MAPEFIX PE SF

Chemical anchor for heavy loads

European Technical Approval option 7 for non cracked concrete

European Technical Approval ETAG 029

Fast Track Ready

WHERE TO USE

Mapefix PE SF is an adhesive for chemical anchoring metal bars in holes made in building materials. It is a two-component, styrene-free product made from a mixture of polyester resins. It has been specifically developed for chemically anchoring steel and zinc-plated steel threaded and deformed bars, which transmit light loads, to solid and perforated substrates such as non-cracked concrete, heavyweight concrete, stone and mixed masonry.
It is also an ideal solution for anchoring close to edges or when there is a limited pitch between each anchor, due to no stress being generated as with conventional mechanical expansion fasteners.
Mapefix PE SF is recommended for anchoring lightweight elements in internal and external substrates with a horizontal, vertical, inclined or overhead axis, and is particularly recommended for anchors in perforated substrates. It may also be used for anchors in damp substrate, and in substrates at temperatures down to -5°C.
Mapefix PE SF is recommended for anchoring elements in place, such as:
- plant equipment;
- sanitary fittings;
- aerials;
- signs;
- window and door fittings.

TECHNICAL CHARACTERISTICS

Mapefix PE SF is a two-component chemical anchoring product, packaged in 300 and 420 ml cartridges with two separate compartments containing component A (resin) and component B (catalyser), at the correct mixing ratio in volume. The two components are mixed together when they are extruded via the static mixer supplied with the cartridge. The mixer is screwed to the end of the cartridge, and no preliminary mixing of the two components is required. 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 with a clean, new one.
Mapefix PE SF does not contain styrene which makes it suitable for use in areas with poor ventilation and, because it has limited shrinkage, it is also suitable for anchors with small circular crests.
Mapefix PE SF is a chemical anchor made from a mixture of styrene-free resins, suitable for application on solid and perforated building materials, such as:
- non-cracked concrete;
- lightweight concrete;
- cellular concrete;
- masonry;
- bricks;
- stone.

Mapefix PE SF is applied in holes made with a drill or hammer drill. We recommend using only a drill on perforated substrates. **Mapefix PE SF** is certified according to ETA European Standards option 7 (anchors in concrete in tension zones) and ETAG 029 (anchors in solid, semi-solid and perforated masonry). The Mapefix PE SF 300 ml size cartridges may be used with conventional silicone extrusion guns for 50 mm diameter cartridges, as long as they are robust enough. The 420 ml cartridges need to be used with a special extrusion gun for 65 mm diameter cartridges.

RECOMMENDATIONS

MAPEI

Do not apply on dusty or crumbling surfaces. For use on damp or wet substrates, please contact the MAPEI Technical Services Department.
Do not use on surfaces with traces of oil, grease and stripping compound otherwise the bond may be compromised.
Do not apply if the temperature is lower than -5°C. If used on natural stone, check if it impregnates into the stone.
Do not apply loads until it has completely hardened (T_{cure}).
Do not use the product in holes made with a diamond-tipped bit (cored holes). Do not use for anchors in tension zones.

APPLICATION PROCEDURE

Design of the anchor

The size of the hole in the substrate, the depth of the anchor, the diameter of the anchoring element and the maximum permitted loads must be calculated by a qualified design engineer. The tables below illustrate a practical summary of some of our suggestions, based on experience and testing carried out within the company.

Preparation of solid surfaces

Make holes in the substrate with a drill or a hammer drill, according to the type of material to be drilled. Remove all traces of dust and loose material from inside the holes with compressed air. Clean the surface inside the holes with a suitable long-bristled bottlebrush. Remove all traces of dust and loose material again from inside the holes with compressed air.

Preparation of perforated surfaces

Drill holes in the substrate with a drill. Clean the surface inside the holes with a suitable long-bristled bottlebrush. Place a mesh bush in the hole, with a diameter and length suitable for the size of the hole.

Preparation of the metal bar

Clean and degrease the bar before anchoring it in the substrate.

