STAHLFIX

CHEMICAL ANCHORING

PROFESSIONAL

ETA APPROVED OPTION 7

SOCOTEC

WRAS APPROVED PRODUCT

WYRÓB BUDOWLANY

CSTB le futur en construction

Mai 2012

May 2012

New Generation of Chemical Anchors for Rebars and Threaded Rods Fixings

Contents:

Chemical anchors : Introduction

Chemical anchors have been used since 1950 worldwide.

Unlike “mechanical anchors”, chemically bonding epoxy resin has the power to spread the load on the entire fastening Onface which results in very high loading capacity.

Chemical anchoring is recommended for all kinds of building materials: concrete, reinforced concrete, stone, solid brick, hollow brick, marble, or similair, and can be used in different environments and at varying temperatures.

It also has the inherent attribute of protecting the rods or rebar from corrosion. The resin is impermeable to water, frost and chemicals thereby extending the life of the fixing anchor.

This product complies with European and international regulations.

Chemical anchors: Practical

The two-component resin system is contained within two compartments housed separately within a single cartridge unit. This can be a co-axial chamber or a foil-bag with two compartments. To use the product the cartridge is placed in a special extrusion tool which forces a piston in the back of the cartridge to push both components from the cartridge and through a special helical plastic mixing nozzle. This has the effect of thoroughly mixing both components for an optimal chemical reaction.

The resin mix is injected directly into a pre-drilled hole. This hole should have been cleaned thoroughly of dust and debris. A threaded rod is inserted into the hole by hand with a slow rotation. The anchor may be loaded after the setting time recommended depending on the ambient temperature (see the data of each technical product). Once cured the resin is non-toxic and not contaminating to water.

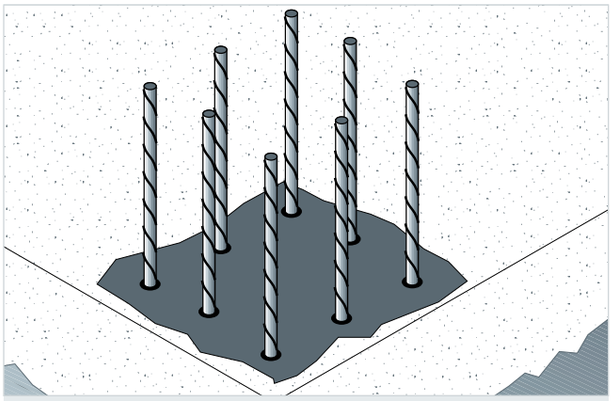
Overview of applications :

- The preferred solution for awkward, incongruent, difficult to reach fixings
- Replaces tradtional mechanical fastening systems
- Especially suited to fixing very high loads
- Long life of fixing, even more durable than the building material
- Allows fixings in any material without imparting a stress onto the material during the fixing phase. e.g. close to the edge applications, suitable for concrete, stone, bricks, and hollow material and perforated blocks.
- Solves anchoring situations where traditional mechanical anchors would crack the Onface of the material
- Resistant to vibration and rust

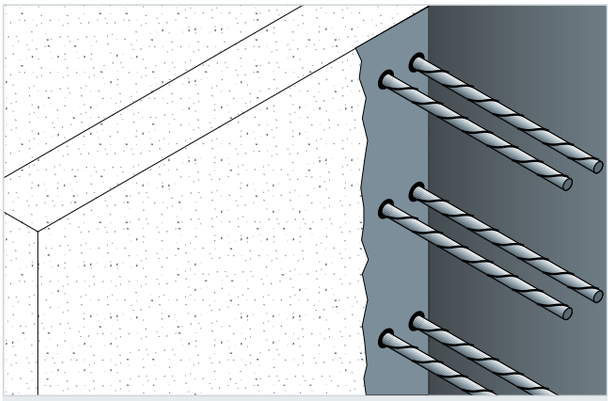
APPLICATIONS

- Rebars
- Threaded rods
- Studs
- Security doors
- Awnings and porches
- Garage doors
- Terraces and balconies
- Sun protection panels
- Satellite dishes
- Kitchen cabinets and fittings
- Sanitary ware
- Ramps and railings
- Escalators
- Pipes and poles
- Air conditioning installations
- Cable ducting
- Lighting fixtures
- Columns and arches
- Mail boxes
- Signage
- Road construction
- Swimming pools
- Boilers and raditors
- Fences and screens

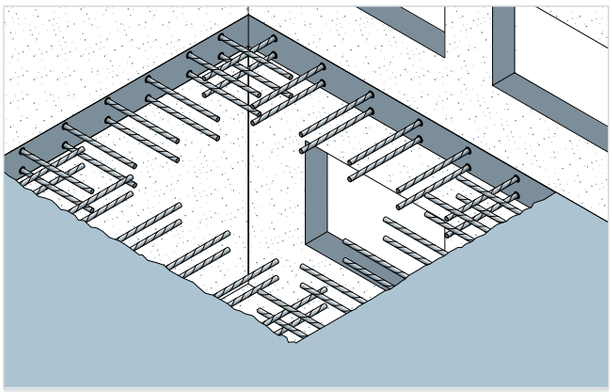
Examples of use - 1



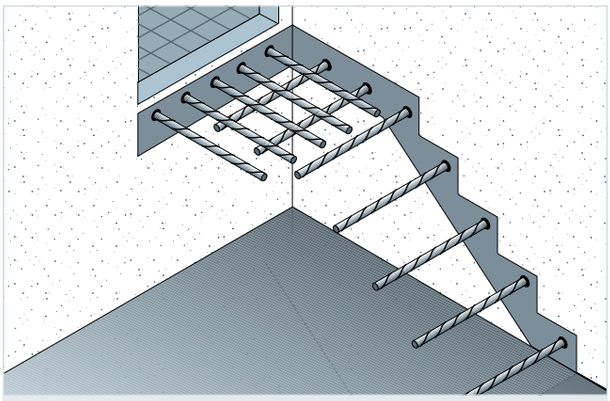
Anchor for a base plate in existing foundation work.



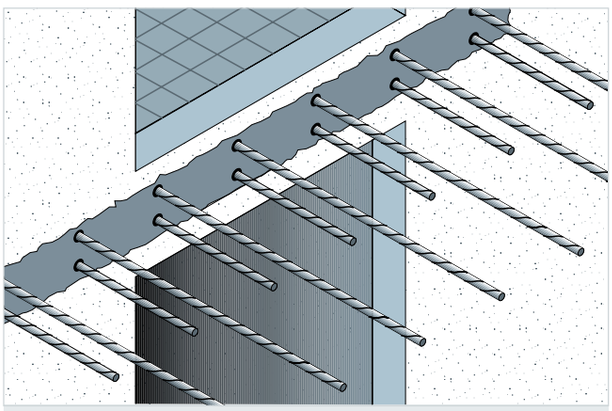
Connections for a new wall plate into concrete.
e.g. for building extensions.



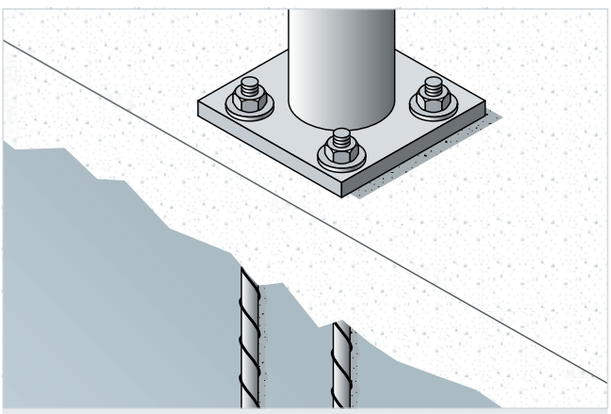
Anchoring of frame supports in ceiling work.



Anchoring a landing & stairwell.

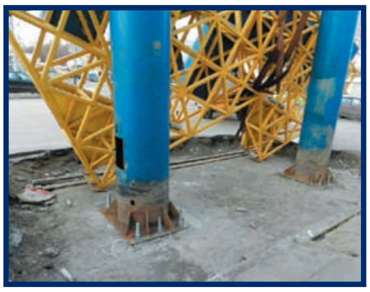


Connection of a cantilever balcony.



Best solution for re-inforcing steel Swif-Inox® stainless steel 1.4429 for external conditions noise, etc.

Examples of use - 2



Examples of use - 3

Edge of Bridge

Static Screed

Wall Fitting

Misplaced bars

Wall Strengthening

Reinforcement

Diaphragm walls

Slab connections

Stairway

Joint strengthening

Cantilevers/balconies

Ducting

Tunnels

Base plates

Barriers

Stahlfix products in general

Epoxy acrylate (EA)

Epoxy acrylate resin system is a powerful two-component fast gelling and curing system. This is based on a modified epoxy acrylate resin. Applicable in one action, this resin provides excellent characteristics for fixing in a corrosive environment.

Suitable for:  **Br / Cr / Co / St / We**

Epoxy acrylate styrene free (EASF)

Epoxy acrylate resin system is a powerful low odour two-component fast gelling and curing system. This is based on a modified epoxy acrylate resin without styrene. Applicable in one action, this resin provides excellent characteristics for fixing in a corrosive environment, economical and particularly suitable for use indoors.

Suitable for: **Br / Ho / Co / St / Ma / Re / We**

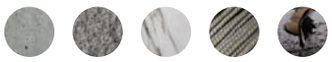
Vinylester styrene free (VESF)

Vinylester styrene free resin system is a powerful low odour two-component fast gelling and curing system. Applicable in one action, this resin provides excellent characteristics for fixing in a very corrosive environment and is particularly suitable for very high loads.

Suitable for:  **Br / Ho / Co / St / Ma / Re / We**

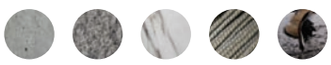
Pure epoxy 1:1 (PE)

Pure Epoxy 1:1 resin is a solvent-free low odour two-compnent slow gelling and curing system. Applicable in one action this resin is particularly suitable for deep, large diameter and very high load applications, in high corrosion areas. No shrinkage. Longer working times make it particularly suitable for use with rebars.

Suitable for:  **Co / St / Ma / Re / We**

Hammer Glass Capsules (HC)

Glass capsules are designed specifically for applications in solid materials for example concrete or stone. The glass capsule is placed in the drilled hole and the anchor rod is driven in manually in a hammering action to break the capsule. The capsule, containing both the resin and hardener components is then allowed to mix and react.

Suitable for :  **Co / St / Ma / Re / We**

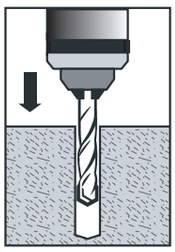
Key :

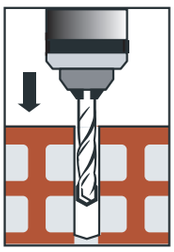
Co = Concrete / **Br** = Brick / **Ho** = Hollow / **St** = Natural stone / **Ma** = Marble / **Re** = Rebars / **We** = Damp / wet

User Guide

Solid material

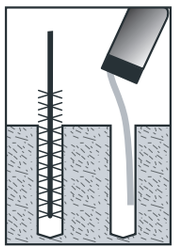
Hollow material

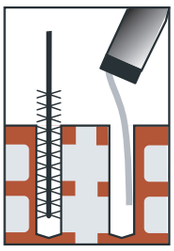




1

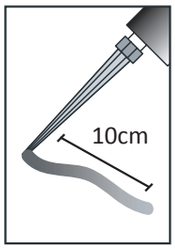
Drill a hole using a hammer drill, maintaining the drill perpendicular to the hole.

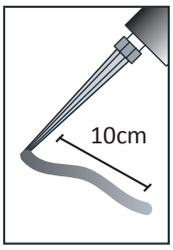




2

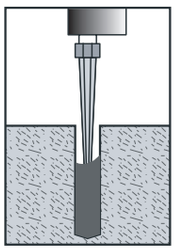
Clean the hole by 3 shots of the push pump, or a vacuum, following by application of the steel brush. Remove further debris by 3 further shots of the push pump or until the hole is clear of debris.

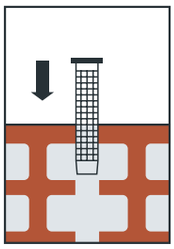




3 **ATTENTION!**

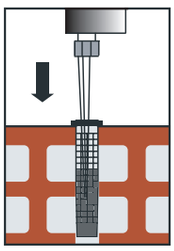
Attach the mixer nozzle. First extrude some material until the mix is adequate and even colour. Never inject poorly mixed material.





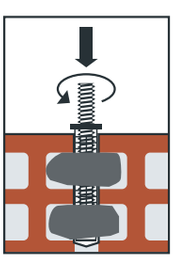
4

Inject the resin from the bottom of the hole, gradually withdrawing from the hole upwards. To stop the flow, release the back pressure by clicking the trigger at the rear of the tool.



5

The rebar or threaded rod is inserted into the hole in a rotational movement to ensure a complete coating of the resin around the anchor. Light hammer strikes may be employed for deeper fixings.



6

The anchor fixing must lay undisturbed during the gelling time and load only imparted to the fixing after the curing time.

Stahlfix epoxy acrylate - 1

Product Information

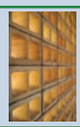
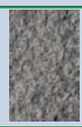
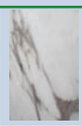
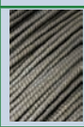
Epoxy acrylate resin system is a powerful two-component fast gelling and curing system. This is based on a modified epoxy acrylate resin. Applicable in one action, this resin provides excellent characteristics for fixing in a corrosive environment.

Features

- Good chemical resistance
- Suitable for medium and heavy loads
- Excellent durability
- Suitable for outdoor applications
- Threaded rods and rebars

Approvals

INSTYTUT
TECHNIKI
BUDOWLANEJ
ITB-0973/W

Brick	Hollow	Concrete	Stone	Marble	Rebar	Wet
						
✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓		

sizes 300ml / 380ml

Gel and cure times

**Resin temperature must be at least 20ºC

Base material temperature (°C)	35	25	15	5	-5	-10**
Gel time (min.)	3	6	8	19	50	60
Curing time (min.)	20	20	20	30	90	180

Typical performance data for standard embedment depth (single threaded rod or rebar)

Ø (mm)	Steel grade 5.8 / Concrete, C20/25									Standard data			
	Characteristic Load (kN)		Design Load (kN)		Recommended Load (kN)		Characterstic Edge Distance (mm)		Character-stic Spacing	Ø Hole diameter in concrete	Ø Hole diameter in fixture	Standard embedment	Recom-mended torque
	Tensile (N)	Shear (V)	Tensile (N)	Shear (V)	Tensile (N)	Shear (V)	Tensile (C)	Shear (C)	(mm)	(mm)	(mm)	(mm)	(Nm)
8	15.2	9.5	8.1	7.6	5.8	5.4	80	100	160	10	9	80	11
10	22.7	15.1	12.6	12.1	9.0	8.6	90	130	180	12	11	90	22
12	38.8	21.9	19.7	17.5	14.1	12.5	110	150	220	14	13	110	38
16	53.6	40.8	28.9	32.7	20.7	23.3	125	170	250	18	17	125	95
20	68.6	63.7	41.1	51.0	29.4	36.4	170	190	340	24	22	170	170
24	91.7	91.8	48.9	73.4	34.9	52.4	210	240	420	28	26	210	260
30	151.2	207.1	80.6	166.1	57.6	118.6	280	350	560	35	33	280	480

Typical ultimate physical properties

	N/mm²	Test method	Storage / Shelf life	IMPORTANT
Compressive strength	58.91	(EN ISO 604) / (ASTM 695)	This product should be stored between +5˚C & +25˚C. The Shelf life of the product is 12 months from the manufacture date. Avoid direct sunlight.	The information and data given is based on our own experience, research and testing and is believed to be reliable and accurate. However, as Stahlfix cannot know the varied uses to which its products may be applied, or the methods of application used, no warranty as to the fitness or suitability of its products is given or implied. It is the users responsibility to determine suitability of use. For further information please contact our Technical Department.
Flexural strength	23.68	(EN ISO 178) / (ASTM 795)		
Flexural modulus	3340.00	"		
Tensile strength	12.25	(EN ISO 527) / (ASTM 638)		
E modulus	10235.43	"		

Stahlfix epoxy acrylate - 2

Characteristic (Vrk) & design (Vrd) shear loads for various threaded rod grades + rebar

Ø Threaded rod Diameter (mm)	Steel grade 5.8		Steel grade 8.8		Steel grade 10.9		Steel grade A4-70		Steel grade A4-80	
	Vrk (kN)	Vrd (kN)	Vrk (kN)	Vrd (kN)	Vrk (kN)	Vrd (kN)	Vrk (kN)	Vrd (kN)	Vrk (kN)	Vrd (kN)
8	9.5	7.6	14.6	11.7	19.0	15.2	12.8	8.2	14.6	9.4
10	15.1	12.1	23.2	18.6	30.2	24.1	20.3	13.0	23.2	14.9
12	21.9	17.5	33.7	27.0	43.8	35.1	29.5	18.9	33.7	21.6
16	40.8	32.7	62.8	50.2	81.6	65.3	55.0	32.5	62.8	40.3
20	63.7	51.0	98.0	78.4	127.4	101.9	85.8	55.0	98.0	62.8
24	91.8	73.4	141.2	113.0	183.6	146.8	123.6	79.2	141.2	90.5
30	207.1	166.1	207.6	166.1	269.9	215.9	129.8	64.9	207.6	103.8

Rebar Ø (mm)	Bst 500	
	Vrk (kN)	Vrd (kN)
8	16.6	11.1
10	25.9	17.3
12	37.3	24.9
14	50.8	33.9
16	66.4	44.3
20	103.9	69.3
25	162.0	108.0
32	265.1	176.7
40	414.6	276.4

Notes:

- All grades shown for information.

