VECO

VINYLESTER STYRENE-FREE

REVISION R02.11 19.08.2022

NOTE: THIS TECHNICAL DATA SHEET REPLACES ALL PREVIOUS VERSIONS. THE INSTRUCTIONS IN THIS DOCUMENTATION ARE BASED ON OUR TESTS AND EXPERIENCE AND HAVE BEEN PREPARED TO THE BEST OF OUR KNOWLEDGE AND CONSCIENCE. DUE TO THE VARIETY OF DIFFERENT MATERIALS AND SUBSTRATES AND THE MANY DIFFERENT POSSIBLE APPLICATIONS BEYOND OUR CONTROL, WE ASSUME NO REPONSIBILITY FOR THE RESULTS ACHIEVED. SINCE THE CONSTRUCTION AND NATURE OF THE SUBSTRATE AND THE PROCESSING CONDITIONS ARE BEYOND OUR CONTROL, WE DO NOT ACCEPT ANY LIABILITY FOR THIS PUBLICATION. IN ANY CASE, IT IS RECOMMENDED TO CARRY OUT APPROPRIATE TESTS BEFORE USE.

CHEMOFAST®
Hanns-Martin-Schleyer-Str. 23
D-47877 Willich
Telehpone 0 21 54/81 23-0
Fax 0 21 54/81 23-3 26
www.chemofast.de
info@chemofast.de

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Application in non-cracked concrete

Application in cracked concrete

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Post-installed rebar

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Hanns-Martin-Schleyer-Str. 23
D-47877 Willich

Telehpone 0 21 54/81 23-0
Fax 0 21 54/81 23-3 26

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info@chemofast.de

1. General

Product description

The VECO mortar is a 2-component reaction resin mortar based an Vinylester Economic resin styrene-free and will be delivered in a 2-c cartridge (SF - foil tube cartridge and ST - standard cartridge) system. This cost-effective product may be used in combination with a hand-, battery- or pneumatic tool and a static mixer. It was designed especially for the anchoring of threaded rods or reinforcing bars into concrete (also porous and light). Based on the excellent standing behaviour the usability for overhead application is given. The VECO mortar product is characterised, by a huge range of applications including seismic C1 + C2 with an installation temperature from -10°C and an application temperature up to 80°C.

Properties and benefits

- European Technical Assessment for bonded fasteners acc. to EAD 330499-01-0601 (Option 1, Seismic C1 and C2): ETA-19/0402
- European Technical Assessment for post-installed rebar acc. to. EAD 330087-00-0601: ETA-19/0477
- For heavy anchoring - doweling and post-installed rebar connection
- Overhead application; waterfilled bore holes
- Suitable for attachment points with small edge- and axial distances due to an anchoring free of expansion forces
- High chemical resistance
- Low odour
- 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

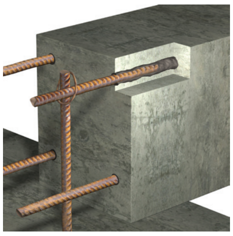
Suitable for the fixation of facades, roofs, wood constructions, metal constructions; metal profils, columns, beams, consoles, railings, sanitary devices, cable trays, piping, post-installed rebar connection (reconstruction or reinforcement), etc.

Handling and storage

- Storage: store in a cold and dark place, storage temperature: from +5°C up to +25 °C
- Shelf life: 18 months for cartridges (ST), 9 months for foil tubes (SF)

Applications and intended use

- Base material:
  cracked and non-cracked concrete, light-concrete, porous-concrete, natural stone (Attention! natural stone, can discolour; shall be checked in advance; hammer drilled bore holes,
- Anchor elements:
  Threaded rods (zinc plated or hot dip, stainless steel and high corrosion resistance steel), reinforcing bars, profiled rod, steel section with undercuts (e.g. perforated section)
- Temperature range:
  -10°C up to +40°C installation temperature
  cartridge temperature min. +5°C; optimal +20°C
  -40°C to +80°C base material temperature after full curing



CHEMOFAST®
Hanns-Martin-Schleyer-Str. 23
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Fax 0 21 54/81 23-3 26
www.chemofast.de
info@chemofast.de

Mortar properties

Properties	Test Method	Result
UV resistance	-	Pass
Watertightness	DIN EN 12390-8	0 mm
Temperature stability	-	120 °C
pH-value	-	> 12
Density	-	1,77 kg / dm³
Compressive strength	EN 196 Teil1	88 N / mm²
Flexural strength	EN 196 Teil1	15 N / mm²
E modulus	EN 12504-4	14000 N / mm²
Shrinkage	-	< 0,3 %
Hardness Shore D	-	90
Electrical resistance	IEC 93	$3,6\ 10^9$ W m
Thermal conductivity	IEC 60093	0,65 W/m·K

Reactivity

Temperature of base material	VECO Tropical		VECO Standard, Blue[1]		VECO Express	
	Gelling- and working time	Full curing time in dry base material[2]	Gelling- and working time	Full curing time in dry base material[2]	Gelling- and working time	Full curing time in dry base material[2]
-10 °C to -6°C					60 min	4 h
-5 °C to -1°C			90 min	6 h	45 min	2 h
0 °C to +4°C			45 min	3 h	25 min	80 min
+5 °C to +9°C			25 min	2 h	10 min	45 min
+ 10 °C to +14°C	30 min	5 h	20 min	100 min	4 min	25 min
+ 15 °C to +19°C	20 min	210 min	15 min	80 min	3 min	20 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 temperature	+5 °C to +45 °C		+5 °C to +40 °C		0°C to +30 °C	

[1] The Economic blue injection mortar has a curing time proof by changing the color from blue to gray after curing minimum time. The curing time proof is only valid for the standard version of the mortar.

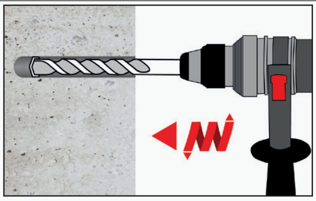
[2] The curing times in wet concrete has to be doubled.

Hanns-Martin-Schleyer-Str. 23
D-47877 Willich
Telehpone 0 21 54/81 23-0
Fax 0 21 54/81 23-3 26
www.chemofast.de
info@chemofast.de

2. Anchorage in concrete

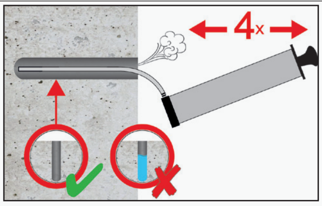
Installation instructions - concrete

Drilling of the bore hole

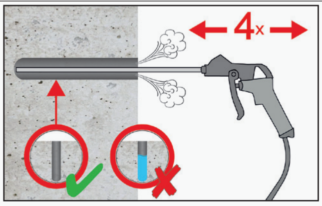


1. Drill with hammer drill a hole into the base material to the size and embedment depth required by the selected anchor (see page 7 - 8). In case of aborted drill hole: the drill hole shall be filled with mortar

Attention! Standing water must be removed before cleaning.



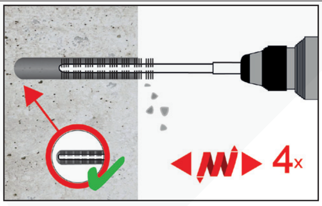
or



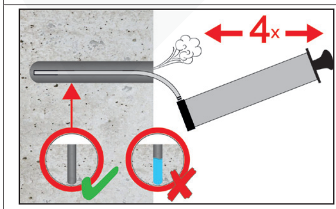
2a. Starting from the bottom or back of the bore hole, blow the hole clean with compressed air (min. 6 bar) or a hand pump (see page 7) a minimum of four times. If the bore hole ground is not reached an extension shall be used.

