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European Technical Assessment Body for construction products



European Technical Assessment

ETA-20/1280 of 20 August 2024

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	Injection System EJOT MULTIFIX Epoxy / Sormat ITH Epoxy for concrete
Product family to which the construction product belongs	Bonded fastener for use in concrete
Manufacturer	EJOT SE & Co. KG Market Unit Construction In der Stockwiese 35 57334 Bad Laasphe GERMANY
Manufacturing plant	EJOT Herstellwerk 24
This European Technical Assessment contains	49 pages including 3 annexes which form an integral part of this assessment.
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	EAD 330499-02-0601, Edition 12/2023
This version replaces	ETA-20/1280 issued on 9 March 2021



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Specific Part

1 Technical description of the product

The "Injection System EJOT MULTIFIX Epoxy / Sormat ITH Epoxy for concrete" is a bonded anchor consisting of a cartridge with injection mortar Injection mortar EJOT MULTIFIX SE1000 SEISMIC / Sormat ITH-EPOXe+ and a steel element according to Annex A 3 and Annex 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 6, C 8 to C 11, C 13 to C 16, B 3
Characteristic resistance to shear load (static and quasi-static loading)	See Annex C 1, C 7, C 12, C 17
Displacements under short-term and long-term loading	See Annex C 18 to C 20
Characteristic resistance and displacements for seismic performance categories C1 and C2	See Annex C 21 to C 28

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire	See Annex C 29 to C 31

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

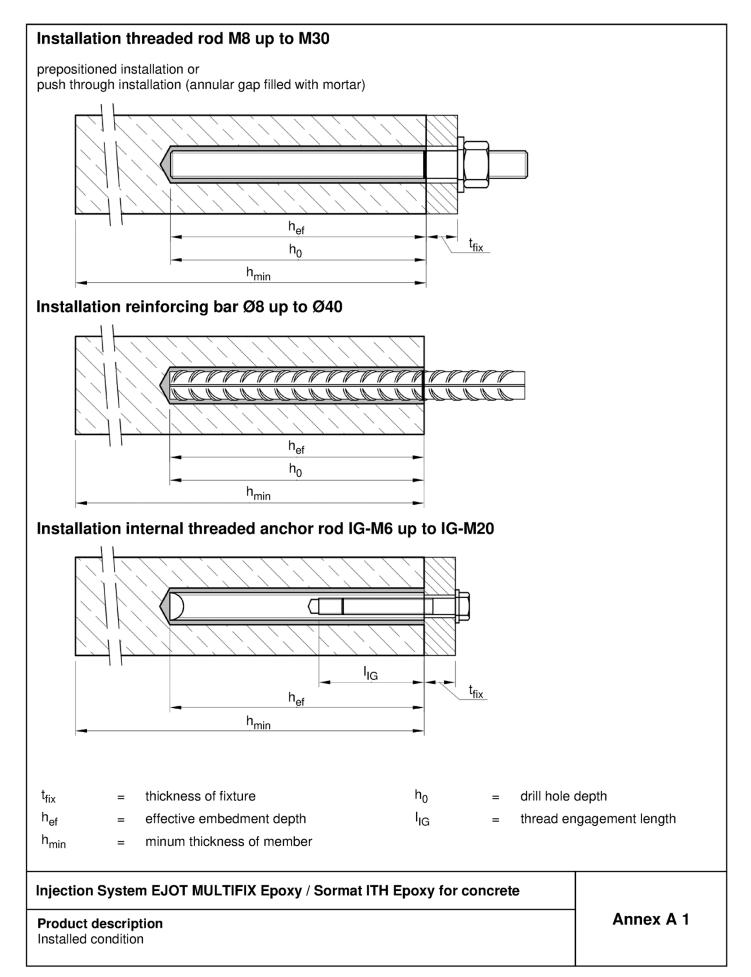
5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable European Assessment Document

