PA

POLYESTER

REVISION R02.00 14.10.2024

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1. General

Product description

The PA is a 2-component reaction resin mortar based on polyester and will be delivered in a 2-C cartridge (standard cartridge; foil tube cartridge) system. This product may be used in combination of a hand-, battery-, or pneumatic tool and a static mixer. It was designed as a costeffective alternative for the anchoring of threaded rods for approved applications. By using a perforated sleeve, an easy and save application in hollow bricks is guaranteed. The PA product is characterised by manifold applications with an ambiance temperature up to 80°C.

Properties and benefits

- European Technical Assessment for bonded fasteners acc. to ETAG 001-Part 1 and Part 5, used as European Assessment Document (Option 7): ETA-11/0286
- Performance data for use in masonry based on In-house tests
- Overhead application
- Suitable for attachment points with small edge- and axial distances due to an anchoring free of expansion forces
- Reduced chemical resistance
- High bending and pressure strength
- Cartridge can be reused up to the end of the shelf life by replacing the static mixer or resealing cartridge with the sealing cap

Applications samples

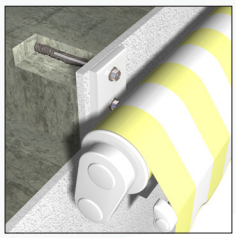
Suitable for the fixation of facades, roofs, wood constructions, metal constructions; metal profils, columns, beams, consoles, railings, sanitary devices, cable trays, piping, etc.

Handling and storage

- Storage: store in a cold and dark place, storage temperature: from +5°C up to +25 °C
- Shelf life: 12 months

Applications and intended use

- Base material:
  non-cracked concrete, light-concrete, porous-concrete, solid masonry, hollow brick, natural stone (Attention! natural stone, can discolour; shall be checked in advance; solid anchoring base: hammer drilled bore holes, perforated bricks: rotary drilled bore holes
- Anchor elements:
  Threaded rods (zinc plated or hot dip, stainless steel and high corrosion resistance steel), profiled rod, steel section with undercuts (e.g. perforated section)
- Temperature range:
  Installation temperature see table Reactivity
  Cartridge temperature see table Reactivity
  Anchoring base temperature after complete curing
  -40°C to +80°C



Mortar properties

Properties	Test Method	Result
UV resistance	-	Pass
Watertightness	DIN EN 12390-8	0 mm
Temperature stability	-	80 °C
Density	-	1,77 kg / dm³
Compressive strength	EN 196 Teil1	89 N / mm²
Flexural strength	EN 196 Teil1	33 N / mm²
E modulus	EN 196 Teil1	14000 N / mm²
Shrinkage	-	< 0,3 %
Electrical resistance	IEC 93	1,6 10^8 Ω m
Thermal conductivity	ICE 60093	0,54 W/m·K

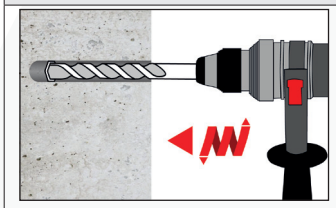
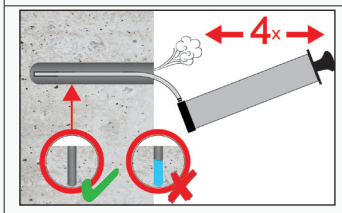
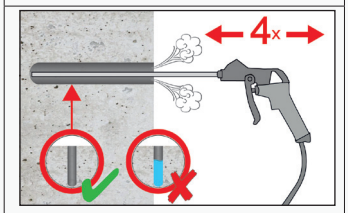
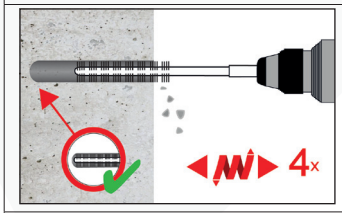
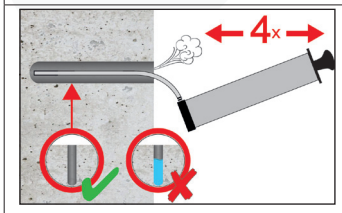
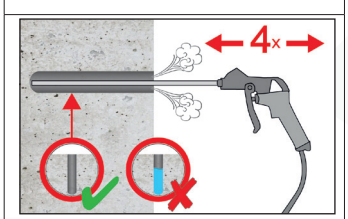
Reactivity