- M30 threaded rodding is 8.8 grade instead of 5.8 grade

- M30 for A4-70 tensile strength of 500N/mm2, instead of 700N/mm2.

- Security factor of 1.25 for steel

- Security factor of 1.56 for stainless steel, for M30 = Security factor of 2.0

- Security factor of 1.5 for Rebar BSt 500.

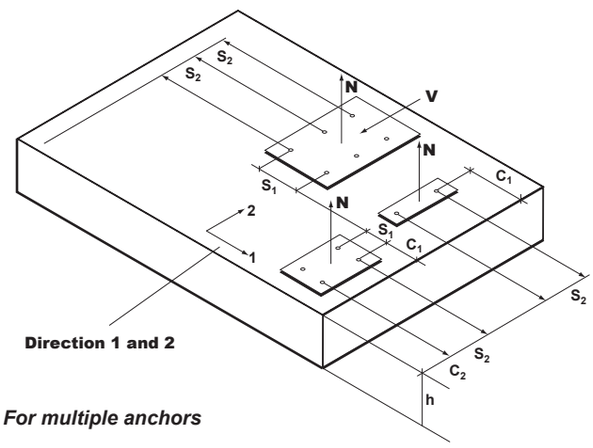
Stahlfix epoxy acrylate - 3

Reduction factors : Spacing and edge distance

Spacing reduction factor f_A								Edge reduction factor f_R														
Tensile load / Shear load								Tensile load f_{RN}							Shear load f_{RV}							
Spacing	Ø Threaded rod / Rebar (mm)							Edge distance (mm)	Ø Threaded rod / Rebar (mm)													
	8	10	12	16	20	24	30		8	10	12	16	20	24	30	8	10	12	16	20	24	30
40	0.64							40	0.64							0.25						
50	0.67	0.63						50	0.73	0.63						0.44	0.30					
60	0.70	0.65	0.63					60	0.82	0.70	0.63					0.63	0.48	0.30				
70	0.73	0.68	0.64					70	0.90	0.77	0.68					0.81	0.65	0.44				
80	0.76	0.70	0.66	0.63				80	1.00	0.84	0.74	0.63				1.00	0.83	0.58	0.40			
90	0.79	0.73	0.68	0.64				90		0.91	0.80	0.67					1.00	0.72	0.53			
100	0.82	0.75	0.70	0.65	0.63			100		1.00	0.86	0.72	0.63					0.86	0.67	0.35		
125	0.89	0.81	0.75	0.69	0.66	0.63		110			0.92	0.77	0.66					1.00	0.80	0.44		
150	0.96	0.88	0.80	0.73	0.69	0.65	0.63	120			1.00	0.81	0.70	0.64					1.00	0.58	0.35	
160	1.00	0.90	0.82	0.74	0.70	0.66	0.64	140				0.91	0.78	0.67	0.63					0.72	0.46	0.30
175		0.94	0.85	0.76	0.72	0.68	0.65	160				1.00	0.85	0.73	0.66					0.91	0.62	0.35
200		1.00	0.90	0.80	0.75	0.70	0.68	180					0.93	0.80	0.72					1.00	0.77	0.46
225			0.95	0.84	0.78	0.73	0.70	200					1.00	0.86	0.78						0.92	0.57
240			1.00	0.86	0.80	0.75	0.72	220						0.92	0.84						1.00	0.68
250				0.87	0.81	0.76	0.73	240						1.00	0.90							0.78
275				0.91	0.84	0.78	0.75	265							1.00							1.00
280				0.92	0.85	0.79	0.76															
300				0.95	0.88	0.81	0.78															
320				1.00	0.90	0.83	0.80															
350					0.94	0.86	0.83															
400					1.00	0.92	0.88															
440						0.96	0.92															
480						1.00	0.96															
500							0.98															
525							1.00															

Loads in hollow material (tensile or shear)

Size	Recommended load (kN)
	Hollow brick 7 N/mm2
M8	0.8
M10	1.7
M12	2.7
M16	3.6



Design according to Anchor theory *

$$FR_N = \frac{N_{rd}}{1.4} \cdot f_B \cdot f_{RN} \cdot f_A \qquad \textit{(tensile)}$$

$$FR_v = \frac{V_{rd}}{1.4} \cdot f_B \cdot f_{RV} \cdot f_A \qquad \textit{(shear)}$$

FR_α *(shear + tensile)*

$$FR_\alpha = FR_N - (FR_N - FR_V)\frac{\alpha}{90}$$

f_B = *Resistance factor of Concrete*

$f_B = 1 + 0.02\,(1 - \frac{\alpha}{90}) \cdot (f_{cc,eff} - 25)$

$[15 \le f_{cc,eff} \le 55]$

α = *Angle of load*

f_A = *Reduction factor "Spacing"*

f_{cc} = *Resistance on cube N/mm²*

f_R = *Reduction factor "edge distance"*

For multiple anchors

$$f_A = f_{A1}(s_1) \,.\, f_{A2}(s_2) \,.\, f_{Ax}(s_x)$$

$$f_{RN} = f_{RN1}(c_1) \,.\, f_{RN2}(c_2) \,.\, f_{RNx}(c_x)$$

$$f_{RV} = f_{RV1}(c_1) \,.\, f_{RV2}(c_2) \,.\, f_{RVx}(c_x)$$

$h = h_{nom} + 40mm$

h_{nom} = *embedment depth*

N_{rd} , V_{rd} = *Approved design resistance*

FR_N , FR_V , FR_α = *Recommended loads*

***** Design according to post-installed rebar theory : see design section.***

Stahlfix epoxy acrylate styrene free - 1

Product information

Epoxy acrylate resin system is a powerful low odour two-component fast gelling and curing system. This is based on a modified epoxy acrylate resin without styrene. Applicable in one action, this resin provides excellent characteristics for fixing in a corrosive environment, economical and particularly suitable for use indoors.

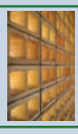
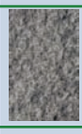
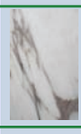
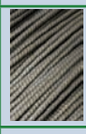
Features

- Suitable for application underwater or in wet holes.
- Good chemical resistance.
- Excellent durability
- Suitable for medium and heavy loads.
- Equally suitable for indoor applications

Agréments

INSTYTUT TECHNIKI BUDOWLANEJ
ITB-0974/W

Imperial College London Consultants
SPO/ICON-RT-09-07 VER 4

Bricks	Hollow	Concrete	Stone	Marble	Rebar	Wet
						
✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓		

sizes 300ml / 380ml

Gel and cure times

Base material temperature (°C)	35	25	15	5	-5	-10**
Gel time (min.)	3	6	8	18	50	60
Curing time (min.)	20	20	20	30	90	180

**Resin temperature must be at least 20ºC

Typical performance data for standard embedment depth (single threaded rod or rebar)

Ø (mm)	Steel grade 5.8 / Concrete, C20/25									Standard data			
	Characteritic Resistance(kN)		Design Resistance (kN)		Recommended Load (kN)		Characterstic Edge Distance (mm)		Character-stic Spacing	Ø Hole diameter in concrete	Ø Hole diameter in fixture	Standard embedment	Recom-mended torque
	Tensile (N)	Shear (V)	Tensile (N)	Shear (V)	Tensile (N)	Shear (V)	Tensile (C)	Shear (C)	(mm)	(mm)	(mm)	(mm)	(Nm)
8	19.0	9.5	12.7	7.6	9.1	5.4	80	100	160	10	9	80	11
10	30.2	15.1	16.0	12.1	11.4	8.6	90	130	180	12	11	90	22
12	43.8	21.9	20.3	17.5	14.5	12.5	110	150	220	14	13	110	38
16	61.4	40.8	28.4	32.7	20.3	23.3	125	170	250	18	17	125	95
20	97.6	63.7	38.9	51.0	27.8	36.4	170	190	340	24	22	170	170
24	127.1	91.8	50.4	73.4	36.0	52.4	210	240	420	28	26	210	260
30	179.7	207.1	71.3	166.1	50.9	118.6	280	350	560	35	33	280	480

Typical ultimate physical properties

	N/mm²	Test method	Storage / Shelf life	IMPORTANT
Compressive strength	62.70	(EN ISO 604) / (ASTM 695)	This product should be stored between +5˚C & +25˚C. The Shelf life of the product is 12 months from the manufacture date. Avoid direct sunlight.	The information and data given is based on our own experience, research and testing and is believed to be reliable and accurate. However, as stahlfix cannot know the varied uses to which its products may be applied, or the methods of application used, no warrantyas to the fitness or suitability of its products is given or implied. It is the users responsibility to determine suitability of use. For further information please contact our Technical Department.
Flexural strength	23.88	(EN ISO 178) / (ASTM 795)		
Flexural modulus	3250.33	"		
Tensile strength	12.85	(EN ISO 527) / (ASTM 638)		
E modulus	6860.33	"		

Design resistance for single threaded rod and rebar (without edge distance or spacing influence)

Concrete class: C20/25 : (According Eurocode 2 , On Cylinder 20N/mm² On Cube 25N/mm²).

Threaded rod : steel grade 5.8

Ø (mm)	Ø hole (mm)	Design resistance (N_{rd})* (tensile) (kN)																		hef failure (mm)	Design resistance (kN)
8	10	12.7																		78	12.7
10	12		16.0	17.8	19.6	20.1											=	Steel failure		113	20.1
12	14				20.3	22.1	24.0	25.8	27.7	29.2										159	29.2
16	18					27.0	29.3	31.5	33.8	36.0	38.3	40.5	42.8	45.0	49.5	54.1	54.4			242	54.4
Depth (mm)		80	90	100	110	120	130	140	150	160	170	180	190	200	220	240	260	280	300	350		
20	24	38.9	41.2	43.5	45.7	50.3	54.9	64.0	68.6	80.1	84.9									371	84.9
24	28				48.0	52.8	57.6	62.4	67.2	72.1	84.1	96.1	108.1	120.1	122.4					510	122.4
30	40								71.3	76.4	89.1	101.8	114.5	127.3	140.0	152.7	178.2	203.6	229.1	254.5	1096	278.9
Depth (mm)		170	180	190	200	220	240	260	280	300	350	400	450	500	550	600	700	800	900	1000		

Rebar: Yield strength fyk = 500N/mm2

Ø (mm)	Ø hole (mm)	Design resistance (N_{rd})* (tensile) (kN)																		hef failure (mm)	Design resistance (kN)
8	12	13.0	16.2	19.4	21.9															135	21.9
10	14		17.8	21.4	24.9	28.5	32.1	34.1									=	Steel failure		192	34.1
12	16			22.2	25.9	29.6	33.3	36.9	40.6	44.3	48.0	49.2								266	49.2
14	18				28.9	33.1	37.2	41.3	45.5	49.6	53.8	57.9	62.0	66.2	66.9					324	66.9
16	22					36.0	40.5	45.0	49.5	54.1	58.6	63.1	67.6	72.1	76.6	81.1	85.6	87.4		388	87.4
Depth (mm)		80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	400	450	500		
20	28	45.7	51.5	57.2	62.9	68.6	80.1	91.5	102.9	114.4	125.8	136.6								597	136.6
25	32			62.5	68.8	75.1	87.6	100.1	112.6	125.1	137.6	150.1	175.1	200.1	213.4					853	213.4
32	40					84.1	95.0	108.6	122.2	135.7	149.3	162.9	190.0	217.2	244.3	271.5	298.6	325.8	349.7	1288	349.7
40	50							123.2	138.6	154.0	169.4	184.7	215.5	246.3	277.1	307.9	338.7	369.5	400.3	431.1	1774	546.3
Depth (mm)		200	225	250	275	300	350	400	450	500	550	600	700	800	900	1000	1100	1200	1300	1400		

Characteristic (Vrk) & design (Vrd) shear loads for various threaded rod grades + rebar

Ø (mm)	Steel grade 5.8		Steel grade 8.8		Steel grade 10.9		Steel grade A4-70		Steel grade A4-80	
	Vrk (kN)	Vrd (kN)	Vrk (kN)	Vrd (kN)	Vrk (kN)	Vrd (kN)	Vrk (kN)	Vrd (kN)	Vrk (kN)	Vrd (kN)
8	9.5	7.6	14.6	11.7	19.0	15.2	12.8	8.2	14.6	9.4
10	15.1	12.1	23.2	18.6	30.2	24.1	20.3	13.0	23.2	14.9
12	21.9	17.5	33.7	27.0	43.8	35.1	29.5	18.9	33.7	21.6
16	40.8	32.7	62.8	50.2	81.6	65.3	55.0	32.5	62.8	40.3
20	63.7	51.0	98.0	78.4	127.4	101.9	85.8	55.0	98.0	62.8
24	91.8	73.4	141.2	113.0	183.6	146.8	123.6	79.2	141.2	90.5
30	207.1	166.1	207.6	166.1	269.9	215.9	129.8	64.9	207.6	103.8

Rebar Ø (mm)	Bst 500	
	Vrk (kN)	Vrd (kN)
8	16.6	11.1
10	25.9	17.3
12	37.3	24.9
14	50.8	33.9
16	66.4	44.3
20	103.9	69.3
25	162.0	108.0
32	265.1	176.7
40	414.6	276.4

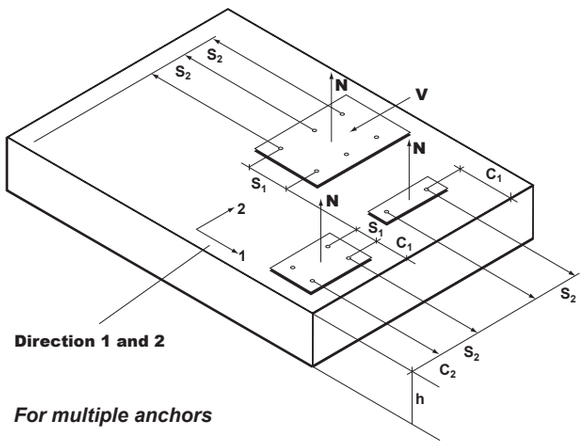
Stahlfix epoxy acrylate styrene free - 3

