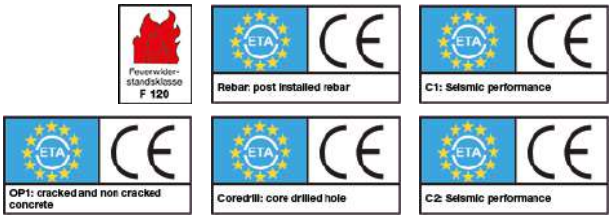
MAPEFIX EP 100

Epoxy resin for structural chemical anchor, including in seismic areas



WHERE TO USE

Mapefix EP 100 is an adhesive for chemically anchoring metal bars in holes drilled in building materials. It is a two-component, pure epoxy resin-based product containing no solvents. It is available in 585 ml bi-axial cartridges.
It is specifically formulated for anchoring threaded components and rebar made from steel and galvanized steel that transmit structural loads into solid substrates such as concrete, lightweight concrete, stone, wood and sound masonry.
It is also suitable for anchoring metal bars in tension and compression zones, in cracked or non-cracked concrete, including in areas at risk of seismic activity (C1 and C2 classes).
Also, because no stress is generated as with conventional mechanical expansion fasteners, it is an ideal solution for anchoring components close to edges or when there is a limited pitch between each anchor. The epoxy formulate **Mapefix EP 100** allows for extended workability times (see Table 1), thus making the resin ideal for anchoring in case of high surrounding temperatures or if the application needs to be interrupted.
The use of **Mapefix EP 100** is recommended for any kind of anchors on a horizontal, vertical or sloping axis and on ceilings, in tension and compression zones subjected to static and dynamic stresses and seismic loads. **Mapefix EP 100** may also be used for immersed and permanently damp anchors in marine and industrial surroundings exposed to aggressive chemicals. Application is allowed at temperatures between 0°C and +40°C, including on damp or wet substrates or in flooded holes. **Mapefix EP 100** may be used for smooth, rough, core-drilled holes or holes made with a hammer-drill, and anchors with big or small circular crests. **Mapefix EP 100** is recommended for anchoring elements and features such as:

- post-installed rebars;
- immersed anchors or in damp environments;
- underwater anchors;
- anchors in marine and industrial surroundings;
- rails of overhead cranes and tramways;
- industrial engines;
- antennas and signs;
- pylons;
- safety barriers;
- street guardrails.

TECHNICAL CHARACTERISTICS

Mapefix EP 100 is a two-component chemical anchor supplied in 585 ml bi-axial cartridges containing the two components A (resin) and B (catalyser) in their correct proportions.
The two components are mixed together when they are extruded through the static mixer supplied with the cartridge. The mixer is screwed to the end of the cartridge and no pre-mixing of the two components is required.
It is recommended to use all the product within the start setting time T_{gel} (see Table 1), to avoid wasting the material contained in the static mixer.
If only part of the cartridge is used, the remaining product may be used, even after a number of days, by replacing the original static mixer clogged by hardened resin with a clean, new mixer.

MAPEI

The 585 ml cartridges can be used with specific guns for bi-axial cartridges from the **Mapei Gun** range with manual, electric or pneumatic drive.
Mapefix EP 100 does not have a significant volumetric shrinkage, therefore it is also siuitable for large applications or with big circular crests.
Mapefix EP 100 is compatible with many kinds of building materials, such as:
- concrete in tension and compression zones;
- lightweight concrete;
- cellular concrete;
- calcium silicate elements;
- masonry, stone, rock, bricks;
- solid and hollow-core substrates;
- wood;
- stone.

Mapefix EP 100 is certified according to European standards ETA option 1 (anchors in concrete in tension and compression zones), ETA REBAR (anchors for supplementary reinforcement), ETA CORE DRILL option (anchors for core-drilled holes), ETA seismic performance classes C1 and C2 (for use in areas at risk of seismic activity) and resistance to fire.
Mapefix EP 100 performance characteristics contribute to extend the service life of the anchor to over 100 years.

RECOMMENDATIONS

- Do not use on dusty and crumbling surfaces.
- Do not use on surfaces which are dirty with oil, grease or stripping compounds, the bonding could be compromised or reduced.
- Store the packaging at the temperature range indicated in Table 1.
- Do not apply if the temperature of the air or substrate is lower than 0°C.
- Do not apply loads until it has completely hardened (see Table 1).

