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European Technical Assessment Body for construction products



European Technical Assessment

ETA-17/0650 of 26 April 2024

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the **European Technical Assessment:**

Trade name of the construction product

Product family to which the construction product belongs

Manufacturer

Manufacturing plant

This European Technical Assessment contains

This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of

This version replaces

Deutsches Institut für Bautechnik

Sympafix chemical anchor C200Plus-UltraBond for concrete

Bonded fasteners and bonded expansion fasteners for use in concrete

Sympafix B.V. Fluorietweg 25E 1812RR ALKMAAR **NIEDERLANDE**

Sympafix, Plant 2

43 pages including 3 annexes which form an integral part of this assessment

EAD 330499-02-0601, Edition 11/2023

ETA-17/0650 issued on 14 May 2019

Z48175.24

European Technical Assessment ETA-17/0650

English translation prepared by DIBt



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Specific Part

1 Technical description of the product

The "Sympafix chemical anchor C200Plus-UltraBond for concrete" is a bonded anchor consisting of a cartridge with injection mortar C200Plus-UltraBond and a steel element according to Annex A 3 and A 5.

The steel element is placed into a drilled hole filled with injection mortar and is anchored via the bond between metal part, injection mortar and concrete.

The product description is given in Annex A.

2 Specification of the intended use in accordance with the applicable European Assessment Document

The performances given in Section 3 are only valid if the anchor is used in compliance with the specifications and conditions given in Annex B.

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the anchor of at least 50 and/or 100 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

3 Performance of the product and references to the methods used for its assessment

3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic resistance to tension load (static and quasi-static loading)	See Annex C 1 to C 4, C 6 to C 7, C 9 to C 10, B 3
Characteristic resistance to shear load (static and quasi-static loading)	See Annex C 1, C 5, C 8, C 11
Displacements under short-term and long-term loading	See Annex C 12 to C 14
Characteristic resistance and displacements for seismic performance categories C1 and C2	See Annex C 15 to C 23

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire	See Annex C 24 to C 26

3.3 Hygiene, health and the environment (BWR 3)

Essential characteristic	Performance
Content, emission and/or release of dangerous substances	No performance assessed

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4 Assessment and verification of constancy of performance (AVCP) system applied, with reference to its legal base

In accordance with EAD 330499-02-0601 the applicable European legal act is: [96/582/EC]. The system to be applied is: 1

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable European Assessment Document

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at Deutsches Institut für Bautechnik.

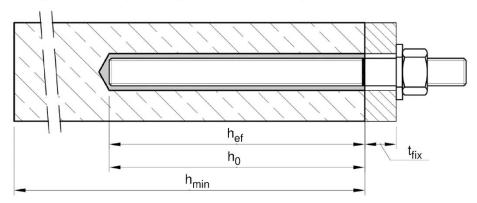
Issued in Berlin on 26 April 2024 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock Head of Section *beglaubigt:*Baderschneider

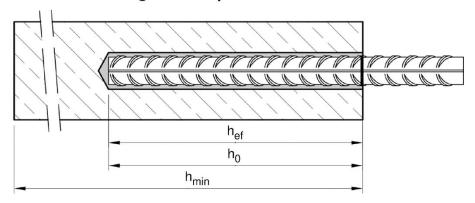


Installation threaded rod M8 up to M30

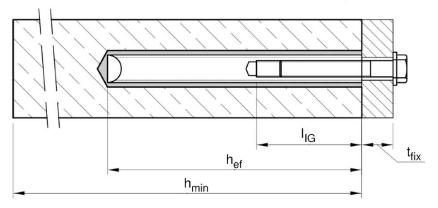
prepositioned installation or push through installation (annular gap filled with mortar)



Installation reinforcing bar Ø8 up to Ø32



Installation internal threaded anchor rod IG-M6 up to IG-M20



 t_{fix} = thickness of fixture h_0 = drill hole depth

 h_{ef} = effective embedment depth I_{IG} = thread engagement length

 h_{min} = minum thickness of member

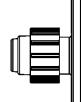
Sympafix chemical anchor C200Plus-UltraBond for concrete Product description Installed condition Annex A 1



Cartridge system

Coaxial Cartridge:

150 ml, 280 ml, 300 ml up to 333 ml and 380 ml up to 420 ml



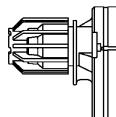
Imprint:

C200Plus-UltraBond

Processing and safety instructions, shelf life, charge number, manufacturer's information, quantity information

Side-by-Side Cartridge:

235 ml, 345 ml up to 360 ml and 825 ml

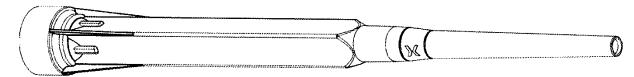


Imprint:

C200Plus-UltraBond

Processing and safety instructions, shelf life, charge number, manufacturer's information, quantity information

Static mixer PM-19E



Piston plug VS and mixer extension VL



Sympafix chemical anchor C200Plus-UltraBond for concrete

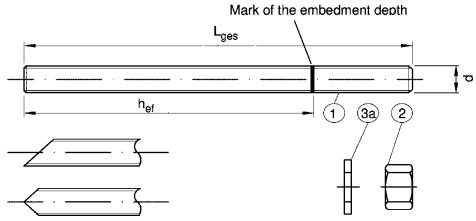
Product description

Injection system

Annex A 2



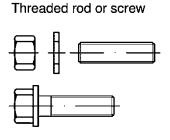
Threaded rod M8 up to M30 with washer and hexagon nut

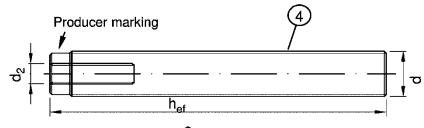


Commercial standard rod with:

- Materials, dimensions and mechanical properties acc. to Table A1
- Inspection certificate 3.1 acc. to EN 10204:2004. The document shall be stored.
- Marking of embedment depth

Internal threaded rod IG-M6 to IG-M20





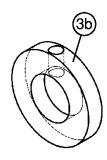
Marking Internal thread

Mark

M8 Thread size (Internal thread)
A4 additional mark for stainless steel

HCR additional mark for high-corrosion resistance steel

Filling washer VFS



Mixer reduction nozzle MR



Sympafix chemical anchor C200Plus-UltraBond for concrete

Product description

Threaded rod; Internal threaded rod Filling washer; Mixer reduction nozzle

Annex A 3



_	ible A1: Mate	erials				
Par	t Designation	Material				
- z - h	inc plated ≥ 5 ot-dip galvanised ≥ 4	acc. to EN ISO 683-4: 5 µm acc. to EN ISO 10 µm acc. to EN ISO 15 µm acc. to EN ISO	4042 146	2:2022 or 1:2022 and EN ISO 10684:	2004+AC:2009 or	
		Property class		Characteristic steel ultimate tensile strength	Characteristic steel yield strength	Elongation at fracture
			4.6	f _{uk} = 400 N/mm ²	f _{vk} = 240 N/mm ²	A ₅ > 8%
1	1 Threaded rod		4.8	f _{uk} = 400 N/mm ²	f _{yk} = 320 N/mm ²	A ₅ > 8%
Timeaueu rou	acc. to		f _{uk} = 500 N/mm²	f _{yk} = 300 N/mm ²	A ₅ > 8%	
	EN ISO 898-1:2013		f _{uk} = 500 N/mm²	f _{yk} = 400 N/mm ²	A ₅ > 8%	
				f _{uk} = 800 N/mm ²	f _{yk} = 640 N/mm ²	$A_5 \ge 12\%^{(3)}$
			4	for anchor rod class 4.6 o	r 4.8	
2	Hexagon nut	acc. to EN ISO 898-2:2022	5	for anchor rod class 5.6 o	r 5.8	
			8	for anchor rod class 8.8		
3a	Washer	(e.g.: EN ISO 887:20	06, E	galvanised or sherardized N ISO 7089:2000, EN ISC	7093:2000 or EN ISO 7	7094:2000)
3b	Filling washer	Steel, zinc plated, ho	t-dip	galvanised or sherardized	10	Te
	Internal threaded	Property class		Characteristic steel ultimate tensile strength	Characteristic steel yield strength	Elongation at fracture
4	anchor rod	acc. to	5.8	f _{uk} = 500 N/mm²	$f_{yk} = 400 \text{ N/mm}^2$	A ₅ > 8%
		EN ISO 898-1:2013	8.8	f _{uk} = 800 N/mm ²	f _{yk} = 640 N/mm ²	A ₅ > 8%
	inless steel A2 (Moto				=>+ + + + + + + + + + + + + + + + + + +	
	inless steel A4 (Mate	rial 1.4401 / 1.4404 / 1	.457	1 / 1.4567 or 1.4541, acc. t 1 / 1.4362 or 1.4578, acc. t · 1.4565, acc. to EN 10088	o EN 10088-1:2014)	
	inless steel A4 (Mate	rial 1.4401 / 1.4404 / 1	.457	1 / 1.4362 or 1.4578, acc. t	o EN 10088-1:2014)	Elongation at fracture
Hig	inless steel A4 (Mate h corrosion resistan	rial 1.4401 / 1.4404 / 1 ce steel (Material 1.45 I	.457 i29 oi	1 / 1.4362 or 1.4578, acc. t 1.4565, acc. to EN 10088 Characteristic steel	o EN 10088-1:2014) -1: 2014) Characteristic steel	
Hig	inless steel A4 (Mate	rial 1.4401 / 1.4404 / 1 ce steel (Material 1.45 Property class acc. to	.457 629 oi 50 70	1 / 1.4362 or 1.4578, acc. to 1.4565, acc. to EN 10088 Characteristic steel ultimate tensile strength $f_{uk} = 500 \text{ N/mm}^2$	o EN 10088-1:2014) -1: 2014) Characteristic steel yield strength	fracture
Hig	inless steel A4 (Mate h corrosion resistan	rial 1.4401 / 1.4404 / 1 ce steel (Material 1.45 Property class	.457 629 oi 50 70	1 / 1.4362 or 1.4578, acc. to 1.4565, acc. to EN 10088 Characteristic steel ultimate tensile strength	o EN 10088-1:2014) -1: 2014) Characteristic steel yield strength $f_{yk} = 210 \text{ N/mm}^2$	fracture A ₅ ≥ 8%
Hig	inless steel A4 (Mate h corrosion resistan	rial 1.4401 / 1.4404 / 1 ce steel (Material 1.45 Property class acc. to EN ISO 3506-1:2020	.457 i29 oi 50 70	1 / 1.4362 or 1.4578, acc. to EN 10088 Characteristic steel ultimate tensile strength $f_{uk} = 500 \text{ N/mm}^2$ $f_{uk} = 700 \text{ N/mm}^2$	o EN 10088-1:2014) -1: 2014) Characteristic steel yield strength $f_{yk} = 210 \text{ N/mm}^2$ $f_{yk} = 450 \text{ N/mm}^2$	fracture $A_5 \ge 8\%$ $A_5 \ge 12\%^{3}$
Hig 1	inless steel A4 (Mate h corrosion resistan	rial 1.4401 / 1.4404 / 1 ce steel (Material 1.45 Property class acc. to EN ISO 3506-1:2020 acc. to	.457 529 or 50 70 80 50 70	1 / 1.4362 or 1.4578, acc. to EN 10088 Characteristic steel ultimate tensile strength $f_{uk} = 500 \text{ N/mm}^2$ $f_{uk} = 700 \text{ N/mm}^2$ $f_{uk} = 800 \text{ N/mm}^2$ for anchor rod class 50 for anchor rod class 70	o EN 10088-1:2014) -1: 2014) Characteristic steel yield strength $f_{yk} = 210 \text{ N/mm}^2$ $f_{yk} = 450 \text{ N/mm}^2$	fracture $A_5 \ge 8\%$ $A_5 \ge 12\%^{3}$
Hig	Threaded rod 1)4)	rial 1.4401 / 1.4404 / 1 ce steel (Material 1.45 Property class acc. to EN ISO 3506-1:2020 acc. to EN ISO 3506-1:2020	.457 529 or 50 70 80 50 70 80	1 / 1.4362 or 1.4578, acc. to EN 10088 Characteristic steel ultimate tensile strength $f_{uk} = 500 \text{ N/mm}^2$ $f_{uk} = 700 \text{ N/mm}^2$ $f_{uk} = 800 \text{ N/mm}^2$ for anchor rod class 50 for anchor rod class 80	o EN 10088-1:2014) -1: 2014) Characteristic steel yield strength $f_{yk} = 210 \text{ N/mm}^2$ $f_{yk} = 450 \text{ N/mm}^2$ $f_{yk} = 600 \text{ N/mm}^2$	fracture $A_5 \ge 8\%$ $A_5 \ge 12\%^{(3)}$ $A_5 \ge 12\%^{(3)}$
Hig	Threaded rod 1)4)	rial 1.4401 / 1.4404 / 1 ce steel (Material 1.45 Property class acc. to EN ISO 3506-1:2020 A2: Material 1.4301 / A4: Material 1.4401 / HCR: Material 1.452	.457 .629 or	1 / 1.4362 or 1.4578, acc. to EN 10088 Characteristic steel ultimate tensile strength $f_{uk} = 500 \text{ N/mm}^2$ $f_{uk} = 700 \text{ N/mm}^2$ $f_{uk} = 800 \text{ N/mm}^2$ for anchor rod class 50 for anchor rod class 70	o EN 10088-1:2014) -1: 2014) Characteristic steel yield strength $f_{yk} = 210 \text{ N/mm}^2$ $f_{yk} = 450 \text{ N/mm}^2$ $f_{yk} = 600 \text{ N/mm}^2$ 541, acc. to EN 10088-1:2014	fracture $A_5 \ge 8\%$ $A_5 \ge 12\%^{3}$ $A_5 \ge 12\%^{3}$ $A_5 \ge 12\%^{3}$ $\therefore 2014$ $\therefore 2014$
	Threaded rod ¹⁾⁴⁾ Hexagon nut ¹⁾⁴⁾	rial 1.4401 / 1.4404 / 1 ce steel (Material 1.45 Property class acc. to EN ISO 3506-1:2020 A2: Material 1.4301 / A4: Material 1.4401 / HCR: Material 1.452 (e.g.: EN ISO 887:20	.457 .629 or	1 / 1.4362 or 1.4578, acc. to 1.4565, acc. to EN 10088 Characteristic steel ultimate tensile strength $f_{uk} = 500 \text{ N/mm}^2$ $f_{uk} = 700 \text{ N/mm}^2$ $f_{uk} = 800 \text{ N/mm}^2$ for anchor rod class 50 for anchor rod class 70 for anchor rod class 80 07 / 1.4311 / 1.4567 or 1.4 04 / 1.4571 / 1.4362 or 1.4 .4565, acc. to EN 10088-1	o EN 10088-1:2014) -1: 2014) Characteristic steel yield strength $f_{yk} = 210 \text{ N/mm}^2$ $f_{yk} = 450 \text{ N/mm}^2$ $f_{yk} = 600 \text{ N/mm}^2$ 541, acc. to EN 10088-1:2014	fracture $A_5 \ge 8\%$ $A_5 \ge 12\%^{(3)}$ $A_5 \ge 12\%^{(3)}$ \vdots
11 2 3a	Threaded rod 1)4) Hexagon nut 1)4) Washer Filling washer	rial 1.4401 / 1.4404 / 1 ce steel (Material 1.45 Property class acc. to EN ISO 3506-1:2020 A2: Material 1.4301 / A4: Material 1.4401 / HCR: Material 1.452 (e.g.: EN ISO 887:20	.457 .629 or	1 / 1.4362 or 1.4578, acc. to 1.4565, acc. to EN 10088 Characteristic steel ultimate tensile strength $f_{uk} = 500 \text{ N/mm}^2$ $f_{uk} = 700 \text{ N/mm}^2$ $f_{uk} = 800 \text{ N/mm}^2$ for anchor rod class 50 for anchor rod class 70 for anchor rod class 80 07 / 1.4311 / 1.4567 or 1.4 04 / 1.4571 / 1.4362 or 1.4 .4565, acc. to EN 10088-1 in ISO 7089:2000, EN ISO orrosion resistance steel Characteristic steel	o EN 10088-1:2014) -1: 2014) Characteristic steel yield strength $f_{yk} = 210 \text{ N/mm}^2$ $f_{yk} = 450 \text{ N/mm}^2$ $f_{yk} = 600 \text{ N/mm}^2$ 541, acc. to EN 10088-1:2014 7093:2000 or EN ISO 7	fracture $A_{5} \ge 8\%$ $A_{5} \ge 12\%^{3}$ $A_{5} \ge 12\%^{3}$ $A_{5} \ge 12\%^{3}$ $\therefore 2014$ $:= 2014$
1 1 2 3a	Threaded rod 1)4) Hexagon nut 1)4) Washer	rial 1.4401 / 1.4404 / 1 ce steel (Material 1.45 Property class acc. to EN ISO 3506-1:2020 A2: Material 1.4301 / A4: Material 1.4401 / HCR: Material 1.452 (e.g.: EN ISO 887:20 Stainless steel A4, H	50 70 80 70 80 71.44 9 or 1 106, E ligh c	1 / 1.4362 or 1.4578, acc. to 1.4565, acc. to EN 10088 Characteristic steel ultimate tensile strength $f_{uk} = 500 \text{ N/mm}^2$ $f_{uk} = 700 \text{ N/mm}^2$ $f_{uk} = 800 \text{ N/mm}^2$ for anchor rod class 50 for anchor rod class 70 for anchor rod class 80 07 / 1.4311 / 1.4567 or 1.4 04 / 1.4571 / 1.4362 or 1.4 .4565, acc. to EN 10088-1 EN ISO 7089:2000, EN ISO orrosion resistance steel	o EN 10088-1:2014) -1: 2014) Characteristic steel yield strength $f_{yk} = 210 \text{ N/mm}^2$ $f_{yk} = 450 \text{ N/mm}^2$ $f_{yk} = 600 \text{ N/mm}^2$ 541, acc. to EN 10088-1578, acc. to EN 10088-12014 7093:2000 or EN ISO 7	fracture $A_5 \ge 8\%$ $A_5 \ge 12\%^{3}$ $A_5 \ge 12\%^{3}$ $A_5 \ge 12\%^{3}$ \vdots