Reduction factors : Spacing and edge distance

Spacing reduction factor f_A								Edge reduction factors f_R														
Tensile load / Shear load								Tensile load f_{RN}								Shear load f_{RV}						
Entraxe	Ø Threaded rod / Rebar (mm)							Edge distance (mm)	Ø Threaded rod / Rebar (mm)							Ø Threaded rod / Rebar (mm)						
	8	10	12	16	20	24	30		8	10	12	16	20	24	30	8	10	12	16	20	24	30
40	0.64							40	0.64							0.25						
50	0.67	0.63						50	0.73	0.63						0.44	0.30					
60	0.70	0.65	0.63					60	0.82	0.70	0.63					0.63	0.48	0.30				
70	0.73	0.68	0.64					70	0.90	0.77	0.68					0.81	0.65	0.44				
80	0.76	0.70	0.66	0.63				80	1.00	0.84	0.74	0.63				1.00	0.83	0.58	0.40			
90	0.79	0.73	0.68	0.64				90		0.91	0.80	0.67					1.00	0.72	0.53			
100	0.82	0.75	0.70	0.65	0.63			100		1.00	0.86	0.72	0.63					0.86	0.67	0.35		
125	0.89	0.81	0.75	0.69	0.66	0.63		110			0.92	0.77	0.66					1.00	0.80	0.44		
150	0.96	0.88	0.80	0.73	0.69	0.65	0.63	120			1.00	0.81	0.70	0.64					1.00	0.58	0.35	
160	1.00	0.90	0.82	0.74	0.70	0.66	0.64	140				0.91	0.78	0.67	0.63					0.72	0.46	0.30
175		0.94	0.85	0.76	0.72	0.68	0.65	160				1.00	0.85	0.73	0.66					0.91	0.62	0.35
200		1.00	0.90	0.80	0.75	0.70	0.68	180					0.93	0.80	0.72					1.00	0.77	0.46
225			0.95	0.84	0.78	0.73	0.70	200					1.00	0.86	0.78						0.92	0.57
240			1.00	0.86	0.80	0.75	0.72	220						0.92	0.84						1.00	0.68
250				0.87	0.81	0.76	0.73	240						1.00	0.90							0.78
275				0.91	0.84	0.78	0.75	265							1.00							1.00
280				0.92	0.85	0.79	0.76															
300				0.95	0.88	0.81	0.78															
320				1.00	0.90	0.83	0.80															
350					0.94	0.86	0.83															
400					1.00	0.92	0.88															
440						0.96	0.92															
480						1.00	0.96															
500							0.98															
525							1.00															

Loads in hollow material (Tensile or shear)

Size	Recommended load (kN)
	hollow brick 7 N/mm2
M8	0.8
M10	1.7
M12	2.7
M16	3.6



*Design according to Anchor theory **

$$FR_N = \frac{N_{rd}}{1.4} \cdot f_B \cdot f_{RN} \cdot f_A \qquad \textit{(tensile)}$$

$$FR_v = \frac{V_{rd}}{1.4} \cdot f_B \cdot f_{RV} \cdot f_A \qquad \textit{(shear)}$$

FR_α *(shear + tensile)*

$$FR_\alpha = FR_N - (FR_N - FR_V)\frac{\alpha}{90}$$

f_B = *Resistance factor of Concrete*

$f_B = 1 + 0.02\,(1 - \frac{\alpha}{90}) \cdot (f_{cc,eff} - 25)$

$[15 \le f_{cc,eff} \le 55]$

α = *Angle of load*

f_A = *Reduction factor "Spacing"*

f_{cc} = *Resistance on cube N/mm²*

f_R = *Reduction factor "edge distance"*

For multiple anchors

$$f_A = f_{A1}(s_1) \,.\, f_{A2}(s_2) \,.\, f_{Ax}(s_x)$$

$$f_{RN} = f_{RN1}(c_1) \,.\, f_{RN2}(c_2) \,.\, f_{RNx}(c_x)$$

$$f_{RV} = f_{RV1}(c_1) \,.\, f_{RV2}(c_2) \,.\, f_{RVx}(c_x)$$

$h = h_{nom} + 40mm$

h_{nom} = *embedment depth*

N_{rd} , V_{rd} = *Approved design resistance*

FR_N , FR_V , FR_α = *Recommended loads*

***** Design according to post-installed rebar theory : see design section.***

Stahlfix tropical styrene free - 1

Product information

Tropical styrene free resin system is a powerful low odour two-component fast gelling and curing system. Applicable in one action, this resin provides excellent characteristics for fixing in acorrosive environment and is particularly suitable for high temperature application up to 45°C.

Features

- Ideal for application in tropical climates
- Good chemical resistance.
- Excellent durability
- Suitable for medium and heavy loads.
- Equally suitable for indoor usage.

Agréments

INSTYTUT TECHNIKI BUDOWLANEJ
ITB-0974/W

sizes 300ml / 380ml

Gel and cure times

Base material temperature (°C)	45	35	25	15	5
Gel time (min.)	5	8	12	15	20
Curing time (min.)	10	15	15	20	50

Typical performance data for standard embedment depth (single threaded rod or rebar)

Ø (mm)	Steel grade 5.8 / Concrete, (C20/25)									Standard data			
	Characteristic Resistance (kN)		Design Resistance (kN)		Recommended Load (kN)		Characterstic Edge Distance (mm)		Character-stic Spacing	Ø Hole diameter in concrete	Ø Hole diameter in fixture	Standard embedment	Recom-mended torque
	Tensile (N)	Shear (V)	Tensile (N)	Shear (V)	Tensile (N)	Shear (V)	Tensile (C)	Shear (C)	(mm)	(mm)	(mm)	(mm)	(Nm)
8	19.0	9.5	12.7	7.6	9.1	5.4	80	100	160	10	9	80	11
10	30.2	15.1	16.0	12.1	11.4	8.6	90	130	180	12	11	90	22
12	43.8	21.9	20.3	17.5	14.5	12.5	110	150	220	14	13	110	38
16	61.4	40.8	28.4	32.7	20.3	23.3	125	170	250	18	17	125	95
20	97.6	63.7	38.9	51.0	27.8	36.4	170	190	340	24	22	170	170
24	127.1	91.8	50.4	73.4	36.0	52.4	210	240	420	28	26	210	260
30	179.7	207.1	71.3	166.1	50.9	118.6	280	350	560	35	33	280	480

Typical ultimate physical properties

	N/mm²	Test method	Storage / Shelf life	IMPORTANT
Compressive strength	62.70	(EN ISO 604) / (ASTM 695)	This product should be stored between +5˚C & +25˚C. The Shelf life of the product is 12 months from the manufacture date. Avoid direct sunlight.	The information and data given is based on our own experience, research and testing and is believed to be reliable and accurate. However, as Stahlfix cannot know the varied uses to which its products may be applied, or the methods of application used, no warranty as to the fitness or suitability of its products is given or implied. It is the users responsibility to determine suitability of use. For further information please contact our Technical Department.
Flexural strength	23.88	(EN ISO 178) / (ASTM 795)		
Flexural modulus	3250.33	"		
Tensile strength	12.85	(EN ISO 527) / (ASTM 638)		
E modulus	6860.33	"		

Design resistance for single threaded rod and rebar (without edge distance or spacing influence)

Concrete class: C20/25 (According Eurocode 2)

Threaded rod : Steel grade 5.8

Ø Rebar (mm)	Ø hole (mm)	Design Resistance (N_{rd})* (tensile) (kN)																		Failure (mm)	design Resistance (kN)
8	10	12.7																		78	12.7
10	12		16.0	17.8	19.6	20.1										=	Steel failure			113	20.1
12	14				20.3	22.1	24.0	25.8	27.7	29.2										159	29.2
16	18					27.0	29.3	31.5	33.8	36.0	38.3	40.5	42.8	45.0	49.5	54.1	54.4			242	54.4
Depth (mm)		80	90	100	110	120	130	140	150	160	170	180	190	200	220	240	260	280	300	350	
20	24	38.9	41.2	43.5	45.7	50.3	54.9	64.0	68.6	80.1	84.9									371	84.9
24	28				48.0	52.8	57.6	62.4	67.2	72.1	84.1	96.1	108.1	120.1	122.4					510	122.4
30	40								71.3	76.4	89.1	101.8	114.5	127.3	140.0	152.7	178.2	203.6	229.1	254.5	1096	278.9
Depth (mm)		170	180	190	200	220	240	260	280	300	350	400	450	500	550	600	700	800	900	1000		

Rebar: Yield strength fyk = 500N/mm2

ø (mm)	Ø hole (mm)	Design resistance (N_{rd})* (tensile) (kN)																		Failure (mm)	Design Resistance (kN)
8	12	13.0	16.2	19.4	21.9															135	21.9
10	14		17.8	21.4	24.9	28.5	32.1	34.1								=	Steel failure			192	34.1
12	16			22.2	25.9	29.6	33.3	36.9	40.6	44.3	48.0	49.2								266	49.2
14	18				28.9	33.1	37.2	41.3	45.5	49.6	53.8	57.9	62.0	66.2	66.9					324	66.9
16	22					36.0	40.5	45.0	49.5	54.1	58.6	63.1	67.6	72.1	76.6	81.1	85.6	87.4		388	87.4
Depth (mm)		80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	400	450	500		
20	28	45.7	51.5	57.2	62.9	68.6	80.1	91.5	102.9	114.4	125.8	136.6								597	136.6
25	32			62.5	68.8	75.1	87.6	100.1	112.6	125.1	137.6	150.1	175.1	200.1	213.4					853	213.4
32	40					84.1	95.0	108.6	122.2	135.7	149.3	162.9	190.0	217.2	244.3	271.5	298.6	325.8	349.7	1288	349.7
40	50							123.2	138.6	154.0	169.4	184.7	215.5	246.3	277.1	307.9	338.7	369.5	400.3	431.1	1774	546.3
Depth (mm)		200	225	250	275	300	350	400	450	500	550	600	700	800	900	1000	1100	1200	1300	1400		

Characteristic (Vrk) & design (Vrd) shear loads for various threaded rod grades + rebar

Size (mm)	Steel grade 5.8		Steel grade 8.8		Steel grade 10.9		Steel grade A4-70		Steel grade A4-80	
	Vrk (kN)	Vrd (kN)	Vrk (kN)	Vrd (kN)	Vrk (kN)	Vrd (kN)	Vrk (kN)	Vrd (kN)	Vrk (kN)	Vrd (kN)
8	9.5	7.6	14.6	11.7	19.0	15.2	12.8	8.2	14.6	9.4
10	15.1	12.1	23.2	18.6	30.2	24.1	20.3	13.0	23.2	14.9
12	21.9	17.5	33.7	27.0	43.8	35.1	29.5	18.9	33.7	21.6
16	40.8	32.7	62.8	50.2	81.6	65.3	55.0	32.5	62.8	40.3
20	63.7	51.0	98.0	78.4	127.4	101.9	85.8	55.0	98.0	62.8
24	91.8	73.4	141.2	113.0	183.6	146.8	123.6	79.2	141.2	90.5
30	207.1	166.1	207.6	166.1	269.9	215.9	129.8	64.9	207.6	103.8

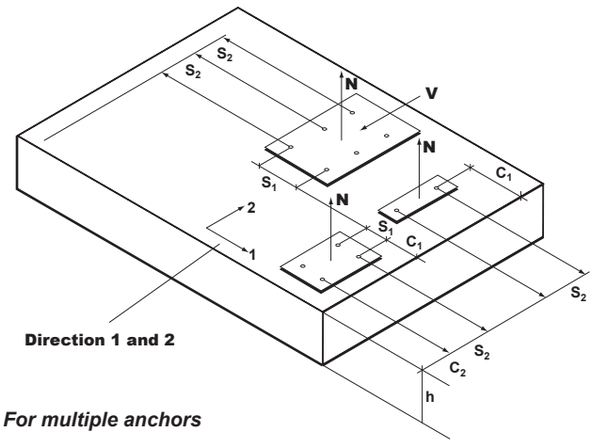
Rebar Ø (mm)	Bst 500	
	Vrk (kN)	Vrd (kN)
8	16.6	11.1
10	25.9	17.3
12	37.3	24.9
14	50.8	33.9
16	66.4	44.3
20	103.9	69.3
25	162.0	108.0
32	265.1	176.7
40	414.6	276.4

Reduction factors : Spacing and edge distance

Spacing reduction factor f_A								Edge reduction factor f_R														
Tensile load / Shear load								Tensile load f_{RN}							Shear load f_{RV}							
Spacing	Ø Threaded rod / Rebar (mm)							Edge distance (mm)	Ø Threaded rod / Rebar (mm)													
	8	10	12	16	20	24	30		8	10	12	16	20	24	30	8	10	12	16	20	24	30
40	0.64							40	0.64							0.25						
50	0.67	0.63						50	0.73	0.63						0.44	0.30					
60	0.70	0.65	0.63					60	0.82	0.70	0.63					0.63	0.48	0.30				
70	0.73	0.68	0.64					70	0.90	0.77	0.68					0.81	0.65	0.44				
80	0.76	0.70	0.66	0.63				80	1.00	0.84	0.74	0.63				1.00	0.83	0.58	0.40			
90	0.79	0.73	0.68	0.64				90		0.91	0.80	0.67					1.00	0.72	0.53			
100	0.82	0.75	0.70	0.65	0.63			100		1.00	0.86	0.72	0.63					0.86	0.67	0.35		
125	0.89	0.81	0.75	0.69	0.66	0.63		110			0.92	0.77	0.66					1.00	0.80	0.44		
150	0.96	0.88	0.80	0.73	0.69	0.65	0.63	120			1.00	0.81	0.70	0.64					1.00	0.58	0.35	
160	1.00	0.90	0.82	0.74	0.70	0.66	0.64	140				0.91	0.78	0.67	0.63					0.72	0.46	0.30
175		0.94	0.85	0.76	0.72	0.68	0.65	160				1.00	0.85	0.73	0.66					0.91	0.62	0.35
200		1.00	0.90	0.80	0.75	0.70	0.68	180					0.93	0.80	0.72					1.00	0.77	0.46
225			0.95	0.84	0.78	0.73	0.70	200					1.00	0.86	0.78						0.92	0.57
240			1.00	0.86	0.80	0.75	0.72	220						0.92	0.84						1.00	0.68
250				0.87	0.81	0.76	0.73	240						1.00	0.90							0.78
275				0.91	0.84	0.78	0.75	265							1.00							1.00
280				0.92	0.85	0.79	0.76															
300				0.95	0.88	0.81	0.78															
320				1.00	0.90	0.83	0.80															
350					0.94	0.86	0.83															
400					1.00	0.92	0.88															
440						0.96	0.92															
480						1.00	0.96															
500							0.98															
525							1.00															

Loads in hollow material (Tensile or shear)

Size	Recommended load (kN)
	Hollow brick 7 N/mm2
M8	0.8
M10	1.7
M12	2.7
M16	3.6



Design according to Anchor theory *

$$FR_N = \frac{N_{rd}}{1.4} \cdot f_B \cdot f_{RN} \cdot f_A \qquad \textit{(tensile)}$$

$$FR_v = \frac{V_{rd}}{1.4} \cdot f_B \cdot f_{RV} \cdot f_A \qquad \textit{(shear)}$$

FR_α *(shear + tensile)*

$$FR_\alpha = FR_N - (FR_N - FR_V)\frac{\alpha}{90}$$

f_B = *Resistance factor of Concrete*

$f_B = 1 + 0.02\,(1 - \frac{\alpha}{90}) \cdot (f_{cc,eff} - 25)$

$[15 \le f_{cc,eff} \le 55]$

α = *Angle of load*

f_A = *Reduction factor "Spacing"*

f_{cc} = *Resistance on cube N/mm²*

f_R = *Reduction factor "edge distance"*

For multiple anchors

$$f_A = f_{A1}(s_1) \cdot f_{A2}(s_2) \cdot f_{Ax}(s_x)$$

$$f_{RN} = f_{RN1}(c_1) \cdot f_{RN2}(c_2) \cdot f_{RNx}(c_x)$$

$$f_{RV} = f_{RV1}(c_1) \cdot f_{RV2}(c_2) \cdot f_{RVx}(c_x)$$

$h = h_{nom} + 40mm$

h_{nom} = *embedment depth*

N_{rd} , V_{rd} = *Approved design resistance*

FR_N , FR_V , FR_α = *Recommended loads*

***** Design according to post-installed rebar theory : see design section.***

Stahlfix vinylester styrene free - 1

Product information

Pure Vinylester styrene free resin system is a powerful low odour two-component fast gelling and curing system. Applicable in one action, this resin provides excellent characteristics for fixing in a very corrosive environment and is particularly suitable for very high loads.