APPLICATION PROCEDURE

Anchor design

The size of the hole to be drilled in the substrate, the depth of the anchoring element, the diameter of the metal bar and the recommended loads must be calculated by a qualified design engineer.
The tables below sum up some suggestions based on the experience and testing obtained following the test methods described in the European Assessment Document EAD 330499-01-0601 (for anchors) and EAD 330087-01-0601 (for post-installed rebar).
MAPEI has a specific software (**Mapefix Software Design**) to support technicians and designers in deciding the correct size of single and multiple anchors on any concrete element: please contact MAPEI Teschnical Services Department.

Preparation of solid substrate

Make holes in the substrate with a drill, a hammer drill or a core drill, depending on the type of material to be drilled and the depth of the hole.
Remove all traces of dust and loose material from inside the holes with hand tools, compressed air or by hydro-blasting. Please refer to the specific recommendations contained in the available ETA certifications.
It is very important that holes are carefully cleaned in order for **Mapefix** to reach the maximum mechanical performance possible.

Preparation of the metal bar

Clean and degrease the bar before anchoring it in the substrate. Remove all traces of rust and form-release compounds.

Preparation of the resin for the chemical anchor

Remove the cap and screw the static mixer to the end of the cartridge. Insert the cartridge in a suitable sealant gun. Discard the first 3 shots of resin; they may not be mixed correctly. Starting from the bottom of the hole, extrude the product into the hole until it is sufficiently full. Insert the metal bar in the hole using a rotary movement to expel all the air until the excess resin comes out of the hole. The metal bar must be inserted in the hole within the start setting time, as indicated in Table 1. Only apply loads to the bar once the resin has completely hardened, as indicated in Table 1.

CONSUMPTION

According to the volume of the hole to be filled.

CLEANING

Use normal solvent-based paint thinners to clean all work tools and equipment.

PACKAGING

Boxes of twelve 585 ml cartridges with 12 static mixers with extension tube.

COLOUR

Grey.

STORAGE

24 months in the original packaging at a temperature of +5° to +25°C.

SAFETY INSTRUCTIONS FOR PREPARATION AND APPLICATION

Instructions for the safe use of our products can be found on the latest version of the Safety Data Sheet, available from our website www.mapei.com.
PRODUCT FOR PROFESSIONAL USE.

TECHNICAL DATA (typical values)

PRODUCT IDENTITY	
Appearance:	cohesive fine mortar
Colour:	grey
Density:	1.50 kg/l

APPLICATION DATA (at +23°C and 50% R.H.)	
Application temperature range:	from 0°C to +40°C
Start setting time:	see Table 1
Complete hardening time:	see Table 1

PERFORMANCE CHARACTERISTICS	
Compressive strength (EN 196-1):	122 N/mm^2
Flexural strength (EN 196-1):	66 N/mm^2
Tensile strength (EN ISO 527-2):	44 N/mm^2
Modulus of elasticity (EN ISO 527-2):	6300 N/mm^2
Hardness (EN ISO 868):	86 Shore D
Electrical resistivity (IEC 93):	$8x10^{12}$ Ω
Thermal conductivity (EN 993-15):	0,5 W/m·k
Heat capacity (EN 993-15):	1350 J/kg·k

Service temperature:	da -40°C a +72°C
Resistance to UV rays:	excellent
Chemical resistance:	excellent
Resistance to water (EN 12390-8):	no permeability

ANCHORS	
Installation parametres for threaded rods:	see Table 2
Characteristic values for threaded rods:	see Table 3
Design loads for threaded rods:	see Table 4
Installation parametres for rebars:	see Table 5
Characteristic values for rebars:	see Table 6
Design loads for rebars:	see Table 7

POST-INSTALLED REBAR	
Design values of ultimate bond stress:	see Table

WARNING

Although the technical details and recommendations contained in this product data sheet correspond to the best of our knowledge and experience, all the above information must, in every case, be taken as merely indicative and subject to confirmation after long-term practical application; for this reason, anyone who intends to use the product must ensure beforehand that it is suitable for the envisaged application. In every case, the user alone is fully responsible for any consequences deriving from the use of the product.
Please refer to the current version of the Technical Data Sheet, available from our website www.mapei.com