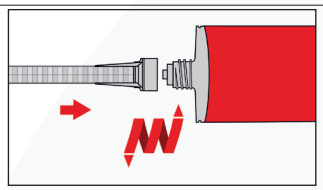
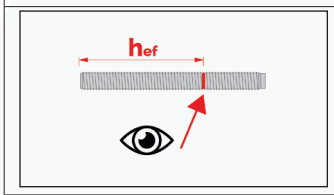
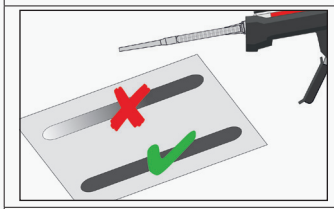
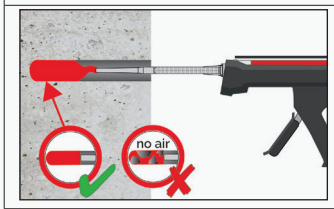
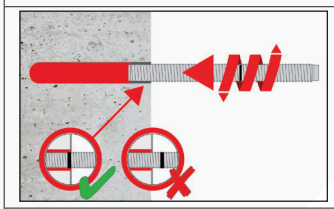
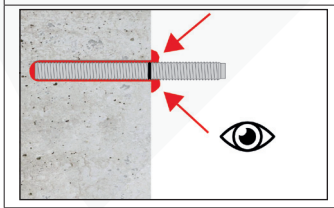
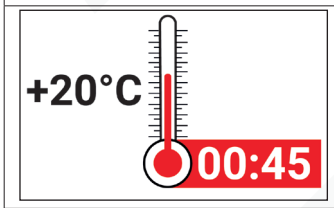
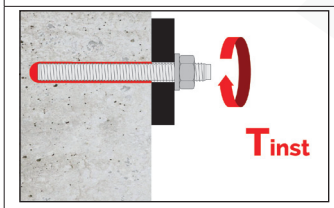
Concrete temperature	PA Tropical		PA Standard		PA Express	
	Max. working time	Min. curing timel[1)]	Max. working time	Min. curing timel[1)]	Max. working time	Min. curing timel[1)]
0 °C to +4°C			45 min	180 min	25 min	120 min
+5 °C to +9°C			25 min	120 min	10 min	60 min
+ 10 °C to +14°C	30 min	300 min	20 min	100 min	4 min	35 min
+ 15 °C to +19°C	20 min	210 min	15 min	80 min	3 min	25 min
+ 20 °C to +29°C	15 min	145 min	6 min	45 min	2 min	15 min
+ 30 °C to +34°C	10 min	80 min	4 min	25 min		
+ 35 °C to +39°C	6 min	45 min	2 min	20 min		
+ 40 °C to +44°C	4 min	25 min				
+45°C	2 min	20 min				
Cartridge temperatur	+5 °C to +45 °C		+5 °C to +40 °C		0°C to +30 °C	

[1)] The curing times in wet concrete has to be doubled.