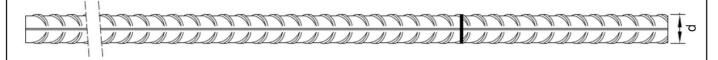
Property class 70 or 80 for anchor rods and hexagon nuts up to M24 and Int
 for IG-M20 only property class 50
 A₅ > 8% fracture elongation if no use for seismic performance category C2 ds and hexagon nuts up to M24 and Internal threaded anchor rods up to IG-M16

⁴⁾ Property class 80 only for stainless steel A4 and HCR

Sympafix chemical anchor C200Plus-UltraBond for concrete	
Product description Materials threaded rod and internal threaded rod	Annex A 4







Minimum value of related rip area $f_{R,min}$ according to EN 1992-1-1:2004+AC:2010 Rib height of the bar shall be in the range $0.05d \le h_{rib} \le 0.07d$ (d: Nominal diameter of the bar; h_{rib} : Rib height of the bar)

Table A2: Materials Reinforcing bar

Part	Designation	Material
Reba	ar	
1	Reinforcing steel according to EN 1992 1 1:2004+AC:2010, Annex C	Bars and rebars from ring class B or C f_{yk} and k according to NDP or NCI according to EN 1992-1-1/NA $f_{uk} = f_{tk} = k \cdot f_{yk}$

Sympafix chemical anchor C200Plus-UltraBond for concrete	
Product description Materials reinforcing bar	Annex A 5



Specification of the intendent Fasteners subject to (Static and		•				
- actionore capped to (Grane and	Working lif	Worki	ng life 100 years			
Base material	uncracked concrete	cracked concrete	uncracked concrete	cracked concrete		
HD: Hammer drilling HDB: Hammer drilling with hollow drill bit CD: Compressed air drilling	M8 to Ø8 to IG-M6 to	M8 to M30, Ø8 to Ø32, -M6 to IG-M20				
Temperature Range:	I: - 40 °C II: - 40 °C III: - 40 °C IV: - 40 °C	0 °C to +40 °C¹) 0 °C to +80 °C²)				
Fasteners subject to (seismic ac	tion):					
	Performance	Category C1	Perform	ance Category C2		
Base material		Cracked and und	cracked concret	e		
HD: Hammer drilling HDB: Hammer drilling with hollow drill bit CD: Compressed air drilling	M8 to Ø8 to		M12 to M24			
Temperature Range:	II: - 40 °C III: - 40 °C	to +40 °C¹) to +80 °C²) to +120 °C³) 5) to +160 °C⁴) 5)	II: - 4 III: - 4	0 °C to +40 °C ¹⁾ 0 °C to +80 °C ²⁾ 0 °C to +120 °C ^{3) 5)} 0 °C to +160 °C ^{4) 5)}		
Fasteners subject to (Fire expos	ure):					
Base material		uncracked and o	cracked concrete	е		
HD: Hammer drilling HDB: Hammer drilling with hollow drill bit CD: Compressed air drilling		Ø 8 to	M30, Ø32, IG-M20			
Temperature Range:		III: - 40 °C	to +40 °C¹) to +80 °C²) to +120 °C³) to +160 °C⁴)			
1) (max. long-term temperature +24°C 2) (max. long-term temperature +50°C 3) (max. long-term temperature +72°C 4) (max. long-term temperature +100°C 5) Only for working life of 50 years	and max. short-term te and max. short-term te	mperature +80°C) mperature +120°C)				
Sympafix chemical anchor C20	0Plus-UltraBond f	or concrete				
Intended use Specifications				Annex B 1		



Base materials:

- Compacted, reinforced or unreinforced normal weight concrete without fibres according to EN 206:2013 + A2:2021.
- Strength classes C20/25 to C50/60 according to EN 206:2013 + A2:2021.

Use conditions (Environmental conditions):

- Structures subject to dry internal conditions (all materials).
- For all other conditions according to EN 1993-1-4:2006+ A2:2020 corresponding to corrosion resistance class:
 - Stainless steel Stahl A2 according to Annex A 4, Table A1: CRC II
 - Stainless steel Stahl A4 according to Annex A 4, Table A1: CRC III
 - High corrosion resistance steel HCR according to Annex A 4, Table A1: CRC V

Design:

- Verifiable calculation notes and drawings are prepared taking account of the loads to be anchored.
 The position of the fastener is indicated on the design drawings (e. g. position of the fastener relative to reinforcement or to supports, etc.).
- Fasteners are designed under the responsibility of an engineer experienced in fasteners and concrete work.
- The fasteners are designed in accordance to EN 1992-4:2018 and Technical Report TR 055, Edition February 2018
- The fasteners under fire exposure are designed in accordance to Technical Report TR 082, Edition June 2023.

Installation:

- Dry, wet concrete or flooded bore holes (not sea-water).
- Hole drilling by hammer (HD), hollow (HDB) or compressed air (CD).
- Overhead installation allowed.
- Fastener installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.
- Installationtemperature in concrete:
 - -5°C up to +40°C for the standard variation of temperature after installation.

Sympafix chemical anchor C200Plus-UltraBond for concrete	
Intended use Specifications (Continued)	Annex B 2



Table B1: Installation parameters for threaded rod												
Threaded rod		M8	M10	M12	M16	M20	M24	M27	M30			
Diameter of elemen	t	$d = d_{nom}$	[mm]	8	10	12	16	20	24	27	30	
Nominal drill hole di	ameter	d_0	[mm]	10	12	14	18	22	28	30	35	
Effective embedme	at donth	h _{ef,min}	[mm]	60	60	70	80	90	96	108	120	
Effective embedmer	п аерит	h _{ef,max}	[mm]	160	200	240	320	400	480	540	600	
Diameter of	Prepositioned ins	tallation d _f ≤	[mm]	9	12	14	18	22	26	30	33	
clearance hole in the fixture ¹⁾	Push through installation df		[mm]	12	14	16	20	24	30	33	40	
Maximum installatio	n torque	max T _{inst}	[Nm]	10	20	40 ²⁾	60	100	170	250	300	
Minimum thickness of member		h _{min}	[mm]	_	h _{ef} + 30 mm ≥ 100 mm			h _{ef} + 2d₀				
Minimum spacing		S _{min}	[mm]	40	50	60	75	95	115	125	140	
Minimum edge dista	ince	c _{min}	[mm]	35	40	45	50	60	65	75	80	

¹⁾ For application under seismic loading the diameter of clearance hole in the fixture shall be at maximum d₁ + 1mm or alternatively the annular gap between fixture and threaded rod shall be filled force-fit with mortar.