LEGAL NOTICE

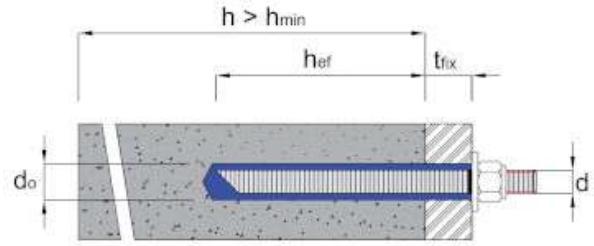
Table 1

Product reaction time			
Substrate temperature	Start setting time T_{gel}	Complete hardening time	
		dry substrate	wet substrate
0°C/+4°C	90 min.	144 h	288 h
+5°C/+9°C	80 min.	48 h	96 h
+10°C/+14°C	60 min.	28 h	56 h
+15°C/+19°C	40 min.	18 h	36 h
+20°C/+24°C	30 min.	12 h	24 h
+25°C/+34°C	12 min.	9 h	18 h

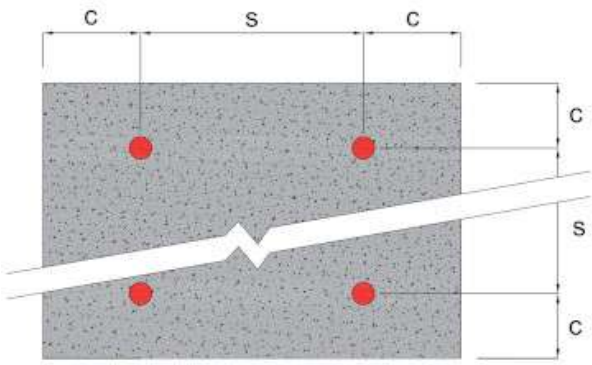
+35°C/+39°C	8 min.	6 h	12 h
+40°C	8 min.	4 h	8 h
Cartridge temperature	+5°C/+40°C		

Table 2

Installation parameters for threaded rods											
Threaded rod				M8	M10	M12	M16	M20	M24	M27	M30
Threaded rod diameter	d		mm	8	10	12	16	20	24	27	30
Hole dameter	d_0		mm	10	12	14	18	22	28	30	35
Minimum edge distance	c_{min}		mm	35	40	45	50	60	65	75	80
Minimum pitch	s_{min}		mm	40	50	60	75	95	115	125	140
Embedment depth	h_{ef}	$h_{ef,min}$	mm	60	60	70	80	90	96	108	120
		$h_{ef,max}$	mm	160	200	240	320	400	480	540	600
Concrete substrate minimum thickness	h_{min}		mm	h_{ef} + 30 mm (≥ 100 mm)			h_{ef} + 2 d_0				
Maximum torque moment	$T_{inst\ max}$		Nm	10	20	40	60	100	170	250	300