The hand-pump can be used for anchor sizes up to bore hole diameter 20 mm.

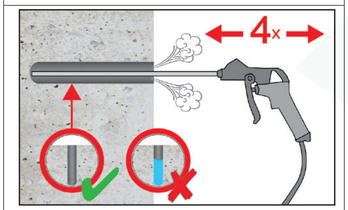
For bore holes lager then 20 mm or deeper 240 mm, compressed air (min. 6 bar) must be used.



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).



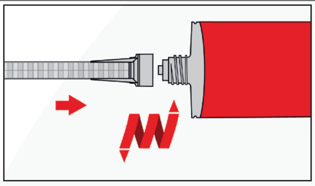
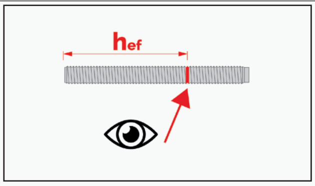
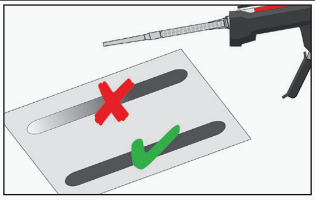
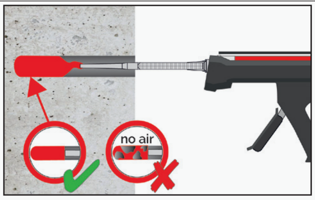
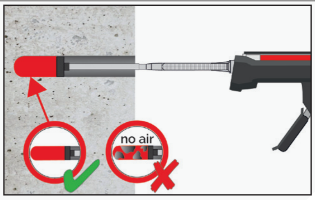
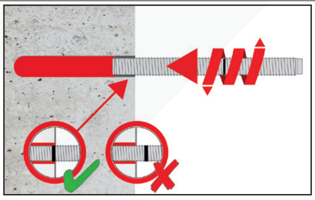
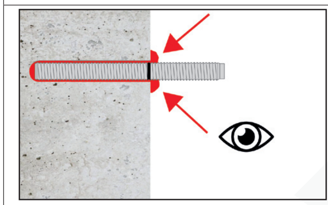
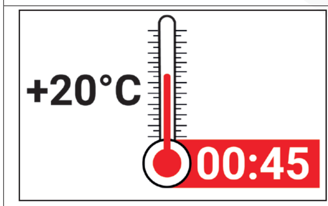
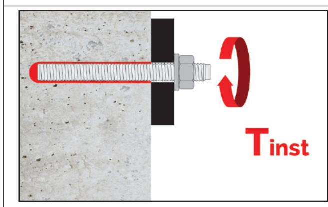
or



2c. Finally blow the hole clean again 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 larger than 20 mm or deeper 240 mm, compressed air (min. 6 bar) must be used.

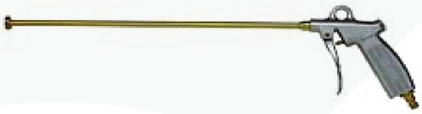
After cleaning, the bore hole has to be protected against re-contamination in an appropriate way, until dispensing the mortar in the bore hole. If necessary, the cleaning has to be repeated directly before dispensing the mortar. In-flowing water must not contaminate the bore hole again.

	**3.** Attach a supplied static-mixing nozzle to the cartridge and load the cartridge into the correct dispensing tool. After 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 or blue (VECO 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.** Piston plugs and mixer nozzle extensions shall be used according to table page 7 for the following applications: • Horizontal assembly (horizontal direction) and ground erection (vertical downwards direction): Drill bit-Ø $d_0 \geq 18$ mm and embedment depth hef > 250mm • Overhead assembly (vertical upwards direction): Drill bit-Ø $d_0 \geq 18$ mm
	**8.** 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.
	**9.** 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).
	**10.** 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).
	**11.** After full curing, the add-on part can be installed with the max. torque (see page 8) by using a calibrated torque wrench.

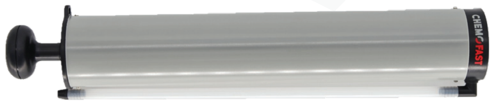
CHEMOFAST®
Hanns-Martin-Schleyer-Str. 23
D-47877 Willich
Telehpone 0 21 54/81 23-0
Fax 0 21 54/81 23-3 26
www.chemofast.de
info@chemofast.de

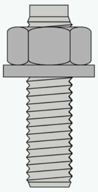
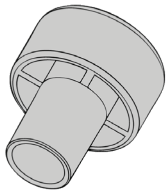
Installation accessories - concrete

CAC - Rec. compressed air tool (min 6 bar)
Drill bit diameter (d_0): all diameters



MAC - Hand pump (volume 750 ml)
Drill bit diameter (d_0): 10 mm to 20 mm
Drill hole depth (h_0): < 240 mm



									
Threaded rod	Rebar	d_0 Drill bit - Ø HD	d_b Brush-Ø		$d_{b,min}$ min. Brush-Ø	Piston plug	Installation direction and use of piston plug		
[mm]	[mm]	[mm]	[-]	[mm]	[mm]	[-]	↓	→	↑
M 8		10	RBT 10	12	10,5	No piston plug required			
M 10	8	12	RBT 12	14	12,5				
M 12	10	14	RBT 14	16	14,5				
	12	16	RBT 16	18	16,5				
M 16	14	18	RBT 18	20	18,5	VS 18	h_{ef} > 250 mm	h_{ef} > 250 mm	all
	16	20	RBT 20	22	20,5	VS 20			
M 20	20	24	RBT 24	26	24,5	VS 24			
M 24		28	RBT 28	30	28,5	VS 28			
M 27	25	32	RBT 32	34	32,5	VS 32			
M 30	28	35	RBT 35	37	35,5	VS 35			
	32	40	RBT 40	41,5	40,5	VS 40			

Hanns-Martin-Schleyer-Str. 23
D-47877 Willich
Telehpone 0 21 54/81 23-0
Fax 0 21 54/81 23-3 26
www.chemofast.de
info@chemofast.de

Setting parameter - concrete

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

Rebar size			ø8	ø10	ø12	ø14	ø16	ø20	ø25
Outer diameter of anchor	$d = d_{nom}$	[mm]	8	10	12	14	16	20	25
Nominal drill hole diameter	d_0	[mm]	12	14	16	18	20	25	32
Effective embedment depth	$h_{ef,min}$	[mm]	60	60	70	75	80	90	100
	$h_{ef,max}$	[mm]	160	200	240	280	320	400	500
Minimum thickness of member	h_{min}	[mm]	h_{ef} + 30 mm ≥ 100 mm		$h_{ef} + 2d_0$				
Minimum spacing	S_{min}	[mm]	50	55	65	70	80	100	130
Minimum edge distance	C_{min}	[mm]	50	55	65	70	80	100	130

Hanns-Martin-Schleyer-Str. 23
D-47877 Willich
Telehpone 0 21 54/81 23-0
Fax 0 21 54/81 23-3 26
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info@chemofast.de

Recommended loads - concrete

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 ETA(s) 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 ETA-19/0402.