Table B2: Installation parameters for reinforcing bar

Reinforcing bar	_				Ø 12 ¹⁾	Ø 14	Ø 16	Ø 20	Ø 24 ¹⁾	Ø 25 ¹⁾	Ø 28	Ø 32
Diameter of element	$d = d_{nom}$	[mm]	8	10	12	14	16	20	24	25	28	32
Nominal drill hole diameter	d ₀	[mm]	10 12	12 14	14 16	18	20	25	30 32	30 32	35	40
Effective embedment denth	h _{ef,min}	[mm]	60	60	70	75	80	90	96	100	112	128
Effective embedment depth	h _{ef,max}	[mm]	160	200	240	280	320	400	480	500	560	640
Minimum thickness of member	h _{min}	[mm]		30 mm)0 mm	2			h _e	_f + 2d ₀			
Minimum spacing	s _{min}	[mm]	40	50	60	70	75	95	120	120	130	150
Minimum edge distance	c _{min}	[mm]	35	40	45	50	50	60	70	70	75	85

¹⁾ both nominal drill hole diameter can be used

Table B3: Installation parameters for Internal threaded anchor rod

Internal threaded anchor rod		IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20		
Internal diameter of anchor rod	d ₂		6	8	10	12	16	20	
Outer diameter of anchor rod1)	$d = d_{nom}$	[mm]	10	12	16	20	24	30	
Nominal drill hole diameter	d ₀		12	14	18	22	28	35	
Effective and color and dente	h _{ef,min}	[mm]	60	70	80	90	96	120	
Effective embedment depth	h _{ef,max}	[mm]	200	240	320	400	480	600	
Diameter of clearance hole in the fixture	d _f ≤	[mm]	7	9	12	14	18	22	
Maximum installation torque	max T _{inst}	[Nm]	10	10	20	40	60	100	
Thread engagement length min/max	l _{IG}	[mm]	8/20	8/20	10/25	12/30	16/32	20/40	
Minimum thickness of member	h _{min}	[mm]		30 mm 0 mm	h _{ef} + 2d ₀				
Minimum spacing	s _{min}	[mm]	50	60	75	95	115	140	
Minimum edge distance	c _{min}	[mm]	40	45	50	60	65	80	
1) vacue se estate de conseile	•	•		•	•	•	•	•	

¹⁾ With metric threads

Sympafix chemical anchor C200Plus-UltraBond for concrete

Intended use

Installation parameters

Annex B 3

²⁾ Maximum installation torque for M12 with steel Grade 4.6 is 35 Nm



					manul	ALER ROLL						
Threaded Rod	Re- inforcing bar	Internal threaded anchor rod	d ₀ Drill bit - Ø HD, HDB, CD	d _t Brush		d _{b,min} min. Brush - Ø	Piston plug	1	on direction piston plu			
[mm]	[mm]	[mm]	[mm]		[mm]	[mm]		↓	\Rightarrow	1		
M8	8		10	RB10	11,5	10,5						
M10	8 / 10	IG-M6	12	RB12	13,5	12,5		NI				
M12	10 / 12	IG-M8	14	RB14	15,5	14,5		No plug	required			
	12		16	RB16	17,5	16,5						
M16	14	IG-M10	18	RB18	20,0	18,5	VS18					
	16		20	RB20	22,0	20,5	VS20					
M20		IG-M12	22	RB22	24,0	22,5	VS22					
	20		25	RB25	27,0	25,5	VS25					
M24		IG-M16	28	RB28	30,0	28,5	VS28	h _{ef} >	h _{ef} >	all		
M27	24 / 25		30	RB30	31,8	30,5	VS30	250 mm	250 mm			
	24 / 25		32	RB32	34,0	32,5	VS32					
M30	28	IG-M20	35	RB35	37,0	35,5	VS35					
	32		40	RB40	43,5	40,5	VS40					

Hand pump (Volume 750 ml, $h_0 \le 10 d_s$, $d_0 \le 20$ mm)



Brush RB



Compressed air tool

(min 6 bar)



Piston Plug VS



Brush extension RBL



Sympafix chemical anchor C200Plus-UltraBond for concrete	
Intended use Cleaning and setting tools	Annex B 4



Table B5:	Workin	g time and cu	ring time	
Tempera	ature in bas	se material	Minimum curing time 1)	
	Т		t _{work}	t _{cure}
- 5°C	to	- 1 °C	50 min	5 h
0°C	to	+ 4°C	25 min	3,5 h
+ 5°C	to	+ 9°C	15 min	2 h
+ 10°C	to	+ 14 °C	10 min	1 h
+ 15°C	to	+ 19°C	6 min	40 min
+ 20 °C	to	+ 29 °C	3 min	30 min
+ 30 °C	to	+ 40 °C	2 min	30 min
Cart	ridge tempe	erature	+5°C to	+40°C

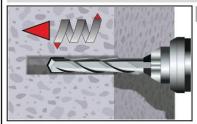
The minimum curing time is only valid for dry base material. In wet base material the curing time must be doubled.

Sympafix chemical anchor C200Plus-UltraBond for concrete	
Intended use Working time and curing time	Annex B 5



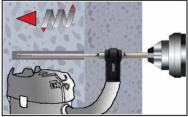
Installation instructions

Drilling of the bore hole



Hammer drilling (HD) / Compressed air drilling (CD)

Drill a hole to the required embedment depth.
Drill bit diameter according to Table B1, B2 or B3.
Aborted drill holes shall be filled with mortar.
Proceed with Step 2 (MAC or CAC).



1b. Hollow drill bit system (HDB) (see Annex B 4)

Drill a hole to the required embedment depth.

Drill bit diameter according to Table B1, B2 or B3.

The hollow drilling system removes the dust and cleans the bore hole.

Proceed with Step 3.

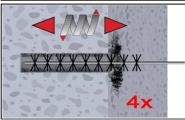
Attention! Standing water in the bore hole must be removed before cleaning.

Manual Air Cleaning (MAC)

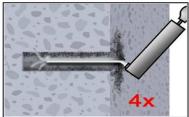
for bore hole diameter $d_0 \le 20$ mm and bore hole depth $h_0 \le 10d_{nom}$ (uncracked concrete only)



Blow the bore hole clean minimum 4x from the bottom or back by hand pump (Annex B 4).



Brush the bore hole minimum 4x with brush RB according to Table B4 over the entire embedment depth in a twisting motion (if necessary, use a brush extension RBL).

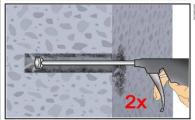


Finally blow the bore hole clean minimum 4x from the bottom or back by hand pump (Annex B 4).

Compressed Air Cleaning (CAC):

All diameter in cracked and uncracked concrete, all drilling methods

2c.



2a. Blow the bore hole clean minimum 2x with compressed air (min. 6 bar) (Annex B 4) over the entire embedment depth until return air stream is free of noticeable dust. (If necessary, an extension shall be used.)

Sympafix chemical anchor C200Plus-UltraBond for concrete

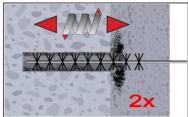
Intended use

Installation instructions

Annex B 6



Installation instructions (continuation)

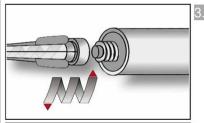


Brush the bore hole minimum 2x with brush RB according to Table B4 over the entire embedment depth in a twisting motion. (If necessary, a brush extension shall be used .RBL)



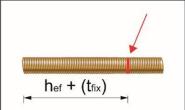
Finally blow the bore hole clean minimum 2x with compressed air (min. 6 bar) (Annex B 4) over the entire embedment depth until return air stream is free of noticeable dust. (If necessary, an extension shall be used.)

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



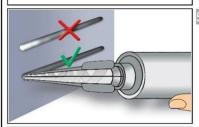
Screw on static-mixing nozzle PM-19E and load the cartridge into an appropriate dispensing tool.

For every working interruption longer than the maximum working time t_{work} (Annex B 5) as well as for new cartridges, a new static-mixer shall be used.

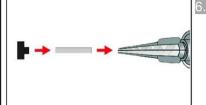


Mark embedment depth on the anchor rod. Consider t_{fix} in case of push through installations.

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



Not proper mixed mortar is not sufficient for fastening. Dispense and discard mortar until an uniform grey colour is shown (at least 3 full strokes).



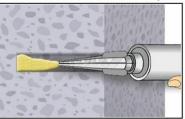
Piston plugs VS and mixer nozzle extensions VL shall be used according to Table B4 for the following applications:

- Horizontal and vertical downwards direction: Drill bit-Ø d₀ ≥ 18 mm and embedment depth h_{ef} > 250mm
- Vertical upwards direction: Drill bit-Ø d₀ ≥ 18 mm
 Assemble mixing nozzle, mixer extension and piston plug before injecting mortar.

Sympafix chemical anchor C200Plus-UltraBond for concrete Intended use Installation instructions (continuation) Annex B 7

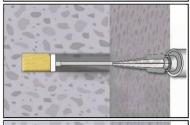


Installation instructions (continuation)



7a. Injecting mortar without piston plug VS

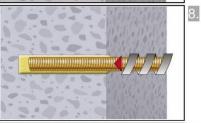
Starting at bottom of the hole and fill the hole up to approximately two-thirds with mortar. (If necessary, a mixer nozzle extension shall be used.) Slowly withdraw of the static mixing nozzle avoid creating air pockets Observe the temperature related working time t_{work} (Annex B 5).



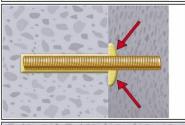
Injecting mortar with piston plug VS

Starting at bottom of the hole and fill the hole up to approximately two-thirds with mortar. (If necessary, a mixer nozzle extension shall be used.) During injection the piston plug is pushed out of the bore hole by the back pressure of the mortar.

Observe the temperature related working time twork (Annex B 5).

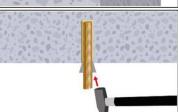


Insert the anchor rod while turning slightly up to the embedment mark.



Annular gap between anchor rod and base material must be completely filled with mortar. In case of push through installation the annular gap in the fixture must be filled with mortar also.

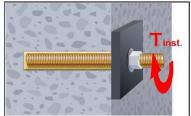
Otherwise, the installation must be repeated starting from step 7 before the maximum working time t_{work} has expired.



For application in vertical upwards direction the anchor rod shall be fixed (e.g. wedges).



Temperature related curing time t_{cure} (Annex B 5) must be observed. Do not move or load the fastener during curing time.



Install the fixture by using a calibrated torque wrench. Observe maximum installation torque (Table B1 or B3).

In case of static requirements (e.g. seismic), fill the annular gab in the fixture with mortar (Annex 2). Therefore replace the washer by the filling washer VFS and use the mixer reduction nozzle MR.

Sympafix chemical anchor C200Plus-UltraBond for concrete

Intended use

Installation instructions (continuation)

Annex B 8



T	able C1: Characteristic values resistance of threade			ension	resist	ance	and s	teel s	hear			
Th	readed rod			M8	M10	M12	M16	M20	M24	M27	M30	
Cro	oss section area	A _s	[mm²]	36,6	58	84,3	157	245	353	459	561	
Ch	aracteristic tension resistance, Steel failu	re ¹⁾		•								
Ste	el, Property class 4.6 and 4.8	N _{Rk,s}	[kN]	15 (13)	23 (21)	34	63	98	141	184	224	
Ste	el, Property class 5.6 and 5.8	N _{Rk,s}	[kN]	18 (17)	29 (27)	42	78	122	176	230	280	
Ste	el, Property class 8.8	N _{Rk,s}	[kN]	29 (27)	46 (43)	67	125	196	282	368	449	
Sta	tinless steel A2, A4 and HCR, class 50	N _{Rk,s}	[kN]	18	29	42	79	123	177	230	281	
Sta	inless steel A2, A4 and HCR, class 70	N _{Rk,s}	[kN]	26	41	59	110	171	247	_3)	_3)	
Sta	inless steel A4 and HCR, class 80	N _{Rk,s}	[kN]	29	46	67	126	196	282	_3)	_3)	
Ch	aracteristic tension resistance, Partial fac	tor ²⁾										
Ste	el, Property class 4.6 and 5.6	γ _{Ms,N}	[-]				2,0	כ				
Ste	eel, Property class 4.8, 5.8 and 8.8	γ _{Ms,N}	[-]				1,	5				
Sta	inless steel A2, A4 and HCR, class 50	γ _{Ms,N}	[-]				2,8	6				
Sta	inless steel A2, A4 and HCR, class 70	γ _{Ms,N}	[-]	1,87								
Sta	inless steel A4 and HCR, class 80	γ _{Ms,N}	[-]	1,6								
Ch	aracteristic shear resistance, Steel failure	1)		ı	1							
اء ا	Steel, Property class 4.6 and 4.8	V ⁰ _{Rk,s}	[kN]	9 (8)	14 (13)	20	38	59	85	110	135	
	Steel, Property class 5.6 and 5.8	$V^0_{Rk,s}$	[kN]	11 (10)	17 (16)	25	47	74	106	138	168	
evel	Steel, Property class 8.8	V [∪] Rk,s	[kN]	15 (13)	23 (21)	34	63	98	141	184	224	
<u> </u>	Stainless steel A2, A4 and HCR, class 50	$V^0_{Rk,s}$	[kN]	9	15	21	39	61	88	115	140	
Without lever	Stainless steel A2, A4 and HCR, class 70	$V^{0}_{Rk.s}$	[kN]	13	20	30	55	86	124	_3)	_3)	
>	Stainless steel A4 and HCR, class 80	$V^0_{Rk,s}$	[kN]	15	23	34	63	98	141	_3)	_3)	
	Steel, Property class 4.6 and 4.8	M [∪] Rk,s	[Nm]	15 (13)	30 (27)	52	133	260	449	666	900	
arm	Steel, Property class 5.6 and 5.8	M ⁰ Rk,s	[Nm]	19 (16)	37 (33)	65	166	324	560	833	1123	
	Steel, Property class 8.8	M ⁰ Rk,s	[Nm]	30 (26)	60 (53)	105	266	519	896	1333	1797	
h F	Stainless steel A2, A4 and HCR, class 50	M ⁰ Rk,s	[Nm]	19	37	66	167	325	561	832	1125	
	Stainless steel A2, A4 and HCR, class 70	M ⁰ Rk,s	[Nm]	26	52	92	232	454	784	_3)	_3)	
	Stainless steel A4 and HCR, class 80	M ⁰ Rk,s	[Nm]	30	59	105	266	519	896	_3)	_3)	
Ch	aracteristic shear resistance, Partial facto											
Ste	el, Property class 4.6 and 5.6	γ _{Ms,V}	[-]				1,6	7				
Ste	el, Property class 4.8, 5.8 and 8.8	γ _{Ms,V}	[-]				1,2	:5				
Sta	uinless steel A2, A4 and HCR, class 50	γ _{Ms,V}	[-]				2,3	8				
Sta	tinless steel A2, A4 and HCR, class 70	γ _{Ms,V}	[-]				1,5	6				
Sta	inless steel A4 and HCR, class 80	γ _{Ms,V}	[-]				1,3	3				