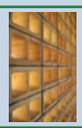
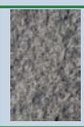
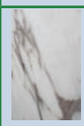
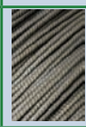
Features

- European Technical Agreement ETA (option 7).
- Heavy & critical loads (overhead applications).
- Excellent chemical resistance.
- Excellent durability.
- **Durability life of the fixing: 50 years guarantee.**
- Wet and underwater applications.
- **Recommended for rebar.**

Approvals

INSTYTUT TECHNIKI BUDOWLANEJ
ITB-0974/W

Imperial College London Consultants
SPO/ICON-RT-09-07 VER 4

Bricks	Hollow	Concrete	Stone	Marble	Rebar	Damp
						
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✓	✓	✓	✓	✓	✓	✓

CSTB
For rebars

size 380ml

Gel and cure times

Base material temperature (°C)	35	25	15	5	-5	-10**
Gel time (min.)	3	6	7	20	50	60
Curing time (min.)	20	20	20	30	90	180

Typical performance data for standard embedment depth (single threaded rod or rebar)

Ø (mm)	Steel grade 5.8 / Concrete, (C20/25)									Standard data			
	Characteristic Resistance (kN)		Design Resistance (kN)		Recommended Load (kN)		Characterstic Edge Distance (mm)		Character-stic Spacing	Ø Hole diameter in concrete	Ø Hole diameter in fixture	Standard embedment	Recom-mended torque
	Tensile (N)	Shear (V)	Tensile (N)	Shear (V)	Tensile (N)	Shear (V)	Tensile (C)	Shear (C)	(mm)	(mm)	(mm)	(mm)	(Nm)
8	19.0	9.5	12.7	7.6	9.1	5.4	80	100	160	10	9	80	11
10	30.2	15.1	19.3	12.1	13.8	8.6	90	130	180	12	11	90	22
12	43.8	21.9	27.2	17.5	19.4	12.5	110	150	220	14	13	110	38
16	81.0	40.8	37.5	32.7	26.8	23.3	125	170	250	18	17	125	95
20	126.0	63.7	50.0	51.0	35.7	36.4	170	190	340	24	22	170	170
24	157.5	91.8	62.5	73.4	44.6	52.4	210	240	420	28	26	210	260
30	183.0	207.1	72.6	166.1	51.9	118.6	280	350	560	35	33	280	480

Typical ultimate physical properties

	N/mm²	Test method	Storage / Shelf life	IMPORTANT
Compressive strength	29.47	(EN ISO 604) / (ASTM 695)	This product should be stored between +5˚C & +25˚C. The Shelf life of the product is 18 months from the manufacture date. Avoid direct sunlight.	The information and data given is based on our own experience, research and testing and is believed to be reliable and accurate. However, as Stahlfix cannot know the varied uses to which its products may be applied, or the methods of application used, no warranty as to the fitness or suitability of its products is given or implied. It is the users responsibility to determine suitability of use. For further information please contact our Technical Department.
Flexural strength	3852	(EN ISO 178) / (ASTM 795)		
Flexural modulus	13.84	"		
Tensile strength	10560	(EN ISO 527) / (ASTM 638)		
E modulus	6860.33	"		

Design resistance for single threaded rod and rebar (without edge distance or spacing influence)

Concrete class: C20/25 (According Eurocode 2 : On Cylindre 20N/mm² On Cube : 25N/mm²).

Threaded rod : Steel grade 5.8

Diameter (mm)	Ø hole (mm)	Design resistance (N_{rd}) (Tensile) * (kN)																		hef (mm)	Design resistance (kN)
8	10	12.7																		71	12.7
10	12		19.3	20.1												=	Steel failure			94	20.1
12	14				27.2	29.2														118	29.2
16	18					36.0	39.0	41.9	44.9	47.9	50.9	53.9	54.4							182	54.4
Depth (mm)		80	90	100	110	120	130	140	150	160	170	180	190	200	220	240	260	280	300	350		
20	24	50.0	52.9	55.9	58.8	64.7	70.6	76.5	82.3	84.9										289	84.9
24	28				59.3	65.2	71.1	77.1	83.0	88.9	103.7	118.5	122.4							413	122.4
30	40								72.6	77.8	90.7	103.7	116.6	129.6	142.6	155.5	181.5	207.4	233.3	259.2	1076	278.9
Depth (mm)		170	180	190	200	220	240	260	280	300	350	400	450	500	550	600	700	800	900	1000		

Rebar : Yield strength fyk = 500N/mm2

Diameter (mm)	Ø hole (mm)	Design resistance (N_{rd}) (Tensile) * (kN)																		hef (mm)	Design Resistance (kN)
8	12	14.2	17.8	21.4	21.9															123	21.9
10	14		21.5	25.8	30.0	34.1										=	Steel failure			159	34.1
12	16			29.7	34.7	39.6	44.6	49.2												199	49.2
14	18				38.6	44.1	49.6	55.2	60.7	66.2	66.9									243	66.9
16	22					47.9	53.9	59.9	65.9	71.9	77.9	83.9	87.4							292	87.4
Depth (mm)		80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	400	450	500		
20	28	58.8	66.2	73.5	80.9	88.2	102.9	117.6	132.3	136.6										465	136.6
25	32			77.2	84.9	92.6	108.0	123.5	138.9	154.4	169.8	185.2	213.4							691	213.4
32	40					82.9	96.8	110.6	124.4	138.2	152.1	165.9	193.5	221.2	248.8	276.5	304.1	331.8	349.7	1265	349.7
40	50							125.7	141.4	157.1	172.8	188.5	219.9	251.4	282.8	314.2	245.6	377.0	408.5	439.9	1739	546.3
Depth (mm)		200	225	250	275	300	350	400	450	500	550	600	700	800	900	1000	1100	1200	1300	1400		

Characteristic (Vrk) & design (Vrd) shear loads for various threaded rod grades + rebar

SIZE	Steel grade 5.8		Steel grade 8.8		Steel grade 10.9		Steel grade A4-70		Steel grade A4-80	
	Vrk (kN)	Vrd (kN)	Vrk (kN)	Vrd (kN)	Vrk (kN)	Vrd (kN)	Vrk (kN)	Vrd (kN)	Vrk (kN)	Vrd (kN)
M8	9.5	7.6	14.6	11.7	19.0	15.2	12.8	8.2	14.6	9.4
M10	15.1	12.1	23.2	18.6	30.2	24.1	20.3	13.0	23.2	14.9
M12	21.9	17.5	33.7	27.0	43.8	35.1	29.5	18.9	33.7	21.6
M16	40.8	32.7	62.8	50.2	81.6	65.3	55.0	32.5	62.8	40.3
M20	63.7	51.0	98.0	78.4	127.4	101.9	85.8	55.0	98.0	62.8
M24	91.8	73.4	141.2	113.0	183.6	146.8	123.6	79.2	141.2	90.5
M30	207.1	166.1	207.6	166.1	269.9	215.9	129.8	64.9	207.6	103.8

Rebar Ø (mm)	Bst 500	
	Vrk (kN)	Vrd (kN)
8	16.6	11.1
10	25.9	17.3
12	37.3	24.9
14	50.8	33.9
16	66.4	44.3
20	103.9	69.3
25	162.0	108.0
32	265.1	176.7
40	414.6	276.4

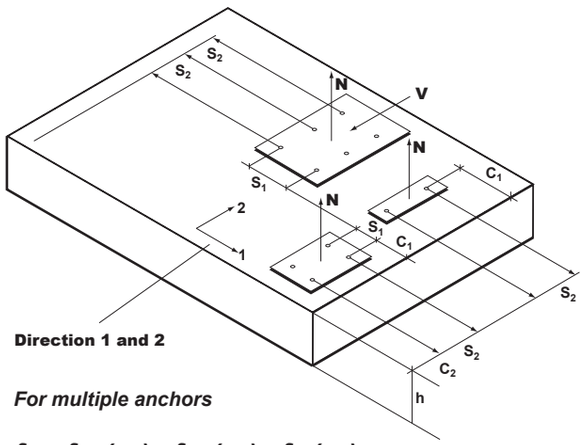
Stahlfix vinylester styrene free - 3

Reduction factors : Spacing and edge distance

Spacing reduction factor f_A								Edge reduction factor f_R															
Tensile load / Shear load								Tensile load f_{RN}								Shear load f_{RV}							
Spacing	Ø Threaded rod / Rebar (mm)							Edge distance (mm)	Ø Threaded rod / Rebar (mm)							Ø Threaded rod / Rebar (mm)							
	8	10	12	16	20	24	30		8	10	12	16	20	24	30	8	10	12	16	20	24	30
40	0.64							40	0.64							0.25						
50	0.67	0.63						50	0.73	0.63						0.44	0.30					
60	0.70	0.65	0.63					60	0.82	0.70	0.63					0.63	0.48	0.30				
70	0.73	0.68	0.64					70	0.90	0.77	0.68					0.81	0.65	0.44				
80	0.76	0.70	0.66	0.63				80	1.00	0.84	0.74	0.63				1.00	0.83	0.58	0.40			
90	0.79	0.73	0.68	0.64				90		0.91	0.80	0.67					1.00	0.72	0.53			
100	0.82	0.75	0.70	0.65	0.63			100		1.00	0.86	0.72	0.63					0.86	0.67	0.35		
125	0.89	0.81	0.75	0.69	0.66	0.63		110			0.92	0.77	0.66					1.00	0.80	0.44		
150	0.96	0.88	0.80	0.73	0.69	0.65	0.63	120			1.00	0.81	0.70	0.64					1.00	0.58	0.35	
160	1.00	0.90	0.82	0.74	0.70	0.66	0.64	140				0.91	0.78	0.67	0.63					0.72	0.46	0.30
175		0.94	0.85	0.76	0.72	0.68	0.65	160				1.00	0.85	0.73	0.66					0.91	0.62	0.35
200		1.00	0.90	0.80	0.75	0.70	0.68	180					0.93	0.80	0.72					1.00	0.77	0.46
225			0.95	0.84	0.78	0.73	0.70	200					1.00	0.86	0.78						0.92	0.57
240			1.00	0.86	0.80	0.75	0.72	220						0.92	0.84						1.00	0.68
250				0.87	0.81	0.76	0.73	240						1.00	0.90							0.78
275				0.91	0.84	0.78	0.75	265							1.00							1.00
280				0.92	0.85	0.79	0.76															
300				0.95	0.88	0.81	0.78															
320				1.00	0.90	0.83	0.80															
350					0.94	0.86	0.83															
400					1.00	0.92	0.88															
440						0.96	0.92															
480						1.00	0.96															
500							0.98															
525							1.00															

Loads in hollow material (Tensile or shear)

Size	Recommended load (kN)
	Hollow brick 7 N/mm2
M8	0.8
M10	1.7
M12	2.7
M16	3.6



Direction 1 and 2

Design according to Anchor theory *

$$FR_N = \frac{N_{rd}}{1.4} \cdot f_B \cdot f_{RN} \cdot f_A \qquad \textit{(tensile)}$$

$$FR_v = \frac{V_{rd}}{1.4} \cdot f_B \cdot f_{RV} \cdot f_A \qquad \textit{(shear)}$$

FR_α *(shear + tensile)*

$$FR_\alpha = FR_N - (FR_N - FR_V)\frac{\alpha}{90}$$

f_B = *Resistance factor of Concrete*

$f_B = 1 + 0.02\,(1 - \frac{\alpha}{90}) \cdot (f_{cc,eff} - 25)$

$[15 \le f_{cc,eff} \le 55]$

α = *Angle of load*

f_A = *Reduction factor "Spacing"*

f_{cc} = *Resistance on cube N/mm²*

f_R = *Reduction factor "edge distance"*

For multiple anchors

$$f_A = f_{A1}(s_1) \cdot f_{A2}(s_2) \cdot f_{Ax}(s_x)$$

$$f_{RN} = f_{RN1}(c_1) \cdot f_{RN2}(c_2) \cdot f_{RNx}(c_x)$$

$$f_{RV} = f_{RV1}(c_1) \cdot f_{RV2}(c_2) \cdot f_{RVx}(c_x)$$

$h = h_{nom} + 40mm$

h_{nom} = *embedment depth*

N_{rd} , V_{rd} = *Approved design resistance*

FR_N , FR_V , FR_α = *Recommended loads*

***** Design according to post-installed rebar theory : see design section.***

Stahlfix pure epoxy - 1

Product information

Stahlfix Pure Epoxy **(PE)** 1:1 Resin is a high performance, two component epoxy resin system. Applied in one single action this resin will produce a high performance, strong fixing with exceptionally high chemical resistance.

Advantages

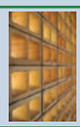
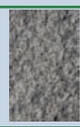
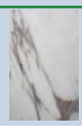
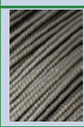
- Solvent Free
- Ideal for diamond drilled holes
- Ideal for fixings using rebar and threaded rod
- Excellent durability
- Suitable for underwater application and in damp conditions
- Longer working times

Approvals

INSTYTUT TECHNIKI BUDOWLANEJ
ITB-0973/W

Imperial College London Consultants
SPO/ICON-RT-09-07 VER 4

WRAS APPROVED PRODUCT
BS 6920

Bricks	Hollow	Concrete	Stone	Marble	Rebar	Damp
						
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Size 400ml

Gel and cure times

Base Material Temperature (°C)	45	40	35	25	15	5
Gel Time (min.)	4	5	20	40	60	180
Loading Time (min.)	180	180	180	240	300	960

Typical performance data for standard embedment depth (single threaded rod or rebar)

Size	Steel grade 5.8 / Béton, (C20/25)									Standard data			
	Characteristic Resistance		Design Resistance		Recommended Load		Characteristic Edge Distances (mm)		Characteristic Spacing	Ø Hole in Concrete	Ø hole in fixture	Embedment Depth	Recommended Torque
	Tensile (N)	Shear (V)	Tensile (N)	Shear (V)	Tensile (N)	Shear (V)	Tensile (C)	Shear (C)	(mm)	(mm)	(mm)	(mm)	(Nm)
8	19.0	9.5	12.7	7.6	9.1	5.4	80	100	160	10	9	80	11
10	30.2	15.1	19.3	12.1	13.8	8.6	90	130	180	12	11	90	22
12	43.8	21.9	27.2	17.5	19.4	12.5	110	150	220	14	13	110	38
16	81.0	40.8	37.5	32.7	26.8	23.3	125	170	250	18	17	125	95
20	126.0	63.7	50.0	51.0	35.7	36.4	170	190	340	24	22	170	170
24	157.5	91.8	62.5	73.4	44.6	52.4	210	240	420	28	26	210	260
30	183.0	207.1	72.6	166.1	51.9	118.6	280	350	560	35	33	280	480

Typical ultimate physical properties

	N/mm²	Test Method	Shelf Life / Storage	IMPORTANT
Compressive strength	82.48	(EN ISO 604) / (ASTM 695)	This product should be stored between +5˚C & +25˚C. The Shelf life of the product is 24 months from the manufacture date. Avoid direct sunlight.	The information and data given is based on our own experience, research and testing and is believed to be reliable and accurate. However, as Stahlfix cannot know the varied uses to which its products may be applied, or the methods of application used, no warranty as to the fitness or suitability of its products is given or implied. It is the users responsibility to determine suitability of use. For further information please contact our Technical Department.
Flexural strength	41.64	(EN ISO 178) / (ASTM 795)		
Flexural modulus	4249.00	"		
Tensile strength	28.21	(EN ISO 527) / (ASTM 638)		
E modulus	4811.00	"		

Design resistance for single threaded rod and rebar (without edge distance and spacing influence)

Concrete class: C20/25 (According Eurocode 2, On Cylindre : 20N/mm² On Cube : 25N/mm²).