Preparation of the resin for the chemical anchor

For the 300 ml cartridge, unscrew the upper cap and cut off the tips of the black and white containers which protrude from the cartridge. This operation is not required with the 420 ml cartridge. Screw the static mixer to the end of the cartridge. nsert the cartridge in the extrusion gun. Discard the first three shots of resin, as it may not be mixed correctly. Starting from the bottom of the hole, extrude the product in the hole until it is full. Insert the metal bar in the hole using a rotary movement to expel all the air until all excess resin comes out of the hole. The metal bar must be inserted in the hole within the start setting time (T_{gel}); only apply loads to the bar once the resin has completely hardened (T_{cure}), as indicated in table 1.

CONSUMPTION

According to the size of hole to be filled.

CLEANING

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

PACKAGING

Boxes of 12 pieces (300 or 420 ml cartridges) with 12 static mixers.

COLOURS AVAILABLE

Light grey.

STORAGE

300 ml cartridges: 12 months in its original packaging at a temperature of between +5°C and +25°C. 420 ml cartridges: 18 months in its original packaging at a temperature of between +5°C and +25°C.

TECHNICAL DATA (typical values)	
PRODUCT IDENTITY	
Consistency:	thixotropic paste
Colour:	light grey
Density (g/cm³):	1.74
APPLICATION DATA (at +23°C and 50% R.H.)	
Application temperature range:	from -5°C to +35°C
Start setting time T_{gel}:	see table 1

Final hardening time T_{cure}:	see table 1
PERFORMANCE CHARACTERISTICS	
Compressive strength (N/mm²):	75
Flexural strength (N/mm²):	30
Dynamic modulus of elasticity (N/mm²):	4000
Resistance to UV rays:	good
Chemical resistance:	good
Resistance to water:	very good
In-service temperature range:	from -40°C to +80°C
Maximum permitted tensile loads:	see tables 2 and 3
Characteristic strenght:	see tables 4 and 5
Maximum recommended loads:	see tables 6 and 8

Reaction time of product			
Substrate temperature	**Start setting time T_{gel}**	**Final hardening time T_{cure}**	
		dry substrate	**damp substrate**
°C	minutes/hours	minutes/hours	minutes/hours
-5*	90’	6 h	12 h
0	45’	3 h	6 h
+5	25’	2 h	4 h
+10	15’	80’	3 h
+20	6’	45’	90’
+30	4’	25’	50’
+35	2’	20’	40’

Table 1: reaction time of resin
*** temperature of the product +15°C**

Installation parameters for threaded bar in concrete								
threaded bar			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
diameter of threaded bar (mm)	**d**		8	10	12	16	20	24
diameter of anchor hole (mm)	**d_o**		10	12	14	18	24	28
minimum distance from edge (mm)	**S_{min}**		40	50	60	80	100	120
minimum pitch between bars (mm)	**C_{min}**		40	50	60	80	100	120
anchoring depth of threaded bar (mm)	**h_{ef}**	min	60	60	70	80	90	96
		max	160	200	240	320	400	480
minimum thickness of concrete (mm)	**h_{min}**		**h_{ef}** + 30 mm ≥ 100 mm			**h_{ef}** + 2d0		
thickness of fixed element (mm)	**T_{fix}**	min	0					
		max	1500					
tightening torque (Nm)	**T_{inst}**		10	20	40	80	120	160

Table 2: installation parameters for concrete

Installation parameters for threaded bar in solid and perforated brick masonry							
threaded bar	**M8**	**M8-M10**		**M12-M16**			
mesh sleeve (P = plastic, M = metal)	12 x 80 (P) 12 x 80 (M)	15 x 85 (P) 16 x 85 (M)	16 x 130 (M)	20 x 85 (P) 20 x 85 (M)	20 x 130 (M)	20 x 130 (M)	
diameter of threaded bar (mm)	8	8 - 10		12 - 16			

diameter of anchor hole (mm)	d_o	12	15	16	20		
depth of threaded bar (mm)	h_{ef}	80	85	130	85	130	200
depth of hole (mm)	h_o	85	90	135	90	135	205
minimum thickness of masonry (mm)	h_{min}	115	115	195	115	195	240
tightening torque (Nm)	T_{inst}	according to type of masonry: please refer to ETA certification					

