mechanical Properties

6.1 Resin Component			
UV Resistance		Pass	
Watertightness	DIN EN 12390-8	0	[mm]
Density		1,5	[kg / dm ³]
Compressive strength	EN 196 p.1	122	[N / mm ²]
Tensile strength	DIN EN ISO 527 p.2	44	[N / mm ²]
Flexural strength	EN 196 p.1	66	[N / mm ²]
E Modulus	DIN EN ISO 527 p.2	6300	[N / mm ²]
Shrinkage	DIN 52450	< 1,4	[%]
Hardness Shore A	DIN EN ISO 868	99,4	
Hardness Shore D	DIN EN ISO 868	86,1	
Electrical resistance	IEC 93	8,0 x 10 ¹²	[Ω]
Thermal conductivity	DIN EN 993 p.15	0,5	[W / m · K]
Thermal heat capacity	DIN EN 993 p.15	1350	[J / Kg · K]

Anchor on Concrete



ETA-20/1282

6.2 Metal Fixing Components		
Type	Material	Coating
BFK bar	steel grade 5.8	white zinc plated ≥ 5µm ISO 4042
Hex nut	DIN 934 grade 8	
Washer	DIN 125/1	
BFK bar A4	stainless steel grade A4 70	-
Nut A4	stainless steel grade DIN 934 - A4 70	
Washer A4	stainless steel grade DIN 125/1 - A4	

Anchor diameter		M8	M10	M12	M16	M20	M24	M27	M30		
Stressed cross-section	A _s	[mm ²]	36,6	58,0	84,3	157	245	353	459	561	
Recommended Bending moment	Barra/bar cl. 5.8	M _{5,8}	[Nm]	11	21	37	95	185	320	476	640
	Barra/bar cl. 8.8	M _{8,8}	[Nm]	17	34	60	152	297	513	762	1028
	Barra/bar cl. A4 70	M _{A470}	[Nm]	12	24	42	107	208	360	250 ^(*)	340 ^(*)

(*) Cl. A4-50 (M27-M30)

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7.1 STATIC and QUASI STATIC LOADS THREADED RODS



Single anchor with large anchor spacing and edge distances in concrete C20/25

ETA-20/1282

Design acc. EN 1992-4:2018 ($\gamma_c=1,5$; $\psi_{sus}=1$)

Threaded bar diameter gr. 5.8			M8	M10	M12	M16	M20	M24	M27	M30		
Hole diameter	d_o	[mm]	10	12	14	18	22	28	30	35		
Nominal embedment depth	h_{nom}	[mm]	80	90	110	125	170	210	240	270		
Tensile 24°C ³⁾	Cracked concrete	Characteristic	$N_{R,cr}$	[kN]	14,1	19,8	29,0	44,0	74,8	95,0	122,1	152,7
		Design	$N_{rd,cr}$ ¹⁾	[kN]	6,7	9,4	13,8	20,9	35,6	45,2	58,2	72,7
		Recommended	N_{cr} ²⁾	[kN]	4,8	6,7	9,9	15,0	25,4	32,3	41,5	51,9
	Un-cracked concrete	Characteristic	$N_{R,ucr}$	[kN]	18,3	29,0	56,7	68,7	109,0	149,7	182,9	218,2
		Design	$N_{rd,ucr}$ ¹⁾	[kN]	12,2	19,3	27,0	32,7	51,9	71,3	87,1	103,9
		Recommended	N_{ucr} ²⁾	[kN]	8,7	13,8	19,3	23,4	37,1	50,9	62,2	74,2
Edge distance	$C_{cr,N}$	[mm]	120	135	165	190	255	315	360	405		
Spacing	$S_{cr,N}$	[mm]	$2 \cdot C_{cr,N}$									
Minimum support thickness	h_{min}	[mm]	$h_{ef} + 30 \text{ mm} \geq 100 \text{ mm}$				$h_{ef} + 2 \cdot d_o$					
Torque max	T_{max}	[Nm]	10	20	40	60	100	170	250	300		