Drawing 1



Drawing 2

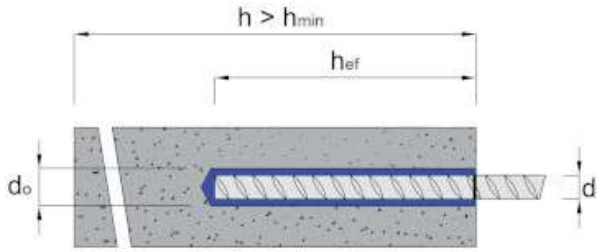
Table 3

Characteristics values of tension loads under static and quasi-static action, 100 years service life												
Working temperature(*)	Threaded rods			M8	M10	M12	M16	M20	M24	M27	M30	
Bond resistance in uncracked concrete C20/25, hammer drilled holes (HD) or compressed air drilled holes (CD)												
+24°C/+40°C	Dry, wet and flooded bore hole	$\tau_{Rk,ucr,100}$	N/mm²	20.0	20.0	19.0	19.0	18.0	17.0	16.0	16.0	
+50°C/+72°C				15.0	15.0	15.0	14.0	13.0	13.0	12.0	12.0	
Bond resistance in uncracked concrete C20/25, hammer drilled holes with hollow drill bit (HDB)												
+24°C/+40°C	Dry and wet hole	$\tau_{Rk,ucr,100}$	N/mm²	17.0	16.0	16.0	16.0	15.0	14.0	14.0	13.0	
+50°C/+72°C				14.0	14.0	14.0	13.0	13.0	12.0	12.0	11.0	
+24°C/+40°C	Flooded bore hole			16.0	16.0	16.0	15.0	15.0	14.0	14.0	13.0	
+50°C/+72°C				14.0	14.0	14.0	13.0	13.0	12.0	12.0	11.0	
Bond resistance in cracked concrete C20/25, hammer drilled holes (HD), compressed air drilled holes (CD) or with hollow drill bit (HDB)												
+24°C/+40°C	Dry, wet and flooded bore hole	$\tau_{Rk,cr,100}$	N/mm²	6.5	6.5	7.5	7.5	7.5	7.5	7.5	7.5	
+50°C/+72°C				5.5	5.5	6.5	6.5	6.5	6.5	6.5	6.5	
Increasing factors for concrete		ψ_c	C25/30	1.02								
			C30/37	1.04								
			C35/45	1.07								
			C40/50	1.08								
			C45/55	1.09								
			C50/60	1.10								
(*) continuous working temperature/temporary maximum peak working temperature												

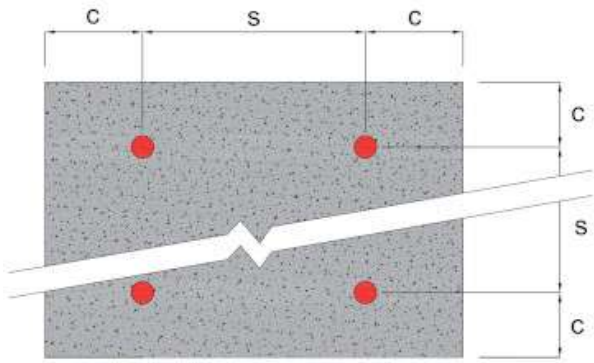
Table 4

Design loads[1] for a single anchor in concrete, dry/wet condition, hammer drill (HD), at least 100 years service life