Table 3: installation parameters in solid and perforated brick masonry

Recommended loads (1) for a single anchor in concrete										
minimum anchor depth										
					M8	**M10**	**M12**	**M16**	**M20**	**M24**
	service temperature 2)				min h_{ef}	min h_{ef}	min h_{ef}	min h_{ef}	min h_{ef}	min h_{ef}
anchor depth			h_{ef}	mm	60	60	70	80	90	96
tensile load	24°C/40°C	non-cracked concrete	$N_{Rec,stat}$	**kN**	5.1	6.0	8.4	12.8	16.7	18.4
	50°C/80°C	non-cracked concrete	$N_{Rec,stat}$		3.9	4.5	6.3	9.6	13.5	17.2
shear load without bending moment	24°C/40°C	non-cracked concrete	$V_{Rec,stat}$		6.3	7.3	9.4	12.0	14.8	16.7
	50°C/80°C	non-cracked concrete	$V_{Rec,stat}$		6.3	7.3	9.4	12.0	14.8	16.7
distance from edge			$C_{cr,N}$	mm	90	90	105	120	135	144
pitch between each bar			$S_{cr,N}$	mm	2 x Ccr,N					

Table 4: recommended loads and minimum anchor depth

Recommended loads (1) for a single anchor in concrete										
intermediate anchor depth										
					M8	**M10**	**M12**	**M16**	**M20**	**M24**
	service temperature 2)				h_{ef}	h_{ef}	h_{ef}	h_{ef}	h_{ef}	h_{ef}
anchor depth			h_{ef}	mm	80	90	110	125	170	210
tensile load	24°C/40°C	non-cracked concrete	$N_{Rec,\ stat}$	kN	6.8	9.0	13.2	19.9	33.9	50.3
	50°C/80°C	non-cracked concrete	$N_{Rec,\ stat}$		5.2	6.7	9.9	15.0	25.4	37.7
shear load without bending moment	24°C/40°C	non-cracked concrete	$V_{Rec,\ stat}$		6.3	9.7	14.3	23.4	38.4	54.1
	50°C/80°C	non-cracked concrete	$V_{Rec,\ stat}$		6.3	9.7	14.3	23.4	38.4	54.1
distance from edge		non-cracked concrete	$C_{cr,\ N}$	mm	120	135	165	188	255	315
pitch between each bar		non-cracked concrete	$S_{cr,\ N}$	mm	2 x Ccr,N					

Table 5: recommended loads and intermediate anchor depth

Recommended loads (1) for a single anchor in concrete										
maximum anchor depth										
					M8	**M10**	**M12**	**M16**	**M20**	**M24**
	service temperature 2)				max h_{ef}	max h_{ef}	max h_{ef}	max h_{ef}	max h_{ef}	max h_{ef}
anchor depth			h_{ef}	mm	160	200	240	320	400	480
tensile load	24°C/40°C	non-cracked concrete	$N_{Rec,stat}$	kN	8.6	13.8	20.0	37.6	58.6	84.3
	50°C/80°C	non-cracked concrete	$N_{rec,stat}$		8.6	13.8	20.0	37.6	58.6	84.3
shear load without	24°C/40°C	non-cracked concrete	$V_{Rec,\ stat}$		6.3	9.7	14.3	26.9	42.3	60.6

bending moment	50°C/80°C	non-cracked concrete	$V_{rec,stat}$		6.3	9.7	14.3	26.9	42.4	60.6
distance from edge			$C_{cr,N}$	mm	240	300	360	480	600	720
pitch between each bar			$S_{cr,N}$	mm	2 x Ccr,N					