Threaded bar diameter			M8	M10	M12	M16	M20	M24	M27	M30			
Shear ⁴⁾	$C \geq 10x_{nom}$	cl.5.8	Characteristic	$V_{R,5.8}$	[kN]	11,0	17,4	25,3	47,1	73,5	105,9	137,7	168,3
			Design	$V_{rd,5.8}$ ¹⁾	[kN]	8,8	13,9	20,2	37,7	58,8	84,7	110,1	134,6
			Recommended	$V_{5.8}$ ²⁾	[kN]	6,3	9,9	14,4	26,9	42,0	60,5	78,7	96,2
		cl.8.8	Characteristic	$V_{R,8.8}$	[kN]	14,8	23,2	33,6	62,8	98,0	141,0	183,6	224,0
			Design	$V_{rd,8.8}$ ¹⁾	[kN]	11,8	18,6	26,9	50,2	78,4	113,0	146,9	179,5
			Recommended	$V_{8.8}$ ²⁾	[kN]	8,4	13,3	19,2	35,9	56,0	80,7	104,9	128,2
		cl.A4-70	Characteristic	$V_{R,A4-70}$	[kN]	12,8	20,3	29,5	55,0	85,8	123,6	114,8	140,3
			Design	$V_{rd,A4-70}$ ¹⁾	[kN]	8,3	13,1	19,0	35,4	55,3	79,7	48,2 ⁵⁾	58,9 ⁵⁾
			Recommended	V_{A4-70} ²⁾	[kN]	5,9	9,3	13,6	25,3	39,5	56,9	34,4 ⁵⁾	42,1 ⁵⁾

1kN \cong 100 kgf (Red values = steel failure)

¹⁾ Design loads include γ_M see ETA

²⁾ Recommended loads included $\gamma_M \times \gamma_F$ see ETA, with $\gamma_F = 1.4$

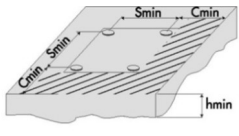
³⁾ For higher temperatures and for flooded bore holes see the certification ETA-20/1282

⁴⁾ Value of pure shear with distance from the edge $C \geq 10 \cdot h_{nom}$

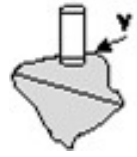
⁵⁾ cl. A4-50 (M27-M30)

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Minimum installation distances

Anchor diameter				M8	M10	M12	M16	M20	M24	M27	M30
	Minimum distance form edge	C_{min}	[mm]	35	40	45	50	60	65	75	80
	Minimum distance between anchors	S_{min}	[mm]	40	50	60	75	95	115	125	140

Shear load across the edge concrete C20/25 at a distance of C_{min}

Anchor diameter				M8	M10	M12	M16	M20	M24	M27	M30
	Cracked concrete	$V_{rd,cmin}$	[kN]	2,0	2,6	3,2	4,1	5,9	7,3	9,3	10,7
		V_{cmin}	[kN]	1,4	1,8	2,3	2,9	4,2	5,2	6,6	7,7

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7.2 STATIC and QUASI STATIC LOADS REBAR as ANCHORS



Single anchor with large anchor spacing and edge distances in concrete C20/25

ETA-20/1284

Design acc. EN 1992-4:2018 ($\gamma_c=1,5$; $\psi_{sUS}=1$)

Rebar diameter B500 ⁵⁾ (EN 10080)			Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø28	Ø32		
Nominal embedment depth			h_{nom}	[mm]	80	90	110	115	125	170	210	250	280
Hole diameter			d_o	[mm]	12	14	16	18	20	25	32	35	40
Tensile 24°C ³⁾	Cracked concrete	Characteristic	$N_{R,cr}$	[kN]	12,1	19,8	29,0	32,9	40,8	64,1	99,0	120,9	154,8
		Design	$N_{rd,cr}^{1)}$	[kN]	5,7	9,4	13,8	15,7	19,4	30,5	47,1	57,6	73,7
		Recommended	$N_{cr}^{2)}$	[kN]	4,1	6,7	9,9	11,2	13,9	21,8	33,7	41,1	52,7
	Un-cracked concrete	Characteristic	$N_{R,ucr}$	[kN]	28,1	39,6	58,1	60,7	68,7	109,0	149,7	194,4	230,5
		Design	$N_{rd,ucr}^{1)}$	[kN]	13,4	18,8	27,0	28,9	32,7	51,9	71,3	92,6	109,8
		Recommended	$N_{ucr}^{2)}$	[kN]	9,6	13,5	19,3	20,6	23,4	37,1	50,9	66,1	78,4
Edge distance			$C_{cr,N}$	[mm]	120	135	165	175	190	255	315	375	420
Spacing			$S_{cr,N}$	[mm]	$2 \cdot C_{cr,N}$								
Minimum support thickness			h_{min}	[mm]	$h_{ef} + 30 \text{ mm}$ $\geq 100 \text{ mm}$		$h_{ef} + 2 \cdot d_o$						
Minimum distance from edge			C_{min}	[mm]	35	40	45	50	50	60	70	75	85
Minimum distance between anchors			S_{min}	[mm]	40	50	60	70	75	95	120	130	150