Threaded rod : Steel grade 5.8

Ø Threaded rod (mm)	Ø hole (mm)	Design resistance (N_{rd}) * (Tensile) (kN)																			hef (mm)	Design resistance (kN)
8	10	12.7																			59	12.7
10	12	20.1															=	Steel failure			75	20.1
12	14		29.2																		91	29.2
16	18					51.3	54.4														127	54.4
Depth (mm)		80	90	100	110	120	130	140	150	160	170	180	190	200	220	240	260	280	300	350		
20	24	84.9																			163	84.9
24	28			122.4																	196	122.4
30	40					187.8	203.4	219.1	234.7	273.8	278.9										357	278.9
Depth (mm)		170	180	190	200	220	240	260	280	300	350	400	450	500	550	600	700	800	900	1000		

Rebar : Yield strength fyk = 500N/mm2

Ø (mm)	Ø hole (mm)	Design resistance (N_{rd}) * (Tensile) (kN)																			hef (mm)	Design resistance (kN)
8	12	17.1	21.4	21.9																	102	21.9
10	14		26.7	32.0	34.1												=	Steel failure			128	34.1
12	16			38.5	44.9	49.2															153	49.2
14	18				52.3	59.8	66.9														179	66.9
16	22					68.4	76.9	85.5	87.4												205	87.4
Depth (mm)		80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	400	450	500		
20	28	104.3	117.4	130.4	136.6																262	136.6
25	32			163.0	179.3	195.6	213.4														327	213.4
32	40					250.4	292.1	333.8	349.7												419	349.7
40	50							417.3	469.4	521.6	546.3										524	546.3
Depth (mm)		200	225	250	275	300	350	400	450	500	550	600	700	800	900	1000	1100	1200	1300	1400		

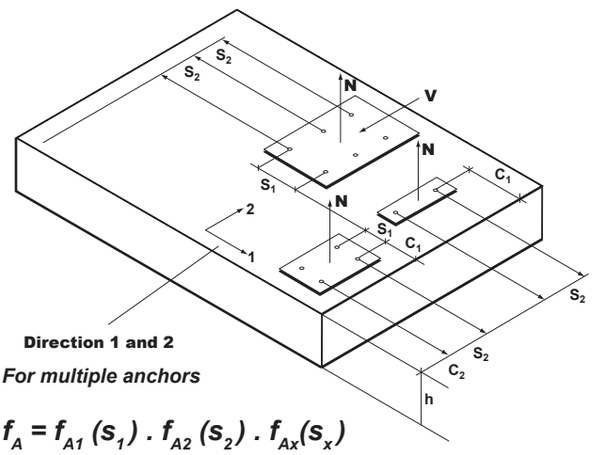
Characteristic (Vrk) & design (Vrd) shear loads for various threaded rod grades + rebar

Size	Steel grade 5.8		Steel grade 8.8		Steel grade 10.9		Steel grade A4-70		Steel grade A4-80	
	Vrk (kN)	Vrd (kN)	Vrk (kN)	Vrd (kN)	Vrk (kN)	Vrd (kN)	Vrk (kN)	Vrd (kN)	Vrk (kN)	Vrd (kN)
M8	9.5	7.6	14.6	11.7	19.0	15.2	12.8	8.2	14.6	9.4
M10	15.1	12.1	23.2	18.6	30.2	24.1	20.3	13.0	23.2	14.9
M12	21.9	17.5	33.7	27.0	43.8	35.1	29.5	18.9	33.7	21.6
M16	40.8	32.7	62.8	50.2	81.6	65.3	55.0	32.5	62.8	40.3
M20	63.7	51.0	98.0	78.4	127.4	101.9	85.8	55.0	98.0	62.8
M24	91.8	73.4	141.2	113.0	183.6	146.8	123.6	79.2	141.2	90.5
M30	207.1	166.1	207.6	166.1	269.9	215.9	129.8	64.9	207.6	103.8

Rebar Ø (mm)	Bst 500	
	Vrk (kN)	Vrd (kN)
8	16.6	11.1
10	25.9	17.3
12	37.3	24.9
14	50.8	33.9
16	66.4	44.3
20	103.9	69.3
25	162.0	108.0
32	265.1	176.7
40	414.6	276.4

Reduction factors : Spacing and edge distance

Spacing reduction factor f_A								Edge reduction factor f_R													
Tensile load / Shear load								Tensile load f_{RN}							Shear load f_{RV}						
Spacing	Ø Threaded rod / Rebar (mm)							Edge distance (mm)	Ø Threaded rod / Rebar (mm)												
	8	10	12	16	20	24	30		8	10	12	16	20	24	30	8	10	12	16	20	24	30
40	0.64							40	0.64							0.25						
50	0.67	0.63						50	0.73	0.63						0.44	0.30					
60	0.70	0.65	0.63					60	0.82	0.70	0.63					0.63	0.48	0.30				
70	0.73	0.68	0.64					70	0.90	0.77	0.68					0.81	0.65	0.44				
80	0.76	0.70	0.66	0.63				80	1.00	0.84	0.74	0.63				1.00	0.83	0.58	0.40			
90	0.79	0.73	0.68	0.64				90		0.91	0.80	0.67					1.00	0.72	0.53			
100	0.82	0.75	0.70	0.65	0.63			100		1.00	0.86	0.72	0.63					0.86	0.67	0.35		
125	0.89	0.81	0.75	0.69	0.66	0.63		110			0.92	0.77	0.66					1.00	0.80	0.44		
150	0.96	0.88	0.80	0.73	0.69	0.65	0.63	120			1.00	0.81	0.70	0.64					1.00	0.58	0.35	
160	1.00	0.90	0.82	0.74	0.70	0.66	0.64	140				0.91	0.78	0.67	0.63					0.72	0.46	0.30
175		0.94	0.85	0.76	0.72	0.68	0.65	160				1.00	0.85	0.73	0.66					0.91	0.62	0.35
200		1.00	0.90	0.80	0.75	0.70	0.68	180					0.93	0.80	0.72					1.00	0.77	0.46
225			0.95	0.84	0.78	0.73	0.70	200					1.00	0.86	0.78						0.92	0.57
240			1.00	0.86	0.80	0.75	0.72	220						0.92	0.84						1.00	0.68
250				0.87	0.81	0.76	0.73	240						1.00	0.90							0.78
275				0.91	0.84	0.78	0.75	265							1.00							1.00
280				0.92	0.85	0.79	0.76															
300				0.95	0.88	0.81	0.78															
320				1.00	0.90	0.83	0.80															
350					0.94	0.86	0.83															
400					1.00	0.92	0.88															
440						0.96	0.92															
480						1.00	0.96															
500							0.98															
525							1.00															



Direction 1 and 2

Design according to Anchor theory *

$$FR_N = \frac{N_{rd}}{1.4} \cdot f_B \cdot f_{RN} \cdot f_A \qquad \textit{(tensile)}$$

$$FR_v = \frac{V_{rd}}{1.4} \cdot f_B \cdot f_{RV} \cdot f_A \qquad \textit{(shear)}$$

FR_α *(shear + tensile)*

$$FR_\alpha = FR_N - (FR_N - FR_V)\frac{\alpha}{90}$$

f_B = *Resistance factor of Concrete*

$f_B = 1 + 0.02\,(1 - \frac{\alpha}{90}) \cdot (f_{cc,eff} - 25)$

$[15 \le f_{cc,eff} \le 55]$

α = *Angle of load*

f_A = *Reduction factor "Spacing"*

f_{cc} = *Resistance on cube N/mm²*

f_R = *Reduction factor "edge distance"*

For multiple anchors

$$f_A = f_{A1}(s_1) \cdot f_{A2}(s_2) \cdot f_{Ax}(s_x)$$

$$f_{RN} = f_{RN1}(c_1) \cdot f_{RN2}(c_2) \cdot f_{RNx}(c_x)$$

$$f_{RV} = f_{RV1}(c_1) \cdot f_{RV2}(c_2) \cdot f_{RVx}(c_x)$$

$h = h_{nom} + 40mm$

h_{nom} = *embedment depth*

N_{rd} , V_{rd} = *Approved design resistance*

FR_N , FR_V , FR_α = *Recommended loads*

***** Design according to post-installed rebar theory : see design section.***

Stahlfix hammer capsules - 1

Product information

Glass capsules are designed specifically for applications in solid materials for example concrete or stone. The glass capsule is placed in the drilled hole and the anchor rod is driven in manually in a hammering action to break the capsule. The capsule, containing both the resin and hardener components is then allowed to mix and react.

Features

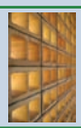
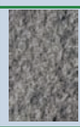
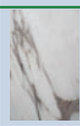
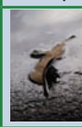
- Suitable for heavy loads.
- Excellent chemical resistance.
- European Technical Approval (option 8).
- Excellent durability.

Approvals

DIBt approval

ETA APPROVED 09/0192

Option 8
(uncracked concrete)

Bricks	Hollow	Concrete	Stone	Marble	Rebars	Damp
						
		✓ ✓	✓ ✓	✓ ✓	✓ ✓	✓ ✓

Sizes

M8-M12-M12-M16-M20-M24-M30*

Gel and cure times

Base material temperature (°C)	30	25	15	5
Gel time (min.)	10	20	60	300
Curing time (min.)	20	40	120	600

Typical performance data at standard depth (single threaded rod or rebar)

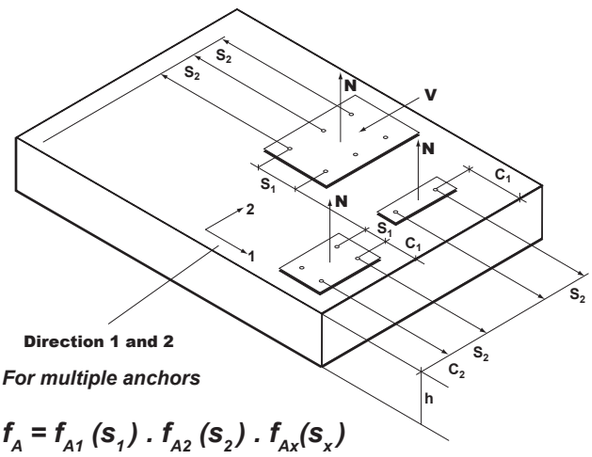
Ø (mm)	Steel grade 5.8 / Béton, (C20/25)							Standard Data			
	Characteristic Resistance (kN)		Design Resistance (kN)		Characteristic Edge Distance (mm)		Characteristic Spacing	Ø hole diameter in concrete	Ø hole dianeter in fixture	Embedment Dapth	Recommended torque
	Tensile (N)	Shear (V)	Tensile (N)	Shear (V)	Tensile (C)	Shear (C)	(mm)	(mm)	(mm)	(mm)	(Nm)
8	20.0	9.0	7.9	5.1	80	100	160	10	9	80	10
10	30.0	14.0	11.9	8.0	90	130	180	12	11	90	20
12	40.0	21.0	15.9	12.0	110	150	220	14	13	110	40
16	50.0	39.0	19.8	22.3	125	170	250	18	17	125	80
20	75.0	61.0	29.8	34.9	170	190	340	24	22	170	120
24	90.0	88.0	37.7	50.3	210	240	420	28	26	210	180
30*	150.0	140.0	60.0	60.0	280	350	560	35	33	280	400

Size of product

size	L_a (mm)	D_p (mm)	L_p (mm)	V_p cc	V_s cc/cm	Storage / Shelf Life	IMPORTANT
M8	110	9	80	4.0	0.40	This product should be stored between +5˚C & +25˚C. The Shelf life of the product is 12 months from the manufacture date. Avoid direct sunlight.	The information and data given is based on our own experience, research and testing and is believed to be reliable and accurate. However, as Stahlfix cannot know the varied uses to which its products may be applied, or the methods of application used, no warranty as to the fitness or suitability of its products is given or implied. It is the users responsibility to determine suitability of use. For further information please contact our Technical Department.
M10	130	11	80	5.5	0.52		
M12	160	13	95	9.0	0.66		
M16	190	17	95	15.8	0.95		
M20	260	22	175	53.0	2.40		
M24	300	24	210	76.0	2.54		
M30	380	33	265	191.0	3.88		

Reduction factors : Spacing and edge distance

Spacing reduction factor f_A								Edge reduction factor f_R														
Tensile load / Shear load								Tensile load f_{RN}							Shear load f_{RV}							
Spacing	Ø Threaded rod / Rebar (mm)							Edge distance (mm)	Ø Threaded rod / Rebar (mm)													
	8	10	12	16	20	24	30		8	10	12	16	20	24	30	8	10	12	16	20	24	30
40	0.64							40	0.64							0.25						
50	0.67	0.63						50	0.73	0.63						0.44	0.30					
60	0.70	0.65	0.63					60	0.82	0.70	0.63					0.63	0.48	0.30				
70	0.73	0.68	0.64					70	0.90	0.77	0.68					0.81	0.65	0.44				
80	0.76	0.70	0.66	0.63				80	1.00	0.84	0.74	0.63				1.00	0.83	0.58	0.40			
90	0.79	0.73	0.68	0.64				90		0.91	0.80	0.67					1.00	0.72	0.53			
100	0.82	0.75	0.70	0.65	0.63			100		1.00	0.86	0.72	0.63					0.86	0.67	0.35		
125	0.89	0.81	0.75	0.69	0.66	0.63		110			0.92	0.77	0.66					1.00	0.80	0.44		
150	0.96	0.88	0.80	0.73	0.69	0.65	0.63	120			1.00	0.81	0.70	0.64					1.00	0.58	0.35	
160	1.00	0.90	0.82	0.74	0.70	0.66	0.64	140				0.91	0.78	0.67	0.63					0.72	0.46	0.30
175		0.94	0.85	0.76	0.72	0.68	0.65	160				1.00	0.85	0.73	0.66					0.91	0.62	0.35
200		1.00	0.90	0.80	0.75	0.70	0.68	180					0.93	0.80	0.72					1.00	0.77	0.46
225			0.95	0.84	0.78	0.73	0.70	200					1.00	0.86	0.78						0.92	0.57
240			1.00	0.86	0.80	0.75	0.72	220						0.92	0.84						1.00	0.68
250				0.87	0.81	0.76	0.73	240						1.00	0.90							0.78
275				0.91	0.84	0.78	0.75	265							1.00							1.00
280				0.92	0.85	0.79	0.76															
300				0.95	0.88	0.81	0.78															
320				1.00	0.90	0.83	0.80															
350					0.94	0.86	0.83															
400					1.00	0.92	0.88															
440						0.96	0.92															
480						1.00	0.96															
500							0.98															
525							1.00															



Direction 1 and 2

Design according to Anchor theory *

$$FR_N = \frac{N_{rd}}{1.4} \cdot f_B \cdot f_{RN} \cdot f_A \qquad \textit{(tensile)}$$

$$FR_v = \frac{V_{rd}}{1.4} \cdot f_B \cdot f_{RV} \cdot f_A \qquad \textit{(shear)}$$

FR_α *(shear + tensile)*

$$FR_\alpha = FR_N - (FR_N - FR_V)\frac{\alpha}{90}$$

f_B = *Resistance factor of Concrete*

$f_B = 1 + 0.02\,(1 - \frac{\alpha}{90}) \cdot (f_{cc,eff} - 25)$

$[15 \le f_{cc,eff} \le 55]$

α = *Angle of load*

f_A = *Reduction factor "Spacing"*

f_{cc} = *Resistance on cube N/mm²*

f_R = *Reduction factor "edge distance"*

For multiple anchors

$$f_A = f_{A1}(s_1) \cdot f_{A2}(s_2) \cdot f_{Ax}(s_x)$$

$$f_{RN} = f_{RN1}(c_1) \cdot f_{RN2}(c_2) \cdot f_{RNx}(c_x)$$

$$f_{RV} = f_{RV1}(c_1) \cdot f_{RV2}(c_2) \cdot f_{RVx}(c_x)$$

$h = h_{nom} + 40mm$

h_{nom} = *embedment depth*

N_{rd} , V_{rd} = *Approved design resistance*

FR_N , FR_V , FR_α = *Recommended loads*

***** Design according to post-installed rebar theory : see design section.***

Design for anchoring reinforcement (rebars and threaded rods)

• Note: It is the Owner or BET responsibility to check that the book holder is fit to return to the loads specified by the anchors and includes any provisions for their transfer. The installing company must maintain compliance in terms of implementation as defined by the drawings. Sogiva is not responsible for damage due to non-compliance of instructions, to innadequate specification of the connection by the customer, lack of capacity of the base materials to application errors and any other elements unknown to the manufacturer.