2. Anchorage in concrete

Installation instructions

Drilling of the bore hole	
	**1a.** Drill with hammer drill (HD) a hole into the base material to the size and embedment depth required by the selected anchor (see page 8), with hammer (HD). In case of aborted drill hole: the drill hole shall be filled with mortar.
Attention! Standing water must be removed before cleaning.	
 or 	**2a.** Starting from the bottom or back of the bore hole, blow the hole clean with compressed air (min. 6 bar) or a hand pump (see page 7) a minimum of four times. If the bore hole ground is not reached an extension shall be used. The hand-pump can be used for anchor sizes up to bore hole diameter 20 mm. For bore holes lager then 20 mm or deeper 240 mm, compressed air (min. 6 bar) must be used.
	**2b.** Check brush diameter (see page 7) and attach the brush to a drilling machine or a battery screwdriver. Brush the hole with an appropriate sized wire brush > $d_{b,min}$ (see page 7) a minimum of four times. If the bore hole ground is not reached with the brush, a brush extension shall be used (see page 7).
 or 	**2c.** Starting from the bottom or back of the bore hole, blow the hole clean with compressed air (min. 6 bar) or a hand pump (see page 7) a minimum of four times. If the bore hole ground is not reached an extension shall be used. The hand-pump can be used for anchor sizes up to bore hole diameter 20 mm. For bore holes lager then 20 mm or deeper 240 mm, compressed air (min. 6 bar) must be used.
After cleaning, the bore hole has to be protected against re-contamination in an appropriate way, until dispensing the mortar in the bore hole. If necessary, the cleaning has to be repeated directly before dispensing the mortar. In-flowing water must not contaminate the bore hole again.	

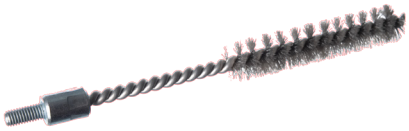
	**3.** Attach a supplied static-mixing nozzle to the cartridge and load the cartridge into the correct dispensing tool. Cut off the foil tube clip before use. For every working interruption longer than the recommended working time (see page 4) as well for new cartridges, a new static-mixer shall be used.
	**4.** Prior to inserting the anchor rod into the filled bore hole, the position of the embedment depth shall be marked on the anchor rods.
	**5.** Prior to dispensing into the anchor hole, squeeze out separately a minimum of three full strokes and discard non-uniformly mixed adhesive components until the mortar shows a consistent grey or blue (PASF Blue) colour. For foil tube cartridges it must be discarded a minimum of six full strokes.
	**6.** Starting from the bottom resp. back of the cleaned anchor hole fill the hole up to approximately two-thirds with adhesive. Slowly withdraw of the static mixing nozzle as the hole is filled avoids creating air pockets. If the bore hole ground is not reached with the static-mixing nozzle, a appropriate extension must be used. Observe the gel-/ working times given (see page 4).
	**7.** Push the threaded rod or reinforcing bar into the anchor hole while turning slightly to ensure positive distribution of the adhesive until the embedment depth is reached. The anchor should be free of dirt, grease, oil or other foreign material..
	**8.** Be sure that the anchor is fully seated at the bottom of the hole and that excess mortar is visible at the top of the hole. If these requirements are not maintained, the application has to be renewed. For overhead application the anchor rod shall be fixed (e. g. wedges)..
	**9.** Allow the adhesive to cure to the specified time prior to applying any load or torque. Do not move or load the anchor until it is fully cured (see page 4).
	**10.** After full curing, the add-on part can be installed with the max. torque (see page 8) by using a calibrated torque wrench.

Installation accessories

CAC - Rec. compressed air tool (min 6 bar)
Drill bit diameter (d_0): 10 mm to 28 mm

MAC - Hand pump (volume 750 ml)
Drill bit diameter (d_0): 10 mm to 20 mm or drill hole depth up to 240 mm

Steel brush RBT and brush extension



SDS Plus Adapter

Threaded rod	d_0 Drill bit - ØHD	d_b Brush-Ø		$d_{b,min}$ min. Brush-Ø
[mm]	[mm]	[-]	[mm]	[mm]
M 8	10,0	RBT 10	12	10,5
M 10	12,0	RBT 12	14	12,5
M 12	14,0	RBT 14	16	14,5
M 16	18,0	RBT 18	20	18,5
M 20	24,0	RBT 24	26	24,5
M 24	28,0	RBT 28	30	28,5