 $^{^{1)}}$ Values are only valid for the given stress area A_s . Values in brackets are valid for undersized threaded rods with smaller stress area A_s for hot-dip galvanised threaded rods according to EN ISO 10684:2004+AC:2009.

³⁾ Fastener type not part of the ETA

Sympafix chemical anchor C200Plus-UltraBond for concrete	
Performances Characteristic values for steel tension resistance and steel shear resistance of threaded rods	Annex C 1

²⁾ in absence of national regulation



Table C2: Characteristic values of tension loads under static and quasi-static action for a working life of 50 and 100 years									
Fastener				All Anchor types and sizes					
Concrete cone fa	ailure		•						
Uncracked concre	ete	k _{ucr,N}	[-]	11,0					
Cracked concrete		k _{cr,N}	[-]	7,7					
Edge distance		c _{cr,N}	[mm]	1,5 h _{ef}					
Axial distance		s _{cr,N}	[mm]	2 c _{cr,N}					
Splitting		· ·	•	·					
	h/h _{ef} ≥ 2,0			1,0 h _{ef}					
Edge distance	$2.0 > h/h_{ef} > 1.3$	c _{cr,sp}	[mm]	$2 \cdot h_{ef} \left(2,5 - \frac{h}{h_{ef}} \right)$					
	h/h _{ef} ≤ 1,3			2,4 h _{ef}					
Axial distance		s _{cr.sp}	[mm]	2 c _{cr.sp}					

Sympafix chemical anchor C200Plus-UltraBond for concrete	
Performances Characteristic values of tension loads under static and quasi-static action for a working life of 50 and 100 years	Annex C 2



Thread	led rod				М8	M10	M12	M16	M20	M24	M27	M30
Steel fa			1							,		
	teristic tension resi	stance	N _{Rk,s}	[kN]	A _s ⋅ f _{uk} (or see Table C1)							
Partial 1		amayata fallum	γ _{Ms,N}	[-]				see Ta	ble C1			
	ned pull-out and one teristic bond resistation		d concrete C	20/25								
	I: 24°C/40°C	and m undragne	τ _{Rk,ucr}	[N/mm²]	17	17	16	15	14	13	13	13
ure ra	II: 50°C/80°C	Dry, wet concrete and	τ _{Rk,ucr}	[N/mm²]	17	17	16	15	14	13	13	13
Temperature range	III: 72°C/120°C	flooded bore hole	τ _{Rk,ucr}	[N/mm²]	15	14	14	13	12	12	11	11
Tem	IV: 100°C/160°C		τ _{Rk,ucr}	[N/mm²]	12	11	11	10	9,5	9,0	9,0	9,0
	teristic bond resist	ance in cracked o	oncrete C20/	/25								
Femperature range	I: 24°C/40°C	D	^τ Rk,cr	[N/mm²]	7,0	7,5	8,0	9,0	8,5	7,0	7,0	7,0
ture	II: 50°C/80°C	Dry, wet concrete and	^τ Rk,cr	[N/mm²]	7,0	7,5	8,0	9,0	8,5	7,0	7,0	7,0
прега	III: 72°C/120°C	flooded bore hole	^τ Rk,cr	[N/mm²]	6,0	6,5	7,0	7,5	7,0	6,0	6,0	6,0
	IV: 100°C/160°C		^τ Rk,cr	[N/mm²]	5,5	5,5	6,0	6,5	6,0	5,5	5,5	5,5
	ion factor ψ ⁰ sus in α	cracked and uncr	acked concre	ete C20/25								
I: 24°C/40°C				0,90								
ture		concrete and	Ψ^0 sus	0 sus [-] -	0,87							
прега	III: 72°C/120°C	flooded bore hole	. 303					0,7	75			
Ten	IV: 100°C/160°C			0,66								
Increas	ing factors for cond	crete	Ψ _C	[-]	(f _{ck} / 20) ^{0,1}							
	teristic bond resista concrete strength o	, ,		τ _{Rk,ucr} =	Ψ _C * ^τ Rk,ucr,(C20/25) Ψ _C * ^τ Rk,cr,(C20/25)							
	ete cone failure			τ _{Rk,cr} =			Ψ(; *HK,C	r,(C20/	25)		
	nt parameter							see Ta	ble C2			
Splittin												
	nt parameter							see Ta	ble C2			
ınstalla	ation factor	<u> </u>								No Per	former	nce
for day	and wat somerate	MAC					1,2				essed	
ioi ary i	and wet concrete	CAC	γ _{inst}	[-]				1,				
for flar	dod boro bole	 	-									
for flood	ded bore hole	HDB CAC			ete			1, 1, 1,	2			



	racteristic va working life			ls un	der st	tatic	and q	uasi-	statio	actio	on
Threaded rod				M8	M10	M12	M16	M20	M24	M27	M30
Steel failure										I	
Characteristic tension res	istance	N _{Rk,s}	[kN]	A _s ⋅ f _{uk} (or see Table C1)							
Partial factor		γ _{Ms,N}	[-]				see Ta	able C1			
Combined pull-out and	concrete failure	,									
Characteristic bond resist	tance in uncracke	d concrete C20)/25								
Temperature angle II: 24°C/40°C	Dry, wet concrete and	^τ Rk,ucr,100	[N/mm²]	17	17	16	15	14	13	13	13
를 II: 50°C/80°C	flooded bore hole	^τ Rk,ucr,100	[N/mm²]	17	17	16	15	14	13	13	13
Characteristic bond resist	tance in cracked o	oncrete C20/2	5								
II: 20°C/40°C	Dry, wet concrete and	^τ Rk,cr,100	[N/mm²]	5,5	6,0	6,5	6,5	6,5	6,5	6,5	6,5
Hen H: 20°C\80°C	flooded bore hole	^τ Rk,cr,100	[N/mm²]	5,5	6,0	6,5	6,5	6,5	6,5	6,5	6,5
Reduktion factor ψ ⁰ sus.10	₀ in cracked and ι	incracked cond	rete C20/2	5							
II: 24°C/40°C	Dry, wet concrete and	٥,,,	r 1	0,90							
ਜੂ	flooded bore hole	Ψ ⁰ sus,100	[-]	0,87							
Increasing factors for con	crete	Ψς	[-]				(f _{ck} /	20) ^{0,1}			
Characteristic bond resist	tance depending	τ _B	k,ucr,100 =	Ψc * [†] Rk,ucr,100,(C20/25)							
on the concrete strength			Rk,cr,100 =	Ψc • [†] Rk,cr,100,(C20/25)							
Concrete cone failure			rik,ci, ioo			' ' '	'TK,CI	, 100,(02	.0/23)		
Relevant parameter							see Ta	able C2	2		
Splitting											
Relevant parameter							see Ta	able C2	<u> </u>		
Installation factor	_	_									
for dry and wet concrete	MAC					1,2				rformar sessed	ice
list ary and not controle	CAC	γ _{inst}	[-]					,0			
for flooded bore hole	HDB	+		1,2							
TOT HOUSES BOTE HOLE	JOAO	<u>I</u>] 1,4								

Sympafix chemical anchor C200Plus-UltraBond for concrete	
Performances Characteristic values of tension loads under static and quasi-static action for a working life of 100 years (threaded rod)	Annex C 4



Table C5: Characteristic for a working					nder s	tatic a	nd qu	asi-st	atic acti	on
Threaded rod			M8	M10	M12	M16	M20	M24	M27	M30
Steel failure without lever arm								•		
Characteristic shear resistance Steel, strength class 4.6, 4.8 and 5.6, 5.8	V ⁰ Rk,s	[kN]			0,6 •	A _s • f _{uk}	(or see	Table C	1)	
Characteristic shear resistance Steel, strength class 8.8 Stainless Steel A2, A4 and HCR, all strength classes	V ⁰ Rk,s	[kN]	0,5 ⋅ A _s ⋅ f _{uk} (or see Table C1)							
Partial factor	[-]	see Table C1								
Ductility factor	k ₇	[-]	1,0							
Steel failure with lever arm	- I									
Characteristic bending moment	M ⁰ Rk,s	[Nm]			1,2 •	W _{el} • f _{uk}	(or see	Table C) 1)	
Elastic section modulus	W _{el}	[mm³]	31	62	109	277	541	935	1387	1874
Partial factor	γ _{Ms,V}	[-]				see	Table C	1		
Concrete pry-out failure										
Factor	k ₈	[-]					2,0			
Installation factor	γinst	[-]					1,0			
Concrete edge failure										
Effective length of fastener	l _f	[mm]		n	nin(h _{ef} ; 1	12 · d _{noi}	m)		min(h _{ef} ;	300mm)
Outside diameter of fastener	d _{nom}	[mm]	8	10	12	16	20	24	27	30
Installation factor	γinst	[-]					1,0			

Sympafix chemical anchor C200Plus-UltraBond for concrete	
Performances Characteristic values of shear loads under static and quasi-static action for a working life of 50 and 100 years (threaded rod)	Annex C 5



1,4

		working life of	ou yea									
	I threaded ancho	rods			IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20		
Steel fa	ailure ¹⁾		1					<u> </u>	ı	1		
	teristic tension resi	stance, 5.8	N _{Rk,s}	[kN]	10	17	29	42	76	123		
Steel, s	strength class	8.8	N _{Rk,s}	[kN]	16	27	46	67	121	196		
	factor, strength cla		γ _{Ms,N}	[-]		1,5						
	teristic tension resi 4 and HCR, Strenç		N _{Rk,s}	[kN]	14	26	41	59	110	124		
Partial	factor		γ _{Ms,N}	[-]			1,87			2,86		
Combi	ned pull-out and o	concrete cone failu	re									
	teristic bond resista	ance in uncracked c	oncrete C	20/25					1			
ure	I: 24°C/40°C		^τ Rk,ucr	[N/mm²]	17	16	15	14	13	13		
nperat range	II: 50°C/80°C	Dry, wet concrete	τ _{Rk,ucr}	[N/mm²]	17	16	15	14	13	13		
Temperature range	III: 72°C/120°C	and flooded bore hole	τ _{Rk,ucr}	[N/mm²]	14	14	13	12	12	11		
Ter	IV: 100°C/160°C	τ _{Rk,ucr}	[N/mm ²]	11	11	10	9,5	9,0	9,0			
Charac	teristic bond resista	ance in cracked con)/25		•	•		•	•		
<u>l</u> e	I: 24°C/40°C	Dry, wet concrete and flooded bore hole	τ _{Rk,cr}	[N/mm²]	7,5	8,0	9,0	8,5	7,0	7,0		
ratı ge	II: 50°C/80°C		τ _{Rk,cr}	[N/mm²]	7,5	8,0	9,0	8,5	7,0	7,0		
Temperature range	III: 72°C/120°C		τ _{Rk,cr}	[N/mm²]	6,5	7,0	7,5	7,0	6,0	6,0		
Ter	IV: 100°C/160°C		τ _{Rk,cr}	[N/mm²]	5,5	6,0	6,5	6,0	5,5	5,5		
Redukt	ion factor ψ ⁰ sus in o	cracked and uncrack	<u> </u>	ete C20/25	5		1		1			
	I: 24°C/40°C						0.	,90				
atu Je	II: 50°C/80°C	Dry, wet concrete			0,87							
Temperature range	III: 72°C/120°C	and flooded bore hole	Ψ ⁰ sus	[-]	0,75							
Tell 1	IV: 100°C/160°C	I llooded bole flole						66				
•	ing factors for cond	rete	Ψ _c	[-]				20) ^{0,1}				
	-		70									
	teristic bond resist icrete strength clas	ance depending on		τ _{Rk,ucr} =				ucr,(C20/25)				
	ete cone failure			τ _{Rk,cr} =			Ψc 'Rk,	cr,(C20/25)				
	nt parameter						see Ta	able C2				
	ng failure				<u> </u>		555 16	<u></u>				
_	nt parameter						see Ta	able C2				
	ation factor											
	MAC					1,2		L .	ormance a	assesse		
for dry	and wet concrete	CAC	γinst	[-]				,0				
		HDB	- ""	'			1	,2				

¹⁾ Fastenings (incl. nut and washer) must comply with the appropriate material and property class of the internal threaded rod. The characteristic tension resistance for steel failure is valid for the internal threaded rod and the fastening element.