• Property class 5.8 • Concrete - C20/25 • Hammer drilling (HD) • dry, wet concrete					M8	M10	M12	M16	M20	M24
Recommended tension load	40°C / 24°C [1] ψ^0_{sus} = 0,60	uncracked	$N_{rec,stat}$	[kN]	6,8	9,0	13,2	19,9	33,9	50,3
		cracked	$N_{rec,stat}$	[kN]	3,6	5,0	7,4	11,2	NPA	
			$N_{rec,eq,C1}$	[kN]	2,6	3,5	5,3	7,7		
			$N_{rec,eq,C2}$	[kN]	NPA		1,7	3,3		
	80°C / 50°C [1] ψ^0_{sus} = 0,60	uncracked	$N_{rec,stat}$	[kN]	5,2	6,7	9,9	15,0	25,4	37,7
		cracked	$N_{rec,stat}$	[kN]	2,8	3,9	5,8	8,7	NPA	
			$N_{rec,eq,C1}$	[kN]	2,1	2,8	4,1	6,1		
			$N_{rec,eq,C2}$	[kN]	NPA		1,4	2,6		
Recommended shear load without lever arm [2) 3)]		uncracked	$V_{rec,stat}$	[kN]	6,3	9,7	14,3	20,8	34,1	48,1
		cracked	$V_{rec,stat}$	[kN]	6,3	8,4	11,7	14,8	NPA	
			$V_{rec,eq,C1}$	[kN]	4,2	5,8	8,5	12,5		
			$V_{rec,eq,C2}$	[kN]	NPA		2,8	5,3		
Embedment depth			h_{ef}	[mm]	80	90	110	125	170	210
Edge distance			c ≥	[mm]	120	135	165	190	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.

3) In case of seismic action, the annular gap between the anchor rod and the through hole of the attachment must be filled with mortar, otherwise α_{gap} = 0,5 acc. to ETA-19/0402 must be taken into account.

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

$N_{rec,eq}$, $V_{rec,eq}$ = Recommended load under seismic action

Hanns-Martin-Schleyer-Str. 23
D-47877 Willich
Telehpone 0 21 54/81 23-0
Fax 0 21 54/81 23-3 26
www.chemofast.de
info@chemofast.de

Rebar

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

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

If the conditions are not fulfilled the loads must be calculated acc. to EN 1992-4.
For further details observe ETA-19/0477.

• Property class BSt 500 • Concrete - C20/25 • Hammer drilling (HD) • dry, wet concrete					ø8	ø10	ø12	ø14	ø16	ø20	ø25
Recommended tension load	40°C / 24°C [1)] ψ_{sus}^{0} = 0,60	uncracked	$N_{rec,stat}$	[kN]	5,6	7,9	11,5	14,0	16,2	27,6	42,5
Recommended tension load	80°C / 50°C [1)] ψ_{sus}^{0} = 0,60	uncracked	$N_{rec,stat}$	[kN]	4,4	6,2	9,1	11,0	13,7	21,2	32,7
Recommended shear load without lever arm [2)]		uncracked	$V_{rec,stat}$	[kN]	6,7	10,5	14,8	18,0	20,8	34,1	48,4
Embedment depth			h_{ef}	[mm]	80	90	110	115	125	170	210
Edge distance			c ≥	[mm]	120	135	165	172,5	187,5	255	315
Axial distance			s ≥	[mm]	240	270	330	345	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

Hanns-Martin-Schleyer-Str. 23
D-47877 Willich
Telehpone 0 21 54/81 23-0
Fax 0 21 54/81 23-3 26
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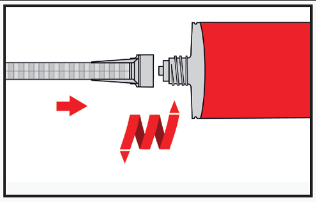
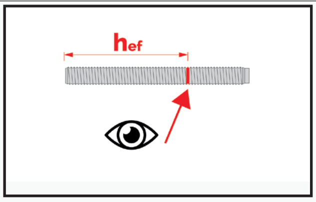
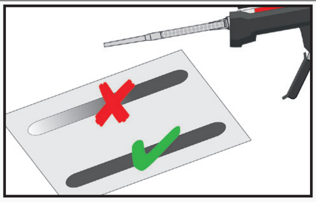
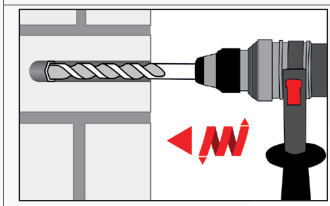
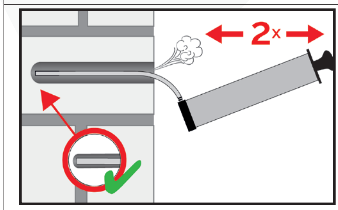
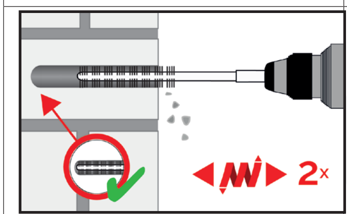
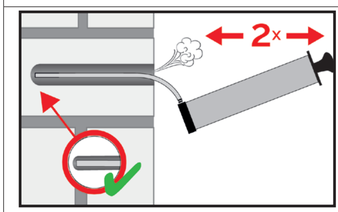
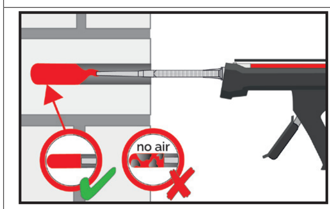
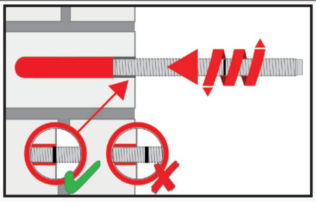
info@chemofast.de

3. Anchorage in masonry

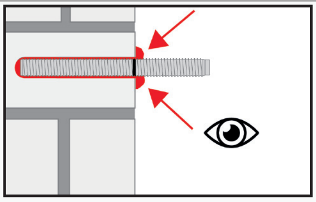
Installation instructions

Preparation of cartridge		
	1.	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.
	2.	Prior to inserting the anchor rod into the filled bore hole, the position of the embedment depth shall be marked on the anchor rods.
	3.	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.
Installation in solid masonry (without sleeve)		
	4.	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.
	5a.	Starting from the bottom or back of the bore hole, blow the hole clean with handpump (see page 12) a minimum to two times.
	5b.	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.
	5c.	Finally blow the hole clean again with handpump (see page 12) a minimum of two times.
	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).

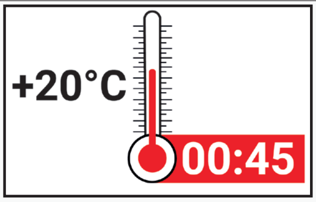


7. Push the threaded rod or reinforcing bar into the anchor hole while turning slightly to ensure positive distribution of the adhesive until the embedment depth is reached.

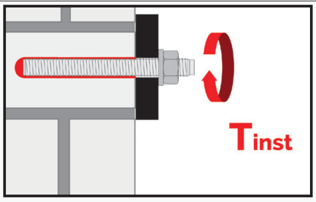
The anchor should be free of dirt, grease, oil or other foreign material.



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.