Table 6: recommended loads and maximum anchor depth

Designed according to EN 1992-4:2017 (Eurocode 2)

(1) recommended loads for the following design conditions:

- $^{\alpha}sus \leq 0.60$
- $^{\Psi}sus \leq 1.0$
- threaded bar in minimum class 5.8 steel
- shear load without bending moment
- concrete minimum class C20/25
- $C \geq C_{cr,N}$
- $S \geq S_{cr,N}$
- $h \geq 2 \times h_{ef}$
- safety factor included
- $^{\alpha}gap = 1.0$ (no play between fixed element and metal bar)
- rough finish hole using a hammer drill
- for different design conditions to the above, use **Mapefix Software Design**, developed in compliance with current European standards

(2) constant servive temperature/maximum peak temperature

Typical bond-strength (3)										
non-cracked class 20/25 concrete										
					M8	**M10**	**M12**	**M16**	**M20**	**M24**
service temperature	24°C/40°C	dry and damp concrete	MPa	†Rk, ucr	8.5	8.0	8.0	8.0	8.0	8.0
					8.5	8.0	8.0	8.0	8.0	8.0
	50°C/80°C	wet concrete			6.5	6.0	6.0	6.0	6.0	6.0
					6.5	6.0	6.0	6.0	6.0	6.0
safety factor for concrete	C25/30		Ψ_c		1.04					
	C30/37				1.08					
	C35/45				1.13					
	C40/50				1.15					
	C45/55				1.17					
	C50/60				1.19					

Table 7: typical bond-strength

(3) typical values for designing single and multiple anchors in concrete; compliant with EOTA TR 029 guidelines

Consumption of Mapefix PE SF in concrete						
minimum anchor depth						
bar	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
diameter of bar in mm	8	10	12	16	20	24
diameter of hole in mm	10	12	14	18	24	28
depth of anchor	60	60	70	80	90	96
number of anchors with 300 ml cartridge	***161***	***132***	***95***	***64***	***22***	***17***
number of anchors with 420 ml cartridge	***225***	***184***	***134***	***89***	***31***	***24***
maximum anchor depth						
bar	M8	M10	M12	M16	M20	M24
diameter of bar in mm	8	10	12	16	20	24
diameter of hole in mm	10	12	14	18	24	28
depth of anchor	160	200	240	320	400	480
number of anchors with 300 ml cartridge	***60***	***39***	***28***	***16***	***5***	***3***

number of anchors with 420 ml cartridge	***84***	***55***	***39***	***22***	***7***	***5***

Table 8: consumption (including 10% waste)

Consumption of Mapefix PE SF in solid and perforated brick masonry						
with plastic mesh bush						
bar	M8	M10	M12		M16	
diameter of bar in mm	8	10	12		16	
diameter of hole in mm	12	15	20		20	
plastic mesh bush (diameter x length)	12 x 80	15 x 85	20 x 85		20 x 85	
depth of anchor	80	85	85		85	
depth of hole in mm	85	90	90		90	
number of anchors with 300 ml cartridge	45	27	13		22	
number of anchors with 420 ml cartridge	63	38	19		31	
with metal mesh bush						
bar	**M8**	**M10**	**M12**		**M16**	
diameter of bar in mm	8	10	12	12	16	16
diameter of hole in mm	12	16	16	20	20	20
plastic mesh bush (diameter x length)	12 x 80	16 x 85	16 x 130	20 x 85	20 x 130	20 x 200
depth of anchor	80	85	130	85	130	200
depth of hole in mm	85	90	135	90	135	205
number of anchors with 300 ml cartridge	45	22	20	13	15	10
number of anchors with 420 ml cartridge	63	31	28	19	22	14

Table 9: consumption (including 20%)

STORAGE

300 ml cartridges: 12 months in its original packaging at a temperature of between +5°C and +25°C.
420 ml cartridges: 18 months in its original packaging at a temperature of between +5°C and +25°C.

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

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