Setting parameter

Anchor size			M8	M10	M12	M16	M20	M24
Outer diameter of anchor	$d = d_{nom}$	[mm]	8	10	12	16	20	24
Nominal drill hole diameter	d_0	[mm]	10	12	14	18	24	28
Effective embedment depth	$h_{ef,min}$	[mm]	60	60	70	80	90	96
	$h_{ef,max}$	[mm]	160	200	240	320	400	480
Diameter of clearance hole in the fixture	$d_f \leq$	[mm]	9	12	14	18	22	26
Maximum torque moment	$T_{inst} \leq$	[Nm]	10	20	40	80	120	160
Minimum thickness of member	h_{min}	[mm]	h_{ef} + 30 mm ≥ 100 mm			h_{ef} + $2d_0$		
Minimum spacing	S_{min}	[mm]	40	50	60	80	100	120
Minimum edge distance	C_{min}	[mm]	40	50	60	80	100	120

Recommended loads

Threaded rod

The recommended loads are only valid for single anchors for a roughly design, if the following conditions are valid:

- $c \geq 1{,}5 \times h_{ef}$ $s \geq 3{,}0 \times h_{ef}$ $h \geq 2 \times h_{ef}$
- ψ_{sus} = 1,0; percentage of dead load ≤ ψ^0_{sus} see table below
- The recommended loads have been calculated using the partial safety factors for resistances stated in the ETA and with a partial safety factor for actions of γ_f=1.4. The partial safety factor for seismic action is γ_1 = 1,0.

If the conditions are not fulfilled the loads must be calculated acc. to EN 1992-4.
For further details observe the specifications of ETA-11/0286.

• Property class 8.8 • Concrete - C20/25 • Hammer drilling (HD) • dry, wet concrete					M8	M10	M12	M16	M20	M24
Recommended tension load	40°C / 24°C [1]	uncracked	$N_{rec,stat}$	[kN]	9,1	12,1	16,8	21,2	33,9	50,3
	80°C / 50°C [1]		$N_{rec,stat}$	[kN]	7,7	10,8	14,8	18,7	29,7	44,0
Recommended shear load without lever arm [2]			$V_{rec,stat}$	[kN]	9,7	11,9	16,5	20,8	34,1	48,1
Embedment depth			h_{ef}	[mm]	80	90	110	125	170	210
Edge distance			c ≥	[mm]	120	135	165	187,5	255	315
Axial distance			s ≥	[mm]	240	270	330	375	510	630

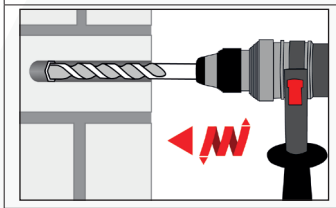
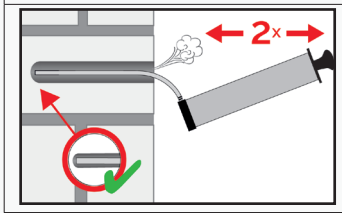
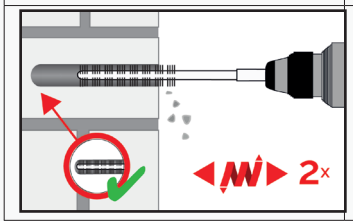
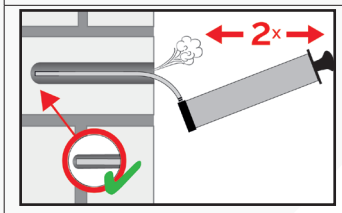
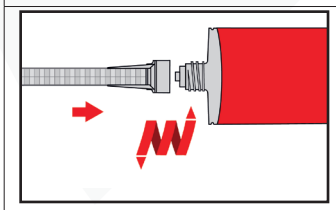
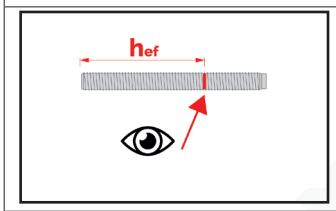
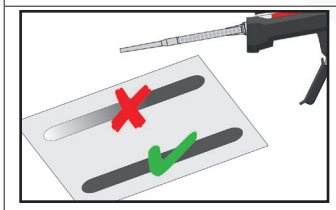
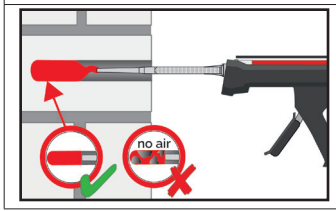
[1] Short term temperature/ Long term temperature.

