



Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments



European Technical Assessment

ETA-21/0928 of 29 November 2021

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

Deutsches Institut für Bautechnik

CELO Injection system ResiFIX Pure Epoxy plus for concrete

Bonded fastener for use in concrete

CELO Befestigungssysteme GmbH Industriestraße 6 86551 Aichach DEUTSCHLAND

Werk 2, Deutschland

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

EAD 330499-01-0601, Edition 04/2020



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Specific Part

1 Technical description of the product

The "CELO Injection system ResiFIX Pure Epoxy plus for concrete" is a bonded anchor consisting of a cartridge with injection mortar Injection mortar ResiFIX Pure Epoxy plus EPPSF and a steel element according to Annex A3 and A5.

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 B 3, C 1 to C 5, C 7 to C 9, C 11 to C13
Characteristic resistance to shear load (static and quasi-static loading)	See Annex C 1, C 6, C 10, C 14
Displacements under short-term and long-term loading	See Annex C 15 to C 17
Characteristic resistance and displacements for seismic performance categories C1 and C2	See Annex C 18 to C 21

3.2 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 the European Assessment Document EAD 330499-01-0601 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 29 November 2021 by Deutsches Institut für Bautechnik

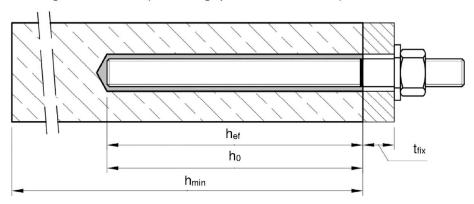
Dipl.-Ing. Beatrix Wittstock Head of Section beglaubigt: Baderschneider



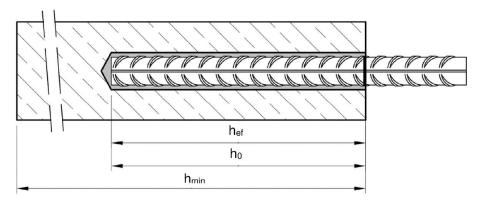
Installation threaded rod M8 up to M30

prepositioned installation or

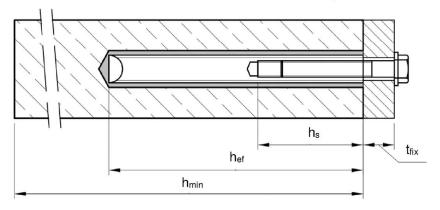
push through installation (annular gap filled with mortar)



Installation reinforcing bar Ø8 up to Ø32



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



 t_{fix} = thickness of fixture

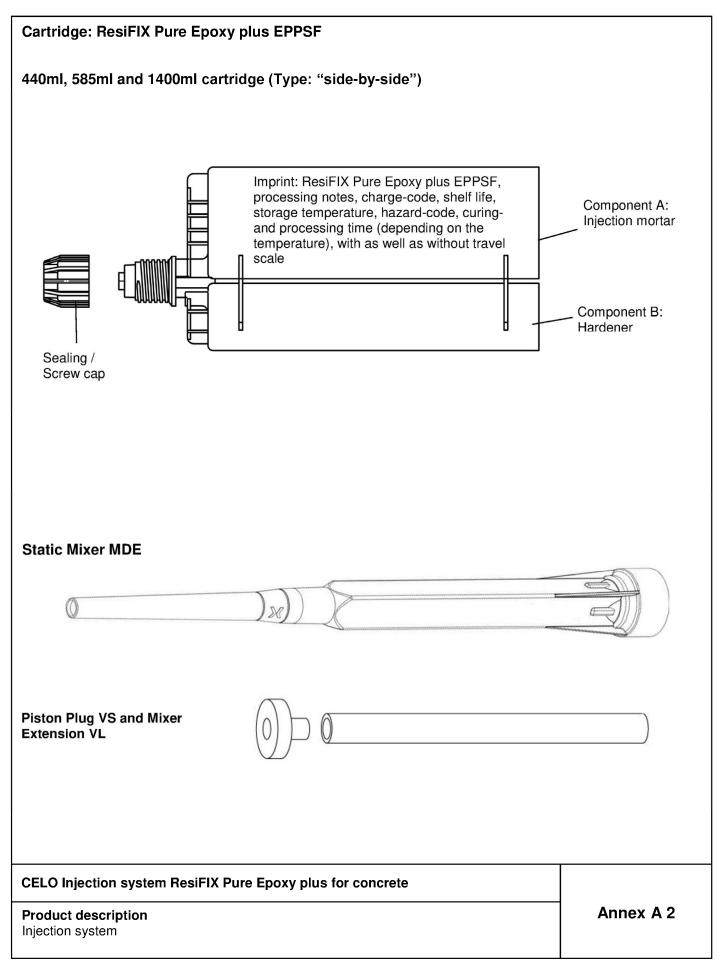
h_{ef} = effective anchorage depth

 h_0 = depth of drill hole

 h_{min} = minimum thickness of member

CELO Injection system ResiFIX Pure Epoxy plus for concrete	
Product description Installed condition	Annex A 1







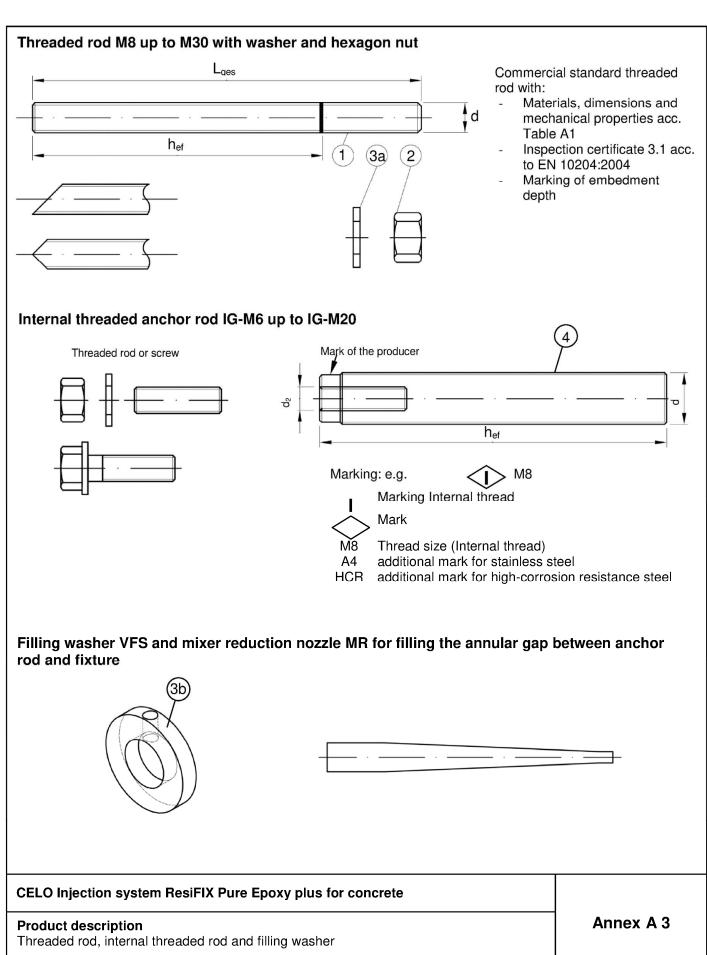




Table A1: Materials								
Part	Designation	Material						
- zi - ho	nc plated ≥ 5 ot-dip galvanised ≥ 4	acc. to EN ISO 683-4:2 µm acc. to EN ISO 0 µm acc. to EN ISO 5 µm acc. to EN ISO	4042 146	2:2018 or 1:2009 and EN ISO 10684:	2004+AC:2009 or			
		Property class		Characteristic steel ultimate tensile strength	Characteristic steel yield strength	Elongation at fracture		
			4.6	f _{uk} = 400 N/mm ²	f _{yk} = 240 N/mm ²	A ₅ > 8%		
1	Threaded rod		4.8	f _{uk} = 400 N/mm ²	f _{yk} = 320 N/mm ²	A ₅ > 8%		
•	Thi caded red	acc. to EN ISO 898-1:2013		f _{uk} = 500 N/mm ²	f _{vk} = 300 N/mm ²	A ₅ > 8%		
		EN 150 696-1.2013	5.8	f _{uk} = 500 N/mm ²	f _{vk} = 400 N/mm ²	A ₅ > 8%		
				f _{uk} = 800 N/mm ²	f _{yk} = 640 N/mm ²	A ₅ ≥ 12% ³⁾		
		and to	4	for anchor rod class 4.6 o	1 -			
2	Hexagon nut	acc. to EN ISO 898-2:2012	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 EN ISO 7089:2000, EN ISC	7093:2000 or EN ISO	7094:2000)		
3b	Filling washer	Steel, zinc plated, ho	t-dip	galvanised or sherardized	1			
	Internal threaded	Property class		Characteristic steel ultimate tensile strength	Characteristic steel yield strength	Elongation at fracture		
4	anchor rod	acc. to		f _{uk} = 500 N/mm ²	$f_{yk} = 400 \text{ N/mm}^2$	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%		
Stair	nless steel A4 (Mater	rial 1.4401 / 1.4404 / 1	.457	1 / 1.4567 or 1.4541, acc. t 1 / 1.4362 or 1.4578, acc. t r 1.4565, acc. to EN 10088	o EN 10088-1:2014)			
		Property class		Characteristic steel ultimate tensile strength	Characteristic steel yield strength	Elongation at fracture		
1	Threaded rod ¹⁾⁴⁾		50	f _{uk} = 500 N/mm ²	f _{vk} = 210 N/mm ²	A ₅ ≥ 8%		
•	Timedaca roa	acc. to	70	f _{uk} = 700 N/mm ²	f _{vk} = 450 N/mm ²	A ₅ ≥ 12% ³⁾		
		EN ISO 3506-1:2020	80	f _{uk} = 800 N/mm ²	$f_{yk} = 600 \text{ N/mm}^2$	$A_5 \ge 12\%^{(3)}$		
			50	for anchor rod class 50	1.7			
2	Hexagon nut 1)4)	acc. to EN ISO 3506-1:2020	70	for anchor rod class 70				
			80	for anchor rod class 80				
A2: Material 1.4301 / 1.4307 / 1.4311 / 1.4567 or 1.4541, acc. to EN 10088-1:2014 A4: Material 1.4401 / 1.4404 / 1.4571 / 1.4362 or 1.4578, acc. to EN 10088-1:2014 HCR: Material 1.4529 or 1.4565, acc. to EN 10088-1: 2014 (e.g.: EN ISO 887:2006, EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7094:2000)								
3b	Filling washer	Stainless steel A4, H	igh c	orrosion resistance steel				
	Internal threaded	Property class		Characteristic steel ultimate tensile strength	Characteristic steel yield strength	Elongation at fracture		
4	anchor rod ¹⁾²⁾	acc. to	50	f _{uk} = 500 N/mm ²	f _{yk} = 210 N/mm ²	A ₅ > 8%		
		EN ISO 3506-1:2020	70	f _{uk} = 700 N/mm ²	f _{yk} = 450 N/mm ²	A ₅ > 8%		
				•	• • • • • • • • • • • • • • • • • • • •			