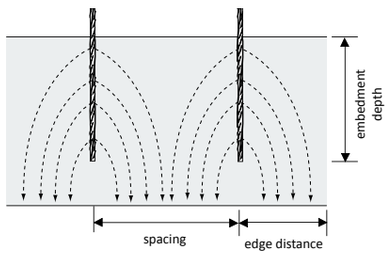
***These tests can be carried out by Sogiva.**

2. Introduction

According to the two European standards in force, there are two design theory :

1. “Anchor” Theory (Doweling)

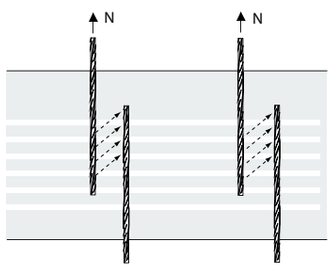
Doweling is one application that can be done using reinforcing bars. Comprising this method, it is possible to apply a shear load on the dowel. In this method the tensile strength is transferred into the concrete. Two failure modes are possible with this application: concrete cone failure and steel failure.



Without connection re-inforcement

2. Post - Installed Rebar Theory

Reinforcement bars increase the tensile strength of the concrete. Cast in reinforcement bars are positioned prior to pouring concrete into the re-encofrced iron cast created by the rebars. Post-installed rebars transfer the tensile strength between the neighboring reinforcement bars. The concrete volume needs to be large enough to accomodate the transfer of tensile strength. The overlap connection of the reinforcement bars are goverened by the Rules for Concrete Building Europe Code 2 (EC2).



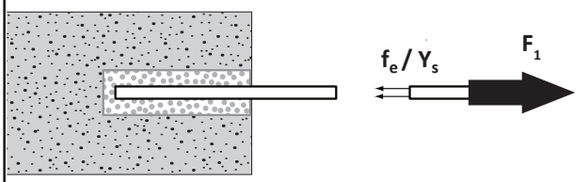
With connection re-inforcement

A. Anchor Theory - 1

A-1 Application types:

- Unreinforced concrete
- **Concrete reinforced or was not idea of the location and diameters of rebars.**
- Natural ston, Solid bricks, marble, wood.
- Rebars, threaded rods, studs.

A-2 Failure modes:



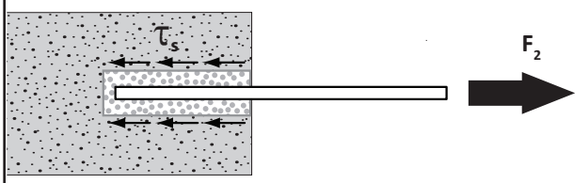
1) Steel failure

Steel failure

Equilibrium equation:

$F_1 = [\ \pi.\Phi^2/4\ ].f_e / Y_s$ Y_s = Safety Factor

*Perfect Anchor



2) Sliding concrete - epoxy

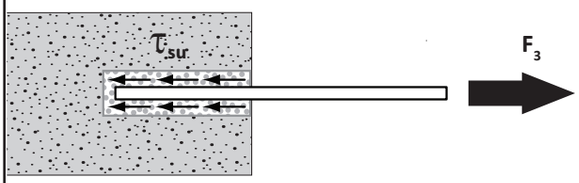
Relative sliding of epoxy against concrete

Equilibrium equation :

$F_2 = \pi.\Phi_{epoxy}.L.\tau_{s\ epoxy\ -\ concrete}$

* Anchor length ≤ length of perfect anchor

Quality of concrete < C20/25



3) Sliding steel - epoxy

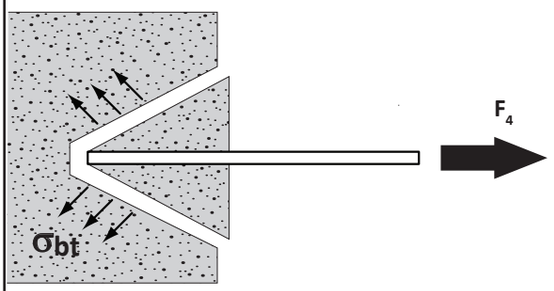
Relative sliding of steel against epoxy

Equilibrium equation :

$F_3 = \pi.\Phi_{steel}.L.\tau_{su\ steel\ -\ epoxy}$

* Anchor length ≤ length of perfect anchor

Quality of concrete > C20/25



4) Concrete Cone Failure

Concrete cone failure

Equilibrium equation :

F_4 = Cone surface x horizontal projection of σ_{bt}

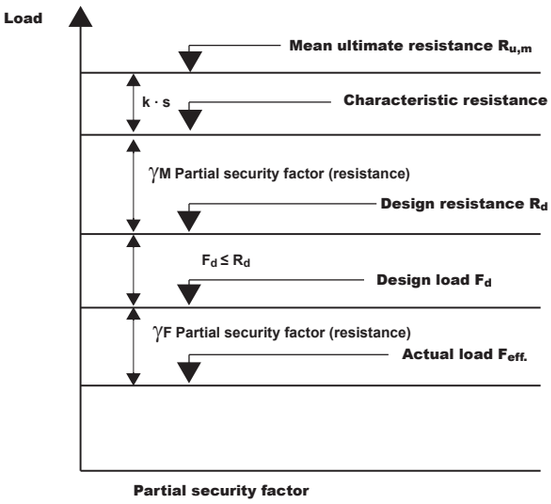
Note : Surface of the concrete cone at 45° of radius R = $2^{1/2}$. π . R^2

* Anchor length ≥ length of perfect anchor

Quality of concrete < C20/25

*** Failure domain determinant**

A - 3 Principle of partial safety concept according to EC2 - ETAG 001



- Characteristic resistance in concrete / concrete cone = tests
- Characteristic resistance of steel

$N_{Rk,s}$ = As . fu (tensile)

$V_{Rk,s}$ = 0,5 . As. fu (shear)

- $R_d = \frac{Rk}{\gamma M}$ = Design resistance

γM = partial safety factor (According eurocode 2 chap 7)

As = cross section

fu = min. tensile strength (N/mm²)

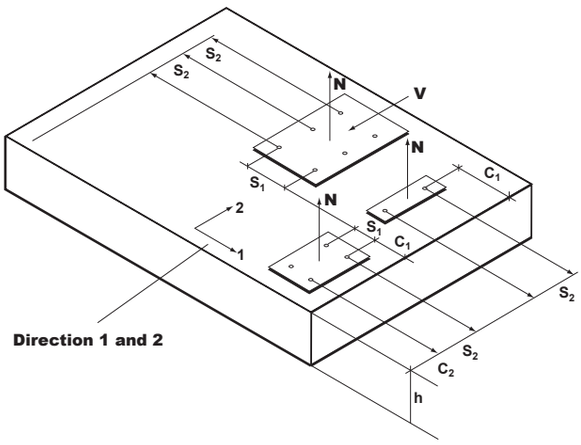
A - 4 Distances

The sheets detailed by type of resin give the values of design resistance N_{rd} (Tensile) and V_{rd} (shear) and the reduction factors to be used with insufficient spacing & edge distance.

Reduction factors : Spacing and edge distance

Spacing reduction factor f_A								Edge reduction factors f_R														
Tensile load / Shear load								Tensile load f_{RN}							Shear load f_{RV}							
Spacing	Ø Threaded rod / rebar (mm)							Edge distance (mm)	Ø Threaded rod / rebar (mm)													
	8	10	12	16	20	24	30		8	10	12	16	20	24	30	8	10	12	16	20	24	30
40	0.64							40	0.64							0.25						
50	0.67	0.63						50	0.73	0.63						0.44	0.30					
60	0.70	0.65	0.63					60	0.82	0.70	0.63					0.63	0.48	0.30				
70	0.73	0.68	0.64					70	0.90	0.77	0.68					0.81	0.65	0.44				
80	0.76	0.70	0.66	0.63				80	1.00	0.84	0.74	0.63				1.00	0.83	0.58	0.40			
90	0.79	0.73	0.68	0.64				90		0.91	0.80	0.67					1.00	0.72	0.53			
100	0.82	0.75	0.70	0.65	0.63			100		1.00	0.86	0.72	0.63					0.86	0.67	0.35		
125	0.89	0.81	0.75	0.69	0.66	0.63		110			0.92	0.77	0.66					1.00	0.80	0.44		
150	0.96	0.88	0.80	0.73	0.69	0.65	0.63	120			1.00	0.81	0.70	0.64					1.00	0.58	0.35	
160	1.00	0.90	0.82	0.74	0.70	0.66	0.64	140				0.91	0.78	0.67	0.63					0.72	0.46	0.30
175		0.94	0.85	0.76	0.72	0.68	0.65	160				1.00	0.85	0.73	0.66					0.91	0.62	0.35
200		1.00	0.90	0.80	0.75	0.70	0.68	180					0.93	0.80	0.72					1.00	0.77	0.46
225			0.95	0.84	0.78	0.73	0.70	200					1.00	0.86	0.78						0.92	0.57
240			1.00	0.86	0.80	0.75	0.72	220						0.92	0.84						1.00	0.68
250				0.87	0.81	0.76	0.73	240						1.00	0.90							0.78
275				0.91	0.84	0.78	0.75	265							1.00							1.00
280				0.92	0.85	0.79	0.76															
300				0.95	0.88	0.81	0.78															
320				1.00	0.90	0.83	0.80															
350					0.94	0.86	0.83															
400					1.00	0.92	0.88															
440						0.96	0.92															
480						1.00	0.96															
500							0.98															
525							1.00															

Anchor Theory - 3



Recommended Load (tensile) :

$$FR_N = \frac{N_{rd}}{1.4} \cdot f_B \cdot f_{RN} \cdot f_A$$

Recommended Load (shear) :

$$FR_v = \frac{V_{rd}}{1.4} \cdot f_B \cdot f_{RV} \cdot f_A$$

Combined Load (tensile + shear) :

$$\frac{F_{SN}}{F_{RN}} + \frac{F_{SV}}{F_{RV}} \leq 1{,}2$$

Oblique Load :

$$F_\alpha = F_{RN} - (F_{RN} - F_{RV}) \frac{\alpha}{90}$$

N_{rd} , V_{rd} : *Approved design resistance according to the data sheets*

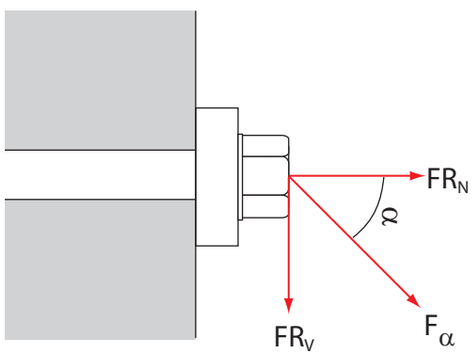
F_{SN} , F_{SV} : *service loads (tensile , shear)*

f_B = Resistance factor of concrete $= 1 + 0.02 \left(1 - \frac{\alpha}{90}\right) \cdot (f_{cc,eff} - 25) \quad [15 \leq f_{cc,eff} \leq 55]$

f_A = "Spacing" reduction factor

f_R = "edge distance" reduction factor

α = Angle of load



For multiple anchors :

$f_A = f_{A1}(s_1) \cdot f_{A2}(s_2) \cdot f_{Ax}(s_x)$

$f_{RN} = f_{RN1}(c_1) \cdot f_{RN2}(c_2) \cdot f_{RNx}(c_x)$

$f_{RV} = f_{RV1}(c_1) \cdot f_{RV2}(c_2) \cdot f_{RVx}(c_x)$

$h = h_{nom}$ + 40mm h_{nom} = embedment depth f_{cc} = Resistance on cube N/mm²

A - 5 Design of anchors According our homologation EOTA 10/0265 (Vinylester styrene free)

The fitness of the anchors (rebar or threaded rod) for the intended use is given under the following conditions :

- The anchorages are designed in accordance with the Guideline for European Technical Approval ETAG 001 “Metal anchors for use in concrete”, Annex C, Method A, for bonded anchors under the responsibility of an engineer experienced in anchorages and concrete work.

For the verifications given below according to Annex C the following shall be observed :

- For the verification “concrete cone failure” (clause 5.2.2.4; Annex C of the ETAG, $N_{RK,c}$ shall be determined according to (1) and (2); the smaller of the values according to (1) and (2) is decisive.

(1) $N_{RK,c}$ According to equation (5.2) annex C of the ETAG

where : $N^0_{RK,c}$ According to Table 8 of Annex 5
$S_{cr,N}$ and $C_{cr,N}$ According to Table 5 of Annex 4
$\psi_{ucr,N} = 1,0$

(2) $N_{RK,c}$ According to the equation (5.2) Annex C of the ETAG

where : $N^0_{RK,c} = 0,75 \times 15,5 \times h_{ef}^{1,5} \times f_{ck,cube}^{0.5}$
$S_{cr,N} = 3\ h_{ef}$ and $c_{cr,n} = 1,5\ h_{ef}$
$\psi_{ucr,N} = 1,0$

- For the verification “splitting failure due to loading” (clause 5.2.2.6, Annex C of the ETAG), $N_{RK,sp}$ shall be determined according to (3).

(3) $N_{RK,sp}$ According to equation (5.3), Annex C of the ETAG

where : $N^0_{RK,c}$ According to table 8 of Annex 5
$S_{cr,sp}$ and $C_{cr,sp}$ According to table 8 of Annexe 5
$\psi_{ucr,N} = 1,0$ and $\psi_{h,sp} = 1,0$

For the verification “concrete pryout failure” (clause 5.2.3.3, Annex C of the ETAG), $N_{RK,c}$ for equation (5.6), Annex C of the ETAG shall be determined according to (1).

- Verifiable calculation notes and drawings are prepared taking account of the loads to be anchored.

- The position of the anchor is indicated on the design drawings (e.g. position of the anchor relative to reinforcement or to support, etc.).

WEB LINK

www.eota.be (TR023, TR029)
www.cstb.fr
www.cimsa.fr

B - Post-installed rebar theory - 1

B-1 - Application domain

The design method presented here is based on Eurocode 2 EN 1992-1-1 <design structures in concrete part 1, Rules, General requirements and requirements for buildings>

This method therefore only applies to reinforced concrete. **In the case of unreinforced concrete - or if you are unaware of reinforcement - , It is necessary to use the theory of anchor used in this brochure explained on pages 26 to 30.**

Indeed the anchor forces contained within reinforced concrete, non reinforced concrete and plain concrete do not follow the same path.