Threaded rod					M8		M10		M12		M16		M20		M24		M27		M30		M33		M36		M39		M42	
Embedment depth			h_{ef}	mm	min h_{ef}	max h_{ef}	min h_{ef}	max h_{ef}	min h_{ef}	max h_{ef}	min h_{ef}	max h_{ef}	min h_{ef}	max h_{ef}	min h_{ef}	max h_{ef}	min h_{ef}	max h_{ef}	min h_{ef}	max h_{ef}	min h_{ef}	max h_{ef}	min h_{ef}	max h_{ef}	min h_{ef}	max h_{ef}	min h_{ef}	max h_{ef}
					60	160	60	200	70	240	80	320	90	400	96	480	108	540	120	600	132	660	144	720	156	780	168	840
	Temperature[2]																											
Tensile load	+24°C/+40°C	non-cracked	$N_{Rec,stat}$	kN	12.0	12.0	15.2	19.3	19.2	28.0	23.5	52.7	28.0	82.0	30.8	118.0	36.8	153.3	43.1	187.3	41.4	231.3	47.2	272.7	53.3	325.3	59.5	374.0
		cracked	$N_{Rec,stat}$		6.5	12.0	8.2	19.3	13.2	28.0	16.4	52.7	19.6	82.0	21.6	118.0	25.8	153.3	30.2	187.3	29.0	231.3	33.1	272.7	37.3	325.3	41.7	374.0
		seismic C1	$N_{Rec,seis}$		9.1	16.8	11.4	27.1	16.0	39.2	19.5	73.7	23.3	114.8	25.7	165.2	30.7	214.7	35.9	262.3	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
		seismic C2	$N_{Rec,seis}$		n.a.	n.a.	n.a.	n.a.	14.3	39.2	18.0	72.1	23.3	114.8	25.7	165.2	30.7	205.2	35.9	262.3	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	+50°C/+72°C	non-cracked	$N_{Rec,stat}$		12.0	12.0	15.2	19.3	19.2	28.0	23.5	52.7	28.0	82.0	30.8	118.0	36.8	153.3	43.1	187.3	41.4	231.3	47.2	272.7	53.3	325.3	59.5	374.0
		cracked	$N_{Rec,stat}$		5.5	12.0	6.9	19.3	11.4	28.0	16.4	52.7	19.6	82.0	21.6	118.0	25.8	153.3	30.2	187.3	29.0	231.3	33.1	271.4	37.3	318.6	41.7	338.7
		seismic C1	$N_{Rec,seis}$		7,7	16.8	9.7	27.1	16.0	39.2	19.5	73.7	23.3	114.8	25.7	165.2	30.7	214.7	35.9	262.3	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
		seismic C2	$N_{Rec,seis}$		n.a.	n.a.	n.a.	n.a.	12.3	39.2	15.4	61.6	22.7	100.9	25.7	148.6	30.7	175.3	35.9	226.9	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Shear load without bending moment	+24°C/+40°C	non-cracked	$V_{Rec,stat}$		8.8	8.8	9.1	13.6	11.7	20.0	14.9	37.6	18.4	59.2	20.8	84.8	25.3	110.4	30.1	135.2	35.2	166.4	40.6	196.0	46.4	234.4	52.4	269.6
		cracked	$V_{Rec,stat}$		6.2	8.8	6.4	13.6	8.3	20.0	10.6	37.6	13.0	59.2	14.7	84.8	17.9	110.4	21.3	135.2	24.9	166.4	28.8	196.0	32.8	234.4	37.1	269.6
		seismic C1	$V_{Rec,seis}$		8.6	8.6	9.0	13.3	11.6	19.6	14.8	36.8	18.2	58.0	20.6	83.1	25.0	108.2	29.8	132.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
		seismic C2	$V_{Rec,seis}$		n.a.	n.a.	n.a.	n.a.	11.6	19.6	14.8	36.8	18.2	58.0	20.6	83.1	25.0	108.2	29.8	132.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	+50°C/+72°C	non-cracked	$V_{Rec,stat}$		8.8	8.8	9.1	13.6	11.7	20.0	14.9	37.6	18.4	59.2	20.8	84.8	25.3	110.4	30.1	135.2	35.2	166.4	40.6	196.0	46.4	234.4	52.4	269.6
		cracked	$V_{Rec,stat}$		6.2	8.8	6.4	13.6	8.3	20.0	10.6	37.6	13.0	59.2	14.7	84.8	17.9	110.4	21.3	135.2	24.9	166.4	28.8	196.0	32.8	234.4	37.1	269.6
		seismic C1	$V_{Rec,seis}$		8.6	8.6	9.0	13.3	11.6	19.6	14.8	36.8	18.2	58.0	20.6	83.1	25.0	108.2	29.8	132.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
		seismic C2	$V_{Rec,seis}$		n.a.	n.a.	n.a.	n.a.	11.6	19.6	14.8	36.8	18.2	58.0	20.6	83.1	25.0	108.2	29.8	132.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Minimum edge distance			$c_{cr,N}$	mm	90	240	90	300	105	360	120	480	135	600	144	720	162	810	180	900	198	990	216	1080	234	1170	252	1260
Minimum pitch between bars			$s_{cr,N}$	mm	2 x $c_{cr,N}$																							
not covered by the ETA																												



Drawing 3



Drawing 4

Table 5

Installation parameters for rebars													
Rebar			ϕ8	ϕ10	ϕ12		ϕ14	ϕ16	ϕ20	ϕ24	ϕ25	ϕ28	ϕ32
Rebar diameter	d	mm	8	10	12		14	16	20	24	25	28	32
Hole diameter	d_0	mm	10-12	12-14	14	16	18	20	25	30-32	30-32	35	40
Minimum edge distance	c_{min}	mm	35	40	45		50	50	60	70	70	75	85
Minimum spacing between rebars	s_{min}	mm	40	50	60		70	75	95	120	120	130	150
Embedment depth	h_{ef} $h_{ef,min}$	mm	60	60	70		75	80	90	96	100	112	128
	h_{ef} $h_{ef,max}$	mm	160	200	240		280	320	400	480	500	560	640
Concrete substrate minimum thickness	h_{min}	mm	h_{ef} + 30 mm (≥ 100 mm)				h_{ef} + 2 d_0						