¹⁾ Property class 70 or 80 for anchor rods and hexagon nuts up to M24 and Internal threaded anchor rods up to IG-M16

 $^{^{\}rm 4)}$ Property class 80 only for stainless steel A4 and HCR

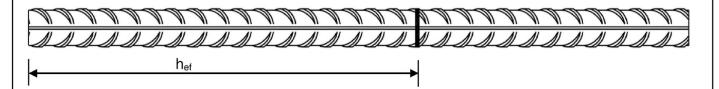
CELO Injection system ResiFIX Pure Epoxy plus for concrete	
Product description Materials threaded rod and internal threaded rod	Annex A 4

²⁾ for IG-M20 only property class 50

 $^{^{3)}\,}A_5 > 8\%$ fracture elongation if \underline{no} use for seismic performance category C2



Reinforcing bar Ø8 up to Ø32



- 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 ≤ h ≤ 0,07d
 (d: Nominal diameter of the bar; h: Rip height of the bar)

Table A2: Materials

Part	Designation	Material				
Reinf	orcing bars					
1	FN 1992-1-1-2007-2017-0 Annov ()	Bars and de-coiled rods class B or C f_{yk} and k according to NDP or NCL of EN 1992-1-1/NA $f_{uk} = f_{tk} = k \cdot f_{yk}$				

CELO Injection system ResiFIX Pure Epoxy plus for concrete	
Product description Materials reinforcing bar	Annex A 5



Specifications of intended use								
Anchorages subject to (Static and quasi-static loads):								
	for a working I	ife of 50 years	for a working life of 100 years					
Base material	Uncracked concrete	cracked concrete	Uncracked concrete	cracked concrete				
Hammer drilling (HD), Hammer drilling with hollow drill bit (HDB) or compressed air drilling (CD)	Ø8 to	M30, Ø32, IG-M20	M8 to M30, Ø8 to Ø32, IG-M6 to IG-M20					
Diamond drilling (DD)	M8 to M30, Ø8 to Ø32, IG-M6 to IG-M20	No performance assessed	M8 to M30, ∅8 to ∅32, IG-M6 to IG-M20	No performance assessed				
Temperature Range:		to +40 °C¹) to +72 °C²)	I: - 40 °C II: - 40 °C					

Anchorages subject to (Seismic action):

	for Performance Category C1	for Performance Category C2				
Base material	Cracked and und	cracked concrete				
Hammer drilling (HD), Hammer drilling with hollow drill bit (HDB) or compressed air drilling (CD)	M8 to M30, ∅8 to ∅32	M12 to M24				
Diamond drilling (DD)	No performance assessed	No performance assessed				
Temperature Range:	I: - 40 °C to +40 °C ¹⁾ II: - 40 °C to +72 °C ²⁾	I: - 40 °C to +40 °C ¹⁾ II: - 40 °C to +72 °C ²⁾				

^{1) (}max long term temperature +24 °C and max short term temperature +40 °C)

Base materials:

- Compacted, reinforced or unreinforced normal weight concrete without fibres according to EN 206:2013 + A1:2016.
- Strength classes C20/25 to C50/60 according to EN 206:2013 + A1:2016.

Use conditions (Environmental conditions):

- Structures subject to dry internal conditions (all materials).
- For all other conditions according to EN 1993-1-4:2006+A1:2015 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

CELO Injection system ResiFIX Pure Epoxy plus for concrete	
Intended Use Specifications	Annex B 1

^{2) (}max long term temperature +50 °C and max short term temperature +72 °C)

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Design:

- 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 supports, etc.).
- Anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete work.
- The anchorages are designed in accordance to EN 1992-4:2018 and Technical Report TR 055, Edition February 2018

Installation:

- Dry, wet concrete or flooded bore holes (not sea-water).
- · Hole drilling by hammer (HD), hollow (HDB), compressed air (CD) or diamond drill mode (DD).
- · Overhead installation allowed.
- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.

CELO Injection system ResiFIX Pure Epoxy plus for concrete	
Intended Use Specifications	Annex B 2



Table B1: Installation parameters for threaded rod											
Anchor size				M8	M10	M12	M16	M20	M24	M27	M30
Diameter of element	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 embedment depth		h _{ef,min}	[mm]	60	60	70	80	90	96	108	120
		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	Push through i	nstallation d _f	[mm]	12	14	16	20	24	30	33	40
Maximum torque mo	ment	max T _{inst} ≤	[Nm]	10	20	40 ¹⁾	60	100	170	250	300
Minimum thickness of member		h _{min}	[mm]	1	_f + 30 m : 100 mr			i	n _{ef} + 2d ₀		
Minimum spacing		s _{min}	[mm]	40	50	60	75	95	115	125	140
Minimum edge distance		c _{min}	[mm]	35	40	45	50	60	65	75	80

¹⁾ Maximum Torque moment for M12 with steel Grade 4.6 is 35 Nm

Table B2: Installation parameters for rebar

Anchor size				Ø 10 ¹⁾	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 1		14 1	6 18	20	25	30 32	30 32	35	40
h _{ef,min} [mm		[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]	h _{ef} + 30 mm ≥ 100 mm			$h_{ef} + 2d_0$						
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

Anchor size			IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20
Internal diameter of anchor rod	d ₂	[mm]	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	[mm]	12	14	18	22	28	35
Effective embedment death	h _{ef,min}	[mm]	60	70	80	90	96	120
Effective embedment depth	h _{ef,max}		200	240	320	400	480	600
Diameter of clearance hole in the fixture	d _f ≤	[mm]	7	9	12	14	18	22
Maximum torque moment	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⁾ With metric threads according to EN 1993-1-8:2005+AC:2009

CELO Injection system ResiFIX Pure Epoxy plus for concrete	
Intended Use Installation parameters	Annex B 3



Table B4	: Paran	neter clea	ning and s	etting	tool	s				
				and the state of t						
Threaded Rod	Rebar	Internal threaded anchor rod	d ₀ Drill bit - Ø HD, HDB, CD, DD	d _t Brush		d _{b,min} min. Brush - Ø	Piston plug	Installatio of	n directio piston plu	
[mm]	[mm]	[mm]	[mm]		[mm]	[mm]		1	→	1
M8	8		10	RB10	11,5	10,5		•		
M10	8 / 10	IG-M6	12	RB12	13,5	12,5		No olua	roguirod	
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	h _{ef} >	h _{ef} >	
M24		IG-M16	28	RB28	30,0	28,5	VS28	1	250 mm	all
M27	24 / 25		30	RB30	31,8	30,5	VS30	250 mm	∠50 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			

CAC - Rec. compressed air tool (min 6 bar)

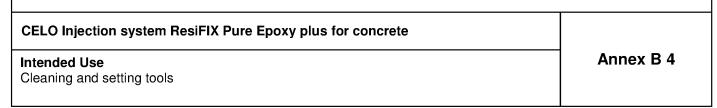
Drill bit diameter (d₀): all diameters





Drill bit diameter (d₀): all diameters

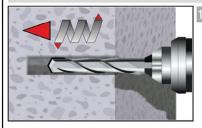
The hollow drill bit system contains the Heller Duster Expert hollow drill bit and a class M vacuum with minimum negative pressure of 253 hPa \underline{and} flow rate of minimum 150 m³/h (42 l/s).





Installation instructions

Drilling of the bore hole (HD, HDB, CD)

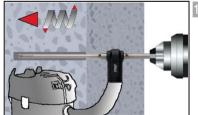


Hammer (HD) or compressed air drilling (CD)

Drill a hole into the base material to the size and embedment depth required by the selected anchor (Table B1, B2 or B3).

Proceed with Step 2.

In case of aborted drill hole, the drill hole shall be filled with mortar.



Hollow drill bit system (HDB) (see Annex B 3)

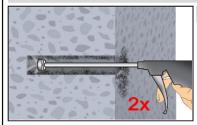
Drill a hole into the base material to the size and embedment depth required by the selected anchor (Table B1, B2 or B3). This drilling system removes the dust and cleans the bore hole during drilling (all conditions).

Proceed with Step 3.

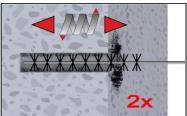
In case of aborted drill hole, the drill hole shall be filled with mortar.

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

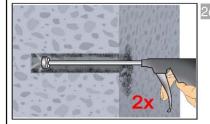
CAC: Cleaning for dry, wet and water-filled bore holes with all diameter in uncracked and cracked concrete



Starting from the bottom or back of the bore hole, blow the hole clean with compressed air (min. 6 bar) (Annex B 4) a minimum of two times until return air stream is free of noticeable dust. If the bore hole ground is not reached an extension shall be used.



Check brush diameter (Table B4). Brush the hole with an appropriate sized wire brush $> d_{b,min}$ (Table B4) a minimum of two times. If the bore hole ground is not reached with the brush, a brush extension must be used.



Finally blow the hole clean again with compressed air (min. 6 bar) (Annex B 4) a minimum of two times until return air stream is free of noticeable dust. If the bore hole ground is not reached an extension shall be used.

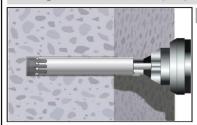
After cleaning, the bore hole has to be protected against re-contamination in an appropriate way, until dispensing the mortar in the bore hole. If necessary, the cleaning has to be repeated directly before dispensing the mortar. In-flowing water must not contaminate the bore hole again.

CELO Injection system ResiFIX Pure Epoxy plus for concrete	
Intended Use Installation instructions	Annex B 5



Installation instructions (continuation)

Drilling of the bore hole (DD)



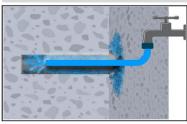
Diamond drilling (DD)

Drill with diamond drill a hole into the base material to the size and embedment depth required by the selected anchor (Table B1, B2, or B3). Proceed with Step 2.

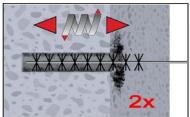
In case of aborted drill hole, the drill hole shall be filled with mortar.

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

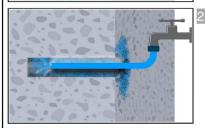
SPCAC: Cleaning for dry, wet and water-filled bore holes with all diameter in uncracked and cracked concrete



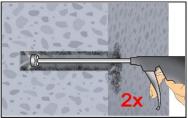
2a. Rinsing with water until clear water comes out.