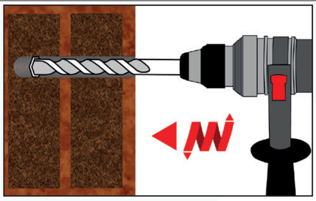


9. Allow the adhesive to cure to the specified time prior to applying any load or torque. Do not move or load the anchor until it is fully cured. (see page 4).

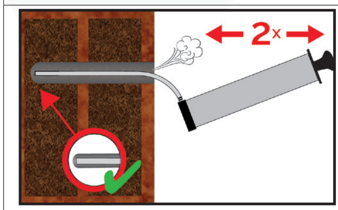


10. After full curing, the fixture can be installed with up to the max. installation torque (see page 16 - 17) by using a calibrated torque wrench.

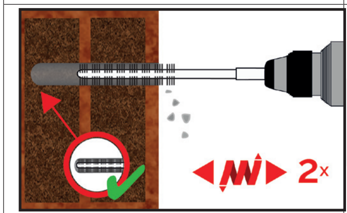
Installation in solid and hollow masonry (with sleeve)



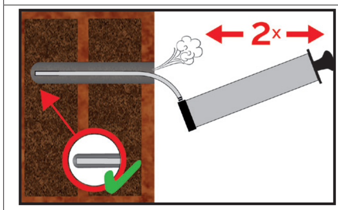
4. Holes to be drilled perpendicular to the surface of the base material by using a hard-metal tipped hammer drill bit. Drill a hole, with drill method according to page 12, into the base material, with nominal drill hole diameter and bore hole depth according to the size and embedment depth required by the selected anchor. In case of aborted drill hole the drill hole shall be filled with mortar.



5a. Starting from the bottom or back of the bore hole, blow the hole clean with handpump (see page 12) a minimum of two times.

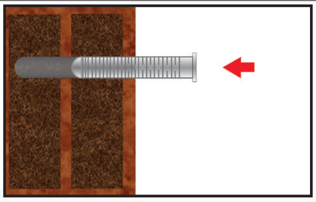
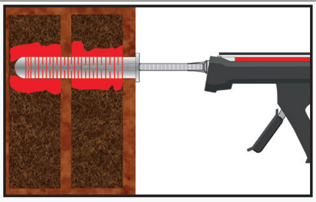
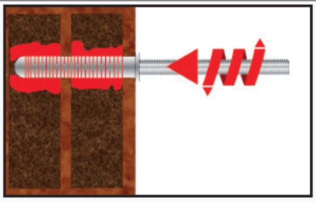
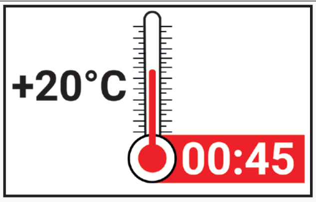
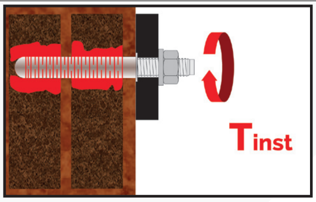


5b. Attach an appropriate sized wire brush > $d_{b,min}$ (see page 12) to a drill or a cordless screwdriver and brush the hole clean with a minimum of two times in a twisting motion. If the bore hole ground is not reached with the brush, a brush extension must be used.



5c. Finally blow the hole clean again with handpump (see page 12) a minimum of two times.

Hanns-Martin-Schleyer-Str. 23
D-47877 Willich
Telehpone 0 21 54/81 23-0
Fax 0 21 54/81 23-3 26
www.chemofast.de
info@chemofast.de

	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. For installation through insulation the sleeve SH 16x130/330 shall be cutted at the top end according to the insulation thickness.
	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 16 - 17) by using a calibrated torque wrench.

Installation parameters and accessories

Solid brick and autoclaved aerated concrete			M8	M10	M12	M16
Nominal drill hole diameter	d_0	[mm]	10	12	14	18
Effective anchorage depth	h_{ef}	[mm]	80	90	100	100
Drill hole depth	h_0	[mm]	80	90	100	100
Minimum wall thickness	h_{min}	[mm]	h_{ef} + 30			
Diameter of clearance hole in the fixture	d_f	[mm]	9	12	14	18
Brushes		[-]	RBT10	RBT12	RBT14	RBT18
Min. brush diameter	$d_{b,min} \geq$	[mm]	10,5	12,5	14,5	18,5
Max. installation torque	$T_{inst,max}$	[Nm]	see tables on page 16-17			

Hollow brick and solid brick with sleeve			M8	M8/M10			M12 /M16		
Perforated sleeve			SH12x80	SH16x85	SH16x130[1)]	SH16x130/ 330	SH20x85	SH20x130	SH20x200
Nominal drill hole diameter	d_0	[mm]	12	16	16	16	20	20	20
Effective anchorage depth	h_{ef}	[mm]	80	85	130	130	85	130	200
Drill hole depth	h_0	[mm]	85	90	135	135 $+t_{fix}$ [1)]	90	135	205
Minimum wall thickness	h_{min}	[mm]	115	115	175	175	115	175	240
Diameter of clearance hole in the fixture	d_f	[mm]	9	9 (M8) / 12 (M10)			14 (M12) / 18 (M16)		
Brushes		[-]	RBT12	RBT16			RBT20		
Min. brush diameter	$d_{b,min} \geq$	[mm]	12,5	16,5			20,5		
Max. installation torque	$T_{inst,max}$	[Nm]	see tables on page 16-17						

[1)] t_{fix} < 200 mm

Steel brush RBT and brush extension

Hand pump (volume 750 ml)

SDS Plus Adapter

Hanns-Martin-Schleyer-Str. 23
D-47877 Willich
Telehpone 0 21 54/81 23-0
Fax 0 21 54/81 23-3 26
www.chemofast.de
info@chemofast.de