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

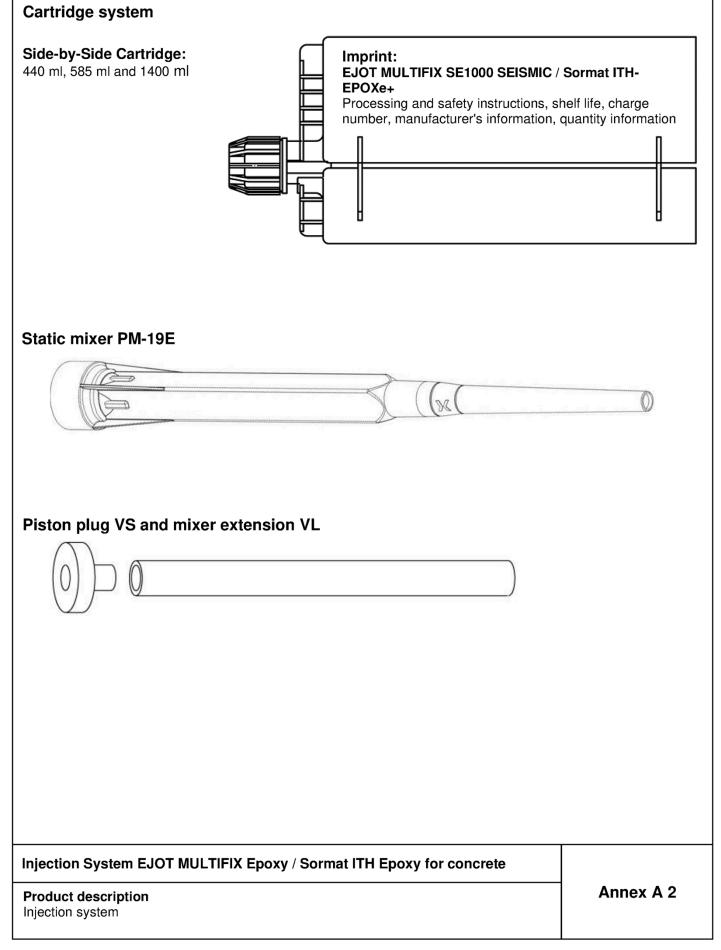
Issued in Berlin on 20 August 2024 by Deutsches Institut für Bautechnik