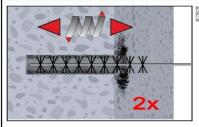
Check brush diameter (Table B4). Brush the hole with an appropriate sized wire brush $> d_{b,min}$ (Table B4) a minimum of two times. If the bore hole ground is not reached with the brush, a brush extension must be used.



Rinsing again with water until clear water comes out.



Starting from the bottom or back of the bore hole, blow the hole clean with compressed air (min. 6 bar) (Annex B 4) a minimum of two times until return air stream is free of noticeable dust. If the bore hole ground is not reached an extension shall be used.



Check brush diameter (Table B4). Brush the hole with an appropriate sized wire brush $> d_{b,min}$ (Table B4) a minimum of two times. If the bore hole ground is not reached with the brush, a brush extension must be used.

CELO Injection system ResiFIX Pure Epoxy plus for concrete

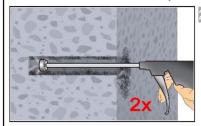
Intended Use

Installation instructions (continuation)

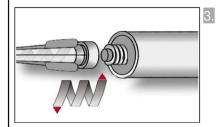
Annex B 6



Installation instructions (continuation)

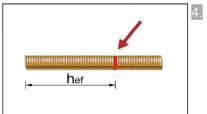


Finally blow the hole clean again with compressed air (min. 6 bar) (Annex B 4) a minimum of two times until return air stream is free of noticeable dust. If the bore hole ground is not reached an extension shall be used.

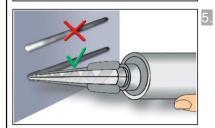


Attach the supplied static-mixing nozzle to the cartridge and load the cartridge into the correct dispensing tool.

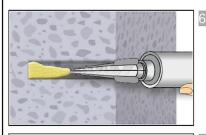
For every working interruption longer than the recommended working time (Table B5) as well as for new cartridges, a new static-mixer shall be used.



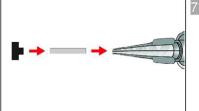
Prior to inserting the anchor rod into the filled bore hole, the position of the embedment depth shall be marked on the anchor rods.



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



Starting from the bottom or back of the cleaned anchor hole, fill the hole up to approximately two-thirds with adhesive. Slowly withdraw the static mixing nozzle as the hole fills to avoid creating air pockets. If the bottom or back of the anchor hole is not reached, an appropriate extension nozzle must be used. Observe the gel-/ working times given in Table B5.



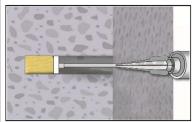
Piston plugs shall be used according to Table B4 for the following applications:

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

CELO Injection system ResiFIX Pure Epoxy plus for concrete	
Intended Use Installation instructions (continuation)	Annex B 7

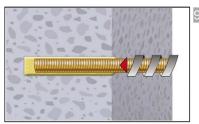


Installation instructions (continuation)



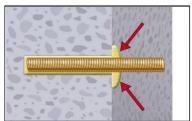
Insert piston plug to back of the hole and inject adhesive. If the bottom or back of the anchor hole is not reached, an appropriate extension nozzle must be used.

During injection the piston plug is naturally pushed out of the borehole by the back pressure of the mortar. Observe the gel-/ working times given in Table B5.

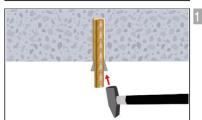


Push the fixing element into the anchor hole while turning slightly to ensure positive distribution of the adhesive until the embedment mark has reached the surface level.

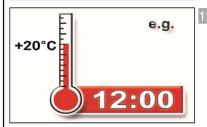
The anchor shall be free of dirt, grease, oil or other foreign material.



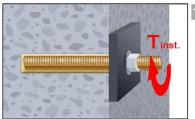
After inserting the anchor, the annular gab between anchor rod and concrete, in case of a push through installation additionally also the fixture, must be complete filled with mortar. If excess mortar is not visible at the top of the hole, the requirement is not fulfilled and the application has to be renewed.



For overhead application the anchor rod shall be fixed (e.g. wedges) until the mortar has started to harden.



Allow the adhesive to cure to the specified time prior to applying any load or torque. Do not move or load the anchor until it is fully cured (attend Table B5).



After full curing, the add-on part can be installed with up to the max. torque (Table B1 or B3) by using a calibrated torque wrench. In case of prepositioned installation the annular gab between anchor and fixture can be optional filled with mortar. Therefor substitute the washer by the filling washer and connect the mixer reduction nozzle to the tip of the mixer. The annular gap is filled with mortar, when mortar oozes out of the washer.

CELO Injection system ResiFIX Pure Epoxy plus for concrete	
Intended Use Installation instructions (continuation)	Annex B 8



Table B5:	Ma	aximum w	orking time and minir	num curing time		
Concrete temperature		Gelling working time	Minimum curing time in dry concrete	Minimum curing time in wet concrete		
0 °C	to	+ 4 °C	90 min	144 h	288 h	
+ 5 °C	to	+ 9 °C	80 min	48 h	96 h	
+ 10 °C	to	+ 14 °C	60 min	28 h	56 h	
+ 15 °C	to	+ 19 °C	40 min	18 h	36 h	
+ 20 °C	to	+ 24 °C	30 min	12 h	24 h	
+ 25 °C	to	+ 34 °C	12 min	9 h	18 h	
+ 35 °C	to	+ 39 °C	8 min	6 h	12 h	
+4	+40 °C		8 min	4 h	8 h	
Cartridge temperature		+5°C to +40°C				

CELO Injection system ResiFIX Pure Epoxy plus for concrete	
Intended Use Curing time	Annex B 9



Т	able C1:	Characteristic values for steel tension resistance and steel shear resistance of threaded rods										
Si	ze				M8	M10	M12	M16	M20	M24	M27	M30
Cr	oss section area	a	A _s	[mm²]	36,6	58	84,3	157	245	353	459	561
Cr	naracteristic te	nsion resistance, Steel failu	re 1)			•						
Ste	eel, Property cla	ass 4.6 and 4.8	N _{Rk,s}	[kN]	15 (13)	23 (21)	34	63	98	141	184	224
Ste	eel, Property cla	ass 5.6 and 5.8	N _{Rk,s}	[kN]	18 (17)	29 (27)	42	78	122	176	230	280
Ste	eel, Property cla	ass 8.8	N _{Rk,s}	[kN]	29 (27)	46 (43)	67	125	196	282	368	449
Sta	ainless steel A2	, A4 and HCR, class 50	N _{Rk,s}	[kN]	18	29	42	79	123	177	230	281
Sta	ainless steel A2	, A4 and HCR, class 70	N _{Rk,s}	[kN]	26	41	59	110	171	247	_3)	_3)
Sta	ainless steel A4	and HCR, class 80	N _{Rk,s}	[kN]	29	46	67	126	196	282	_3)	_3)
Cr	naracteristic te	nsion resistance, Partial fac	tor ²⁾									
Ste	eel, Property cla	ass 4.6 and 5.6	γ _{Ms,N}	[-]				2,0)			
Ste	eel, Property cla	ass 4.8, 5.8 and 8.8	γMs,N	[-]				1,	5			
Sta	ainless steel A2	, A4 and HCR, class 50	γ _{Ms,N}	[-]				2,8	6			
Sta	ainless steel A2	, A4 and HCR, class 70	γ _{Ms,N}	[-]				1,8	7			
		and HCR, class 80	γ _{Ms,N}	[-]	1,6							
Cr		ear resistance, Steel failure		1								
=	Steel, Property	class 4.6 and 4.8	V ⁰ _{Rk,s}	[kN]	9 (8)	14 (13)	20	38	59	85	110	135
arm	Steel, Property	class 5.6 and 5.8	V ⁰ Rk,s	[kN]	11 (10)	17 (16)	25	47	74	106	138	168
Without lever	Steel, Property	class 8.8	$V^0_{Rk,s}$	[kN]	15 (13)	23 (21)	34	63	98	141	184	224
Į į	Stainless steel	A2, A4 and HCR, class 50	V ⁰ Rk,s	[kN]	9	15	21	39	61	88	115	140
Vith	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 ⁰ 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
Vith lever	Stainless steel	A2, A4 and HCR, class 50	M ⁰ Rk.s	[Nm]	19	37	66	167	325	561	832	1125
Ĭ₹	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			[Nm]	30	59	105	266	519	896	_3)	_3)
Cr	naracteristic sh	ear resistance, Partial facto	M ⁰ _{Rk,s}									
Ste	eel, Property cla	ass 4.6 and 5.6	γ _{Ms,V}	[-]	1,67							
Ste	eel, Property cla	ass 4.8, 5.8 and 8.8	γ _{Ms,V}	[-]	1,25							
Sta	ainless steel A2	, A4 and HCR, class 50	γ _{Ms,V}	[-]		2,38						
Sta	ainless steel A2	, A4 and HCR, class 70	γ _{Ms,V}	[-]				1,5	6			
Stainless steel A4 and HCR, class 80				[-]	1,33							

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.
2) in absence of national regulation
3) Anchor type not part of the ETA

CELO Injection system ResiFIX Pure Epoxy plus for concrete	
Performances Characteristic values for steel tension resistance and steel shear resistance of threaded rods	Annex C 1



Table C2:	Characteristic values for Concrete cone failure and Splitting with all kind of action						
Anchor				All Anchor type 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		<u>.</u>					
	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}			