Rebar diameter				Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø28	Ø32		
Shear ⁴⁾	$C \geq 10 \cdot h_{nom}$	Rebar B400 ⁵⁾	Characteristic	$V_{R,B400}$	[kN]	11,0	17,3	24,9	33,9	44,2	69,1	108,0	135,5	176,9
			Design	$V_{rd,B400}^{1)}$	[kN]	7,3	11,5	16,6	22,6	29,5	46,1	72,0	90,3	117,9
			Recommended	$V_{B400}^{2)}$	[kN]	5,2	8,2	11,9	16,1	21,1	32,9	51,4	64,5	84,3
		Rebar B500 ⁵⁾	Characteristic	$V_{R,B500}$	[kN]	13,8	21,6	31,1	42,3	55,3	86,4	135,0	169,3	221,2
			Design	$V_{rd,B500}^{1)}$	[kN]	9,2	14,4	20,7	28,2	36,9	57,6	90,0	112,9	147,5
			Recommended	$V_{B500}^{2)}$	[kN]	6,6	10,3	14,8	20,2	26,3	41,1	64,3	80,6	105,3

1kN \cong 100 kgf (Red values = steel failure)

- ¹⁾ Design loads include γ_M see ETA
- ²⁾ Recommended loads included $\gamma_M \times \gamma_F$ see ETA, with $\gamma_F = 1,4$
- ³⁾ For higher temperatures and for flooded bore holes see the certification ETA-20/1282
- ⁴⁾ Value of pure shear with distance from the edge $C \geq 10 \cdot h_{nom}$
- ⁵⁾ Calculation carried out considering $f_{uk}/f_{yk} = 1,10$ see EC2-Annex C

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7.3 POST-INSTALLED REINFORCING BARS



ETA-21/0802

APPLICATION EXAMPLES

<p>Overlapping joints for rebar connections of slabs and beams</p>	
<p>Overlapping joints at a foundation of a wall or column where the rebars are stressed in tension</p>	
<p>End anchoring of slabs or beams</p>	
<p>Rebar connection for components stressed primarily in compression</p>	
<p>Anchoring of reinforcement to cover the line of acting tensile force</p>	

Note: in the figures above no transverse reinforcement is represented, the transverse reinforcement as required by EC2 shall be present, furthermore the shear transfer between old and new concrete shall be designed according to EC2.

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8. DESIGN VALUES of BOND RESISTANCE (static/quasi static and seismic load)



Design acc. to EN1992-1-1:2004+AC2010, EN 1992-1-2:2004+AC:2008 and Annex B2 and B3 of ETA-20/1283

ETA-20/1283

Post-installed rebar connection				Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø22	Ø24	Ø25	Ø28	Ø32	
Hole diameter	d _o	HD / DD / HDB	[mm]	12	14	16	18	20	25	28	32	32	35	40	
		CD		-	-	16	18	20	26	28	32	32	35	40	
Max embedment depth l _{v,MAX}		HD / CD / DD	[mm]	800	1000	1300			1000						
		HDB		800	1000										
Min anchorage depth	ℓ _{b,MIN}		[mm]	Eq. 8.6 – Eq. 8.7 EN 1992-1-1:2004+AC2010											
Min overlap length	ℓ _{o,MIN}		[mm]	Eq. 8.11 EN 1992-1-1:2004+AC2010											
Amplification factor	α _b	C12/15 - C50/60	HD / CD / HDB	1,0											
			DD	1,5											
Minimum spacing	s _{min}		[mm]	≥ 5·Ø ≥ 50 mm											
Minimum concrete cover min C	Without Drilling Aid		[mm]	1) ³ 30 mm + 0,06·lv ≥ 2·Ø								1) ³ 40 mm + 0,06·lv ≥ 2Ø			
				2) 50 mm + 0,08·lv								2) 60 mm + 0,08·lv ≥ 2Ø			
	1) ³ 30 mm + 0,02·lv ≥ 2·Ø								1) ³ 40 mm + 0,02·lv ≥ 2Ø						
	2) 50 mm + 0,02·lv								2) 60 mm + 0,02·lv ≥ 2Ø						
	With Drilling Aid			4) 30 mm + 0,02·lv ≥ 2·Ø								4) 40 mm + 0,02·lv ≥ 2Ø			

DESIGN of BOND RESISTANCE [N/mm ²]				Concrete class EN206							
f _{bd,PIR} = f _{bd} · k _b				C12/15	C16/20	C20/25	C25/30	C30/37	C40/50	C45/55	C50/60
for good bond conditions	f _{bd,PIR}	HD / CD / HDB	Ø8- Ø32	1,6	2,0	2,3	2,7	3,0	3,7	4,0	4,3
		DD	Ø8- Ø32	1,6	2,0	2,3	2,7				
reduction factor for all drilling methods	k _b	HD / CD / HDB		1,0							
		DD		1,0				0,90	0,73	0,68	0,63
factor "for all other bond conditions"	η ₁			0,7							
Under FIRE EXPOSURE	f _{bd,fi}		[N/mm ²]	f _{bd,fi} = k _η (θ) · f _{bd,PIR} · γ _c / γ _{M,fi} ⁵⁾							