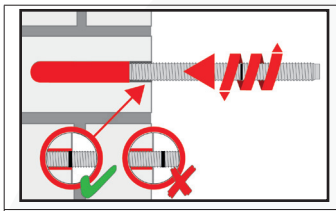
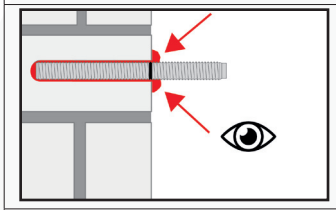
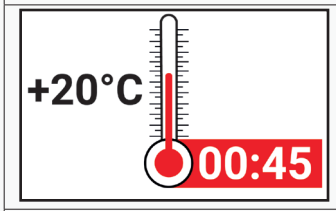
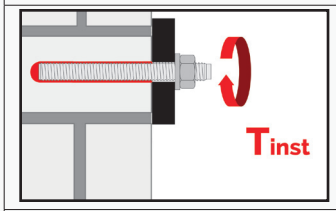
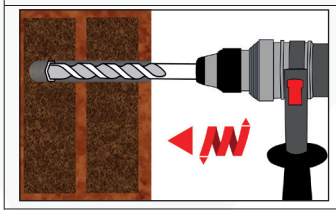
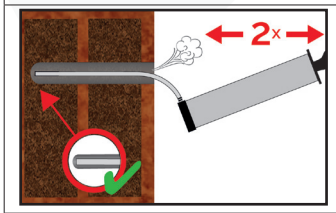
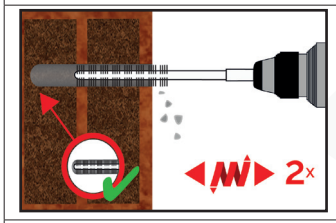
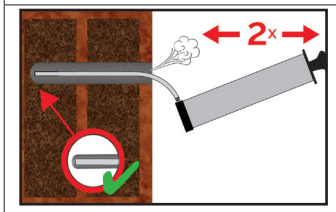
[2] Shear loads are valid for all specified temperature ranges.

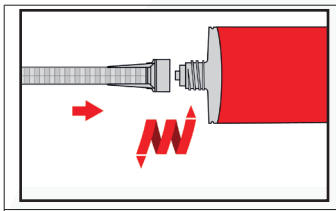
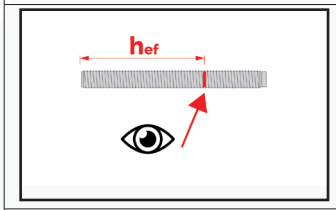
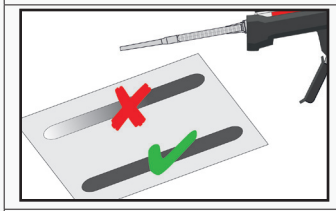
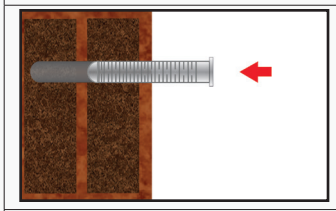
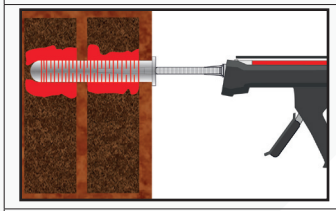
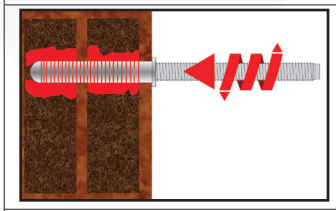
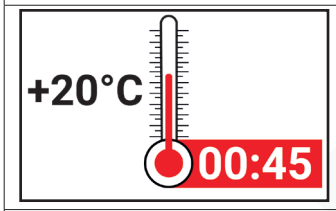
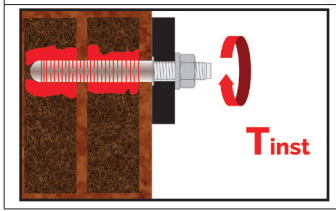
$N_{rec,stat}$, $V_{rec,stat}$ = Recommended load under static and quasi-static action