CAC

for flooded bore hole

Sympafix chemical anchor C200Plus-UltraBond for concrete	
Performances Characteristic values of tension loads under static and quasi-static action for a working life of 50 years (internal threaded anchor rod)	Annex C 6

²⁾ For IG-M20 strength class 50 is valid



1,2

1,4

	working life o				l	I	I	l			
Internal threaded ancho	r rods			IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20		
Steel failure ¹⁾		ĪN.	FLAND.	10	17	I 00	40	70	100		
Characteristic tension res	· · ·	N _{Rk,s}	[kN]	10	17	29	42	76	123 196		
Steel, strength class	8.8	N _{Rk,s}	[kN]	16 27 46 67 121							
Partial factor, strength cla		γMs,N	[-]		ı	1	,5		Г		
Characteristic tension res Steel A4 and HCR, Streng		N _{Rk,s}	[kN]	14	26	41	59	110	124		
Partial factor		γ _{Ms,N}	[-]			1,87			2,86		
Combined pull-out and	concrete cone fai	lure									
Characteristic bond resist	ance in uncracked	concrete Ca	20/25					,			
Temperature range II: 24°C/40°C	Dry, wet concrete	τRk,ucr,100	[N/mm²]	17	16	15	14	13	13		
II: 20°C/80°C	II: 50°C/80°C and flooded bore hole		[N/mm²]	17	16	15	14	13	13		
Characteristic bond resist	ance in cracked co	ncrete C20/	25				•	•	•		
I: 24°C/40°C	Dry, wet concrete	^τ Rk,cr,100	[N/mm²]	6,0	6,5	6,5	6,5	6,5	6,5		
Temperature range II: 24°C/40°C	and flooded bore hole	^τ Rk,cr,100	[N/mm²]	6,0	6,5	6,5	6,5	6,5	6,5		
Reduktion factor ψ ⁰ sus,100	in cracked and ur	ncracked co	ncrete C2	20/25		•	•	•	•		
II: 24°C/40°C	Dry, wet concrete		[-]	0,90							
H II: 50°C/80°C	flooded bore hole	Ψ sus,100	ניז	0,87							
Increasing factors for con-	crete	Ψς	[-]			(f _{ck} /	20) ^{0,1}				
Characteristic bond resist	ance depending		ıcr,100 =		Ų	/c • τ _{Rk,uc}		25)			
on the concrete strength (
Concrete cone failure		*KK	,cr,100 =			Ψc ^{• τ} Rk,cr	,100,(020/2	5)			
Relevant parameter						see Ta	able C2				
Splitting failure			I			000					
Relevant parameter						see Ta	able C2				
Installation factor											
	MAC				1,2		No Perf	ormance a	assessec		
for dry and wet concrete	CAC	γ _{inst}	[-1			1	,0				
				i							

¹⁾ Fastenings (incl. nut and washer) must comply with the appropriate material and property class of the internal threaded rod. The characteristic tension resistance for steel failure is valid for the internal threaded rod and the fastening element.

[-]

 γ_{inst}

for flooded bore hole

HDB

CAC

Sympafix chemical anchor C200Plus-UltraBond for concrete	
Performances Characteristic values of tension loads under static and quasi-static action for a working life of 100 years (internal threaded anchor rod)	Annex C 7

²⁾ For IG-M20 strength class 50 is valid



1,0

Table C8: Character for a work						static :	and qua	si-stati	c action		
Internal threaded anchor rods				IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20		
Steel failure without lever arm ¹)		•		•	•					
Characteristic shear resistance,	5.8	V ⁰ Rk,s	[kN]	5	9	15	21	38	61		
Steel, strength class	8.8	V ⁰ Rk,s	[kN]	8	14	23	34	60	98		
Partial factor, strength class 5.8 a	and 8.8	γ _{Ms,V}	[-]				1,25				
Characteristic shear resistance, Stainless Steel A4 and HCR, Strength class 70 ²⁾		V ⁰ Rk,s	[kN]	7	13	20	30	55	40		
Partial factor		γ _{Ms,V}	[-]			1,56			2,38		
Ductility factor		k ₇	[-]	1,0							
Steel failure with lever arm1)		•									
Characteristic bending moment,	5.8	M ⁰ Rk,s	[Nm]	8	19	37	66	167	325		
Steel, strength class	8.8	M ⁰ Rk,s	[Nm]	12	30	60	105	267	519		
Partial factor, strength class 5.8 a	and 8.8	γ _{Ms,V}	[-]				1,25				
Characteristic bending moment, Stainless Steel A4 and HCR, Strength class 70 ²⁾		М ⁰ _{Rk,s}	[Nm]	11	26	52	92	233	456		
Partial factor		γ _{Ms,V}	[-]			1,56			2,38		
Concrete pry-out failure											
Factor		k ₈	[-]				2,0				
Installation factor	[-]				1,0						
Concrete edge failure		•									
Effective length of fastener		I _f	[mm]		min	(h _{ef} ; 12 • c	l _{nom})		min(h _{ef} ; 300m		
Outside diameter of fastener		d _{nom}	[mm]	10	12	16	20	24	30		

¹⁾ Fastenings (incl. nut and washer) must comply with the appropriate material and property class of the internal threaded rod. The characteristic tension resistance for steel failure is valid for the internal threaded rod and the fastening element.

[-]

 γ_{inst}

Installation factor

Sympafix chemical anchor C200Plus-UltraBond for concrete	
Performances Characteristic values of shear loads under static and quasi-static action for a working life of 50 and 100 years (internal threaded anchor rod)	Annex C 8

²⁾ For IG-M20 strength class 50 is valid



		working I												
Reinfor	rcing bar				Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø3
Steel fa			T.,	1						- 41				
Charact	teristic tension resi	stance	N _{Rk,s}	[kN]						f _{uk} 1)				
Cross s	ection area		A _s	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial f	factor		γ _{Ms,N}	[-]					1,	4 ²⁾				
	ned pull-out and o													
Charact	teristic bond resista	nce in uncra	cked concre	te C20/25										
<u>e</u>	I: 24°C/40°C	Dry, wet	^τ Rk,ucr	[N/mm ²]	14	14	14	14	13	13	13	13	13	13
nperatı range	II: 50°C/80°C	concrete	τ _{Rk,ucr}	[N/mm²]	14	14	14	14	13	13	13	13	13	13
Temperature range	III: 72°C/120°C	and flooded	^τ Rk,ucr	[N/mm²]	13	12	12	12	12	11	11	11	11	11
<u>T</u> e	IV: 100°C/160°C	bore hole	τ _{Rk,ucr}	[N/mm²]	9,5	9,5	9,5	9,0	9,0	9,0	9,0	9,0	8,5	8,5
Charact	teristic bond resista	nce in crack		1 -	· ·	<u> </u>	, ,	ŕ	,	, , , , , , , , , , , , , , , , , , ,	,	· ' · · · ·	<u> </u>	
	I: 24°C/40°C	Dry, wet	τ _{Rk,cr}	[N/mm²]	5,5	5,5	6,0	6,5	6,5	6,5	6,5	7,0	7,0	7,0
Temperature range	II: 50°C/80°C	concrete	τ _{Rk,cr}	[N/mm²]	5,5	5,5	6,0	6,5	6,5	6,5	6,5	7,0	7,0	7,0
nperat range	III: 72°C/120°C	and		[N/mm ²]	4,5	5,0	5,0	5,5	5,5	5,5	5,5	6,0	6,0	6,0
en en	IV: 100°C/160°C	flooded bore hole	τRk,cr	 	4,0	4,5	4,5	5,0	5,0	5,0	5,0	5,0	5,0	5,0
			TRk,cr	[N/mm²]		4,0	4,5	3,0	3,0	3,0	٥,0	٥,٠	٥,0	ا,د
nedukti	ion factor ψ ⁰ sus in c	racked and t	Incracked co		.0/23									
eg l: 24°C/40°C Dr		Dry, wet							-	90				
ĎΕ,	II: 50°C/80°C	concrete and	Ψ ⁰ sus	[-]					0,	87				
emp ra	III: 72°C/120°C	flooded							0,	75				
ř	IV: 100°C/160°C	bore hole							0,	66				
Increas	ing factors for cond	rete	Ψς	[-]	(f _{ck} / 20) ^{0,1}									
	teristic bond resista ling on the concrete			τ _{Rk,ucr} =				Ψ_{C}	• τ _{Rk,υ}	cr,(C20	/25)			
class	ing on the concrete	suengui		$\tau_{Rk,cr} =$				Ψc	• τ _{Rk,}	cr,(C20.	(25)			
	ete cone failure			·							·			
Relevar	nt parameter							:	see Ta	ble C	2			
Splittin	g													
Relevar	nt parameter							;	see Ta	ble C	2			
Installa	tion factor			,										
		MAC	1				1,2				Perfor	mance	asses	sed
for dry a	and wet concrete	CAC	γ _{inst}	[-]						,0				
for El	dod bore bele	HDB	-	''						,2				
	ded bore hole	CAC								,4				
	shall be taken from t		ns of reinfor	cing bars										
Symp	eafix chemical a	nchor C200	Plus-Ultra	Bond for	conc	rete								
	mances cteristic values of ter orking life of 50 yea		nder static an	d quasi-sta	itic acti	on					A	nnex	c C 9	



Reinfo	rcing bar				Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 3		
Steel fa			T.,	ī						. 1\						
	teristic tension res	istance	N _{Rk,s}	[kN]			1			f _{uk} 1)	ſ					
	section area		A _s	[mm²]	50	79	113	154	201	314	452	491	616	80		
Partial 1			γ _{Ms,N}	[-]					1,	4 ²						
	ned pull-out and			h- 000/0E												
	teristic bond resist	Dry, wet concrete	⁷ Rk,ucr,100	[N/mm ²]	14 14 14 14 13			13	13	13	13	13				
Temperature range	II: 50°C/80°C	and flooded bore hole	^τ Rk,ucr,100	[N/mm²]	14	14	14	14	13	13	13	13	13	13		
Charac	teristic bond resist	ance in crack	ed concrete	C20/25												
Temperature range	I: 24°C/40°C	Dry, wet concrete and	^τ Rk,cr,100	[N/mm²]	4,5	4,5	4,5	4,5	4,5	4,0	4,0	4,0	4,0	4,0		
	II: 50°C/80°C	flooded bore hole	^τ Rk,cr,100	[N/mm²]	4,5	4,5	4,5	4,5	4,5	4,0	4,0	4,0	4,0	4,0		
Redukt	ion factor ψ ⁰ sus,10	₀ in cracked a	nd uncracke	d concrete	C20/2	25										
Temperature range	Dry, wet concrete and		Ψ ⁰ sus,100	[-]	0,90											
Temp	II: 50°C/80°C	flooded bore hole	* Sus,100	.,						87						
Increas	sing factors for con	crete	Ψс	[-]	(f _{ck} / 20) ^{0,1}											
	teristic bond resist ling on the concret			i,ucr,100 =	Ψc * ^τ Rk,ucr,100,(C20/25) Ψc * ^τ Rk,cr,100,(C20/25)											
	ete cone failure			11,01,100												
	nt parameter							;	see Ta	able C	2					
Splittin																
Releva	nt parameter							;	see Ta	able C	2					
Installa	ation factor															
fau almı		MAC	_				1,2		4	l	Perfor	mance	asse	ssed		
ior dry	and wet concrete	CAC HDB	γ _{inst}	[-]						,0 ,2						
for floor	ded bore hole	CAC	-							<u>,2</u> ,4						
	shall be taken from bsence of national r		ons of reinford	cing bars												