Beatrix Wittstock Head of Section *beglaubigt:* Baderschneider

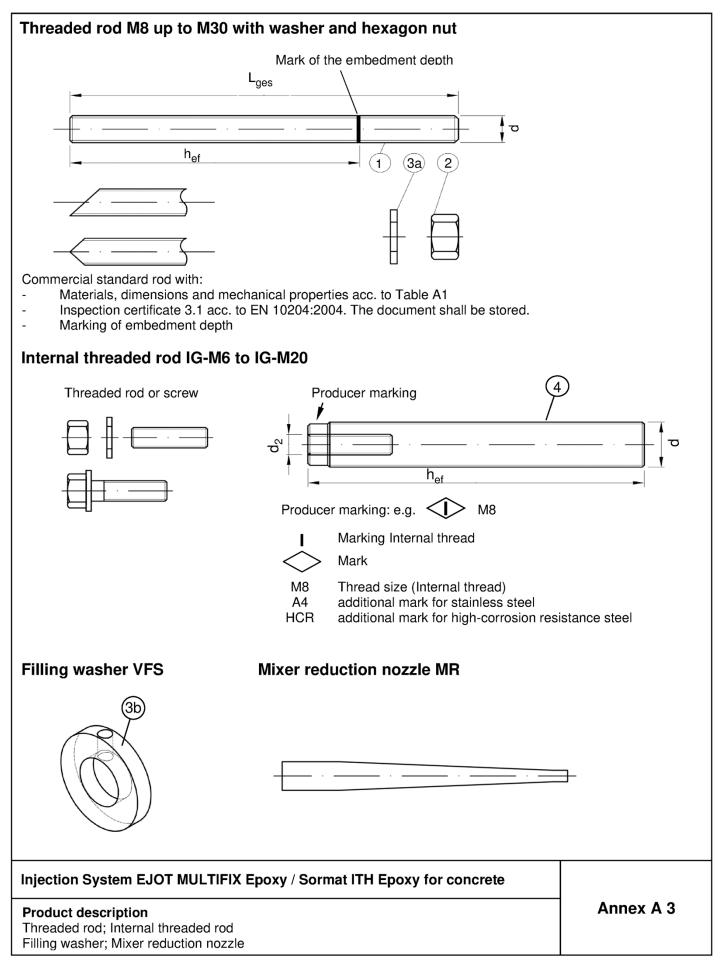














Part	Designation	Material								
Stee	el, zinc plated (Steel	acc. to EN ISO 683-4:2								
		5 µm acc. to EN ISO			2004 . A C 2000 or					
		15 μm acc. to EN ISO		1:2022 and EN ISO 10684: 68:2016	2004+AC.2009 01					
		Property class		Characteristic steel ultimate tensile strength	Characteristic steel yield strength	Elongation at fracture				
			4.6	f _{uk} = 400 N/mm ²	$f_{yk} = 240 \text{ N/mm}^2$	A ₅ > 8%				
1	Threaded rod		4.8	f _{uk} = 400 N/mm ²	f _{yk} = 320 N/mm ²	A ₅ > 8%				
	meaded fou	acc. to		f _{uk} = 500 N/mm ²	$f_{yk} = 300 \text{ N/mm}^2$	A ₅ > 8%				
		EN ISO 898-1:2013		$f_{uk} = 500 \text{ N/mm}^2$	$f_{vk} = 400 \text{ N/mm}^2$	A ₅ > 8%				
				$f_{\rm uk} = 800 \text{ N/mm}^2$	$f_{vk} = 640 \text{ N/mm}^2$	$A_5 \ge 12\%^{(3)}$				
			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						
			8	for anchor rod class 8.8						
3a	Washer			galvanised or sherardized		7004.0000				
3b	Filling washer			EN ISO 7089:2000, EN ISC galvanised or sherardized	7.093:2000 or EN ISO	7094:2000)				
50			-uip	Characteristic steel	Characteristic steel	Elongation at				
	Internal threaded	Property class		ultimate tensile strength	yield strength	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	$f_{yk} = 640 \text{ N/mm}^2$	A ₅ > 8%				
Stai	nless steel A4 (Mate	rial 1.4401 / 1.4404 / 1 ce steel (Material 1.45	.457	1 / 1.4567 or 1.4541, acc. t 1 / 1.4362 or 1.4578, acc. t r 1.4565, acc. to EN 10088 Characteristic steel	o EN 10088-1:2014)	Elongation at				
		Property class		ultimate tensile strength	yield strength	fracture				
1	Threaded rod ¹⁾⁴⁾		50	f _{uk} = 500 N/mm ²	f _{yk} = 210 N/mm ²	A ₅ ≥ 8%				
		acc. to		acc. to EN ISO 3506-1:2020			70	f _{uk} = 700 N/mm ²	f _{yk} = 450 N/mm²	$A_5 \ge 12\%^{(3)}$
			80	f _{uk} = 800 N/mm ²	$f_{yk} = 600 \text{ N/mm}^2$	$A_5 \ge 12\%^{(3)}$				
		t-	50	for anchor rod class 50						
2	Hexagon nut ¹⁾⁴⁾	acc. to EN ISO 3506-1:2020	70	for anchor rod class 70						
				for anchor rod class 80		1 001 1				
3a	Washer	A4: Material 1.4401 / HCR: Material 1.4529	1.44 9 or	307 / 1.4311 / 1.4567 or 1.4 104 / 1.4571 / 1.4362 or 1.4 1.4565, acc. to EN 10088-1 EN ISO 7089:2000, EN ISC	578, acc. to EN 10088 : 2014	-1:2014				
3b	Filling washer	Stainless steel A4, H	igh c	orrosion resistance steel						
4	Internal threaded	Property class		Characteristic steel ultimate tensile strength	Characteristic steel yield strength	Elongation at fracture				
4	anchor rod ¹⁾²⁾	acc. to	50	$f_{uk} = 500 \text{ N/mm}^2$	f _{yk} = 210 N/mm ²	A ₅ > 8%				
		EN ISO 3506-1:2020		$f_{uk} = 700 \text{ N/mm}^2$	f _{yk} = 450 N/mm ²	A ₅ > 8%				
2) 3)	for IG-M20 only property $A_5 > 8\%$ fracture elongat		rform	ance category C2	d anchor rods up to IG-M1	6				
Pr	oduct description	OT MULTIFIX Epoxy		ormat ITH Epoxy for co	oncrete	Annex A 4				



Reinforcing bar: ø8 up to ø40		
	ANNININININININI AAAAAAAAAAAAAAAAAAAAAA	AAAAAA
Minimum value of related rip area f _{R,min} accor Rib height of the bar shall be in the range 0,0 (d: Nominal diameter of the bar; h _{rib} : Rib heig	5d ≤ h _{rib} ≤ 0,07d	
Table A2: Materials Reinforcing b	ar	
art Designation	Material	
ebar		
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 $f_{uk} = f_{tk} = k \cdot f_{yk}$	to EN 1992-1-1/NA
njection System EJOT MULTIFIX Epoxy Product description Materials reinforcing bar	/ Sormat ITH Epoxy for concrete	Annex A 5
58535.24		8.06.01-51/2