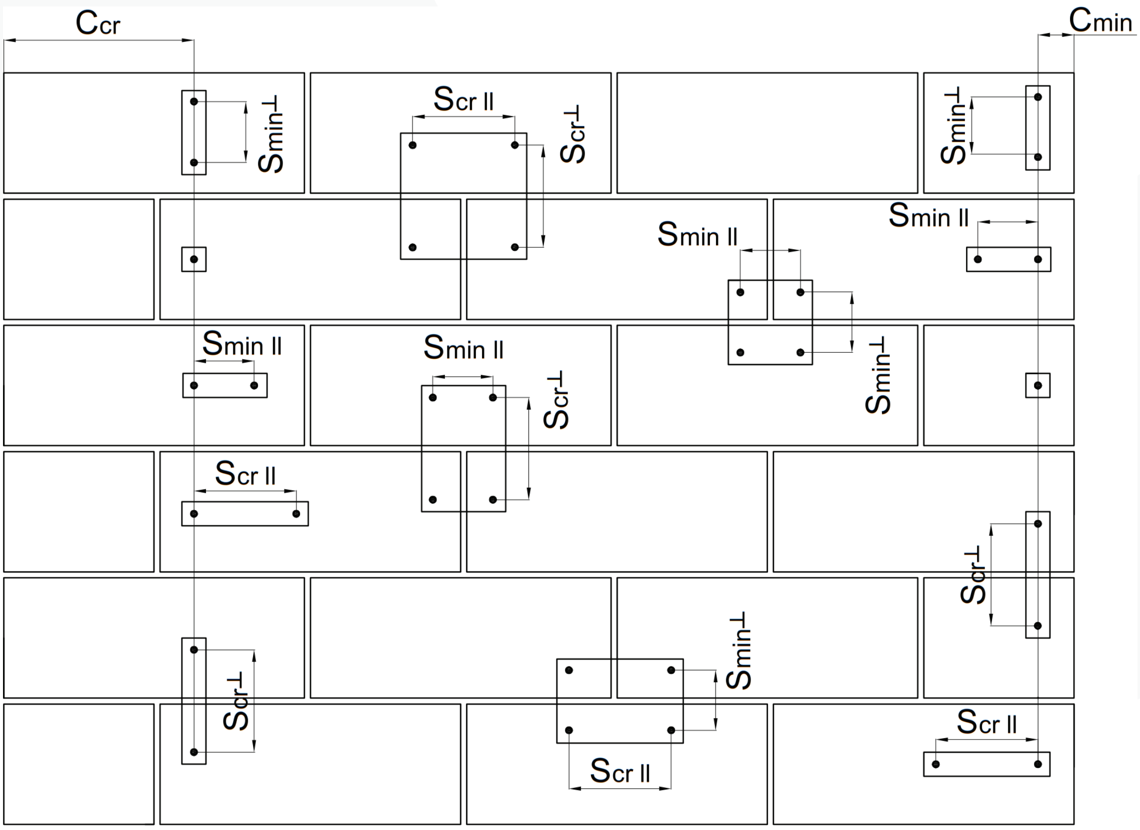
Calculation of recommended loads

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

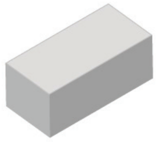
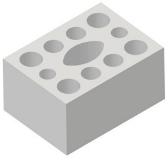
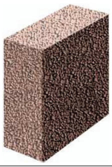
The following conditions must be met:

- Dry environment
- Temperature range 24/40°C (long-term/short-term)
- Spacing distance $s \geq s_{cr}$
- Edge distance $c \geq c_{cr}$
- 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
- Drilling method:
  "rotary drilling" in hollow brick and autoclaved aerated concrete (AAC),
  "hammer drilling" in solid brick

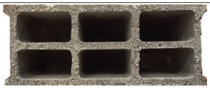
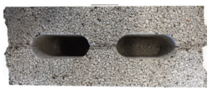
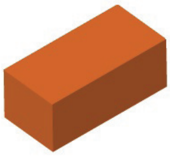
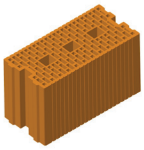
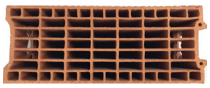
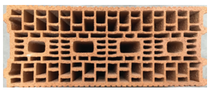
The recommended loads take into account all partial safety factors (resistance 2.5; action 1.4) and all failure modes. An interaction between tension and transverse tension was not taken into account.
If one or more of the conditions listed above are not fulfilled, the application must be recalculated according to TR054 and the requirements of the relevant ETA.



Recommended loads

Naming Compressive strength Density Dimensions	Picture	Anchor rods	Perforated sleeve	T_{inst} [Nm]	c_{cr} [mm]	c_{min} [mm]	s_{cr} [mm]	s_{min} [mm]	N_{empf^*} [kN]	$V_{empf.}$ [kN]
Calcium silica solid bricks acc. to EN 771-2										
Solid limestone KS ≥ 10 N/mm² ρ ≥ 2,0 kg/dm³ ≥ 240x115x71 mm		M8 to M16	without 12x80 16x85; 16x130 20x85; 20x130; 20x200	10	240	120	240	240	0,71	0,71
Perforated limestone KS-L 3DF ≥ 12 N/mm² ρ ≥ 1,4 kg/dm³ ≥ 240x175x113 m		M8 to M16	12x80 16x85; 16x130 20x85; 20x130; 20x200	8	240	100	240	113	0,43	0,26
Perforated limestone KS-L 12DF ≥ 12 N/mm² ρ ≥ 1,4 kg/dm³ ≥ 498x175x238 mm		M8 to M16	12x80 16x85; 16x130 20x85; 20x130;	2	500	100	500	240	0,11	0,36
Autoclaved aerated concrete acc. to EN 771-4										
AAC 2 ≥ 2 N/mm² r ≥ 0,35 kg/dm³ ≥ 449x240x249 mm		M8 to M16	without 12x80 16x85; 16x130 20x85; 20x130; 20x200	2	450	120	240	240	0,26	0,43
AAC 4 ≥ 4 N/mm² ρ ≥ 0,5 kg/dm³ ≥ 449x240x249 mm		M8 to M16	without 12x80 16x85; 16x130 20x85; 20x130; 20x200	2	450	120	240	240	0,26	0,43
AAC 6 ≥ 6 N/mm² ρ ≥ 0,6 kg/dm³ ≥ 449x240x249 mm		M8 to M16	without 12x80 16x85; 16x130 20x85; 20x130; 20x200	2	450	120	240	240	0,57	1,57
Lightweight concrete solid block acc. to EN 771-3										
VBL ≥ 2 N/mm² ρ ≥ 0,6 kg/dm³ ≥ 240x300x113 mm		M8 to M16	without	6	240	120	240	240	0,57	0,6
Leca Lex harkko RUH 200 Kulma ≥ 3 N/mm² ρ ≥ 0,78 kg/dm³ ≥ 498x200x195 mm		M8 to M16	12x80 16x85; 16x130 20x85; 20x130	6	500	120	240	240	0,57	0,73

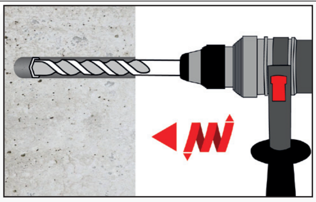
Hanns-Martin-Schleyer-Str. 23
D-47877 Willich
Telephone 0 21 54/81 23-0
Fax 0 21 54/81 23-3 26
www.chemofast.de
info@chemofast.de