The performance characteristics of anchors made frames correspond to those of bars embedded in concrete. We will use all the computation rules of Eurocode 2, in particular, the transmission of anchoring forces in structural elements to be connected must be in accordance with the rules as one of reinforced concrete structures (eg. Transverse reinforcement, concrete cover, etc.).

Anchors must be designed in accordance with the rules pertaining to the fixing of rebar diameters 8 to 32mm.

B-2 - Design of post-installed rebar according EN 1992-1-1

B-2-1 General points

The actual position of the reinforcement in the existing building component must be determined on the basis of the construction documentation and allowed for when dracting.

The transfer of the internal section forces in the joint must be verified in accordance to EN 1992-1-1 when a new building component is being connected. The transfer of shear forces between new and old concrete shall be designed according to EN 1992-1-1. The joints for concreting must be roughened to at least such an extent that aggregate protrude.

The design of rebar connections and determination of the internal section forces to be transferred in the construction joint shall be in keeping with the EN 1992-1-1.

Verification of the immediate local force transfer to the concrete has been provided.

Verification of the transfer of the loads to be anchored to the building component must be provided.

The spacing between post installed rebars shall be greater than the maximum of 4ds and 40mm.

B-2-2 - Determination of the basic anchorage length

B-2-2-1 General Points

The anchorage length l_{bd} must be determined according to EN 1992-1-1, section 8.4.3.

The anchorage depths and overlap lengths must not be less than the minimum values given in the product data sheets.

B-2-2-2 Calculation of the basic anchorage length l_{bqrd}

The basic anchorage length $l_{b,rqd}$ for anchoring the force $A_s.f_{yd}$ in the rebar assuming constant bond stress equal to f_{bd} follows from :

$l_{b,rqd} = (\Phi/4).(\sigma_{sd}/f_{bd})$ where :

Φ = Diameter of the rebar

σ_{sd} = calculated stress in the rebar under the design action

f_{bd} = design value of the bond strength according to table 4 in annex 5

$f_{bd} = 2.25\ \eta_1\ \eta_2\ f_{ctd}$ (According EN 1992-1-1)

with $f_{ctd} = \alpha_{ct}\ f_{ctk,\ 0.05} / \gamma_c$

$\alpha_{ct} = 1$ and $\gamma_c = 1.5$

η_1 coefficient relative to the quality of the bond condition and position of the rebar during concreting.

$\eta_1 = 1,0$ (“good” bond conditions)

$\eta_1 = 0,7$ (all other conditions)

$\eta_2 = 1,0$ (for ø ≤ 32mm)

B-2-2-3 Claculation of the minimum anchorage depth l_{bmin}

Anchoring rebar

In the case of anchoring rebar, the minimum anchorage length l_{bmin} must be determined as follows :

$l_{b,min} = 1.5 \times \text{Max}\ (0,3)\ l_{b,rqd};\ 10\ \Phi;\ 100\text{mm})$ under tension

$l_{b,min} = 1.5 \times \text{Max}\ (0,6)\ l_{b,rqd};\ 10\ \Phi;\ 100\text{mm})$ under compression

Overlap joint

In the case of overlap joint, the minimum anchorage length $l_{o,min}$ must be determined as follows:

$l_{o,min} = 1.5 \times \text{Max}\ (0,3.\alpha_6.l_{b,rqd};\ 15\ \Phi;\ 200\text{mm})$ EN 1992-1-1 Equation 8.11 modified according to TR023 § 4.2

Where $\alpha_6 = (\rho_1/25)^{0.5} \leq 1.5$ ρ_1 is the percentage of reinforcement lapped within 0.65 l_0 from the centre of the length considered.

B-2-2-4 Calculation of the design anchorage length l_{bd}

Anchoring rebar

In the case of anchoring rebar, the design anchoring length l l_{bd} must be determined as follows :

$l_{bd} + \alpha_1\ \alpha_2\ \alpha_3\ \alpha_4\ \alpha_5\ l_{b,rqd} \geq l_{b,min}$

Où $\alpha_1\ \alpha_2\ \alpha_3\ \alpha_4\ \alpha_5$ determined according to EN 1992-1-1. Table 8.2

Overlap joint

In the case of overlap joint, the design anchorage length l_{bd} must be determined as follows:

$l_o = \alpha_1\ \alpha_2\ \alpha_3\ \alpha_4\ \alpha_5\ \alpha_6\ l_{b,rqd} \geq l_{0,min}$

Où $\alpha_1\ \alpha_2\ \alpha_3\ \alpha_4\ \alpha_5\ \alpha_6$ determined according to EN 1992-1-1 Table 8.2 and 8.3

α_1	Influence of the shape of the rebar	α_1 = 1 for straight rebar
α_2	Influence of the concrete cover	$0.7 \leq \alpha_2 \leq 1.0$ calculated according EN 1992-1-1 Table 8.2
α_3	Influence of the confinement by traverse reinforcement not welded to main reinforcement	α_3=1 because no transverse reinforcement
α_4	Influence of the confinement by welded transverse reinforcement	α_4=1 because no transverse reinforcement
α_5	Influence of the confinement by transverse pressure	$0.7 \leq \alpha_5 \leq 1.0$
α_6	Influence of the overlapping length	$1.0 \leq \alpha_6 \leq 1.5$

B-2-2-5 Transverse reinforcement

The transverse reinforcement required in the zone of the rebar or of the Tension anchor connection must fulfil the requirement in EN 1992-1-1, section 8.7.4.

B-2-2-6 Connection Joint

In case of a connection being made between new and existing concrete where the surface layer of the existing concrete is carbonated, the layer should be removed in the area of the new reinforcing bar (with a daimeter d_s + 60mm) prior to the installation of the new bar. The foregoing may be neglected if building components are new and not carbonated.

B-2-2-7 Additional provisions

The concrete cover required for bonded-in rebars or tension anchor is shown in Annex 8, Table 3, in relation to the drilling method and the hole tolerance.

Furthermore the minimum concrete cover given in EN 1992-1-1, Section 4.4.1.2 shall be observed.

Figure 1: Overlap joints in slabs and beams.

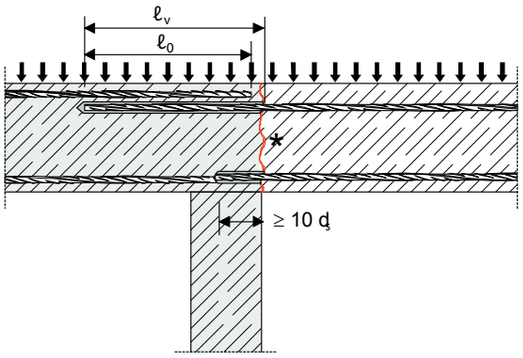


Figure 2: Overlap joint in foundation of a column or wall where the rebars are stressed in tension.

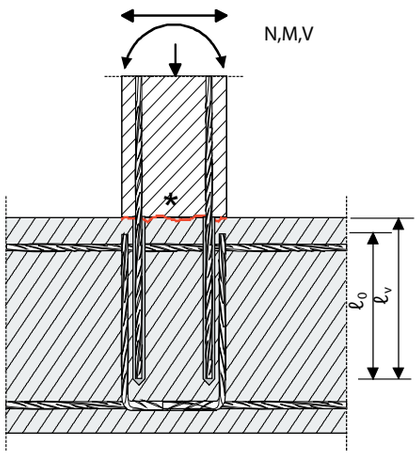


Figure 3: End anchoring of slabs or beams, designed as simply supported.

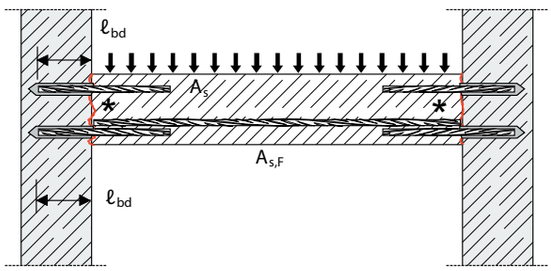


Figure 4: Rebar connection of components stressed primarily in compression. The rebar are stressed in compression.

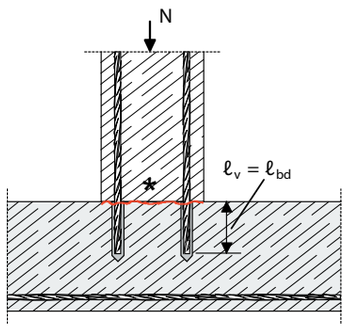
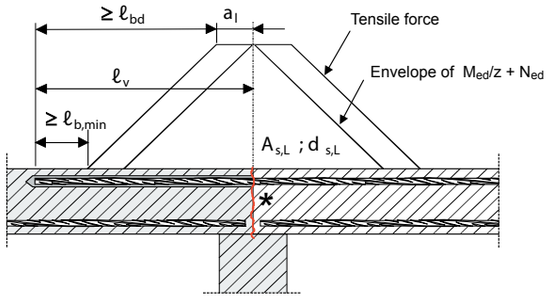
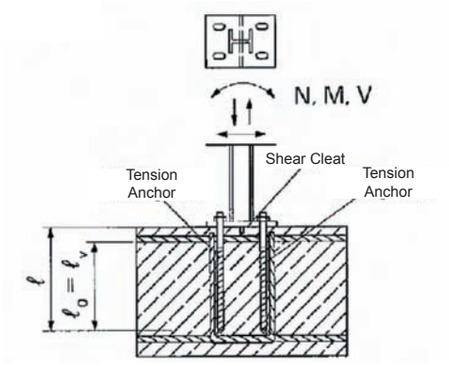


Figure 5: Anchoring of reinforcement to cover the line of acting tensile force.

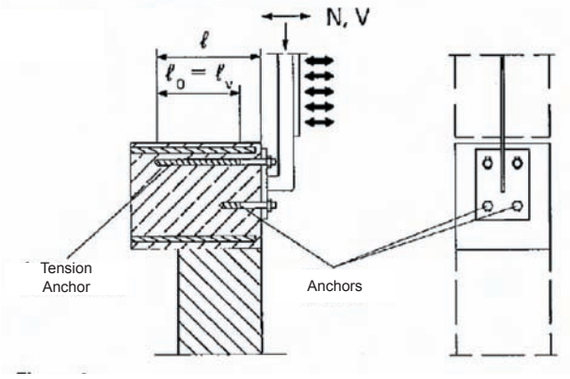


Note to figure 1 to 5 :
In the figures no transverse reinforcement is plotted, the transverse reinforcement as required by EC 2 shall be present.
The shear transfer between old and new concrete shall be designed according to EC2. Description of the bonded-in rebars and overlap joints see Annex 4 and 5.

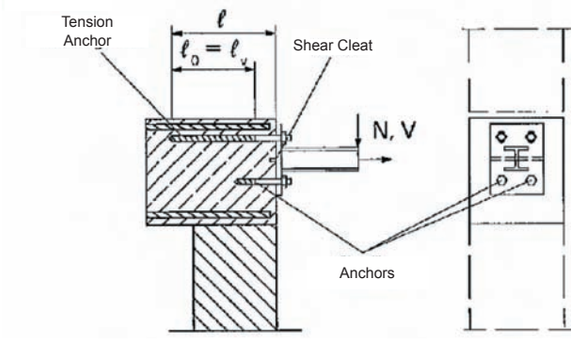
Stahlfix Injection System	**Annex 2**
Application examples of post-installed rebar * **Roughened joint**	



Overlap joint at the foundations of columns.



Overlap joint for anchoring guardrail posts.

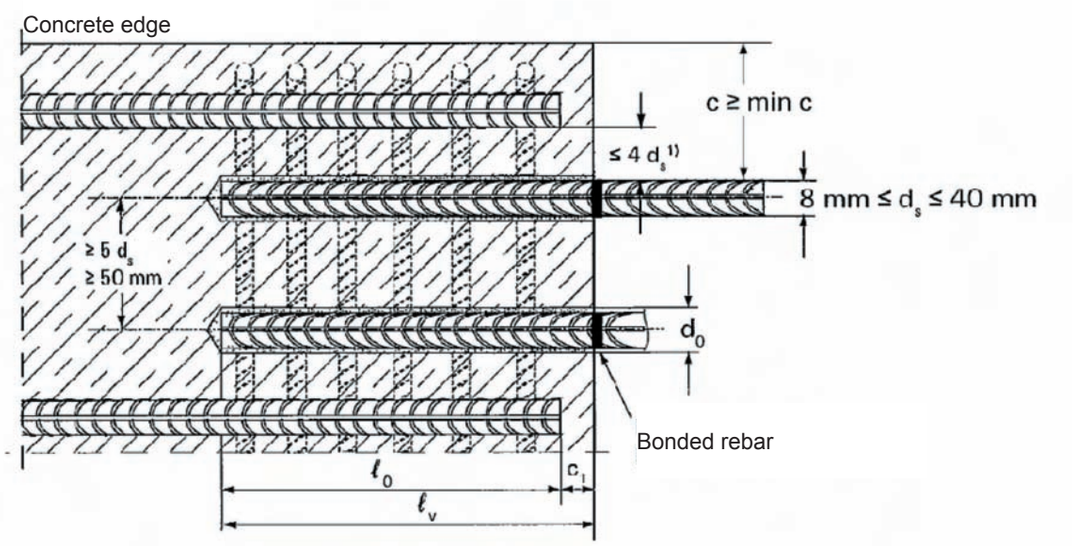


Overlap joint for anchoring Cantilevered beams

The Stahlfix Tension Anchor may transfer only forces in direction of the rebar axis.
The tensile force shall be transferred by an overlap joint into cast in place reinforcement of the member.
the transmission of shear forces shall be ensured by additional measures, e.g. shear cleats or anchors with a European technical approval (ETA). Holes in the anchor plate for the tension anchors should be designed as slotted holes in the direction of the shear force.

Stahlfix Injection System	Annex 3
Application examples Tension Anchor (overlap joint)	

Figure 7: General design rules of construction for bonded-in rebars



1) If the distance between lapped bars exceeds $4d_s$, then the lap length shall be increased by the difference between the clear bar distance and $4d_s$.

Notes on figure 7:

- ℓ_v or. ℓ_0 are in accordance with section B - 2 - 2
- The provision of sufficient transverse reinforcement according to B - 2 - 2 - 5

c	concrete cover post installed rebar
c_1	concrete cover at end-face of bond-in bar
min c	minimum concrete cover according to Annex 5
d_s	diameter bonded-in bar
ℓ_0	lap length
ℓ_v	effective embedment depth
d_0	normal drill bit diameter

Stahlfix Injection System for rebar connection	**Annex 4**
General design rules of construction for bended-in rebars (spacing and edge distance)	

Table 2: Minimum concrete cover min c of the bonded-in rebar or tension anchor depending on drilling method and drilling tolerance.

Drilling method	
Hammer drilling	30mm + 0,006 $\ell_v \geq 2d_s$
Compressed air drilling	50mm + 0,008 ℓ_v

ℓ_v = effective embedment depth

Table 3: Minimum anchorage length [1)] and lap splice length for C20/25 and maximum installation length l_{max} for good bond conditions.