Fasteners subject to (Static	and quasi-static loa	ads):					
	Working life	50 years	Working	life 100 years			
Base material	uncracked concrete	cracked concrete	uncracked concre	ete cracked concrete			
HD: Hammer drilling HDB: Hammer drilling with hollow drill bit CD: Compressed air drilling	M8 to M Ø8 to Ø IG-M6 to I	Ø32,	M8 to M30, Ø8 to Ø32, IG-M6 to IG-M20				
HD: Hammer drilling CD: Compressed air drilling	Ø36 to Ø40	No performance assessed	Ø36 to Ø40	No performance assessed			
DD: Diamond drilling	M8 to M30, Ø8 to Ø40, IG-M6 to IG-M20	No performance assessed	M8 to M30, ∅8 to ∅40, IG-M6 to IG-M2	No performance assessed			
Temperature Range:	II: - 40 C 1	$\begin{array}{ccc} & +40 \ \mathrm{C}^{1)} \\ & +72 \ \mathrm{C}^{2)} \\ & +80 \ \mathrm{C}^{3)} \end{array}$	l: - 40 ll: - 40 lll: - 40	C to +72 C ²⁾			
Fasteners subject to (seismi	c action):						
	Performance C	Category C1	Performance Category C2				
Base material	Cracked and uncr	acked concrete	Cracked and uncracked concrete				
HD: Hammer drilling HDB: Hammer drilling with hollow drill bit CD: Compressed air drilling	M8 to M Ø8 to Ø	,	M12	M12 to M24			
DD: Diamond drilling	No performanc	e assessed	No perform	rmance assessed			
Temperature Range:	I: - 40 C t II: - 40 C t III: - 40 C t			$\begin{array}{ccc} C & to & +40 \ C^{1)} \\ C & to & +72 \ C^{2)} \\ C & to & +80 \ C^{3)} \end{array}$			
Fasteners subject to (fire exp	oosure):						
Base material		Cracked and unc	racked concrete				
HD: Hammer drilling HDB: Hammer drilling with hollow drill bit CD: Compressed air drilling		M8 to Ø8 to IG-M6 to	Ø 32 ,				
DD: Diamond drilling		No performar	ce assessed				
Temperature Range:		I: - 40 C II: - 40 C III: - 40 C	to +72 C ²⁾				
 (max. long-term temperature +24°C (max. long-term temperature +50°C (max. long-term temperature +60°C 	C and max. short-term ter	mperature +72°C)					
Injection System EJOT MULTI	FIX Epoxy / Sormat	ITH Epoxy for cor	ocrete				
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), compressed air (CD) or diamond drill mode (DD).
- 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.