Table 6

Characteristics values of tension loads under static and quasi-static action, at least 100 years service life												
Working temperature(*)	**Rebar**			**ϕ8**	**ϕ10**	**ϕ12**	**ϕ14**	**ϕ16**	**ϕ20**	**ϕ24**	**ϕ25**	**ϕ28**	**ϕ32**
Bond resistance in uncracked concrete C20/25, hammer drilled holes (HD) or compressed air drilled holes (CD)													
+24°C/+40°C	Dry, wet and flooded bore hole	$\tau_{Rk,ucr,100}$	N/mm²	16.0	16.0	16.0	16.0	16.0	16.0	15.0	15.0	15.0	15.0
+50°C/+72°C				12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	11.0	11.0
Bond resistance in uncracked concrete C20/25, hammer drilled holes with hollow drill bit (HDB)													
+24°C/+40°C	Dry and wet hole	$\tau_{Rk,ucr,100}$	N/mm²	14.0	14.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0
+50°C/+72°C				12.0	12.0	12.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
+24°C/+40°C	Flooded bore hole			13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0
+50°C/+72°C				11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Bond resistance in cracked concrete C20/25, hammer drilled holes (HD), compressed air drilled holes (CD) or with hollow drill bit (HDB)													
+24°C/+40°C	Dry, wet and flooded bore hole	$\tau_{Rk,cr,100}$	N/mm²	6.5	6.5	7.5	7,5	7.5	7.5	7.5	7.5	7.5	7.5
+50°C/+72°C				5.5	5.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
Increasing factors for concrete		ψ_c	C25/30	1.02									
			C30/37	1.04									
			C35/45	1.07									
			C40/50	1.08									
			C45/55	1.09									
			C50/60	1.10									
(*) continuous working temperature/temporary maximum peak working temperature													

Table 7

Design loads(1) for a single anchor in concrete, dry/wet condition, hammer drill (HD), at least 100 years service life

					Ø8		Ø10		Ø12		Ø14		Ø16		Ø20		Ø24		Ø25		Ø28		Ø32		Ø34		Ø36		Ø40	
Embedment depth			h_{ef}		min h_{ef}	max h_{ef}	min h_{ef}	max h_{ef}	min h_{ef}	max h_{ef}	min h_{ef}	max h_{ef}	min h_{ef}	max h_{ef}	min h_{ef}	max h_{ef}	min h_{ef}	max h_{ef}	min h_{ef}	max h_{ef}	min h_{ef}	max h_{ef}	min h_{ef}	max h_{ef}	min h_{ef}	max h_{ef}	min h_{ef}	max h_{ef}	min h_{ef}	max h_{ef}
				mm	60	160	60	200	70	240	75	280	80	320	90	400	96	480	100	500	112	560	128	640	136	680	144	720	160	800
	Working temperature(2)																													
Tensile load	+24°C/+40°C	non-cracked	$N_{Rec,stat}$	kN	15.2	20.0	15.2	30.7	19.2	44.3	21.3	60.7	23.5	79.3	28.0	123.6	30.8	177.9	32.8	192.9	38.9	242.1	47.5	315.7	43.3	356.4	47.2	400.0	55.3	493.6
		cracked	$N_{Rec,stat}$		6.5	17.4	8.2	27.2	13,2	44.3	14.9	60.7	16.4	79.3	19.6	123.6	21.6	177.9	23.0	192.9	27.2	242.1	33.2	315.7	30.3	302.6	33.1	339.3	38.7	418.9
		seismic C1	$N_{Rec,seis}$		9.1	24.4	11.4	38.1	16,0	62.0	17.7	85.0	19.5	111.0	23.3	173.0	25.7	249.0	27.3	270.0	32.4	339.0	39.6	442.0						
		seismic C2	$N_{Rec,seis}$																											
	+72°C/+50°C	non-cracked	$N_{Rec,stat}$		12.1	20.0	15.1	30.7	19,2	44.3	21.3	60.7	23.5	79.3	28.0	123.6	30.8	177.9	32.8	192.9	38.9	242.1	47.5	315.7	43.3	356.4	47.2	400.0	55.3	493.6
		cracked	$N_{Rec,stat}$		5.5	14.7	6.9	23.0	11,4	39.2	14.3	53.4	16.4	69.7	19.6	108.9	21.6	156.8	23.0	170.2	27.2	213.5	33.2	278.8	30.3	262.3	33.1	294.1	38.7	363.0
		seismic C1	$N_{Rec,seis}$		7.7	20.6	9.7	32.3	16,0	54.9	17.7	74.7	19.5	97.6	23.3	152.5	25.7	219.6	27.3	238.2	32.4	298.8	39.6	390.3						
		seismic C2	$N_{Rec,seis}$																											
Shear load without bending moment	+24°C/+40°C	non-cracked	$V_{Rec,stat}$		8.8	9.3	9.1	14.7	11,7	20.7	13.3	28.7	14.9	37.3	18.4	58.0	20.8	83.3	22.2	90.0	26.8	113.3	33.4	147.3	37.0	166.7	40.6	186.7	48.3	230.7
		cracked	$V_{Rec,stat}$		6.2	9.3	6.4	14.7	8,3	20.7	9.4	28.7	10.6	37.3	13.0	58.0	14.7	83.3	15.8	90.0	19.0	113.3	23.7	147.3	26.2	166.7	28.8	186.7	34.2	230.7
		seismic C1	$V_{Rec,seis}$		8.7	9.1	9.0	14.4	11,6	20.3	13.2	28.1	14.8	36.6	18.2	56.8	20.6	81.7	22.1	88.2	26.6	111.1	33.2	144.4						
		seismic C2	$V_{Rec,seis}$																											
	+72°C/+50°C	non-cracked	$V_{Rec,stat}$		8.8	9.3	9.1	14.7	11,7	20.7	13.3	28.7	14.9	37.3	18.4	58.0	20.8	83.3	22.2	90.0	26.8	113.3	33.4	147.3	37.0	166.7	40.6	186.7	48.3	230.7
		cracked	$V_{Rec,stat}$		6.2	9.3	6.4	14.7	8,3	20.7	9.4	28.7	10.6	37.3	13.0	58.0	14.7	83.3	15.8	90.0	19.0	113.3	23.7	147.3	26.2	166.7	28.8	186.7	34.2	230.7
		seismic C1	$V_{Rec,seis}$		8.7	9.1	9.0	14.4	11,6	20.3	13.2	28.1	14.8	36.6	18.2	56.8	20.6	81.7	22.1	88.2	26.6	111.1	33.2	144.4						
		seismic C2	$V_{Rec,seis}$																											
Distance from edge			$C_{cr,N}$	mm	90	240	90	300	105	360	112,5	420	120	480	135	600	144	720	150	750	168	840	192	960	204	1020	216	1080	240	1200
Pitch between bars			$S_{cr,N}$	mm	2 x $C_{cr,N}$																									
	not covered by the ETA																													