Table C11: Characteris for a working					nde	r stat	tic aı	nd qı	uasi-	static	actio	1
Reinforcing bar			Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Steel failure without lever arm						•	I.		•			
Characteristic shear resistance	V ⁰ _{Rk,s}	[kN]					0,50	·As·	f _{uk} 1)			
Cross section area	A _s	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial factor	[-]						1,52)					
Ductility factor	[-]						1,0					
Steel failure with lever arm	•	•										
Characteristic bending moment	M ⁰ Rk,s	[Nm]					1.2	W _{el} ·	fuk ¹⁾			
Elastic section modulus	W _{el}	[mm³]	50	98	170	269	402	785	1357	1534	2155	3217
Partial factor	γ _{Ms,V}	[-]						1,5 ²⁾				
Concrete pry-out failure	•	•										
Factor	k ₈	[-]						2,0				
Installation factor	γ_{inst}	[-]						1,0				
Concrete edge failure	<u>'</u>											
Effective length of fastener	I _f	[mm]	min(h _{ef} ; 12 · d _{nom}) min(h _{ef} ; 300mm)								mm)	
Outside diameter of fastener	d _{nom}	[mm]	8	10	12	14	16	20	24	25	28	32
Installation factor	γ _{inst}	[-]				•	•	1,0				

¹⁾ f_{uk} shall be taken from the specifications of reinforcing bars

Sympafix chemical anchor C200Plus-UltraBond for concrete	
Performances Characteristic values of shear loads under static and quasi-static action for a working life of 50 and 100 years (rebar)	Annex C 11

²⁾ in absence of national regulation



Table C12: Dis	placement	s under tensi	on load	J 1)						
Threaded rod			М8	M10	M12	M16	M20	M24	M27	M30
Uncracked concrete C2	20/25 under s	tatic and quasi-s	tatic acti	on for a	working	life of	50 and 1	00 year	s	
Temperature range	δ _{N0} -factor	[mm/(N/mm²)]	0,031	0,032	0,034	0,037	0,039	0,042	0,044	0,046
I: 24°C/40°C II: 50°C/80°C δ _{N∞} -fac		[mm/(N/mm²)]	0,040	0,042	0,044	0,047	0,051	0,054	0,057	0,060
Temperature range	δ _{N0} -factor	[mm/(N/mm²)]	0,032	0,034	0,035	0,038	0,041	0,044	0,046	0,048
III: 72°C/120°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,042	0,044	0,045	0,049	0,053	0,056	0,059	0,062
Temperature range	δ_{N0} -factor	[mm/(N/mm²)]	0,121	0,126	0,131	0,142	0,153	0,163	0,171	0,179
IV: 100°C/160°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,124	0,129	0,135	0,146	0,157	0,168	0,176	0,184
Cracked concrete unde	er static and o	ιμαsi-static actio	n for a w	orking l	ife of 50	and 100) years			
Temperature range	δ _{N0} -factor	[mm/(N/mm²)]	0,081	0,083	0,085	0,090	0,095	0,099	0,103	0,106
I: 24°C/40°C II: 50°C/80°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,104	0,107	0,110	0,116	0,122	0,128	0,133	0,137
Temperature range	δ_{N0} -factor	[mm/(N/mm²)]	0,084	0,086	0,088	0,093	0,098	0,103	0,107	0,110
III: 72°C/120°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,108	0,111	0,114	0,121	0,127	0,133	0,138	0,143
Temperature range	δ_{N0} -factor	[mm/(N/mm²)]	0,312	0,321	0,330	0,349	0,367	0,385	0,399	0,412
IV: 100°C/160°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,321	0,330	0,340	0,358	0,377	0,396	0,410	0,424

¹⁾ Calculation of the displacement

 $\delta_{N0} = \delta_{N0}\text{-factor} \cdot \tau;$ τ : action bond stress for tension

 $\delta_{N\infty} = \delta_{N\infty}$ -factor $\cdot \tau$;

Table C13: Displacements under shear load¹⁾

Threaded rod		M8	M10	M12	M16	M20	M24	M27	M30	
Uncracked and cracked concrete under static and quasi-static action for a working life of 50 and 100 years										
All temperature	δ _{V0} -factor	[mm/kN]	0,06	0,06	0,05	0,04	0,04	0,03	0,03	0,03
ranges	$\delta_{V\infty}$ -factor	[mm/kN]	0,09	0,08	0,08	0,06	0,06	0,05	0,05	0,05

¹⁾ Calculation of the displacement

 $\delta v_0 = \delta v_0$ -factor \cdot V; V: action shear load

 $\delta_{V\infty} = \delta_{V\infty}\text{-factor }\cdot V;$

Sympafix chemical anchor C200Plus-UltraBond for concrete

Performances

Displacements under static and quasi-static action for a working life of 50 and 100 years (threaded rod)

Annex C 12



Table C14: Displ	acements u	ınder tension	load ¹⁾					
Internal threaded anche	or rods		IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20
Uncracked concrete un	der static and	quasi-static actio	n for a wo	rking life	of 50 and 1	00 years		
Temperature range	δ _{N0} -factor	[mm/(N/mm²)]	0,032	0,034	0,037	0,039	0,042	0,046
I: 24°C/40°C II: 50°C/80°C	[mm/(N/mm²)]	0,042	0,044	0,047	0,051	0,054	0,060	
Temperature range	δ _{N0} -factor	[mm/(N/mm²)]	0,034	0,035	0,038	0,041	0,044	0,048
III: 72°C/120°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,044	0,045	0,049	0,053	0,056	0,062
Temperature range	δ _{N0} -factor	[mm/(N/mm²)]	0,126	0,131	0,142	0,153	0,163	0,179
IV: 100°C/160°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,129	0,135	0,146	0,157	0,168	0,184
Cracked concrete unde	r static and qu	asi-static action	ior a work	ing life of	50 and 100	years		
Temperature range I: 24°C/40°C	δ_{N0} -factor	[mm/(N/mm²)]	0,083	0,085	0,090	0,095	0,099	0,106
II: 50°C/80°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,170	0,110	0,116	0,122	0,128	0,137
Temperature range	δ _{N0} -factor	[mm/(N/mm²)]	0,086	0,088	0,093	0,098	0,103	0,110
III: 72°C/120°C $\delta_{N\infty}$ -factor [mm/(N/m		[mm/(N/mm²)]	0,111	0,114	0,121	0,127	0,133	0,143
Temperature range δ _{N0} -factor		[mm/(N/mm²)]	0,321	0,330	0,349	0,367	0,385	0,412
IV: 100°C/160°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,330	0,340	0,358	0,377	0,396	0,424

¹⁾ Calculation of the displacement

 $\delta_{N0} = \delta_{N0}$ -factor $\cdot \tau$; τ : action bond stress for tension

 $\delta_{N\infty} = \delta_{N\infty}\text{-factor }\cdot\tau;$

Table C15: Displacements under shear load¹⁾

Internal threaded	IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20		
Uncracked and c	racked concret	e under static ar	id quasi-sta	tic action f	or a workin	g life of 50 a	and 100 yea	ırs
All temperature	0,07	0,06	0,06	0,05	0,04	0,04		
ranges	$\delta_{V\infty}$ -factor	[mm/kN]	0,10	0,09	0,08	0,08	0,06	0,06

¹⁾ Calculation of the displacement

 $\delta_{V0} = \delta_{V0} \text{-factor} \ \cdot \ V; \text{ action shear load}$

 $\delta v_{\infty} = \delta v_{\infty}$ -factor $\cdot V$;

Sympafix chemical anchor C200Plus-UltraBond for concrete	
Performances	Annex C 13
Displacements under static and quasi-static action	
for a working life of 50 and 100 years (internal threaded anchor rod)	



Table C16:	Displace	ments under	tensi	on loa	ad ¹⁾							
Reinforcing bar			Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Uncracked concre	ete under sta	atic and quasi-s	tatic ac	tion for	a work	ing life	of 50 a	nd 100	years			
Temperature range	δ_{N0} -factor	[mm/(N/mm²)]	0,031	0,032	0,034	0,035	0,037	0,039	0,042	0,043	0,045	0,048
I: 24°C/40°C II: 50°C/80°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,040	0,042	0,044	0,045	0,047	0,051	0,054	0,055	0,058	0,063
Temperature	δ_{N0} -factor	[mm/(N/mm²)]	0,032	0,034	0,035	0,036	0,038	0,041	0,044	0,045	0,047	0,050
range III: 72°C/120°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,042	0,044	0,045	0,047	0,049	0,053	0,056	0,057	0,060	0,065
Temperature	δ _{N0} -factor	[mm/(N/mm²)]	0,121	0,126	0,131	0,137	0,142	0,153	0,163	0,164	0,172	0,186
range IV: 100°C/160°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,124	0,129	0,135	0,141	0,146	0,157	0,168	0,169	0,177	0,192
Cracked concrete	under statio	and quasi-stat	ic actio	n for a	workin	g life of	50 and	100 ye	ears			
Temperature range	δ _{N0} -factor	[mm/(N/mm²)]	0,081	0,083	0,085	0,087	0,090	0,095	0,099	0,099	0,103	0,108
I: 24°C/40°C II: 50°C/80°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,104	0,107	0,110	0,113	0,116	0,122	0,128	0,128	0,133	0,141
Temperature	δ_{N0} -factor	[mm/(N/mm²)]	0,084	0,086	0,088	0,090	0,093	0,098	0,103	0,103	0,107	0,113
range III: 72°C/120°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,108	0,111	0,114	0,118	0,121	0,127	0,133	0,133	0,138	0,148
Temperature	δ _{N0} -factor	[mm/(N/mm²)]	0,312	0,321	0,330	0,340	0,349	0,367	0,385	0,385	0,399	0,425
range IV: 100°C/160°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,321	0,330	0,340	0,349	0,358	0,377	0,396	0,396	0,410	0,449

¹⁾ Calculation of the displacement

 $\delta_{N0} = \delta_{N0}$ -factor $\cdot \tau$; τ : action bond

 $\delta_{N\infty} = \delta_{N\infty} \text{-factor } \cdot \tau;$

 τ : action bond stress for tension

Table C17: Displacements under shear load¹⁾

Reinforcing bar	Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32		
Uncracked and o	tic and	quasi-s	tatic ac	tion fo	r a work	ing life	of 50 a	nd 100	years			
All temperature	δ_{V0} -factor	[mm/kN]	0,06	0,05	0,05	0,04	0,04	0,04	0,03	0,03	0,03	0,03
ranges	$\delta_{V\infty}$ -factor	[mm/kN]	0,09	0,08	0,08	0,06	0,06	0,05	0,05	0,05	0,04	0,04

¹⁾ Calculation of the displacement

 $\delta_{V0} = \delta_{V0}$ -factor \cdot V;

V: action shear load

 $\delta v_{\infty} = \delta v_{\infty}$ -factor $\cdot V$;

Sympafix chemical anchor C200Plus-UltraBond for concrete	
Performances Displacements under static and quasi-static action for a working life of 50 and 100 years (rebar)	Annex C 14



Tabl		racteristic va formance cat							ion			
Thread	led rod				M8	M10	M12	M16	M20	M24	M27	M30
Steel fa	ailure											
Charac	teristic tension res	istance	N _{Rk,s,eq,C1}	[kN]				1,0 •	N _{Rk,s}			
Partial	factor		γ _{Ms,N}	[-]				see Ta	able C1			
Combi	ned pull-out and	concrete failure	•	•								
Charac	teristic bond resist	tance in cracked a	and uncracked	concrete C2	20/25							
<u>a</u>	I: 24°C/40°C	Dmr. wat	^τ Rk,eq,C1	[N/mm ²]	7,0	7,5	8,0	9,0	8,5	7,0	7,0	7,0
Temperature range	II: 50°C/80°C	Dry, wet concrete and	^τ Rk,eq,C1	[N/mm ²]	7,0	7,5	8,0	9,0	8,5	7,0	7,0	7,0
mpe ran	III: 72°C/120°C	flooded bore	^τ Rk,eq,C1	[N/mm²]	6,0	6,5	7,0	7,5	7,0	6,0	6,0	6,0
"	IV: 100°C/160°C	— hole	τ _{Rk,eq,C1}	[N/mm ²]	5,5	5,5	6,0	6,5	6,0	5,5	5,5	5,5
Increas	sing factors for con	crete	Ψc	[-]				1	,0			
	teristic bond resist concrete strength		,	τ _{Rk,eq,C1} =			Ψc	• τ _{Rk,ec}	դ,C1,(C2	0/25)		
Installa	ation factor											
for dry	and wet concrete	CAC						1	,0			
lor dry	and wet concrete	HDB	γ_{inst}	[-]				1	,2			
for floor	ded bore hole	CAC		1				1	.4			