CELO Injection system ResiFIX Pure Epoxy plus for concrete	
Performances Characteristic values for Concrete cone failure and Splitting with all kind of action	Annex C 2



	racteristic va on for a work			s und	der st	atic a	nd q	uasi-	static	;	
Anchor size threaded ro	od			M8	M10	M12	M16	M20	M24	M27	M30
Steel failure											
Characteristic tension res	istance	N _{Rk,s}	[kN]			A _s • f	_{uk} (or s	ee Tab	le C1)		
Partial factor		γ _{Ms,N}	[-]	see Table C1							
Combined pull-out and											
Characteristic bond resist (CD)	ance in uncracke	d concrete C2	20/25 in hamr	mer dril	lled hol	es (HD) and c	ompres	ssed ai	r drillec	l hole:
Temperature range II: 40°C/24°C	Dry, wet concrete and	τ _{Rk,ucr}	[N/mm²]	20	20	19	19	18	17	16	16
de II: 72°C/50°C	flooded bore hole	Tiri,doi		15	15	15	14	13	13	12	12
Characteristic bond resist	ance in uncracke	d concrete C2	20/25 in hamr	ner dril	lled hol	es with	hollow	drill bi	t (HDB))	
º I: 40°C/24°C	Dry, wet			17	16	16	16	15	14	14	13
H: 40°C/24°C H: 72°C/50°C H: 7	concrete		FA.1/ 03	14	14	14	13	13	12	12	11
ta e	flooded bore	^τ Rk,ucr	[N/mm²]	16	16	16	15	15	14	14	13
Ⅱ: 72°C/50°C	hole			14	14	14	13	13	12	12	11
Characteristic bond resist and in hammer drilled hol			25 in hamme	r drilled	holes	(HD) ,	compre	essed a	air drille	d holes	s (CD)
II: 72°C/24°C	Dry, wet concrete and	^τ Rk,cr	[N/mm²]	7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5
원 년 11: 72°C/50°C	flooded bore hole	THK,CI	[14/11111-]	6,0	6,0	7,0	7,0	7,0	7,0	7,0	7,0
Reduction factor ψ^0_{sus} in holes (CD) and in hamme				hamme	er drille	d holes	(HD),	compre	essed a	air drille	ed
II: 72°C/50°C	Dry, wet concrete and	Ψ ⁰ sus	0,80								
d g 	flooded bore hole	303	[-]		0,68						
		C25/30	•					02			
		C30/37						04			
Increasing factors for con	crete	C35/45						07			
Ψc		C40/50 C45/55						08 09			
		C50/60						10			
Concrete cone failure		1000,00		<u> </u>			٠,				
Relevant parameter							see Ta	able C2	<u> </u>		
Splitting											
Relevant parameter			·				see Ta	able C2	!		
Installation factor	TID LIDD CT.		-	I							
for dry and wet concrete (for flooded bore hole (HD		γ_{inst}	[-]					<u>,0</u> ,2			
Tor flooded bore flore (HD	, NDB, CD)							,∠			
CELO Injection syster	m ResiFIX Pure	Epoxy plus	for concrete	e							
Performances Characteristic values of tension loads under static and quasi-static action							Annex C 3				
								<u> </u>			



	rod			M8	M10	M12	M16	M20	M24	M27	M30	
Steel failure		T		<u> </u>								
Characteristic tension re	esistance	N _{Rk,s}	[kN]			A _s • f _u	_{Jk} (or s	ee Tab	le C1)			
Partial factor		γ _{Ms,N}	[-]	see Table C1								
Combined pull-out and												
Characteristic bond resi (CD)	stance in uncracke	ed concrete C2	0/25 in hamr	ner dril	led hol	es (HD) and c	ompres	ssed ai	r drilled	l hole:	
Temperature range II: 40°C/20°C	Dry, wet concrete and	TD1 100	[N/mm²]	20	20	19	19	18	17	16	16	
II: 72°C/50°C	flooded bore hole	^τ Rk,ucr,100	[14/11111]	15	15	15	14	13	13	12	12	
Characteristic bond resi	stance in uncracke	ed concrete C2	0/25 in hamr	ner dril	led hol	es with	hollow	drill bit	t (HDB)		
º I: 40°C/24°C	Dry, wet			17	16	16	16	15	14	14	13	
n e	concrete			14	14	14	13	13	12	12	11	
H: 40°C/24°C II: 72°C/50°C II: 72°C/50°C	flooded bore	^τ Rk,ucr,100	[N/mm ²]	16	16	16	15	15	14	14	13	
H: 72°C/50°C	hole			14	14	14	13	13	12	12	11	
Characteristic bond resi and in hammer drilled he			5 in hamme	r drilled	holes	(HD) ,	compre	essed a	ir drille	ed holes	s (CD)	
ը ⊒: 1: 40°C/24°C	Dry, wet			6,5	6,5	7,5	7,5	7,5	7,5	7,5	7,5	
era 	concrete and	TDk or 100	[N/mm ²]									
Temperature range II: 40°C/24°C	flooded bore hole	[†] Rk,cr,100	[N/mm²]	5,5	5,5	6,5	6,5	6,5	6,5	6,5	6,5	
Tempera range II: 72°C/50°C	flooded bore	C25/30	[N/mm²]	5,5	5,5	6,5	1,	02	6,5	6,5	6,5	
	flooded bore hole	C25/30 C30/37	[N/mm²]	5,5	5,5	6,5	1, 1,	02 04	6,5	6,5	6,5	
Increasing factors for co	flooded bore hole	C25/30 C30/37 C35/45	[N/mm²]	5,5	5,5	6,5	1, 1, 1,	02 04 07	6,5	6,5	6,5	
	flooded bore hole	C25/30 C30/37 C35/45 C40/50	[N/mm²]	5,5	5,5	6,5	1, 1, 1, 1,	02 04 07 08	6,5	6,5	6,5	
Increasing factors for co	flooded bore hole	C25/30 C30/37 C35/45 C40/50 C45/55	[N/mm²]	5,5	5,5	6,5	1, 1, 1, 1,	02 04 07 08 09	6,5	6,5	6,5	
Increasing factors for cc ψ_c	flooded bore hole	C25/30 C30/37 C35/45 C40/50	[N/mm²]	5,5	5,5	6,5	1, 1, 1, 1,	02 04 07 08	6,5	6,5	6,5	
Increasing factors for co ψ_{C}	flooded bore hole	C25/30 C30/37 C35/45 C40/50 C45/55	[N/mm²]	5,5	5,5	6,5	1, 1, 1, 1, 1,	02 04 07 08 09		6,5	6,5	
Increasing factors for coupling Ψ_c Concrete cone failure Relevant parameter	flooded bore hole	C25/30 C30/37 C35/45 C40/50 C45/55	[N/mm²]	5,5	5,5	6,5	1, 1, 1, 1, 1,	02 04 07 08 09		6,5	6,5	
Increasing factors for co \(\psi_c \) Concrete cone failure Relevant parameter Splitting	flooded bore hole	C25/30 C30/37 C35/45 C40/50 C45/55	[N/mm²]	5,5	5,5	6,5	1, 1, 1, 1, 1, see Ta	02 04 07 08 09 10		6,5	6,5	
Increasing factors for co Ψ _c Concrete cone failure Relevant parameter	flooded bore hole	C25/30 C30/37 C35/45 C40/50 C45/55	[N/mm²]	5,5	5,5	6,5	1, 1, 1, 1, 1, see Ta	02 04 07 08 09		6,5	6,5	
Increasing factors for co Ψc Concrete cone failure Relevant parameter Splitting Relevant parameter	flooded bore hole	C25/30 C30/37 C35/45 C40/50 C45/55	[N/mm²]	5,5	5,5	6,5	1, 1, 1, 1, 1, see Ta	02 04 07 08 09 10		6,5	6,5	

CELO Injection system ResiFIX Pure Epoxy plus for concrete	
Performances Characteristic values of tension loads under static and quasi-static action	Annex C 4



Table		racteristic va on for a work					atic a	nd q	uasi-	static		
Ancho	r size threaded ro	od			M8	M10	M12	M16	M20	M24	M27	M30
Steel fa	ailure					•	•		•	•		
Charac	teristic tension res	istance	N _{Rk,s}	[kN]			A _s • f _u	_{Jk} (or s	ee Tab	le C1)		
Partial 1	factor		γ _{Ms,N}	[-]				see Ta	able C1			
Combi	ned pull-out and	concrete failure			ears							
	teristic bond resist					lled ho	les (DD))				
ature e	I: 40°C/24°C	Dry, wet			15	14	14	13	12	12	11	11
Temperature range	II: 72°C/50°C	concrete and flooded bore hole	^τ Rk,ucr	[N/mm²]	12	12	11	10	9,5	9,5	9,0	9,0
	ion factor ψ ⁰ sus in	 	 ete C20/25 in di	ed hole	e (DD)							
	ion ractor Ψ sus in	T				35 (DD)						
nperature range	I: 40°C/24°C	Dry, wet concrete and	Ψ^0 sus	[-]				0,	77			
Temperature range	II: 72°C/50°C	flooded bore hole	Ψ sus	[-]				0,	72			
			C25/30					1,	04			
			C30/37					1,	08			
Increas	sing factors for con-	crete	C35/45					1,	12			
Ψс			C40/50					1,	15			
			C45/55	1,17								
			C50/60					1,	19			
	ned pull-out and				•							
Charac	teristic bond resist	ance in uncracke	d concrete C20	/25 in diam	ond dri	lled ho	les (DD)	1			
Temperature range	I: 40°C/24°C	Dry, wet concrete and	Tal	[N/mm²]	15	14	14	13	12	12	11	11
Temp	II: 72°C/50°C	flooded bore hole	^τ Rk,ucr,100	[11	11	10	10	9,5	9,0	8,5	8,5
	1	1	C25/30	1				1,	04			
			C30/37					1,	08			
Increas	ing factors for con-	crete	C35/45					1,	12			
Ψ_{C}			C40/50					1,	15			
			C45/55					1,	17			
			C50/60					1,	19			
	ete cone failure											
	nt parameter							see Ta	able C2			
Splittin												
	nt parameter							see Ta	able C2	<u>'</u>		
	ation factor	DD)		I								
	and wet concrete (•	$-\gamma_{\text{inst}}$	[-]		10		1	,0	4.4		
TOT TIOO	ded bore hole (DD))		.,		1,2				1,4		
CELO	Injection syster	m ResiFIX Pure	Epoxy plus fo	or concrete	e							
	rmances cteristic values of te	nsion loads under	static and quas	i-static actio	n					Anne	x C 5	



Anchor size threaded rod			M8	M10	M12	M16	M20	M24	M27	M30
Steel failure without lever arm							l	l		
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 C	1)	
Partial factor	$\gamma_{Ms,V}$	[-]				see	Table C	1		
Ductility factor	k ₇	[-]					1,0			
Steel failure with lever arm										
Characteristic bending moment	М 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	γ_{inst}	[-]					1,0			
Concrete edge failure										
Effective length of fastener	I _f	[mm]		n	nin(h _{ef} ; 1	2 · d _{nor}	n)		min(h _{ef} ;	300mm)
Outside diameter of fastener	d _{nom}	[mm]	8	10	12	16	20	24	27	30
Installation factor	γinst	[-]					1,0			