3. Anchorage in masonry

Installation instructions

Installation in solid masonry (without sleeve)	
	**1.** Holes to be drilled perpendicular to the surface of the base material by using a hard-metal tipped hammer drill bit. Drill a hole, with drilling method according to page 12, into the base material, with nominal drill hole diameter and bore hole depth according to the size and embedment depth required by the selected anchor. In case of aborted drill hole the drill hole shall be filled with mortar.
	**2a.** Starting from the bottom or back of the bore hole, blow the hole clean with handpump (see page 12) a minimum to two times.
	**2b.** Attach an appropriate sized wire brush > $d_{b,min}$ (see page 12) to a drill or a cordless screwdriver and brush the hole clean with a minimum of two times in a twisting motion. If the bore hole ground is not reached with the brush, a brush extension must be used.
	**2c.** Finally blow the hole clean again with handpump (see page 12) a minimum of two times.
	**3.** Remove the cap and attach the supplied static-mixing nozzle to the cartridge and load the cartridge into the correct dispensing tool. In case of a foil tube cartridge, cut off the clip before use. For every working interruption longer than the recommended working time (see page 4) as well as for new cartridges, a new static-mixer shall be used.
	**4.** Prior to inserting the anchor rod into the filled bore hole, the position of the embedment depth shall be marked on the anchor rods.
	**5.** Prior to dispensing into the anchor hole, squeeze out separately a minimum of three full strokes and discard non-uniformly mixed adhesive components until the mortar shows a consistent grey colour. For foil tube cartridges it must be discarded a minimum of six full strokes.
	**6.** Starting from the bottom resp. back of the cleaned anchor hole fill the hole up to approximately two-thirds with adhesive. Slowly withdraw of the static mixing nozzle as the hole is filled avoids creating air pockets. Observe the gel-/ working times given (see page 4).

	**7.** Push the threaded rod or reinforcing bar into the anchor hole while turning slightly to ensure positive distribution of the adhesive until the embedment depth is reached. The anchor should be free of dirt, grease, oil or other foreign material.
	**8.** Be sure that the anchor is fully seated at the bottom of the hole and that excess mortar is visible at the top of the hole. If these requirements are not maintained, the application has to be renewed.
	**9.** Allow the adhesive to cure to the specified time prior to applying any load or torque. Do not move or load the anchor until it is fully cured. (see page 4).
	**10.** After full curing, the fixture can be installed with up to the max. installation torque (see page 12) by using a calibrated torque wrench.
Installation in solid and hollow masonry (with sleeve)	
	**1.** Holes to be drilled perpendicular to the surface of the base material by using a hard-metal tipped hammer drill bit. Drill a hole, with drill method according to page 12, into the base material, with nominal drill hole diameter and bore hole depth according to the size and embedment depth required by the selected anchor. In case of aborted drill hole the drill hole shall be filled with mortar.
	**2a.** Starting from the bottom or back of the bore hole, blow the hole clean with handpump (see page 12) a minimum of two times.
	**2b.** Attach an appropriate sized wire brush > $d_{b,min}$ (see page 12) to a drill or a cordless screwdriver and brush the hole clean with a minimum of two times in a twisting motion. If the bore hole ground is not reached with the brush, a brush extension must be used.
	**2c.** Finally blow the hole clean again with handpump (see page 12) a minimum of two times.