Naming Compressive strength Density Dimensions	Picture	Anchor rods	Perforated sleeve	T_{inst}	c_{cr}	c_{min}	s_{cr}	s_{min}	$N_{empf.}$	$V_{empf.}$
				[Nm]	[mm]	[mm]	[mm]	[mm]	[kN]	[kN]
Hollow light weight concrete brick acc. to EN 771-3										
Bloc Creux B40 ≥ 5 N/mm² ρ ≥ 0,8 kg/dm³ ≥ 495x195x190 mm		M8 to M16	16x130 20x130	2	500	100	500	190	0,11	0,26
Leca Lex harkko RUH 200 ≥ 2,7 N/mm² ρ ≥ 0,7 kg/dm³ ≥ 498x200x195 mm		M8 to M16	12x80 16x85; 16x130 20x85; 20x130	8	500	120	500	195	0,57	0,26
Solid clay brick acc. to EN 771-1										
Solid clay brick Mz-1DF ≥ 20 N/mm² ρ ≥ 2,0 kg/dm³ ≥ 240x115x55 mm		M8 to M16	without 12x80 16x85; 16x130 20x85; 20x130; 20x200	6	240	120	240	240	0,43	0,86
Hollow clay brick acc. to EN 771-1										
Hollow clay brick HLZ 16DF ≥ 6 N/mm² ρ ≥ 0,8 kg/dm³ ≥ 497x240x238 mm		M8 to M16	12x80 16x85; 16x130 20x85; 20x130; 20x200	6	500	100	500	238	0,34	0,36
Hollow clay brick BGV Thermo ≥ 4 N/mm² ρ ≥ 0,60 kg/dm³ ≥ 500x200x314 mm		M8 to M16	12x80 16x85; 16x130 20x85; 20x130	2	500	100	500	314	0,11	0,36
Hollow clay brick Calibric R+ ≥ 6 N/mm² ρ ≥ 0,6 kg/dm³ ≥ 500x200x314 mm		M8 to M16	12x80 16x85; 16x130 20x85; 20x130	2	500	100	500	314	0,21	0,36
Hollow clay brick Urbanbric ≥ 6 N/mm² ρ ≥ 0,7 kg/dm³ ≥ 560x200x274 mm		M8 to M16	12x80 16x85; 16x130 20x85; 20x130	2	560	100	560	274	0,26	0,36
Hollow clay brick Porotherm Homebric ≥ 6 N/mm² ρ ≥ 0,7 kg/dm³ ≥ 500x200x299 mm		M8 to M16	12x80 16x85; 16x130 20x85; 20x130	2	500	100	500	300	0,26	0,36
Hollow clay brick Blocchi Leggeri ≥ 4 N/mm² ρ ≥ 0,55 kg/dm³ ≥ 250x120x250 mm		M8 to M16	12x80 16x85; 16x130 20x85; 20x130; 20x200	4	250	100	250	250	0,11	0,43
Hollow clay brick Doppio Uni ≥ 10 N/mm² ρ ≥ 0,9 kg/dm³ ≥ 250x120x120 mm		M8 to M16	12x80 16x85; 16x130 20x85; 20x130; 20x200	4	250	100	250	120	0,26	0,34

4. Post-installed rebar

Installation instruction - concrete

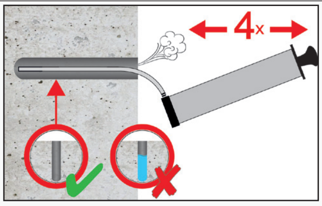
Bore hole drilling



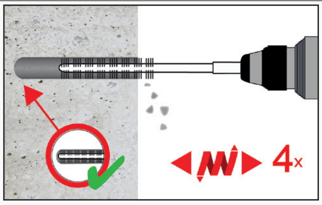
1a. Note: Before drilling, remove carbonated concrete and clean contact areas. Hammer (HD) or compressed air drilling (CD). Drill a hole into the base material to the size and embedment depth required by the selected reinforcing bar with carbide hammer drill (HD) or a compressed air drill (CD). In case of aborted drill hole: the hole shall be filled with mortar.

Attention! Standing water in the bore hole must be removed before cleaning.

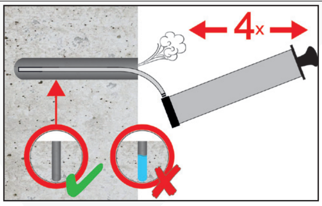
MAC: Cleaning for bore hole diameter $d_0 \leq$ 20mm and bore hole depth $h_0 \leq 10d_s$



2a. Starting from the bottom or the back of the bore hole, blow the hole clean by a hand pump (see page 13) a minimum of four times.

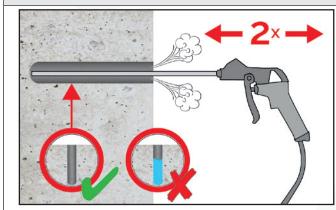


2b. Check the brush diameter (page 12). Brush the hole with an appropriate sized wire brush > $d_{b,min}$ (see page 12) a minimum of four times in a twisting motion. If the borehole ground is not reached with the brush, a brush extension must be used.

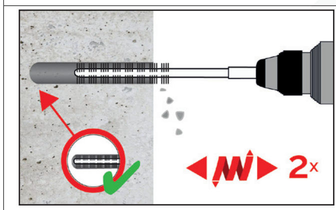


2c. Finally blow the hole clean again with a hand pump (see page 13) a minimum of four times.

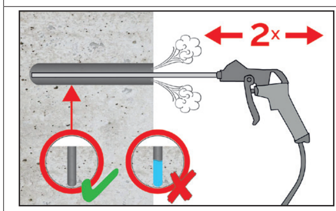
CAC: Cleaning for all bore hole diameter and bore hole depth



2a. Starting from the bottom or back of the bore hole, blow the hole clean with compressed air (min. 6 bar) (see page 13) a minimum of two times until return air stream is free of noticable dust. If the bore hole ground is not reached an extension shall be used.



2b. Check the brush diameter (see page 12). Brush the hole with an appropriate sized wire brush > $d_{b,min}$ (see page 12) a minimum of two times. If the borehole ground is not reached with the brush, a brush extension shall be used.

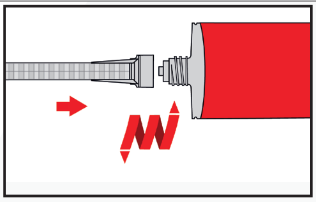


2c. Finally blow the hole clean again with compressed air (min. 6 bar) (see page 13) a minimum of two times until return air stream is free of noticable dust. If the bore hole ground is not reached an extension shall be used.

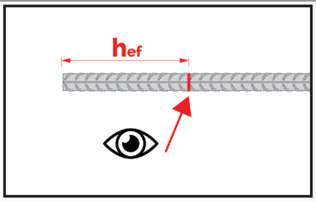
After cleaning, the bore hole has to be protected against re-contamination in an appropriate way, until dispending the mortar in the bore hole. If necessary, the cleaning has to be repeated directly before dispensing the mortar. In-flowing water must not contaminate the bore hole again.

Hanns-Martin-Schleyer-Str. 23
D-47877 Willich
Telehpone 0 21 54/81 23-0
Fax 0 21 54/81 23-3 26
www.chemofast.de
info@chemofast.de

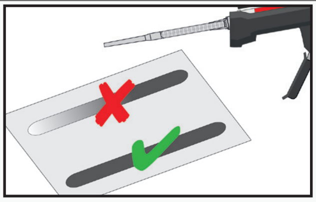
Perparation of bar and cartridge



3. Attach the supplied static-mixing nozzle to the cartridge and load the cartridge into the correct dispensing tool. 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.

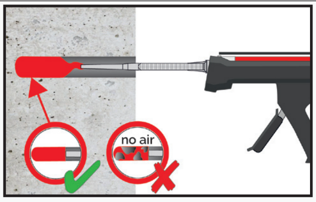


4. Prior to inserting the reinforcing bar into the filled bore hole, the position of the embedment depth shall be marked (e.g. with tape) on the reinforcing bar and insert bar in empty hole to verify hole and depth l_v (see page 13).

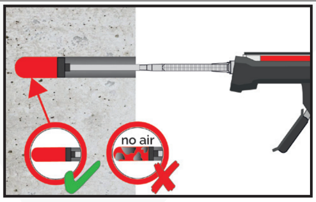


5. Prior to dispensing into the anchor hole, squeeze out separately the mortar until it shows a consistent grey colour, but a minimum of three full strokes and discard non-uniformly mixed adhesive components.