CELO Injection system ResiFIX Pure Epoxy plus for concrete	
Performances Characteristic values of shear loads under static and quasi-static action	Annex C 6



	nternal threaded	d anchor rods			IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20		
Steel failure1)			T.	Т Т		1	<u> </u>		Τ			
	tension resistand	e, <u>5.8</u>	$N_{Rk,s}$	[kN]	10	17	29	42	76	123		
Steel, strength	class	8.8	$N_{Rk,s}$	[kN]	16	27	46	67	121	196		
Partial factor, s	strength class 5.8	3 and 8.8	γ _{Ms,N}	[-]		•	1	,5				
	tension resistand ICR, Strength cla		N _{Rk,s}	[kN]	14	14 26 41 59 110						
Partial factor			γ _{Ms,N}	,								
Combined pu	ll-out and conci	rete cone failu	· •									
Characteristic holes (CD)	bond resistance	e in uncracked	concrete	e C20/25 i	n hamme	r drilled he	oles (HD) a	and comp	ressed air	drilled		
Temperature	I: 40°C/24°C	Dry, wet concrete and	τ	[N]/mm2]	20	19	19	18	17	16		
range	II: 72°C/50°C	flooded bore hole	[₹] Rk,ucr	[N/mm²]	15	15	14	13	13	12		
Characteristic	bond resistance	in uncracked co	oncrete C	20/25 in h	ammer dr	illed holes	with hollo	w drill bit	(HDB)			
	I: 40°C/24°C	Dry, wet			16	16	16	15	14	13		
Temperature	II: 72°C/50°C	concrete	Ι	[NI/mm2]	14	14	13	13	12	11		
range	range I: 40°C/24°C flooded bord		^τ Rk,ucr	[N/mm²]	16	16	15	15	14	13		
•	II: 72°C/50°C hole				14	14	13	13	12	11		
	bond resistance drilled holes wit			/25 in ham	mer drille	ed holes (F	HD), comp	ressed air	drilled ho	les (CD)		
Temperature	I: 40°C/24°C	Dry, wet concrete and	^τ Rk,cr	[N/mm²]	7,0	8,5	8,5	8,5	8,5	8,5		
range	II: 72°C/50°C	flooded bore hole			6,0	7,0	7,0	7,0	7,0	7,0		
Reduction fac	tor ${\psi^0}_{ extsf{sus}}$ in crac	ked and uncra	cked cor	crete C20	/25 in ha	mmer dril	led holes (HD), com	pressed a	ir drilled		
holes (CD) and	d in hammer dril	led holes with I	nollow dri	ll bit (HDB)							
Temperature	I: 40°C/24°C	Dry, wet concrete and	$\Psi^0_{ m sus}$	[-]			0,	80				
range	II: 72°C/50°C	flooded bore hole			0,68							
				5/30				02				
Inoroacina foot	are for concrete			0/37				04				
•	ors for concrete			5/45 0/50				07				
Ψ_{C}				5/55				08 09				
				0/60				10				
Concrete con	e failure						',					
Relevant parar	neter						see Ta	ble C2				
Splitting failui	re			·								
Relevant parar	neter						see Ta	ıble C2				
Installation fa	ctor			<u></u>								
for dry and wet	concrete (HD; F	IDB, CD)		F 3			1	,0				
	e hole (HD; HDB		γ inst	[-]				,2				
for flooded bor 1) Fastenings (The character		, CD) ner) must compl istance for steel	γ _{inst} y with the failure is v	appropriate	e material internal t	and prope	1 erty class of	,2 the intern	al threade	d rod.		

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Annex C 7

CELO Injection system ResiFIX Pure Epoxy plus for concrete

Characteristic values of tension loads under static and quasi-static action

Performances



Table C8:		eristic value or a working				der stat	ic and	quasi-s	tatic	
Anchor size i	internal threade	d anchor rods			IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20
Steel failure1))						•			
Characteristic	tension resistand	ce, 5.8	N _{Rk,s}	[kN]	10	17	29	42	76	123
Steel, strength	n class	8.8	N _{Rk,s}	[kN]	16	27	46	67	121	196
Partial factor,	strength class 5.8	3 and 8.8	γ _{Ms,N}	[-]	1,5					
	tension resistand HCR, Strength cl		N _{Rk,s}	[kN]	14 26 41 59 110				110	124
Partial factor			γ _{Ms,N}	[-]			1,87			2,86
Combined pu	ıll-out and conc	rete cone failu	re	•						
Characteristic holes (CD)	bond resistanc	1	concrete (C20/25 in	hammer	drilled ho	les (HD) a	and compr	essed air	drilled
Tomporatura	I: 40°C/24°C	Dry, wet concrete and			20	19	19	18	17	16
Temperature range	II: 72°C/50°C	flooded bore hole	^τ Rk,ucr,100	[N/mm²]	15	15	14	13	13	12
Characteristic	bond resistance	in uncracked c	oncrete C20)/25 in ha	mmer drill	led holes	with hollo	w drill bit	(HDB)	
	I: 40°C/24°C	Dry, wet	^τ Rk,ucr,100	[N/mm²]	16	16	16	15	14	13
Temperature	II: 72°C/50°C	concrete			14	14	13	13	12	11
range	I: 40°C/24°C	flooded bore		[14/11111-]	16	16	15	15	14	13
	II: 72°C/50°C	hole			14	14	13	13	12	11
	bond resistance er drilled holes wi			5 in hamr	ner drilled	l holes (H	D), compi	ressed air	drilled ho	les (CD)
Temperature	I: 40°C/24°C	Dry, wet concrete and	τ _{Rk,ucr,100}	[N/mm²]	6,5	7,5	7,5	7,5	7,5	7,5
range	II: 72°C/50°C	flooded bore hole	*AK,ucr, 100	[[,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	5,5	6,5	6,5	6,5	6,5	6,5
			C25					,02		
l			C30					,04		
_	tors for concrete		C35					,07		
Ψ_{c}			C40 C45					,08 ,09		
			C50					,09 ,10		
Concrete cor	ne failure		, 200				<u>'</u>	, . •		
Relevant para							see Ta	able C2		
Splitting failu	ire									
Relevant para	meter						see Ta	able C2		
Installation fa	actor									
for dry and we	et concrete (HD; F	HDB, CD)	ν	[_]				,0		
for flooded bo	re hole (HD; HDB	, CD)	γinst	[-]			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.

CELO Injection system ResiFIX Pure Epoxy plus for concrete	
Performances Characteristic values of tension loads under static and quasi-static action	Annex C 8

²⁾ For IG-M20 strength class 50 is valid



	or a working				ici Slal	ic and o	₁ uu31-3	iant		
Anchor size internal threade	d anchor rods			IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20	
Steel failure ¹⁾										
Characteristic tension resistance	ce, 5.8	N _{Rk,s}	[kN]	10	17	29	42	76	123	
Steel, strength class	8.8	N _{Rk,s}	[kN]	16	27	46	67	121	196	
Partial factor, strength class 5.	3 and 8.8	γ _{Ms,N}	[-]			1	,5			
Characteristic tension resistand Steel A4 and HCR, Strength cl		N _{Rk,s}	[kN]	14	14 26 41 59 110					
Partial factor		γ _{Ms,N}	[-]			1,87			2,86	
Combined pull-out and conc	rete cone failu	re for a wo	rking life	of 50 yea	ars					
Characteristic bond resistanc	e in uncracked	l concrete (C20/25 in	diamond	drilled ho	les (DD)				
Temperature I: 40°C/24°C	Dry, wet concrete and	^τ Rk,ucr	[N/mm²]	14	14	13	12	12	11	
range II: 72°C/50°C	flooded bore hole	, 		12	11	10	9,5	9,5	9,0	
Reduction factor ${\psi^0}_{ extsf{sus}}$ in unc	acked concret	e C20/25 ir	n diamond	drilled ho	oles (DD)					
TemperatureI: 40°C/24°C	Dry, wet concrete and	$\Psi^0_{ ext{sus}}$	[-]			0,	77			
range II: 72°C/50°C	flooded bore hole	Y SUS	LJ			0,	72			
		C25					04			
		C30					08			
Increasing factors for concrete		C35					12			
$\Psi_{\mathbf{c}}$		C40		1,15 1,17						
		C45								
Cambinad will all and annu	sta sama failus	C50		of 100		1,	19			
Combined pull-out and concu Characteristic bond resistance						loo (DD)				
	Dry, wet	T	/20/23 III		ariilea no					
Temperature I: 40°C/24°C range	concrete and flooded bore	τ _{Rk,ucr,100}	[N/mm²]	14	14	13	12	12	11	
II: 72°C/50°C	hole			11	10	10	9,5	9,0	8,5	
		C25					04			
		C30					08			
Increasing factors for concrete		C35					12			
$\Psi_{\mathbf{C}}$		C40 C45					15			
		C45					17 19			
Concrete cone failure		1 030	, 50			1,	10			
Relevant parameter						see Ta	able C2			
Splitting failure										
Relevant parameter						see Ta	able C2			
Installation factor										
for dry and wet concrete (DD)		γ _{inst}	[-]			1	,0			
for flooded bore hole (DD)				1,				,4		
 Fastenings (incl. nut and v rod. The characteristic ten For IG-M20 strength class 	sion resistance									
CELO Injection system Re	siFIX Pure Ep	oxy plus f	or concr	ete						
Performances Characteristic values of tension	loads under sta	tic and guas	i-static act	ion			1	Annex C	9	



Table C10: Character	istic va	alues of	shear	loads	under	static a	nd qua	si-stati	c action
Anchor size for internal thread	ed anch	or 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⁾		M 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		γinst	[-]				1,0		
Concrete edge failure									
Effective length of fastener	[mm]		min	(h _{ef} ; 12 • o	d _{nom})		min(h _{ef} ; 300mm		
Outside diameter of fastener	[mm]	10	12	16	20	24	30		
Installation factor		γinst	[-]			•	1,0	•	

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.
2) For IG-M20 strength class 50 is valid

CELO Injection system ResiFIX Pure Epoxy plus for concrete	
Performances Characteristic values of shear loads under static and quasi-static action	Annex C 10