	**3.** Remove the cap and attach the supplied static-mixing nozzle to the cartridge and load the cartridge into the correct dispensing tool. In case of a foil tube cartridge, cut off the clip before use. For every working interruption longer than the recommended working time (see page 4) as well as for new cartridges, a new static-mixer shall be used.
	**4.** Prior to inserting the anchor rod into the filled bore hole, the position of the embedment depth shall be marked on the anchor rods.
	**5.** Prior to dispensing into the anchor hole, squeeze out separately a minimum of three full strokes and discard non-uniformly mixed adhesive components until the mortar shows a consistent grey colour. For foil tube cartridges it must be discarded a minimum of six full strokes.
	**6.** Insert the perforated sleeve flush with the surface of the masonry or plaster. Only use sleeves that have the right length. Never cut the sleeve.
	**7.** Starting from the bottom or back fill the sleeve with adhesive. For quantity of mortar attend cartridges label or installation instructions. Obeserve the gel-/working times given in table on page 4.
	**8.** Push the threaded rod into the anchor hole while turning slightly to ensure positive distribution of the adhesive until the embedment depth is reached. The anchor shall be free of dirt, grease, oil or other foreign material.
	**9.** Allow the adhesive to cure to the specified curing time prior to applying any load or torque. Do not move or load the anchor until it is fully cured (attend tables on page 4).
	**10.** After full curing, the fixture can be installed with up to the max. installation torque (see parameters of brick on page 12) by using a calibrated torque wrench.

Installation accessories

Brush: 20mm Nylon, Length: 80 mm

Blower

Setting parameters

Installation parameters									
Axial distance plug group		$s_{cr,N\ Group}$	[mm]	Hlz, KSL, MZ, KS = 100 Hbl, Hbn = 200				100	
Min. axial distance plug group[1)]		$s_{min\ Group}$	[mm]	Hlz, KSL, MZ, KS = 50 Hbl, Hbn = 200				50	
Axial distance between single plugs		$s_{cr,N\ Single}$	[mm]	250				250	
Edge distance		$c_{cr,N}$	[mm]	250				200 (250)[2)]	
Min. edge distance[3)]		c_{min}	[mm]	250				50 (60)[2)]	
Embedment depth of rod	with sleeve	h_{ef}	[mm]	50	85	85	85	80	90
	without sleeve	h_{ef}	[mm]	60	80	90	110	80	90
Drilling depth	with sleeve	h_0	[mm]	55	90	90	90	105	105
	without sleeve	h_0	[mm]	65	85	95	115	85	95
Minimum part thickness		h_{min}	[mm]	110			125	110	
Drill diameter		d_o	[mm]	11	16	16	16	14	16
Hole diameter in fixed element		d_f	[mm]	7	9	12	14	9	12
Installation torque		T_{inst}	[Nm]	3	8	8	8	2	2

[1)] It is permissible to go below the axial spacing to the minimum value for anchor pairs and groups of four, if the permissible loads are reduced. The maximum loads must not be exceeded.

[2)] Value in brackets applies to solid bricks (Mz and KS).

[3)] Applies to masonry with top load or proof of tilt. Does not apply to shear loads directed towards a free edge.

Calculation of recommended loads

The recommended loads given are for preliminary planning purposes only and do not replace dimensioning.