Filling the bore hole



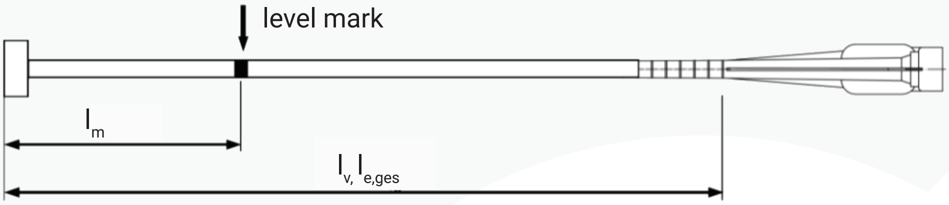
6a. Starting from the bottom or back of the cleaned anchor hole fill the hole up to approximately two-thirds with adhesive. Slowly withdraw of the static mixing nozzle as the hole is filled avoids creating air pockets. For embedment larger than 190 mm an extension nozzle shall be used.



6a. For overhead and horizontal installation and bore holes deeper than 240 mm a piston plug and the appropriate mixer extension must be used.

Observe the gel-/ working times given on page 4.

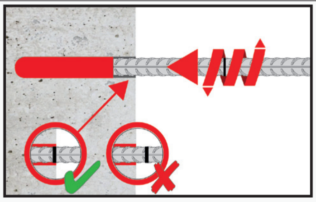
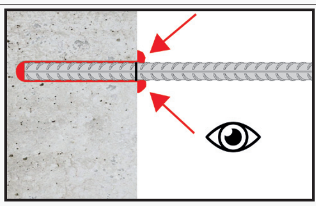
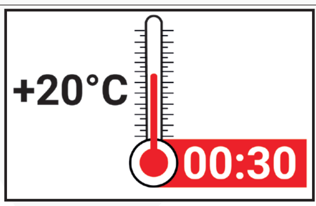
Bar size Ø	Drill bit-Ø		d_b Brush - Ø		$d_{b,min}$ min. Brush - Ø	Piston plug	Cartridge: All sizes				Cartridge: side-by-side (825 ml)	
							Hand or battery tool		Pneumatic tool		Pneumatic tool	
	HD	CD					$l_{v,max}$	Mixer extension	$l_{v,max}$	Mixer extension	$l_{v,max}$	Mixer extension
[mm]	[mm]		[-]	[mm]	[mm]	No.	[cm]	[-]	[cm]	[-]	[cm]	[-]
8	12	-	RBT12	13,5	12,5	-	70	VL 10/0,75	80	VL 10/0,75	80	VL 10/0,75
10	14	-	RBT14	15,5	14,5	VS14			100		1000	
12	16		RBT16	17,5	16,5	VS16						
14	18		RBT18	20,0	18,5	VS18						
16	20		RBT20	22,0	20,5	VS20						
20	25	-	RBT25	27,0	25,5	VS25	50		70			
	-	26	RBT26	28,0	26,5	VS25						
25	32		RBT32	34,0	32,5	VS32						



Injection tool must be marked by mortar level mark l_m and anchorage depth l_v resp. $l_{e,ges}$ with tape or marker.
Quick estimation: $l_m = 1/3 * l_v$

Continue injection until mortar level mark l_m becomes visible.

Optimum mortar volume: $l_m = l_v$ rep. $l_{e,ges} * (1{,}2 * Ø^2/d_0^2 * 0{,}2)$ [mm]

Inserting rebar	
	**7.** Push the reinforcing bar into the anchor hole while turning slightly to ensure positive distribution of the adhesive until the embedment depth is reached. The bar should be free of dirt, grease, oil or other foreign material.
	**8.** Be sure that the bar is inserted in the bore hole until the embedment mark is at the concrete surface 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.** Observe gelling time t_{gel} . Attend that the gelling time can vary according to the base material temperature (see page 4). It is not allowed to move the bar after geling time t_{gel} has elapsed. Allow the adhesive to cure to the specified time prior to applying any load. Do not move or load the bar until it is fully cured (attend table on page 4). After full curing time t_{cure} has elapsed, the add-on part can be installed.

Cleaning and installation tools- concrete

Rec. compressed air tool hand slide valve
(min 6 bar)

Brush RBT and brush extension

Hand pump (volume 750 ml)

SDS Plus Adapter

Hanns-Martin-Schleyer-Str. 23
D-47877 Willich
Telehpone 0 21 54/81 23-0
Fax 0 21 54/81 23-3 26
www.chemofast.de
info@chemofast.de

Design anchorage and lap length

The calculation of the design anchoring lengths of reinforcing bars, if used as end anchoring or as overlapping joint, has to consider the details and provisions of the approval ETA-19/0477 and the EN 1992-1-1:2004+AC:2010.
The design load with corresponding failure mode („pull-out failure“ or „steel failure“) were determined for selected rebar diameters and anchorage lengths. The results for end anchoring and overlapping joints are given in the tables below.

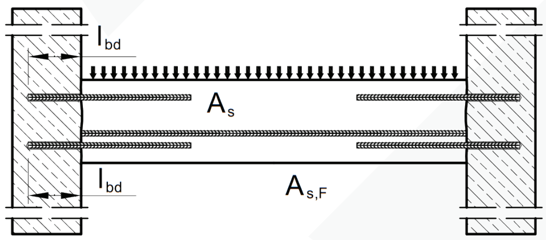
The calculations are based on following assumptions:

- Rebar BSt 500 S, f_{yk} = 500 N/mm², Material safety factor of γ_s = 1,15
- Concrete class C20/25 and „good bond conditions“ acc. EN 1992-1-1:2004+AC:2010 considered. Rebar diameters ≤ d = 25 mm.
- The bond properties of the bars is considered by the coefficients:

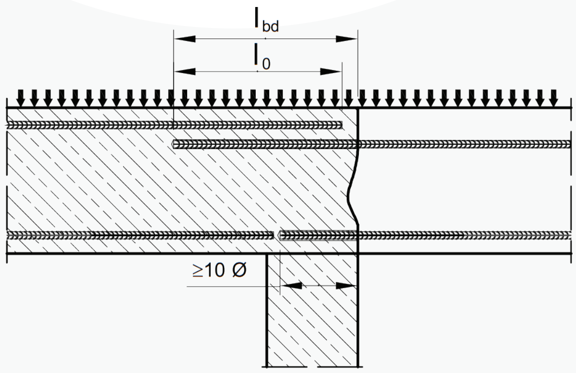
α_1	= 1,0;	is for the effect of the form of the bars assuming adequate cover; 1,0 for straight rebars
α_2	= 1,0;	is for the effect of concrete minimum cover; has to be checked
α_3	= 1,0;	is for the effect of confinement by transverse reinforcement; 1,0 for no transverse reinforcement
α_4	= 1,0;	is for the influence of one or more welded transverse bars; 1,0 for no welded transverse reinforcement
α_5	= 1,0;	is for the effect of the pressure transverse; 1,0 if no transverse pressure is assumed
α_6	= 1,5;	is for the percentage of lapped bars relative to the total cross-section area, 1,5 due to the given situation on the construction side

All drilling methods (hammer drilling, compressed air drilling) are considered by the amplification factor of α_{lb} = 1,5.