Anchor size reinforci	ction for a wo		y		Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Steel failure									•				
Characteristic tension	resistance	N _{Rk,s}	[kN]					A _s ·	f _{uk} 1)				
Cross section area		A _s	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial factor		$\gamma_{Ms,N}$	[-]					1,	4 ²⁾				
Combined pull-out ar													
Characteristic bond re	esistance in unc	racked con	crete C20/	25 in ł	namme	er drille	ed hole	es (HD) and (compr	essed	air dril	led
I: 40°C/24°C usinge II: 72°C/50°C	Dry, wet concrete and	^τ Rk,ucr	[N/mm²]	16	16	16	16	16	16	15	15	15	15
II: 72°C/50°C	flooded bore hole	7 11,400		12	12	12	12	12	12	12	12	11	11
Characteristic bond re	1	cked concre	te C20/25							·			
<u>θ</u> <u>I: 40°C/24°C</u>	⊣ ^{5, 7,} 1131			14	14	13	13	13	13	13	13	13	13
H: 40°C/24°C II: 72°C/50°C II: 72°C/50°C	+	τ _{Rk,ucr}	[N/mm²]	12	12	12	11	11	11	11	11	11	11
를 <mark>된 40°C/24°C</mark>	11100000	nk,uci	[]	13	13	13	13	13	13	13	13	13	13
11. 72 6/66 6	hole			11	11	11	11	11	11	11	11	11	11
Characteristic bond reand in hammer drilled				hamm	er drill	ed hol	es (HC)), com	npress	ed air	drilled	holes	(CD)
age I: 40°C/24°C	Dry, wet concrete and	σ	[N]/ma ma 2]	7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5	8,5	8,5
<i>≂</i> ♀													
Temperature range II: 40°C/24°C	flooded bore	^τ Rk,cr	[N/mm²]	6,0	6,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0
Reduction factor $\psi^0_{\ \ SL}$	flooded bore hole in cracked and	d uncracked	concrete	C20/2		ĺ		·		ĺ	ŕ	ĺ	Í
Reduction factor $\psi^0_{\mbox{ st}}$ holes (CD) and in har	flooded bore hole is in cracked and mmer drilled hole	d uncracked	concrete	C20/2		ĺ		d holes	 s (HD)	ĺ	ŕ	ĺ	Í
Reduction factor $\psi^0_{\mbox{ st}}$ holes (CD) and in har	flooded bore hole is in cracked and mmer drilled hole Dry, wet concrete and	d uncracked es with hollo	concrete w drill bit (C20/2		ĺ		d holes		ĺ	ŕ	ĺ	Í
Reduction factor ψ ⁰ _{SL} holes (CD) and in har	flooded bore hole in cracked and mmer drilled hole Dry, wet	d uncracked	concrete	C20/2		ĺ		d holes	 s (HD)	ĺ	ŕ	ĺ	Í
Reduction factor $\psi^0_{\mbox{ st}}$ holes (CD) and in har	flooded bore hole in cracked and mmer drilled hole Dry, wet concrete and flooded bore	d uncracked es with hollo	concrete w drill bit (l	C20/2		ĺ		0,	(HD) 80	ĺ	ŕ	ĺ	Í
Reduction factor ψ ⁰ _{st} holes (CD) and in har bar and bar l: 40°C/24°C II: 72°C/50°C	flooded bore hole is in cracked and mmer drilled hole Dry, wet concrete and flooded bore hole	d uncracked es with hollo Ψ ⁰ sus	concrete w drill bit (C20/2		ĺ		0, 0, 1,	80 68 02 04	ĺ	ŕ	ĺ	Í
Reduction factor ψ ⁰ _{st} holes (CD) and in har and a holes (ED) and in har a holes [I: 40°C/24°C] H: 72°C/50°C] Increasing factors for contents and a holes (CD) and in har and in har and a holes (CD) and in har a holes (CD) and in holes	flooded bore hole is in cracked and mmer drilled hole Dry, wet concrete and flooded bore hole	d uncracked es with hollo Ψ ⁰ sus C25 C30 C35	concrete w drill bit ([-] /30 /37	C20/2		ĺ		0, 0, 1, 1,	80 68 02 04 07	ĺ	ŕ	ĺ	Í
Reduction factor ψ ⁰ _{st} holes (CD) and in har bar and bar l: 40°C/24°C II: 72°C/50°C	flooded bore hole is in cracked and mmer drilled hole Dry, wet concrete and flooded bore hole	d uncracked es with hollo Ψ ⁰ sus C25 C30 C35 C40	concrete w drill bit (I [-] /30 /37 /45	C20/2		ĺ		0, 0, 1, 1, 1,	80 68 02 04 07	ĺ	ŕ	ĺ	Í
Reduction factor ψ ⁰ _{st} holes (CD) and in har and a holes (ED) and in har a holes [I: 40°C/24°C] H: 72°C/50°C] Increasing factors for contents and a holes (CD) and in har and in har and a holes (CD) and in har a holes (CD) and in holes	flooded bore hole is in cracked and mmer drilled hole Dry, wet concrete and flooded bore hole	d uncracked es with hollo Ψ ⁰ sus C25 C30 C35	concrete w drill bit (I [-] /30 /37 /45 /50	C20/2		ĺ		0, 0, 1, 1, 1, 1,	80 68 02 04 07	ĺ	ŕ	ĺ	Í
Reduction factor ψ ⁰ _{st} holes (CD) and in har and a holes (ED) and in har a holes [I: 40°C/24°C] H: 72°C/50°C] Increasing factors for contents and a holes (CD) and in har and in har and a holes (CD) and in har a holes (CD) and in holes	flooded bore hole is in cracked and mmer drilled hole Dry, wet concrete and flooded bore hole concrete	uncracked es with hollo Ψ ⁰ sus C25 C30 C35 C40 C45	concrete w drill bit (I [-] /30 /37 /45 /50	C20/2		ĺ		0, 0, 1, 1, 1, 1,	80 68 02 04 07 08 09	ĺ	ŕ	ĺ	Í
Reduction factor ψ ⁰ _{SL} holes (CD) and in har and the factor by a like a lik	flooded bore hole is in cracked and mmer drilled hole Dry, wet concrete and flooded bore hole concrete	uncracked es with hollo Ψ ⁰ sus C25 C30 C35 C40 C45	concrete w drill bit (I [-] /30 /37 /45 /50	C20/2		ĺ	drilled	0, 0, 1, 1, 1, 1,	80 68 02 04 07 08 09	, comp	ŕ	ĺ	Í
Reduction factor ψ^0_{SL} holes (CD) and in har like $\frac{1}{40^{\circ}\text{C}/24^{\circ}\text{C}}$ II: $40^{\circ}\text{C}/24^{\circ}\text{C}$ II: $72^{\circ}\text{C}/50^{\circ}\text{C}$ Increasing factors for ψ_c	flooded bore hole is in cracked and mmer drilled hole Dry, wet concrete and flooded bore hole concrete	uncracked es with hollo Ψ ⁰ sus C25 C30 C35 C40 C45	concrete w drill bit (I [-] /30 /37 /45 /50	C20/2		ĺ	drilled	0, 0, 1, 1, 1, 1, see Ta	80 68 02 04 07 08 09 10	, comp	ŕ	ĺ	Í
Reduction factor ψ^0_{SL} holes (CD) and in har list 40°C/24°C list 72°C/50°C list 72°C/50°C Concrete cone failure Relevant parameter Splitting Relevant parameter	flooded bore hole is in cracked and mmer drilled hole Dry, wet concrete and flooded bore hole concrete	uncracked es with hollo Ψ ⁰ sus C25 C30 C35 C40 C45	concrete w drill bit (I [-] /30 /37 /45 /50	C20/2		ĺ	drilled	0, 0, 1, 1, 1, 1, see Ta	80 68 02 04 07 08 09	, comp	ŕ	ĺ	Í
Reduction factor ψ^0_{SL} holes (CD) and in har list 40°C/24°C II: 40°C/24°C II: 72°C/50°C Increasing factors for ψ^0_{C} Concrete cone failure Relevant parameter Splitting Relevant parameter Installation factor	flooded bore hole is in cracked and mmer drilled hole Dry, wet concrete and flooded bore hole concrete	d uncracked es with hollo Ψ ⁰ sus C25 C30 C35 C40 C45	concrete w drill bit (I [-] /30 /37 /45 /50	C20/2		ĺ	drilled	0, 0, 1, 1, 1, 1, see Ta	80 68 02 04 07 08 09 10 able C2	, comp	ŕ	ĺ	Í
Reduction factor ψ^0_{SL} holes (CD) and in har i	flooded bore hole is in cracked and mmer drilled hole Dry, wet concrete and flooded bore hole concrete	d uncracked es with hollo Ψ ⁰ sus C25 C30 C35 C40 C45	concrete w drill bit (I [-] /30 /37 /45 /50	C20/2		ĺ	drilled	0, 0, 1, 1, 1, 1, see Ta	80 68 02 04 07 08 09 10 able C2	, comp	ŕ	ĺ	
Reduction factor \$\psi^0_{SL}\$ holes (CD) and in har specific and in har literature. It is 40°C/24°C literature. It is 72°C/50°C literature. Increasing factors for comparison of the second parameter. Splitting Relevant parameter. Installation factor for dry and wet concrete for flooded bore hole (1) fuk shall be taken from the second parameter. In the second parameter for dry and wet concrete for flooded bore hole (1) fuk shall be taken from the second parameter.	flooded bore hole is in cracked and mmer drilled hole Dry, wet concrete and flooded bore hole concrete te (HD; HDB, CD HD; HDB, CD) m the specification	d uncracked es with hollo Ψ ⁰ sus C25 C30 C35 C40 C45 C50	concrete w drill bit (I [-] /30 /37 /45 /50 /55 /60	C20/2		ĺ	drilled	0, 0, 1, 1, 1, 1, see Ta	80 68 02 04 07 08 09 10 able C2	, comp	ŕ	ĺ	
Reduction factor ψ ⁰ _{SL} holes (CD) and in har 1: 40°C/24°C 1: 72°C/50°C Increasing factors for α Ψ _C Concrete cone failure Relevant parameter Splitting Relevant parameter Installation factor Installation fa	flooded bore hole is in cracked and mmer drilled hole Dry, wet concrete and flooded bore hole concrete te (HD; HDB, CD) m the specification al regulation	d uncracked es with hollo Ψ ⁰ sus C25 C30 C35 C40 C45 C50 γinst ns of reinforci	concrete w drill bit (I [-] /30 /37 /45 /50 /55 /60 [-] ng bars	C20/2 HDB)	5 in h	ĺ	drilled	0, 0, 1, 1, 1, 1, see Ta	80 68 02 04 07 08 09 10 able C2	, comp	ŕ	ĺ	



Anchor size reinforci	ction for a we	J	0. 100			Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 3
Steel failure	ing bai			20	2 10	2 12	דו ש	2 10	<i>D</i> 20	D 2-7	2 23	20	12 0
Characteristic tension	resistance	N _{Rk,s}	[kN]					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 a	nd concrete fail	-	1					- ,					
Characteristic bond re			crete C20/	'25 in I	namme	er drille	ed hole	es (HD) and	compr	essed	air dril	led
I: 40°C/24°C	Dry, wet concrete and	TDI	[N/mm²]	16	16	16	16	16	16	15	15	15	15
H: 72°C/50°C	flooded bore hole	^τ Rk,ucr,100	[[N/]]]	12	12	12	12	12	12	12	12	11	11
Characteristic bond re	sistance in uncra	cked concre	te C20/25	in han	nmer d	rilled h	noles v	vith ho	llow d	rill bit (HDB)		
<u>е</u> I: 40°С/24°С	Dry, wet			14	14	13	13	13	13	13	13	13	13
E 40°C/24°C 1: 40°C/24°C 1: 40°C/24°C 1: 72°C/50°C 1: 72°C/50°C	concrete	_	[N]/ma ma 21	12	12	12	11	11	11	11	11	11	11
원 년 I: 40°C/24°C	flooded bore	^τ Rk,ucr,100	[N/mm²]	13	13	13	13	13	13	13	13	13	13
ਜ਼ <u>ਜ਼ਿ</u> ਜ਼ਿ: 72°C/50°C	hole			11	11	11	11	11	11	11	11	11	11
and in hammer drilled and hammer drilled and in hammer drilled and	Dry, wet concrete and	vw drill bit (HI	DB) [N/mm²]	6,5	6,5	7,5	7,5	7,5	7,5	7,5	7,5	7,5	7,
Б II: 72°С/50°С	flooded bore hole	,,		5,5	5,5	6,5	6,5	6,5	6,5	6,5	6,5	6,5	6,5
•	1	C25.	/30					1,	02				
		C30							04				
Increasing factors for o	concrete	C35							07				
Ψc		C40							80				
		C45.							09 10				
Concrete cone failure	e	000	700					٠,	10				
Relevant parameter	_						:	see Ta	able C	2			
Splitting													
Relevant parameter							;	see Ta	able C	2			
Installation factor													
) γ _{inst}	[-]						,0				
for dry and wet concre		บาเรเ	LJ	I				- 1	,2				
for dry and wet concre for flooded bore hole (HD; HDB, CD)								,—				