(1) valid if there are the following conditions:
- design according to EN 1992-4:2018 (Eurocode 2)
- $\alpha_{sus} \leq 0,60$
- $\psi_{sus} = 1,0$
- class 5.8 steel bar
- shear load without bending moment
- concrete minimum class C20/25
- $C \geq C_{cr,N}$

- $S \geq S_{cr,N}$
- $h \geq 2 \times h_{ef}$
- $\alpha_{gap} = 1,0$ (no hole clearance)
- for other anchoring conditions use **Mapefix Software Design**, developed in compliance with current European standards

(2) continuous working temperature/temporary maximum peak working temperature

Table 8

Design values of ultimate bond stress, all drilling methods, at least 100 years service life											
	Rebar			Concrete class							
	ϕ			C 12/15	C 16/20	C 20/25	C 25/30	C 30/37	C 35/45	C 40/50	C 45/55	C 50/60
Non-seismic action	from 8 to 32 mm	$f_{db,PIR}$ $f_{db,PIR,100y}$	N/mm^2	1.6	2.0	2.3	2.7	3.0	3.4	3.7	4.0	4.3
	34 mm			1.6	2.0	2.3	2.6	2.9	3.3	3.6	3.9	4.2
	36 mm			1.5	1.9	2.2	2.6	2.9	3.3	3.6	3.8	4.1
	40 mm			1.5	1.8	2.1	2.5	2.8	3.1	3.4	3.7	4.0
Seismic action	from 8 to 32 mm	$f_{db,PIR,seis}$ $f_{db,PIR,100y,seis,100y}$			2.0	2.3	2.7	3.0	3.4	3.7	4.0	4.3
	34 mm				2.0	2.3	2.6	2.9	3.3	3.6	3.9	4.2
	36 mm				1.9	2.2	2.6	2.9	3.3	3.6	3.8	4.1
	40 mm				1.8	2.1	2.5	2.8	3.1	3.4	3.7	4.0