Rebar		$l_{b,min}$ [mm]	$l_{o,min}$ [mm]	l_{max}[mm]
Ø d_s	$f_{y,k}$ [N/mm²]			
8 mm	500	170	300	400
10 mm	500	213	300	500
12 mm	500	255	300	600
14 mm	500	298	315	700
16 mm	500	340	360	800
20 mm	500	425	450	1000
25 mm	500	532	563	1000
28 mm	500	595	630	1000
32 mm	500	681	720	1000

1) According EN 1992-1-1 TR023: $l_{b,min}$ (8.6) and $l_{o,min}$ (8.11) with maximum yield stress for rebar BSt 500S, γ_M = 1,15 and α_6 = 1,0

Table 4: Design values of the ultimate bond resistance f_{bd} [1)] in N/mm² for all drilling methods and good conditions

<table>
<tr><th rowspan="2">Rebar Ø d_s</th><th colspan="9">Concrete Class</th></tr>
<tr><th>C12/15</th><th>C16/20</th><th>C20/25</th><th>C25/30</th><th>C30/37</th><th>C35/45</th><th>C40/50</th><th>C45/55</th><th>C50/60</th></tr>
<tr><td>8 to14 mm</td><td rowspan="4">1.6</td><td rowspan="4">2.0</td><td rowspan="4">2.3</td><td rowspan="4">2.7</td><td rowspan="3">3.0</td><td rowspan="3">3.4</td><td rowspan="2">3.7</td><td rowspan="2">4.0</td><td>4.3</td></tr>
<tr><td>16 mm</td><td>4.0</td></tr>
<tr><td>20 mm</td><td colspan="3">3.4</td></tr>
<tr><td>25 to32 mm</td><td colspan="5">2.7</td></tr>
</table>

1) Tabulated values for f_{bd} are valid for good bond conditions according to EN 1992-1-1. For all other bond conditions multiply the values for f_{bd} par 0.7.

Stahlfix Injection System for rebar connection

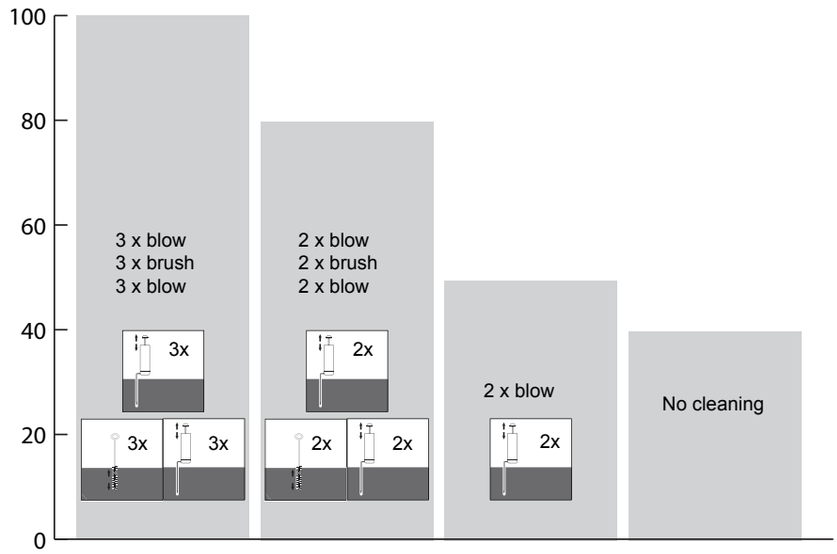
Annex 5

**Minimum concrete cover min c,
minimum anchorage and lap splice length
maximum installation length and design values of the ultimate bond resistance**

1) Cleaning holes

After drilling the hole shall be cleaned. Cleaning is always done by a combination of blowing using a pump or compressor without oil and brushing with a brush. If holes or exceed certain diameters or depths it is imperative to use compressed air from a compressor without oil. For injection systems reducing the load extreme, which is a function of the cleaning of the hole, varies according to the mortar used, tat is to say anchoring properties. The reduction in ultimate load to 60%.

The reduction in ultimate load (%) in relation to hole cleaning



2) Influence of temperature / Resistance to fire

2.1 General

- The strength of a chemical anchor can be influenced by temperature. The following information considers the effects of heat, fire and general climate in the fixing of chemical anchors.

- Cartridges should be stored and kept away from direct sunlight at a temperature of between 5°C and 25°C degrees for safe storage, ,for the life and quality of the product and to ensure an easy and correct extrusion of the resin.

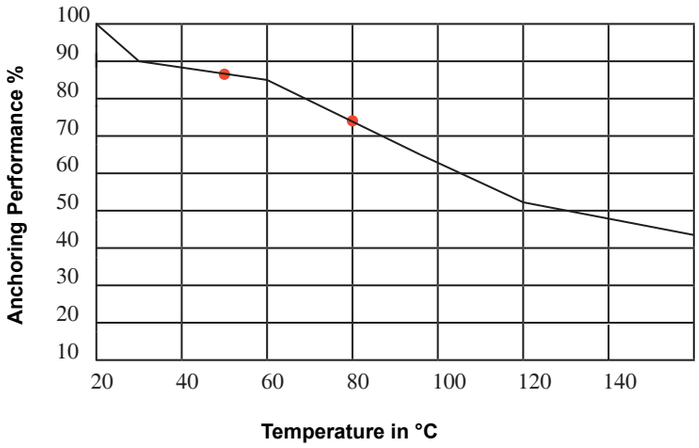
- The servicable temperature range for cured fixings extends from -40°C to 80°C (short term) or +50°C (long term).

2.2 Stahlfix VESF (Pure Vinylester Styrene Free)

- Stahlfix VESF is particularly resistant to temperature, it is one of the best resins manufactured for the world market in its class to resist temperature.

- Stahlfix VESF is resistant up to 80°C, which will provide up to 70% of its normal charactersitc load at 20°C, but if the temperature continues to increase this force will be reduced.

Anchoring performance to temperature



- Once the temperature exceeds 100°C, the tensile strength of concrete itself decreases which naturally results in a lowering of the ultimate strength of any fixings installed within.

- Insulation against the heat is an important factor as it increases the amount of time for the heat to transmit into the fixing. During fire tests on concrete it was shown that there is a large exponential drop in the temperature vs distance from the fixing face which was exposed to fire. After one hour of exposure the results measured were:

  500°C at 1.5 cm from the face
  350°C at 3.5 cm from the face
  80°C at 8 cm from the face

2.3 Temperature ranges

- Range I : - 40°C to 40°C (Short 40°C / Long 26°C)
- Range II : - 40°C to 80°C (Short 80°C / Long 50°C)

2.4 Design resistance

2.4.1 Rebar yield strength = 500 N/mm²

Product	**Stahlfix VESF (Pure Vinylester Styrene Free)**															
Ø rebar* (mm)	**8**		**10**		**12**		**14**		**16**		**20**		**25**		**32**	
Ø hole* (mm)	**12**		**14**		**16**		**18**		**22**		**28**		**32**		**40**	
Depth (mm)	**80**	**140**	**100**	**160**	**140**	**200**	**180**	**260**	**200**	**300**	**250**	**500**	**300**	**700**	**500**	**1300**
Design resistance (kN) Short 40˚C / Long 26˚C**	**14,2**	**21.9**	**21.5**	**34.1**	**34.7**	**49.2**	**49.6**	**66.9**	**55.2**	**87.4**	**73.5**	**136.6**	**82.8**	**213.4**	**138.2**	**349.5**
Design resistance (kN) Short 80˚C / Long 50˚C**	**10,5**	**16**	**16.1**	**25**	**26**	**37**	**37.2**	**50**	**41**	**65**	**55**	**102**	**62**	**160**	**103**	**245**

2.4.2 Threaded Rod : Steel grade 5.8

Product	Stahlfix VESF (Pure Vinylester Styrene Free)										
Ø threaded rod* (mm)	8	10	12	16		20		24		30	
Ø hole* (mm)	10	12	14	18		24		28		40	
Depth (mm)	80	100	120	120	190	170	300	200	450	280	1076
Design resistance** (kN) Short 50˚C / Long 26˚C	12.7	20.1	29.2	36	54.4	50	84.9	59.3	122.4	72.6	278.9
Design resistance** (kN) Short 80˚C / Long 50˚C	9	14	21	25	38	35	59	42	85	50	167

* Rebar = 500 N/mm² / threaded rod : 5.8 / concrete class C20/25

** Design resistance in uncracked concrete, dry or wet, without edge distance or spacing influence
Design resistance for other depths, concrete class, influence edge and spacing. Influence distances see pages 18 to 20 and 26 to 37 in this handbook.

3) Siesmic

3.1 - The following calculations should be used to determine the tension and shear strength of an anchor subjected to stresses as a result of siesmic activity.

- Tension : $N_{rd\ sis} = 0.7\ N_{rd}$

All depths according to data sheet (perfect anchor, steel failure) should increase by 50% in critical areas and 30% in non-critical areas.

- Shear : $V_{rd\ sis} = 0.4\ V_{rd}$

For other depths, concrete class and influence edge distance and spacing see pages 18 to 20 and 26 to 30 in this book.

3.2 The design procedure is fully detailed in EC2 / rebar consider the following rules of EN1998-1:2004 (eurocode 8)

- max f_{yk} = 500N/mm2
- resitricted concrete strengths range: C20/25 to C45/55
- only ductile reinforcement class (class C)
- no combination of post-installed and e.g. bent connection bars to ensure displacement compatilbility
- columns under tension in critical (dissipation) zonesL increase l_{bd} and l_o, respectively, by 50%
- specific bond strength $f_{bd,seism}$

WEB LINK

www.cstb.fr

www.eota.eu

www.cimsa.fr

What you should know - 4

4) Occupational health and safety

The components of Stahlfix cartridges are reactive chemicals. You should wear gloves and eye protection during use.

Each cartridge has the risk and safety codes printed on the labels.

Once cured the resin is non-toxic even in contact with water.

5) Recommendations

Before all installations you should check :

- The use by date of the cartridge
- The loads involved in the fixing
- Both components of the chemical are extruding properly
- The temperature of the fixture is within limits
- Hole cleaning is carried out
- Joint to be roughened (transfer shear forces R_t > 3mm)

During extrusion you should :

- Release about 10cm of the first extrusion to waste (2 trigger pulls) or until an even mixture of resin is achieved.
- Observe carefully the injection amount (always 2/3 effective embedment depth).
- Insert the fixture in a rotational action ensuring the full rod is coated without air holes. Avoid lateral movement.

After fixing you should :

- Respect the curing time before loading the fixture.

After fixing you should :

- Remember to allow enough time according to the ambeint temperature of the base susbstrate and ambient.

Installation tips :

- To ensure a good bond to the concrete it is vital to have a clean surface.
- Always drill without interfering with the concrete reinforcement
- If a drill hole is abandoned, refill with anchor mortar.
- Always check the product data sheet for gelling and curing times.
- Water-impermeable to the joint, i.e. no water can penetrate into the hole at the side of the adhesive compound.

6) Resistance to different chemcial agents

Resin specimens were immersed in Stahlfix different chemicals. Weight, elastic modulus, the visual appearance of the specimens were checked before and after immersion.

May be exposed to the various products listed below for the period indicated and this without any negative effects for the resin

	Pure Epoxy 1:1			Vinylester Styrene free			Epoxy Acrylate			Tropical Styrene free		
Chemical	A	B	C	A	B	C	A	B	C	A	B	C
Water	♦♦	♦♦	♦♦	♦♦	♦♦	♦♦	♦♦	♦♦	♦♦	♦♦	♦♦	♦♦
Salt Water	♦♦	♦♦	♦♦	♦♦	♦♦	♦♦	♦♦	♦♦	♦♦	♦♦	♦♦	♦♦
Hot Water < 80 °C	♦	♦♦	♦♦	♦	♦♦	♦♦	♦	♦♦	♦♦	♦	♦♦	♦♦
Gasoline	♦♦	♦♦	♦♦	♦♦	♦♦	♦♦	♦	♦♦	♦♦	♦	♦♦	♦♦
Kerosene	♦♦	♦♦	♦♦	♦♦	♦♦	♦♦	-	-	-	-	-	-
Oil	♦♦	♦♦	♦♦	♦♦	♦♦	♦♦	♦	♦♦	♦♦	♦	♦♦	♦♦
Methanol	♦	♦♦	♦♦	♦	♦♦	♦♦	♦	♦♦	♦♦	♦	♦♦	♦♦
Hydrochloric Acid 10%	♦♦	♦♦	♦	♦♦	♦♦	♦	♦	♦♦	♦	♦	♦♦	♦
Sulphuric Acid 10%	♦♦	♦♦	♦	♦♦	♦♦	♦	☒	♦♦	♦	☒	♦♦	♦
Phosphoric Acid 10%	♦	♦♦	♦♦	♦	♦♦	♦♦	☒	♦♦	♦♦	☒	♦♦	♦♦
Bleach 14%	♦♦	♦♦	♦♦	♦♦	♦♦	♦♦	♦♦	♦♦	♦♦	♦♦	♦♦	♦♦
White Spirit	♦♦	♦♦	♦♦	♦♦	♦♦	♦♦	♦♦	♦♦	♦♦	♦♦	♦♦	♦♦

A = Immersion / B = Splashing / C = Vapour / - = not applicable

♦♦= No attack after 6 months ♦= Blistered but not destroyed ☒= Destroyed or detached

7) Volatile Organic Compounds - Stahlfix

Product	% VOC	VOC g/L
Polyester	12.64	198.6
Epoxy acrylate	14.59	229.2
Polyester Styrene Free	13.91	211.6
Epoxy acrylate styrene free	13.73	210.2
Arctic Styrene Free	18.31	253.6
Tropical Styrene Free	13.55	206.1
Vinylester Styrene Free	2.10	31.99
Epoxy Pure 1:1	0.00	0.00
Epoxy Pure 3:1	0.00	0.00

Accessories - 1

Extrusion Tools

This tool is designed to simultaneously extrude both components of the chemical anchor cartridge and a pressure release trigger.

380ml

300ml

400ml (Pure Epoxy 1:1)

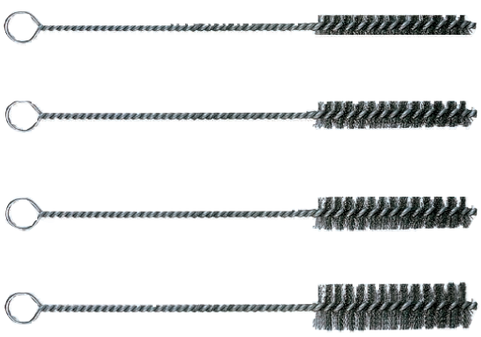
Steel Brushes

10mm

13mm

18mm

28mm



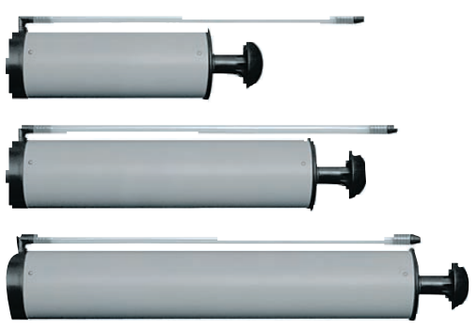
Steel brushing is used to release loose dirt and debris from the fixing holes and is always following by blowing air through the hole to remove the material.

Cleaning push pumps

190mm

280mm

400mm



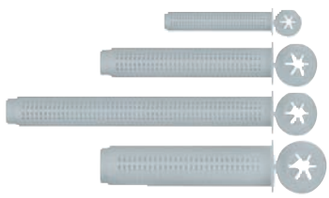
As per the previous statement, a push pump must be employed where no compressed air or vacuum is available to remove all loose dust and debris from the fixing hole.

Accessories - 2

Mixer Nozzles

a 74mm length mixer which contains 9 mixing elements (flights) and a screw thread for attachment to any chemical anchoring cartridge to adequately mix component A+B.

Nylon Perforated sleeves for hollow fixings



12/50

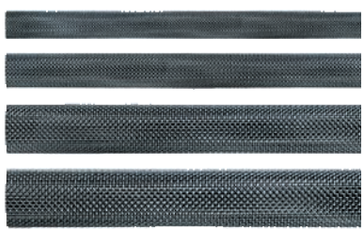
16/85

16/130

20/85

250mm Mixer extensions

Metal perforated sleeves



12mm Ø

16mm Ø

22mm Ø

26mm Ø

Test equipment

Heavy duty kit for ≤ 1-145kN

Medium duty kit for ≤ 1-25kN

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