CELO Injection system ResiFIX Pure Epoxy plus for concrete	
Performances Characteristic values of tension loads under static and quasi-static action	Annex C 12



	aracteristic tion for a wo						stati	c and	d qua	isi-si	atic		
Anchor size reinforcir	ng bar			Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Steel failure													
Characteristic tension r	esistance	N _{Rk,s}	[kN]					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 an	d concrete failu		1	of 50	years								
Characteristic bond re	sistance in unci	acked conc	rete C20/	/25 in (diamor	nd drill	ed hol	es (DE))				
Temperature range II: 40°C/20°C C	Dry, wet concrete and	TDI	[N/mm²]	14	13	13	13	12	12	11	11	11	11
Tem II: 72°C/50°C	flooded bore hole	^T Rk,ucr	[14/11111]	11	11	10	10	10	9,5	9,5	9,5	9,0	9,0
Reduction factor ψ^0_{sus}	in uncracked c	oncrete C20	0/25 in dia	amond	drilled	l holes	(DD)						
nperature range 	Dry, wet concrete and	\u0	r 1					0,	77				
Temperature range II: 40°C/24°C	flooded bore hole	Ψ ⁰ sus	[-]					0,	72				
		C25/	/30					1,	04				
		C30/							80				
Increasing factors for co	oncrete	C35/							12				
Ψ_{C}		C40/							15				
		C45/							17				
Combined sull out on	d concrete feili	C50		of 100	Voor			1,	19				
Combined pull-out an Characteristic bond re							ed hol	es (DF	<u>))</u>				
		201.00 00110	1.010 020/	_5 ///		ia ariii	54 1101						
Temperature range II: 72°C/50°C	Dry, wet concrete and flooded bore	τ _{Rk,ucr,100}	[N/mm²]	14	13	13	13	12	12	11	11	11	11
II: 72°C/50°C	hole	, ,		11	10	10	10	9,5	9,0	9,0	9,0	8,5	8,5
		C25/							04				
Inorogoina footasa fassas	onoroto	C30/							08				
Increasing factors for co	oncrete	C35/							12				
$\Psi_{\mathbf{c}}$		C40/							15 17				
		C50/							17 19				
Concrete cone failure		1 230/	· -	<u> </u>				.,	-				
Relevant parameter								see Ta	able C	2			
Splitting													
Relevant parameter								see Ta	able C	2			
Installation factor													
for dry and wet concrete	•	γinst	[-]					1	,0				
for flooded bore hole (D			<u> </u>		1	,2				1	,4		
1) f _{uk} shall be taken from 2) in absence of nationa		s of reinforci	ng bars										
CELO Injection syst	tem ResiFIX Pu	ıre Epoxy p	olus for c	oncre	te								
Performances Characteristic values of	tension loads un	der static and	d quasi-sta	itic acti	on					A	nnex	C 13	3



Anchor size 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			1	1		l				l	<u> </u>	1
Characteristic shear resistance	V ⁰ Rk,s	[kN]					0,5	· 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,V}	[-]		•	1		•	1,5 ²⁾	ı	•	,	
Ductility factor	k ₇	[-]						1,0				
Steel failure with lever arm		•	•									
Characteristic bending moment	М ⁰ _{Rk,s}	[Nm]					1.2	• W _{el}	• f _{uk} 1)			
Elastic section modulus	W _{el}	[mm³]	50	98	170	269	402	785	1357	1534	2155	3217
Partial factor	γ _{Ms,V}	[-]		•	ı	•		1,5 ²⁾		•	,	
Concrete pry-out failure		•	•									
Factor	k ₈	[-]						2,0				
Installation factor	γinst	[-]						1,0				
Concrete edge failure	•	•	•									
Effective length of fastener	If	[mm]			min(h	ef; 12	• d _{nor}	m)		min((h _{ef} ; 300	mm)
Outside diameter of fastener	d _{nom}	[mm]	8	10	12	14	16	20	24	25	28	32
Installation factor	γinst	[-]		•		•		1,0				

 $^{^{1)}\} f_{uk}$ shall be taken from the specifications of reinforcing bars $^{2)}$ in absence of national regulation

CELO Injection system ResiFIX Pure Epoxy plus for concrete	
Performances Characteristic values of shear loads under static and quasi-static action	Annex C 14



Table C15:	Displacements under tension load ¹⁾ in hammer drilled holes (HD),
	compressed air drilled holes (CD) and in hammer drilled holes with
	hollow drill bit (HDB)

Anchor size threaded ro	od		M8	M10	M12	M16	M20	M24	M27	M30		
Uncracked concrete un	Uncracked concrete under static and quasi-static action for a working life of 50 and 100 years											
Temperature range I:	δ_{N0} -factor	[mm/(N/mm²)]	0,028	0,029	0,030	0,033	0,035	0,038	0,039	0,041		
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,028	0,029	0,030	0,033	0,035	0,038	0,039	0,041		
Temperature range II:	δ_{N0} -factor	[mm/(N/mm²)]	0,038	0,039	0,040	0,044	0,047	0,051	0,052	0,055		
72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,047	0,049	0,051	0,055	0,059	0,064	0,067	0,070		
Cracked concrete unde	r static and c	uasi-static actior	n for a w	orking l	ife of 50	and 100) years					
Temperature range I:	δ_{N0} -factor	[mm/(N/mm²)]	0,069	0,071	0,072	0,074	0,076	0,079	0,081	0,082		
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,100	0,115	0,122	0,128	0,135	0,142	0,155	0,171		
Temperature range II:	δ_{N0} -factor	[mm/(N/mm²)]	0,092	0,095	0,096	0,099	0,102	0,106	0,109	0,110		
72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,134	0,154	0,163	0,172	0,181	0,189	0,207	0,229		

¹⁾ Calculation of the displacement

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

Table C16: Displacements under tension load¹⁾ in diamond drilled holes (DD)

•								•	•	
Anchor size threaded re	od		М8	M10	M12	M16	M20	M24	M27	M30
Uncracked concrete un	der static ar	nd quasi-static ac	tion for a	workin	g life of	50 years	S			
Temperature range I:	δ_{N0} -factor	[mm/(N/mm²)]	0,011	0,012	0,012	0,013	0,014	0,014	0,015	0,015
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,018	0,019	0,019	0,020	0,022	0,023	0,024	0,025
Temperature range II:	δ_{N0} -factor	[mm/(N/mm²)]	0,013	0,014	0,014	0,015	0,016	0,016	0,018	0,018
72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,052	0,053	0,055	0,058	0,062	0,065	0,068	0,070
Uncracked concrete un	der static ar	nd quasi-static ac	tion for a	workin	g life of	100 yea	rs			
Temperature range I:	δ_{N0} -factor	[mm/(N/mm ²)]	0,011	0,012	0,012	0,013	0,014	0,014	0,015	0,015
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,020	0,021	0,021	0,023	0,024	0,025	0,026	0,027
Temperature range II:	δ_{N0} -factor	[mm/(N/mm ²)]	0,013	0,014	0,014	0,015	0,016	0,016	0,018	0,018
72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,038	0,039	0,040	0,043	0,045	0,047	0,049	0,051

¹⁾ Calculation of the displacement

 $\delta_{\text{N0}} = \delta_{\text{N0}}\text{-factor} \cdot \tau;$

τ: action bond stress for tension

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

Table C17: Displacements under shear load¹⁾ for all drilling methods

Anchor size threaded rod				M10	M12	M16	M20	M24	M27	M30
Uncracked and crac	cked concrete unde	er static and qua	asi-stati	c action						
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

 $\delta_{V0} = \delta_{V0}$ -factor · V; V: action shear load

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

CELO Injection system ResiFIX Pure Epoxy plus for concrete

Performances

Displacements under static and quasi-static action (threaded rods)

Annex C 15



Table C18: Displacements under tension load¹⁾ in hammer drilled holes (HD), compressed air drilled holes (CD) and in hammer drilled holes with hollow drill bit (HDB)

Anchor size Internal thr	eaded anchor	rod	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 o	of 50 and 1	00 years		
Temperature range I:	δ _{N0} -factor	[mm/(N/mm²)]	0,029	0,030	0,033	0,035	0,038	0,041
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,029	0,030	0,033	0,035	0,038	0,041
Temperature range II:	δ _{N0} -factor	[mm/(N/mm²)]	0,039	0,040	0,044	0,047	0,051	0,055
72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,049	0,051	0,055	0,059	0,064	0,070
Cracked concrete under	static and qu	asi-static action	for a work	ing life of	50 and 100	years		
Temperature range I:	δ _{N0} -factor	[mm/(N/mm²)]	0,071	0,072	0,074	0,076	0,079	0,082
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,115	0,122	0,128	0,135	0,142	0,171
Temperature range II:	δ_{N0} -factor	[mm/(N/mm²)]	0,095	0,096	0,099	0,102	0,106	0,110
72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,154	0,163	0,172	0,181	0,189	0,229

¹⁾ Calculation of the displacement

$$\begin{split} \delta_{\text{N0}} &= \delta_{\text{N0}}\text{-factor} \cdot \tau; \\ \delta_{\text{N}\infty} &= \delta_{\text{N}\infty}\text{-factor} \cdot \tau; \end{split}$$

τ: action bond stress for tension

Table C19: Displacements under tension load¹⁾ in diamond drilled holes (DD)

Anchor size Internal three	eaded anchor r	od	IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20
Uncracked concrete und	der static and q	uasi-static actio	n for a wo	rking life o	of 50 years	1		
Temperature range I:	δ_{N0} -factor	[mm/(N/mm²)]	0,012	0,012	0,013	0,014	0,014	0,015
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,019	0,019	0,020	0,022	0,023	0,025
Temperature range II:	δ_{N0} -factor	[mm/(N/mm²)]	0,014	0,014	0,015	0,016	0,016	0,018
72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,053	0,055	0,058	0,062	0,065	0,070
Uncracked concrete und	der static and q	uasi-static actio	n for a wo	rking life o	of 100 year	s		
Temperature range I:	δ_{N0} -factor	[mm/(N/mm²)]	0,012	0,012	0,013	0,014	0,014	0,015
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,021	0,021	0,023	0,024	0,025	0,027
Temperature range II:	δ_{N0} -factor	[mm/(N/mm²)]	0,014	0,014	0,015	0,016	0,016	0,018
72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,039	0,040	0,043	0,045	0,047	0,051