End anchoring of slabs or beams (e.g. designed as simply supported)



Overlapping joint for rebar connections of slabs and beams



Rebar Ø8 - Ø25			End anchoring			Overlapping joint		
Concrete class C20/25 Rebar BSt 500 S; f_{yk} = 500 N/mm² Hammer- or compressed air drilling			$\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = 1{,}0$ $\alpha_{lb} = 1{,}5$			$\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = 1{,}0$ $\alpha_6 = 1{,}5$ $\alpha_{lb} = 1{,}5$		
d	$N_{Rd,s}$	$l_{v,max}$	l_{bd}	N_{Rd}	Volume Mortar	l_0	N_{Rd}	Volume Mortar [1)
[mm]	[kN]	[mm]	[mm]	[kN]	[ml]	[mm]	[kN]	[ml]
Ø8	21,9	800	170	9,8	13	300	11,6	23
			240	13,9	18	390	15,0	29
			310	17,9	23	480	18,5	36
			378	21,9	29	567	21,9	43
Ø10	34,1	1000	213	15,4	19	319	15,4	29
			300	21,7	27	450	21,7	41
			390	28,2	35	580	27,9	52
			473	34,1	43	709	34,1	64
Ø12	49,2	1000	255	22,1	27	383	22,1	40
			360	31,2	38	540	31,2	57
			460	39,9	49	700	40,5	74
			567	49,2	60	851	49,2	90
Ø14	66,9	1000	298	30,1	36	447	30,1	54
			420	42,5	51	630	42,5	76
			540	54,6	65	810	54,6	98
			662	66,9	80	992	66,9	120
Ø16	87,4	1000	340	39,3	46	510	39,3	69
			480	55,5	65	720	55,5	98
			620	71,7	84	930	71,7	126
			756	87,4	103	1134	87,4	154
Ø20	136,6	1000	425	61,5	90	638	61,5	135
			600	86,7	127	900	86,7	191
			770	111,3	163	1160	111,8	246
			945	136,6	200	1418	136,6	301
Ø22	165,3	1000	468	74,4	33	702	74,4	198
			650	103,3	46	800	84,8	226
			830	131,9	59	900	95,4	254
			1000[2)	159,0	71	1000[2)	106,0	283
Ø24	196,7	1000	510	88,5	216	766	88,5	323
			670	116,2	283	840	97,1	355
			830	143,9	350	920	106,4	388
			1000[2)	173,4	422	1000[2)	115,6	422
Ø25	213,4	1000	532	96,0	200	797	96,0	300
			690	124,6	259	860	103,6	323
			850	153,5	320	930	112,0	350
			1000[2)	180,6	376	1000[2)	120,4	376

[1) Mortar volume of the overlap joint. The mortar volume of the concrete cover c_1, at the face of the existing reinforcing steel, was not taken into account.

[2) $l_{v,max}$ is limited to 1000 mm, see ETA-19/0477

Hanns-Martin-Schleyer-Str. 23
D-47877 Willich
Telehpone 0 21 54/81 23-0
Fax 0 21 54/81 23-3 26
www.chemofast.de
info@chemofast.de

The specified design load N_{Rd} (End anchoring, Overlapping joints) can be converted to further concrete classes, while maintaining the previously accepted boundary conditions and anchorage lengths l_{bd} or lap length l_0, with the approach as follows:

$N_{Rd,con}$ = min ($N_{Rd,s}$; N_{Rd} * $f_{bd,con}$- Faktor) [kN]

The conversion factor $f_{bd,con}$ can be taken from the table below:

Ø Rebar	Ø8 - Ø20 mm		Ø25 mm	
Concrete class	$f_{bd,PIR}$	$f_{bd,con}$ - Factor	$f_{bd,PIR}$	$f_{bd,con}$ - Factor
[-]	[N/mm²]	[-]	[N/mm²]	[-]
C12/15	1,6	0,70	1,6	0,70
C16/20	2,0	0,87	2,0	0,87
C20/25	2,3	1,00	2,3	1,00
C25/30	2,7	1,17	2,7	1,17
C30/37	3,0	1,30	3,0	1,30
C35/45	3,4	1,48	3,4	1,48
C40/50	3,7	1,61	3,7	1,61
C45/50	4,0	1,74	4,0	1,74
C50/60	4,3	1,87	4,0	1,74

Hanns-Martin-Schleyer-Str. 23
D-47877 Willich
Telehpone 0 21 54/81 23-0
Fax 0 21 54/81 23-3 26
www.chemofast.de
info@chemofast.de

5. Chemical resistance

Chemical Agent	Concentration	Resistant	Not resistant
Accumulator acid		x	
Acetic acid	10%	x	
Acetic acid	40%		x
Laitance			x
Acetone	5%		x
Acetone	10%		x
Acetone	100%		x
Ammonia, aqueous solution	5%	x	
Ammonia, aqueous solution	32%		x
Aniline	100%		x
Beer	100%	x	
Chlorine	All		x
Benzol	100%		x
Boric Acid, aqueous solution		x	
Calcium carbonate, suspended in water	All	x	
Calcium chloride, suspended in water		x	
Calcium hydroxide, suspended in water		x	
Chlorinated lime (Calcium hypochlorite)	10%		x
Carbon tetrachloride	100%	x	
Caustic soda solution	10%	x	
Caustic soda solution	40%		x
Citric acid	10%		x
Citric acid	50%		x
Citric acid	All	x	
Chlorine water, swimming pool	All	x	
Demineralized water	All		x
Diesel oil	100%	x	
Ethyl alcohol, aqueous solution	100%		x
Ethyl alcohol, aqueous solution	50%		x
Formic acid	10%		x
Formic acid	30%		x
Formic acid	100%		x
Formaldehyde, aqueous solution	20%		x
Formaldehyde, aqueous solution	30%	x	
Freon		x	
Fuel Oil		x	
Gasoline (premium grade)	100%	x	
Glycol (Ethylene glycol)		x	
Hydraulic fluid	Conc.	x	
Hydrochloric acid (Muriatic Acid)	Conc.		x
Hydrogen peroxide	10%		x
Hydrogen peroxide	30%		x
Isopropyi alcohol	100%		x
Lactic acid	10%		x
Lactic acid	All	x	
Linseed oil	100%	x	
Lubricating oil	100%	x	
Magnesium chloride, aqueous solution	All	x	
Methanol	100%		x
Standard benzine		x	
Motor oil (SAE 20 W-50)	100%	x	
Nitric acid	10%		x
Oleic acid	100%	x	
Perchloroethylene	100%	x	
Petroleum	100%	x	
Phenol, aqueous solution	8%		x

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

Hanns-Martin-Schleyer-Str. 23
D-47877 Willich
Telehpone 0 21 54/81 23-0
Fax 0 21 54/81 23-3 26
www.chemofast.de
info@chemofast.de

Chemical Agent	Concentration	Resistant	Not resistant
Benzyl alocohol	100%		x
Phosphoric acid	85%	x	
Phosphoric acid	10%		x
Potash lye (Potassium hydroxide)	10%	x	
Potash lye (Potassium hydroxide)	40%	x	
Potassium carbonate, aqueous solution	All	x	
Potassium chlorite, aqueous solution	All	x	
Potassium nitrate, aqueous solution	All	x	
Sea water, salty	All	x	
Sodium carbonate	All	x	
Sodium chloride, aqueous solution	All	x	
Sodium phosphate, aqueous solution	All	x	
Sodium silicate	All	x	
Sulfuric acid	10%	x	
Sulfuric acid	30%		x
Sulfuric acid	70%		x
Tartaric acid	All	x	
Tetrachloroethylene	100%	x	
Toluene			x
Trichloroethylene	100%		x
Turpentine	100%	x	

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

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D-47877 Willich
Telehpone 0 21 54/81 23-0
Fax 0 21 54/81 23-3 26
www.chemofast.de
info@chemofast.de