The following conditions must be met:

- Dry environment
- Temperature range 24/40°C (long-term/short-term)
- Spacing distance s ≥ scr
- Edge distance c ≥ ccr
- Strength class of masonry mortar at least M2.5
- Brick strength as well as density and dimensions
- Joints are visible
- Vertical joint is mortared
- Strength clas of the threaded rod is min. 5.8 oder higher

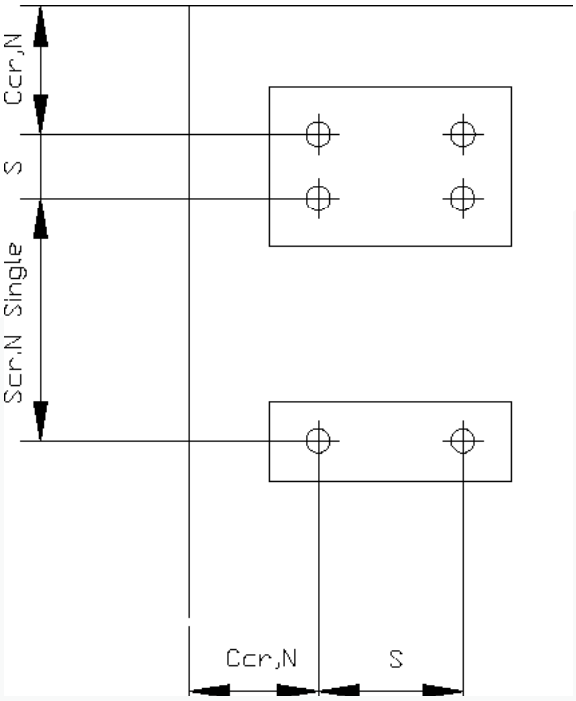
The recommended loads take into account all partial safety factors (resistance 2.5; action 1.4) and all failure modes. An interaction between tension and transverse tension was not taken into account.

Reduced permissible loads with reduced axial spacing per anchor in anchor groups
$s_{cr,N\ Group} \geq s > s_{min}$

Anchor pairs:
red F = $\chi_s \cdot F_{rec}$
$c_s = ½ (1 + s/s_{cr,N\ Group}) \leq 1,0$

Groups of four:
red F = $\chi_{s1} \cdot \chi_{s2} \cdot F_{rec}$
$\chi_{s1,2} = ½ (1 + s_{1,2}/s_{cr,N\ Group}) \leq 1,0$

F_{rec} = Permissible load per anchor
red F = Reduced load per anchor
$s_{cr,N\ Group}$ = Axial spacing
s = Reduced axial spacing



Permissible load in [kN] for each single brick				
Brick format		< 4 DF	4 to 10 DF	≥ 10DF
Without top load	max F [kN]	1,0	1,4	2,0
With top load	max F [kN]	1,4	1,7	2,5

Recommended loads - masonry

Stone	Strength class	Recommended loads		Standard sleeves				Wing sleeve	
				M6	M8	M10	M12	M8	M10
Hollow brick	Hlz 4	F_{rec}	[kN]	0,3	0,3	0,3	0,3	0,3	0,3
	Hlz 6			0,4	0,4	0,4	0,4	0,4	0,4
	Hlz 12			0,7	0,8	0,8	0,8	0,8	0,8
Sand -lime hollow brick	KSL 4	F_{rec}	[kN]	0,3	0,3	0,3	0,3	0,3	0,3
	KSL 6			0,4	0,4	0,4	0,4	0,4	0,4
	KSL 12			0,7	0,8	0,8	0,8	0,8	0,8
Sand -lime solid brick[1)]	KS 12	F_{rec}	[kN]	0,5	1,7	1,7	1,7	1,7	1,7
Solid brick[1)]	Mz 12	F_{rec}	[kN]	0,5	1,7	1,7	1,7	1,7	1,7
Light concrete hollow brick	Hbl 2	F_{rec}	[kN]	0,3	0,3	0,3	0,3	-	-
	Hbl 4			0,5	0,6	0,6	0,6	-	-
Concrete hollow brick	Hbn 4	F_{rec}	[kN]	0,5	0,6	0,6	0,6	-	-

[1)] Anchoring in masonry of solid lime-sand bricks (KS) and masonry bricks (Mz) does not require perforated sleeve.