Sympafix chemical anchor C200Plus-UltraBond for concrete	
Performances Characteristic values of tension loads under seismic action (performance category C1) for a working life of 50 years (threaded rod)	Annex C 15



Table C19:		cteristic val										
Threaded rod					M8	M10	M12	M16	M20	M24	M27	M30
Steel failure			_									
Characteristic tens	ion resist	ance	N _{Rk,s,eq,C1}	[kN]				1,0 •	$N_{Rk,s}$			
Partial factor			γ _{Ms,N}	[-]				see Ta	able C1			
Combined pull-ou	it and co	ncrete failure										
Characteristic bond	d resistar	ce in cracked a	nd uncracked o	concrete C2	0/25							
Temperature B	°C	Dry, wet concrete and	^τ Rk,eq,C1	[N/mm²]	5,5	6	6,5	6,5	6,5	6,5	6,5	6,5
비 원 등 II: 50°C/80)°C	flooded bore hole	^τ Rk,eq,C1	[N/mm²]	5,5	6	6,5	6,5	6,5	6,5	6,5	6,5
Increasing factors	for concre	ete	Ψc	[-]				1	,0			
Characteristic bond on the concrete str			τ	Rk,eq,C1 =			Ψc	• τ _{Rk,ec}	,C1,(C2	0/25)		
Installation factor	•											
for dry and wet cor	norete	CAC			1,0							
	or dry and wet concrete HDB			[-]	1,2							
for flooded bore ho	le	CAC						1	,4			

Sympafix chemical anchor C200Plus-UltraBond for concrete	
Performances Characteristic values of tension loads under seismic action (performance category C1) for a working life of 100 years (threaded rod)	Annex C 16



Table C20:	Characteris (performance									rs			
Threaded rod				М8	M10	M12	M16	M20	M24	M27	M30		
Steel failure	Steel failure												
Characteristic she (Seismic C1)	ear resistance	V _{Rk,s,eq,C1}	[kN]				0,70) ∙ V ⁰ Rk	,s				
Partial factor													
Factor for annula	ar gap	$\alpha_{\sf gap}$	[-]				0,	5 (1,0) ¹⁾					

¹⁾ Value in brackets valid for filled annular gab between fastener and clearance hole in the fixture. Use of special filling washer Annex A 3 is recommended

Sympafix chemical anchor C200Plus-UltraBond for concrete	
Performances Characteristic values of shear loads under seismic action (performance category C1) (threaded rod)	Annex C 17



Ψc * ^τRk,eq,C1,(C20/25)

1,0

1,2

1,4

Tabl	e C21:		acteristic ormance									n			
Reinforcing bar							Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Steel fa	ailure														
Charac	teristic tens	sion resi	stance	N _{Rk,s,eq,C1}	[kN]					1,0 • A	s f _{uk}	1)			
Cross section area			As	[mm²]	50	79	113	154	201	314	452	491	616	804	
Partial	factor			γ _{Ms,N}	[-]					1,	4 ²⁾				
Combi	ned pull-o	ut and c	oncrete failu	ıre											
Charac	teristic bon	d resista	ance in cracke	ed and uncra	icked cond	crete C	20/25								
range	I: 24°C/40	°C	Dry, wet	τ _{Rk,eq,C1}	[N/mm²]	5,5	5,5	6,0	6,5	6,5	6,5	6,5	7,0	7,0	7,0
	II: 50°C/80	o.c	concrete	τ _{Rk,eq,C1}	[N/mm²]	5,5	5,5	6,0	6,5	6,5	6,5	6,5	7,0	7,0	7,0
Temperature	III: 72°C/1	20°C	and flooded	τ _{Rk,eq,C1}	[N/mm²]	4,5	5,0	5,0	5,5	5,5	5,5	5,5	6,0	6,0	6,0
	IV: 100°C/	/160°C	bore hole	τ _{Rk,eq,C1}	[N/mm²]	4,0	4,5	4,5	5,0	5,0	5,0	5,0	5,0	5,0	5,0
Increas	sing factors	for cond	crete	Ψc	[-]			·	·	1	,0		·		

 $\tau_{Rk,eq,C1}$ =

[-]

1) f	shall be t	taken fron	the s	pecifications	of re	einforcina	bars
ʻ "lik	onan oo	takon non		pcomoanono	0	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	54.0

CAC

HDB

CAC

 γ_{inst}

Characteristic bond resistance depending on the concrete strength

class

Installation factor

for flooded bore hole

for dry and wet concrete

Sympafix chemical anchor C200Plus-UltraBond for concrete	
Performances Characteristic values of tension loads under seismic action (performance category C1) for a working life of 50 years (rebar)	Annex C 18

²⁾ in absence of national regulation



Table C22: Characteristic values of tension loads under seismic action (performance category C1) for a working life of 100 years

Reinfo	orcing bar		Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32		
Steel failure						D 10	D IL	2 17	2 10	D 20	D = 7	2 20	2 20	D UL
Characteristic tension resistance N _{Rk,s,eq,C1} [kN]					1,0 • A _s • f _{uk} ¹⁾									
Cross	section area		A _s	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial	factor		γ _{Ms,N}	[-]					1,	4 ²⁾				
Combined pull-out and concrete failure														
Charac	cteristic bond resist	ance in crack	ed and uncra	cked cond	crete C	20/25								
rature	I: 24°C/40°C	Dry, wet concrete	^τ Rk,eq,C1	[N/mm²]	4,5	4,5	4,5	4,5	4,5	4,0	4,0	4,0	4,0	4,0
Temperature range	II: 50°C/80°C	and flooded bore hole	τ _{Rk,eq,C1}	[N/mm²]	4,5	4,5	4,5	4,5	4,5	4,0	4,0	4,0	4,0	4,0
Increas	sing factors for con-	crete	Ψс	[-]	1,0									
Characteristic bond resistance depending on the concrete strength class τ _{Rk,eq,C1} =				k,eq,C1 =	Ψc * ^τ Rk,eq,C1,(C20/25)									
Install	Installation factor													
for dry	for dry and wet concrete CAC HDB				1,0									
loi dry			γ _{inst} [-]		1,2									
for flooded bore hole CAC									1	,4				

 $^{^{\}rm 1)}~{\rm f_{uk}}$ shall be taken from the specifications of reinforcing bars

Sympafix chemical anchor C200Plus-UltraBond for concrete	
Performances Characteristic values of tension loads under seismic action (performance category C1) for a working life of 100 years (rebar)	Annex C 19

²⁾ in absence of national regulation



Table C23: Characteristic values of shear loads under seismic action (performance category C1) for a working life of 50 and 100 years													
Reinforcing bar				Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Steel failure													
Characteristic she	ar resistance	V _{Rk,s,eq}	[kN]					0,35	·As·	fuk ¹⁾			
Cross section area	A _s	[mm²]	50	79	113	154	201	314	452	491	616	804	
Partial factor		γ _{Ms,V}	[-]	1,5 ²⁾									
Factor for annula	r gap	$\alpha_{\sf gap}$	[-]	0,5 (1,0) ³									

 $^{^{1)}}$ f_{uk} shall be taken from the specifications of reinforcing bars

Sympafix chemical anchor C200Plus-UltraBond for concrete	
Performances Characteristic values of shear loads under seismic action (performance category C1) for a working life of 50 and 100 years (rebar)	Annex C 20

²⁾ in absence of national regulation

³⁾ Value in brackets valid for filled annular gab between fastener and clearance hole in the fixture. Use of special filling washer Annex A 3 is recommended



Tabl		cteristic va ormance cat					on			
Thread	ed rod			_	M12	M16	M20	M24		
Steel fa	ailure									
Steel, s Stainles	teristic tension resist trength class 8.8 ss Steel A4 and HCF h class ≥70	·	N _{Rk,s,eq,C2}	[kN]	1,0 • N _{Rk,s}					
Partial t	factor	·	γ _{Ms,N}	[-]		see Ta	ble C1			
Combi	ned pull-out and co	ncrete failure		•						
Charac	teristic bond resistar	nce in cracked a	nd uncracked	concrete C20	/25					
<u>e</u>	I: 24°C/40°C	Dry wet	τ _{Rk,eq,C2}	[N/mm ²]	3,6	3,5	3,3	2,3		
Temperature range	II: 50°C/80°C	Dry, wet concrete and	τ _{Rk,eq,C2}	[N/mm ²]	3,6	3,5	3,3	2,3		
mpe	III: 72°C/120°C	flooded bore	τ _{Rk,eq,C2}	[N/mm ²]	3,1	3,0	2,8	2,0		
<u>ē</u>	IV: 160°C/100°C	hole	τ _{Rk,eq,C2}	[N/mm²]	2,5	2,7	2,5	1,8		
Increas	ing factors for concre	ete	Ψс	[-]		1,	,0			
Characteristic bond resistance depending on the concrete strength class				$\tau_{Rk,eq,C2} = \psi_{c} \cdot \tau_{Rk,eq,C2,(C20/25)}$						
Installa	tion factor									
for dry and wet concrete HDB		and wet concrete		[-]			.0 .2			
for flood	ded bore hole	CAC	1		1,4					

Sympafix chemical anchor C200Plus-UltraBond for concrete	
Performances Characteristic values of tension loads under seismic action (performance category C2) for a working life of 50 years (threaded rod)	Annex C 21



Table C2		ecteristic va ormance cat								
Threaded roo	d				M12	M16	M20	M24		
Steel failure										
Characteristic tension resistance, Steel, strength class 8.8 Stainless Steel A4 and HCR, Strength class ≥70			N _{Rk,s,eq,C2}	[kN]	1,0 ⋅ N _{Rk,s}					
Partial factor			γ _{Ms,N}	[-]		see Ta	ıble C1			
Combined p	ull-out and co	ncrete failure								
Characteristic	bond resistar	nce in cracked a	nd uncracked	concrete C20	/25					
		Dry, wet concrete and	^τ Rk,eq,C2	[N/mm²]	3,6	3,5	3,3	2,3		
Temperature range : : 545	0°C/80°C	flooded bore hole	^τ Rk,eq,C2	[N/mm²]	3,6	3,5	3,3	2,3		
Increasing fac	ctors for concre	ete	Ψc	[-]		1,	,0			
Characteristic bond resistance depending on the concrete strength class				τ _{Rk,eq,C2} =						
Installation f	actor									
for dry and wet concrete CAC		and wet concrete		[-]			,0 ,2			
for flooded bo	re hole	CAC	1		1,4					

Sympafix chemical anchor C200Plus-UltraBond for concrete	
Performances Characteristic values of tension loads under seismic action (performance category C2) for a working life of 100 years (threaded rod)	Annex C 22

Factor for annular gap



 $0,5(1,0)^{1)}$

Table C26: Characteristic values of shear loads under seismic action (performance category C2) for a working life of 50 and 100 years											
Threaded rod				M12	M 16	M20	M24				
Steel failure			·								
Characteristic she Steel, strength cla Stainless Steel A4 Strength class ≥70	ss 8.8 and HCR,	V _{Rk,s,eq,C2}	[kN]	0,70 • V ⁰ _{Rk,s}							
Partial factor		γ _{Ms,V}	[-]		see Ta	ible C1					

¹⁾ Value in brackets valid for filled annular gab between fastener and clearance hole in the fixture. Use of special filling washer Annex A 3 is recommended

[-]

Table C27: Displacements under tension load

 α_{gap}

Threaded rod			M12	M16	M20	M24			
	acked concrete under seismic action (performance category C2) a working life of 50 and 100 years								
All temperature	$\delta_{N,eq,C2(50\%)} = \delta_{N,eq,C2(DLS)}$	[mm]	0,24	0,27	0,29	0,27			
ranges	$\delta_{N,eq,C2(100\%)} = \delta_{N,eq,C2(ULS)}$	[mm]	0,55	0,51	0,50	0,58			

Table C28: Displacements under shear load

Threaded rod			M12	M16	M20	M24					
	under seismic action of 50 and 100 years	nic action (performance category C2)) years									
All temperature	$\delta_{V,eq,C2(50\%)} = \delta_{V,eq,C2(DLS)}$	[mm]	3,6	3,0	3,1	3,5					
ranges	$\delta_{V,eq,C2(100\%)} = \delta_{V,eq,C2(ULS)}$	[mm]	7,0	6,6	7,0	9,3					