- 1) HD= hammer drilling;
- 2) CD= compressed air drilling;
- 3) HDB= hammer drilling with hollow drill bit;
- 4) DD= diamond drilling;
- 5) With:

$$k_{\eta}(\theta) = k_{fi} \cdot 100y(\theta) = 5862 \cdot \theta^{(-1,598)} / (f_{bd,PIR})^{(-4,3)} \leq 1,0 \quad \text{for } \theta \leq 140^{\circ}$$

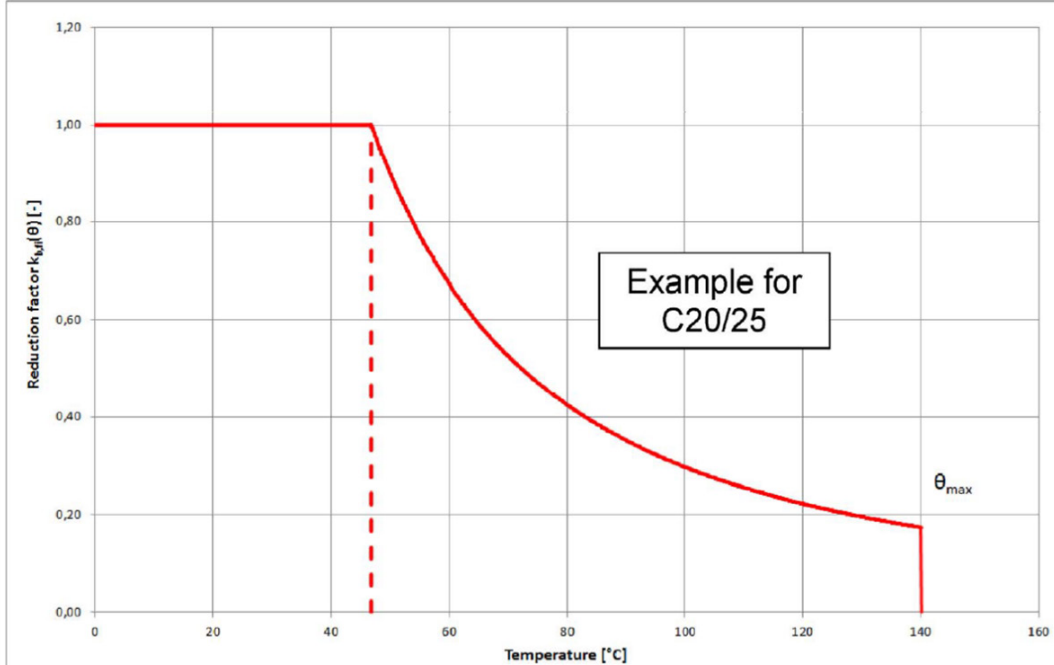
$$k_{\eta}(\theta) = k_{fi} \cdot 100y(\theta) = 0 \quad \text{for } \theta > 140^{\circ}$$

γ_c = 1,5 recommended safety factor acc.to EN 1992-1-1

γ_{M,fi} = 1,0 safety factor under fire exposure acc.to EN 1992-1-2

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Example graph of Reduction factor $k_{fi}(\theta)$ for concrete classes C20/25 for good bond conditions:



9. Resin Chemical Resistance

Chemical agent	Concentration	Resistant	Not resistant
Acetic acid	10		•
Acetone	5		•
Acetone / Acetone	100		•
Ethyl alcohol, aqueous solution	50		•
Ethyl alcohol, aqueous solution	100		•
Chlorinated lime	10		•
Citric acid	10		•
Chlorine water, swimming pool	All		•
Demineralized Water	All		•
Diesel oil	100	•	
Formic acid	10	•	
Formic acid	30		•
Fuel Oil		•	
Gasoline (premium grade)	100	•	
(Ethylene glycol)		•	
Hydraulic fluid			•
Hydrogen peroxide	10		•
Isopropyl alcohol	100		•
Lactic acid	All		•
Linseed oil	100	•	
Lubricating oil	100	•	
Nitric acid	10		•
Methanol	100		•
Phosphoric acid	10	•	
Phosphoric acid	85	•	
Calcium chloride, suspended in water		•	
Sea water, salty	All	•	
Sodium carbonate	All	•	
Sulfuric acid	All		•

Results shown in the table are applicable to brief period of chemical contact with full cured adhesive (e.g. temporary contact with adhesive during a spill)



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By purchasing the product, the user is required to scrupulously observe the instructions on the packaging and on the documentation relating to the product available on the website www.strongtie.eu. Simpson Strong-Tie will not be liable for any damage to persons or things that may be the consequence of a conservation or use other than those described.

The technical sheets (latest revision) of Simpson Strong-Tie products are available on the website www.strongtie.eu

In the case of translations, the official reference documents are those in Italian.