¹⁾ Calculation of the displacement

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

Table C20: Displacements under shear load¹⁾ for all drilling methods

Anchor size Inter	rnal threaded a	nchor rod	IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20			
Uncracked and o	racked concret	ked concrete under static and quasi-static action									
All temperature	δ_{V0} -factor	[mm/kN]	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

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

V: action shear load

 $\delta_{V\infty} = \delta_{V\infty}$ -factor · V;

CELO Injection system ResiFIX Pure Epoxy plus for concrete

Performances

Displacements under static and quasi-static action (Internal threaded anchor rod)

Annex C 16



Table C21:	Displacements under tension load ¹⁾ in hammer drilled holes (HD),
	compressed air drilled holes (CD) and in hammer drilled holes with
	hollow drill bit (HDB)

Anchor size reinfo	orcing 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	tic and quasi-s	tatic ac	tion for	a work	ing life	of 50 a	nd 100	years			
Temp range I:	δ_{N0} -factor	[mm/(N/mm²)]	0,028	0,029	0,030	0,031	0,033	0,035	0,038	0,038	0,040	0,043
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,028	0,029	0,030	0,031	0,033	0,035	0,038	0,038	0,040	0,043
Temp range II:	δ_{N0} -factor	[mm/(N/mm²)]	0,038	0,039	0,040	0,042	0,044	0,047	0,051	0,051	0,054	0,058
72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,047	0,049	0,051	0,053	0,055	0,059	0,065	0,065	0,068	0,072
Cracked concrete	under statio	and quasi-stat	ic actio	n for a	workin	g life of	50 and	l 100 ye	ears			
Temp range I:	δ_{N0} -factor	[mm/(N/mm²)]	0,069	0,071	0,072	0,073	0,074	0,076	0,079	0,079	0,081	0,084
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,115	0,122	0,128	0,135	0,142	0,155	0,171	0,171	0,181	0,194
Temp range II:	δ_{N0} -factor	[mm/(N/mm²)]	0,092	0,095	0,096	0,098	0,099	0,102	0,106	0,106	0,109	0,113
72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,154	0,163	0,172	0,181	0,189	0,207	0,229	0,229	0,242	0,260

¹⁾ Calculation of the displacement

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

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

Table C22: Displacements under tension load¹⁾ in diamond drilled holes (DD)

Anchor size reinfo	Anchor size reinforcing bar			Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Uncracked concre	ete under sta	tic and quasi-s	tatic ac	tion for	a work	ing life	of 50 y	ears/				
Temp range I:	δ_{N0} -factor	[mm/(N/mm²)]	0,008	0,009	0,009	0,01	0,011	0,012	0,013	0,013	0,014	0,015
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,018	0,018	0,019	0,020	0,021	0,024	0,027	0,027	0,028	0,031
Temp range II:	δ_{N0} -factor	[mm/(N/mm²)]	0,009	0,011	0,011	0,012	0,013	0,014	0,015	0,015	0,016	0,018
72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,048	0,051	0,054	0,058	0,061	0,068	0,076	0,076	0,081	0,088
Uncracked concre	Uncracked concrete under static and quas					ing life	of 100	years				
Temp range I:	δ_{N0} -factor	[mm/(N/mm²)]	0,008	0,009	0,009	0,010	0,011	0,012	0,013	0,013	0,014	0,015
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,018	0,020	0,021	0,022	0,024	0,026	0,029	0,029	0,031	0,034
Temp range II:	δ_{N0} -factor	[mm/(N/mm ²)]	0,009	0,011	0,011	0,012	0,013	0,014	0,015	0,015	0,016	0,018
72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,035	0,037	0,040	0,042	0,045	0,049	0,055	0,055	0,059	0,064

¹⁾ Calculation of the displacement

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

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

Table C23: Displacements under shear load¹⁾ for all drilling methods

Anchor size rein	Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32		
Uncracked and	Incracked and cracked concrete under static and quasi-static action											
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

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

CELO Injection system ResiFIX Pure Epoxy plus for concrete

Performances

Displacements under static and quasi-static action (rebar)

Annex C 17

Installation factor

for dry and wet concrete (HD; HDB, CD)

for flooded bore hole (HD; HDB, CD)



1,0

1,2

Table	e C24:		cteristic val rmance cate								ırs						
Anchor	size threa	ded rod				M8	M10	M12	M16	M20	M24	M27	M30				
Steel fa	ailure																
Charact	Characteristic tension resistance N _{Rk,s,eq,C1} [kN] 1,0 • N _{Rk,s}																
Partial factor $\gamma_{Ms,N}$ [-] see Table C1										see Table C1							
Combir	ned pull-ou	t and co	ncrete failure														
1			ice in cracked a mmer drilled ho				hamm	er drille	ed hole	s (HD)	, comp	ressed	air				
Temperat ure range	I: 40°C/24	°C	Dry, wet concrete and	^τ Rk,eq,C1	[N/mm ²]	7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5				
Temp ure ra	II: 72°C/50)°C	flooded bore hole	^τ Rk,eq,C1	[N/mm²]	6,0	6,0	7,0	7,0	7,0	7,0	7,0 7,0					
Increasi	ing factors f	or concre	ete ψ _C	C25/30 to	C50/60				1	,0							

[-]

Table C25: Characteristic values of shear loads under seismic action (performance category C1)

 γ_{inst}

I												
Anchor size threaded rod		М8	M10	M12	M16	M20	M24	M27	M30			
Steel failure												
Characteristic shear resistance (Seismic C1)	V _{Rk,s,eq,C1}	[kN]	0,70 · V ⁰ _{Rk,s}									
Partial factor	$\gamma_{Ms,V}$	[-]	[-] see Table C1									
Factor for annular gap	α_{gap} [-] 0,5 (1,0) ¹⁾											

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

CELO Injection system ResiFIX Pure Epoxy plus for concrete	
Performances Characteristic values of tension and shear loads under seismic action (performance category C1) for a working life of 50 and 100 years (threaded rod)	Annex C 18



1,2

Table C26:	Characteristic values of tension loads under seismic action
	(performance category C1) for a working life of 50 and 100 years

Ancho	r size reinforcin	g bar			Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32	
Steel fa	ailure													•	
Charac	teristic tension re	esistance	N _{Rk,s,eq,C1}	[kN]	$1.0 \cdot A_s \cdot f_{uk}^{1)}$										
Cross section area A _s [mn					50	79	113	154	201	314	452	491	616	804	
Partial factor Y _{Ms,N} [-						1,42)									
Combi	ned pull-out and	d concrete failu	ire	•											
	Characteristic bond resistance in cracked and uncracked concrete C20/25 in hammer drilled holes (HD), compressed air drilled holes (CD) and in hammer drilled holes with hollow drill bit (HDB)														
rature ge	I: 40°C/24°C	Dry, wet concrete and	^τ Rk,eq,C1	[N/mm²]	7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5	8,5	8,5	
T: 40°C/24°C Dry, wet concrete and flooded bore hole TRk,eq,C1 [N/m]					6,0	6,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0	
Increas	C50/60		•	•		1	,0	•	•	•					
	ation factor		•												
for dry	for dry and wet concrete (HD; HDB, CD)					1,0									

¹⁾ fuk shall be taken from the specifications of reinforcing bars

for flooded bore hole (HD; HDB, CD)

Table C27: Characteristic values of shear loads under seismic action (performance category C1)

Anchor size reinforcing bar	Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32		
Steel failure	•	•	•	•								
Characteristic shear resistance	V _{Rk,s,eq,C1}	[kN]					0,35	• 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,V}	[-]						1,52)				
Factor for annular gap	[-]	0,5 (1,0) ³⁾										

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

CELO Injection system ResiFIX Pure Epoxy plus for concrete	
Performances Characteristic values of tension and shear loads under seismic action (performance category C1) for a working life of 50 and 100 years (rebar)	Annex C 19

²⁾ in absence of national regulation

²⁾ in absence of national regulation

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

Installation factor

for dry and wet concrete (HD; HDB, CD)

for flooded bore hole (HD; HDB, CD)



1,0

1,2

Table C28:	Characteristic values of tension loads under seismic action
	(performance category C2) for a working life of 50 and 100 years

Anchor size threaded rod			M12	M16	M20	M24	
Steel failure							
Characteristic tension resistar Steel, strength class 8.8 Stainless Steel A4 and HCR, Strength class ≥70	nce,	N _{Rk,s,eq,C2}	[kN]		1,0 •	$N_{Rk,s}$	
Partial factor		γMs,N	[-]	see Table C1			
Combined pull-out and con-	crete failure						
Characteristic bond resistance drilled holes (CD) and in ham					ner drilled hole	es (HD), comp	ressed air
1.40 G/24 G	Ory, wet concrete and	^τ Rk,eq,C2	[N/mm²]	5,8	4,8	5,0	5,1
	looded bore nole	^τ Rk,eq,C2	[N/mm ²]	5,0	4,1	4,3	4,4
Increasing factors for concrete	e ψ _C	C25/30 to	C50/60	1,0			

[-]

Table C29: Characteristic values of shear loads under seismic action (performance category C2)

 γ_{inst}

Anchor size threaded rod			M12	M16	M20	M24
Steel failure						•
Characteristic shear resistance Steel, strength class 8.8 Stainless Steel A4 and HCR, Strength class ≥70	V _{Rk,s,eq,C2}	[kN]		0,70 •	V ⁰ _{Rk,s}	
Partial factor	γ _{Ms,V}	[-]	see Table C1			
Factor for annular gap	$\alpha_{\sf gap}$	[-]		0,5 (1,0)1)	

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

CELO Injection system ResiFIX Pure Epoxy plus for concrete	
Performances Characteristic values of tension and shear loads under seismic action (performance category C2) for a working life of 50 and 100 years (threaded rod)	Annex C 20



Table C30: Displacements under tension load (threaded rod)							
Anchor size threaded rod M12 M16 M20 M24							
Uncracked and cracked concrete under seismic action (performance category C2)							
All temperature	δ N,eq,C2(DLS)	[mm]	0,21	0,24	0,27	0,36	
ranges	δ N,eq,C2(ULS)	[mm]	0,54	0,51	0,54	0,63	

Table C31: Displacements under shear load (threaded rod)

Anchor size threaded rod			M12	M16	M20	M24
Uncracked and cracked concrete under seismic action (performance category C2)						
All temperature	$\delta_{V,eq,C2(DLS)}$	[mm]	3,1	3,4	3,5	4,2
ranges	$\delta_{V,eq,C2(ULS)}$	[mm]	6,0	7,6	7,3	10,9

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Performances Displacements under seismic action (performance category C2) (threaded rods)	Annex C 21