Sympafix chemical anchor C200Plus-UltraBond for concrete	
Performances Characteristic values of shear loads Displacements under seismic action (performance category C2) for a working life of 50 and 100 years (threaded rod)	Annex C 23



hammer drilled he		oles	(HD), co	mpres	sed ai							ner
Threaded rod					M8	M10	M12	M16	M20	M24	M27	M30
Steel failure												
Characteristic tension			Fire -	30	1,1	1,7	3,0	5,7	8,8	12,7	16,5	20,2
resistance; Steel, Stainless Steel A2, A4 and HCR,	N _{Rk,s,fi}	[kN]	exposure	60	0,9	1,4	2,3	4,2	6,6	9,5	12,4	15,1
strength class 5.8 resp. 50	110,5,11	[]	time [min]	90	0,7	1,0	1,6	3,0	4,7	6,7	8,7	10,7
and higher				120	0,5	0,8	1,2	2,2	3,4	4,9	6,4	7,9
Characteristic bond resistagiven temperature θ	ance in cra	cked a	and uncrac	ked con	crete C	:20/25 ι	ip to C	50/60 u	nder fi	re cond	ditions	tor a
			θ < 2	4°C				1,	,0			
Temperature reduction factor	$k_{fi,p}(\theta)$	[-]	24°C ≤ θ	≤ 379°C			1,3	01 • e ⁻⁰),011∙θ≤	1,0		
			θ > 37	79°C				0,	,0			
Reduction Factor k _{ff} (θ) [-]	100		150	200	250		00	350	4	00	450	
Characteristic bond		Γ	le	emperatu	re θ [°C	J.						
resistance for a given temperature (θ)	$\tau_{Rk,fi}(\theta)$		[N/mm²]	l	$k_{fi,p}(\theta) \cdot \tau_{Rk,cr,(C20/25)}^{1)}$							
	arm											
	lever arm			20	4.4	17	2.0	5 7	00	10.7	16 E	20.2
Characteristic shear			Fire -	30	1,1	1,7	3,0	5,7	8,8	12,7	16,5	
Characteristic shear resistance; Steel, Stainless Steel A2, A4 and HCR,	V _{Rk,s,fi}	[kN]	Fire - exposure time	60	0,9	1,4	2,3	4,2	6,6	9,5	12,4	15,1
Characteristic shear resistance; Steel, Stainless Steel A2, A4 and HCR, strength class 5.8 resp. 50		[kN]	exposure	60 90	0,9 0,7	1,4 1,0	2,3 1,6	4,2 3,0	6,6 4,7	9,5 6,7	12,4 8,7	15,1 10,7
Characteristic shear resistance; Steel, Stainless Steel A2, A4 and HCR, strength class 5.8 resp. 50 and higher	V _{Rk,s,fi}	[kN]	exposure time	60	0,9	1,4	2,3	4,2	6,6	9,5	12,4	
Characteristic shear resistance; Steel, Stainless Steel A2, A4 and HCR, strength class 5.8 resp. 50 and higher Steel failure with lever arm Characteristic bending	V _{Rk,s,fi}	[kN]	exposure time [min]	60 90	0,9 0,7	1,4 1,0	2,3 1,6	4,2 3,0	6,6 4,7	9,5 6,7	12,4 8,7	15,1 10,7
Characteristic shear resistance; Steel, Stainless Steel A2, A4 and HCR, strength class 5.8 resp. 50 and higher Steel failure with lever arm Characteristic bending moment; Steel, Stainless	V _{Rk,s,fi}		exposure time [min] -	60 90 120	0,9 0,7 0,5	1,4 1,0 0,8	2,3 1,6 1,2	4,2 3,0 2,2	6,6 4,7 3,4	9,5 6,7 4,9	12,4 8,7 6,4	15,1 10,7 7,9
Characteristic shear resistance; Steel, Stainless Steel A2, A4 and HCR, strength class 5.8 resp. 50 and higher Steel failure with lever arm Characteristic bending moment; Steel, Stainless Steel A2, A4 and HCR, strength class 5.8 resp. 50	V _{Rk,s,fi}	[kN]	exposure time [min] -	60 90 120 30 60 90	0,9 0,7 0,5 1,1 0,9 0,7	1,4 1,0 0,8 2,2 1,8 1,3	2,3 1,6 1,2 4,7 3,5 2,5	4,2 3,0 2,2 12,0 9,0 6,3	6,6 4,7 3,4 23,4 17,5 12,3	9,5 6,7 4,9 40,4 30,3 21,3	12,4 8,7 6,4 59,9 44,9 31,6	15,1 10,7 7,9 81,0 60,7 42,7
resistance; Steel, Stainless Steel A2, A4 and HCR, strength class 5.8 resp. 50 and higher Steel failure with lever arm Characteristic bending moment; Steel, Stainless Steel A2, A4 and HCR, strength class 5.8 resp. 50 and higher 1) \(\tau_{Rk,cr,(C20/25)}\) characterist	V _{Rk,s,fi}	[Nm]	exposure time [min] -	60 90 120 30 60 90	0,9 0,7 0,5 1,1 0,9 0,7	1,4 1,0 0,8 2,2 1,8 1,3	2,3 1,6 1,2 4,7 3,5 2,5 1,8	4,2 3,0 2,2 12,0 9,0 6,3 4,7	6,6 4,7 3,4 23,4 17,5 12,3 9,1	9,5 6,7 4,9 40,4 30,3 21,3 15,7	12,4 8,7 6,4 59,9 44,9 31,6 23,3	15,1 10,7 7,9 81,0 60,7
Characteristic shear resistance; Steel, Stainless Steel A2, A4 and HCR, strength class 5.8 resp. 50 and higher Steel failure with lever arm Characteristic bending moment; Steel, Stainless Steel A2, A4 and HCR, strength class 5.8 resp. 50 and higher	V _{Rk,s,fi}	[Nm]	exposure time [min] -	60 90 120 30 60 90	0,9 0,7 0,5 1,1 0,9 0,7	1,4 1,0 0,8 2,2 1,8 1,3	2,3 1,6 1,2 4,7 3,5 2,5 1,8	4,2 3,0 2,2 12,0 9,0 6,3 4,7	6,6 4,7 3,4 23,4 17,5 12,3 9,1	9,5 6,7 4,9 40,4 30,3 21,3 15,7	12,4 8,7 6,4 59,9 44,9 31,6 23,3	15,1 10,7 7,9 81,0 60,7 42,7

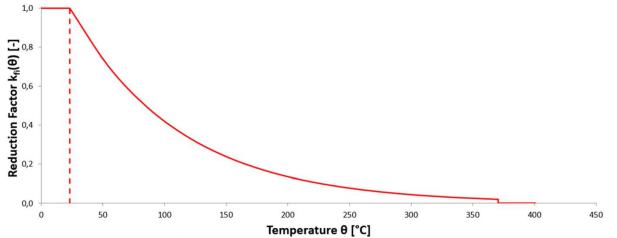


Table C30: Characteristic values of tension and shear loads under fire exposure in hammer drilled holes (HD), compressed air drilled holes (CD) and in hammer drilled holes with hollow drill bit (HDB)

Internal threaded anchor rods					IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20		
Steel failure												
Characteristic tension resistance; Steel, Stainless Steel A4 and HCR, strength class 5.8 and 8.8 resp. 70			Fire	30	0,3	1,1	1,7	3,0	5,7	8,8		
	N	[LANI]	exposure	60	0,2	0,9	1,4	2,3	4,2			
	$N_{Rk,s,fi}$	[kN]	time	90	0,2	0,7	1,0	1,6	3,0			
			[min]	120	0,1	0,5	0,8	1,2	2,2	3,4		

Characteristic bond resistance in cracked and uncracked concrete C20/25 up to C50/60 under fire conditions for a given temperature θ

			θ < 24°C	1,0
Temperature reduction factor	$k_{fi,p}(\theta)$	[-]	24°C ≤ θ ≤ 379°C	1,301 • e ^{-0,011 • θ} ≤ 1,0
	3000		θ > 379°C	0,0



I .												
Characteristic bond resistance for a given temperature (θ)	$\tau_{Rk,fi}(\theta)$		[N/mm²]			$k_{fi,p}(\theta) \cdot \tau_{Rk,cr,(C20/25)}^{1)}$						
Steel failure without lever a	irm	2000	20 20			10			200	310		
Characteristic shear			Fire	30	0,3	1,1	1,7	3,0	5,7	8,8		
resistance; Steel, Stainless	V	Rk,s,fi [kN] exposure time 90 0,2 0,7 1	ovnocuro	60	0,2	0,9	1,4	2,3	4,2	6,6		
Steel A4 and HCR, strength	V Rk,s,fi		1,0	1,6	3,0	4,7						
class 5.8 and 8.8 resp. 70			[min]	120	0,1	0,5	0,8	1,2	2,2	3,4		
Steel failure with lever arm									:01			
Characteristic bending			Fire	30	0,2	1,1	2,2	4,7	12,0	23,4		
	N/O	[Nlm]	evnosure	60	0,2	0,9	1,8	3,5	9,0	17,5		
Steel A4 and HCR, strength	M ⁰ Rk,s,fi	[Nm]	l ume l	90	0,1	0,7	1,3	2,5	6,3	12,3		
class 5.8 and 8.8 resp. 70			[min]	120	0.1	0.5	1.0	1.8	47	91		

¹⁾ $\tau_{Rk,cr,(C20/25)}$ characteristic bond resistance for cracked concrete for concrete strength class C20/25 for the relevant temperature range

Sympafix chemical anchor C200Plus-UltraBond for concrete	
Performances Characteristic values of tension and shear loads under fire exposure (internal threaded anchor rod)	Annex C 25



	teristic v r drilled holes wit	hole	s (HD), d	compre	esse						10.000 m			er	
Reinforcing bar					Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32	
Steel failure															
				30	0,5	1,2	2,3	3,1	4,0	6,3	9,0	9,8	12,3	16,1	
Characteristic tension	N _{Rk,s,fi}	[kN]	Fire exposure	60	0,5	1,0	1,7	2,3	3,0	4,7	6,8	7,4	9,2	12,1	
resistance; BSt 500	HK,S,fi	[KIN]	time [min]	90	0,4	0,8	1,5	2,0	2,6	4,1	5,9	6,4	8,0	10,5	
			Samuel State of State	120	0,3	0,6	1,1	1,5	2,0	3,1	4,5	4,9	6,2	8,0	
Characteristic bond resis given temperature θ	stance in c	racke	d and unci	acked c	oncre	te C20	0/25 u	p to C	50/60	unde	r fire (condit	ions 1	or a	
given temperature o			θ < 22	2°C					1	,0					
Temperature reduction	$k_{fi,p}(\theta)$	[-]	22°C ≤ θ :					1,26	8 • е ⁻⁽	0,011•θ	≤ 1,0	,0			
factor	,p		θ > 37	.0°C					0	,0					
Reduction Factor k _{ff} (θ) [-]) 100)	150	200 Tempera		250 D [°C]	30	0	350		400		450		
Characteristic bond resistance for a given temperature (θ)	$\tau_{Rk,fi}(\theta)$		[N/mm²]	-	k _{fi,p} (θ) • τ _{Rk,cr,(C20/25)} 1)										
Steel failure without leve	r arm										i .				
			F:	30	0,5	1,2	2,3	3,1	4,0	6,3	9,0	9,8	12,3	10 00.000.0	
Characteristic shear	V _{Rk,s,fi}	[kN]	Fire exposure	60	0,5	1,0	1,7	2,3	3,0	4,7	6,8	7,4	9,2	12,1	
resistance; BSt 500			time [min]	90	0,4	0,8	1,5	2,0	2,6	4,1	5,9	6,4	8,0	10,5	
Steel failure with lever ar	m			120	0,3	0,6	1,1	1,5	2,0	3,1	4,5	4,9	6,2	8,0	
Otoor failure with lover at	<u></u>	<u> </u>		30	0,6	1,8	4,1	6,5	9,7	18,8	32,6	36,8	51,7	77,2	
Characteristic bending			Fire	60	0,5	1,5	3,1	4,8	7,2	14,1		27,6	38,8		
moment; BSt 500	M ⁰ Rk,s,fi	[Nm]	exposure time [min]	90	0,4	1,2	2,6	4,2	6,3	12,3		23,9			
				120	0,3	0,9	2,0	3,2	4,8	9,4	16,3	18,4	25,9	38,6	
1) τ _{Rk,cr,(C20/25)} characteri temperature range	stic bond re	sistan	ce for crack	ed concre	ete for	concre	te stre	ngth c	lass C	20/25	for the	releva	nt		
Sympafix chemical and	chor C200l	Plus-	UltraBond	for con	crete						۸۰	nnex	C 26	•	