Injection System EJOT MULTIFIX Epoxy / Sormat ITH Epoxy for concrete

Intended use Specifications (Continued) Annex B 2



Threaded rod							M8	M10	M12	M16		M20	M	<u>л</u>	M27	M30
Diameter of element			d = c	Jaam	[mi	nl	8	10	12	16	· •	20	2		27	30
Nominal drill hole dia	meter			d ₀	[mi	-	10	12	14	18	+	22	2		30	35
			h_	f,min	<u> </u>		60	60	70	80		90	9		108	120
Effective embedment	t depth	ŀ		f,max	[mi	-	160	200	240	320		400	_		540	600
Diameter of	Preposition	ed ins			- [mi	-	9	12	14	18		22	2	3	30	33
clearance hole in	Push thre	ouah ir	nstallatio	on d _f	[mi	-	12	14	16	20		24	3		33	40
the fixture Push through Maximum installation torque			max	·	[Nr	-	10	20	401)	60		100	_		250	300
					-	-		 _{ef} + 30 r				100				000
Minimum thickness of	of member			h _{min}	[mi	n]		≥ 100 m					h _{ef} +	2d ₀		
Minimum spacing				s _{min}	[mi	n]	40	50	60	75		95	11	5	125	140
Minimum edge distar	nce			c _{min}	[mi	n]	35	40	45	50		60	6	5	75	80
 Maximum installati 	ion toraue fo	r M12	with stee	el Grad	e 4.	6 is 3	85 Nm									
Table B2:	nstallatio	on pa	ramet	ters f	or	rein	forci	ng bar	•							
Reinforcing bar			Ø 8 ¹⁾	Ø 10 ¹⁾	a	101)	Ø 14	Ø 16	Ø 20	Ø 241)	a	5 1)	<i>(X</i> 28	<i>(</i> X 22	<i>(X</i> 26	Ø4
	d =															
Diameter of element	d _{nom}	[mm]	8	10		12	14	16	20	24	2	5	28	32	36	40
Nominal drill hole diameter	d ₀	[mm]	10 12	12 14	14	16	18	20	25	30 32	30	32	35	40	45	52/5
Effective embedment	t h _{ef,min}	[mm]	60	60		70	75	80	90	96	10	0	112	128	144	160
depth	h _{ef,max}	[mm]	160	200		40	280	320	400	480	50	0	560	640	720	800
Minimum thickness	h _{min}	[mm]		30 mm	≤ ו	$h_{ef} + 2d_0$										
of member				0 mm		20	70	75	05		-		120	150	100	200
Minimum spacing Minimum edge	s _{min}	[mm]	40	50	+	60	70	75	95	120	12		130	150	180	200
distance	C _{min}	[mm]	35	40	'	45	50	50	60	70	7	0	75	85	180	200
1) both nominal drill h	nole diamete	er can b	be used													
Table B3:	nstallatio	<u>n na</u>	ramo	ore f	or	Into	rnal t	broad	od an	chor	rod					
Internal threaded ar		л ра	ame							M10	IG-			N44C		1400
Internal diameter of a				l ₂ [mn	-1		- M6 6	IG-M8 8	_	10		12		3-M16 16	_	- M20 20
Outer diameter of an			$d = d_{nor}$	<u>m</u> [mn			0	12	_	16		20		24	_	30
Nominal drill hole dia				n [mn	-+-		2	14		18		22		28	_	35
	ineter		h _{ef,m}	<u> </u>	-+		50	70				- <u>-</u> 90		96	<u> </u>	120
Effective embedment	t depth		h _{ef,ma}		-+		00	240	_	20		00	480		<u> </u>	500
Diameter of clearanc hole in the fixture	е		d _f		-		7	9		12		14		18		22
Maximum installation	torque		max T _{in}	st [Nn	าไ	1	0	10	2	20	2	40		60	<u> </u>	100
Thread engagement min/max				G [mn	-	8/	20	8/20	10)/25	12	2/30		6/32	2	0/40
Minimum thickness o	of member		h _m	_{in} [mn	n]		h _{ef} + 30 ≥ 100					h	_{əf} + 2d	0		
			s _m	in [mn	n]	5	50	60		75	ę	95		115		140
Minimum spacing									_				_		_	
Minimum spacing Minimum edge distar	nce		с _т	in [mn	n]	4	10	45		50	6	50		65		80

Injection System EJOT MULTIFIX Epoxy / Sormat TTH Epoxy for concrete

Intended use

Installation parameters

Annex B 3



	KUTTE			manna	HARAN C		6		
hreaded Rod	Re- inforcing	Internal threaded anchor rod	d ₀ Drill bit - Ø	d _b Brush - Ø	d _{b,min} min.	Piston plug	1	lation direction of piston plu	
[mm]	bar [mm]	[mm]	DD HDB, CD [mm]	[mm]	Brush - Ø [mm]		↓		Î
 M8	8	Linni							
M10	8 / 10	IG-M6	10 12	RB10 11,5	10,5	-			
M10 M12			12	RB12 13,5	12,5	-	No plug	required	
	10 / 12 12	IG-M8	14	RB14 15,5 RB16 17,5	14,5 16,5	-			
- M16	12	- IG-M10	18			VS18			
OT IVI	14		20		18,5 20.5	VS18 VS20	-		
- M20		- IG-M12	20		20,5 22.5	VS20 VS22	-		
IVI20	-	IG-M12	22		22,5 25 5		-		
-	20	- IG-M16	25	RB25 27,0	25,5 28 5	VS25	h _{ef} >	h _{ef} >	~ !!
M24	-			RB28 30,0	28,5	VS28	250 mm	250 mm	all
M27	24 / 25	-	30	RB30 31,8	30,5	VS30	-		
-	24 / 25	-	32	RB32 34,0	32,5	VS32	-		
		IG-M20	35	RB35 37,0	35,5	VS35			
M30	28		40		40 5	1000	7		
-	32	-	40	RB40 43,5	40,5	VS40			
-		-	45	RB45 47,0	45,5	VS45			
- - - Cleaninę	32 36 40 g and inst	- - - allation to	45 52 - - 55				all	all	all
- Cleaning 1DB – Ho	32 36 40	- - - allation to	45 52 - - 55	RB45 47,0 RB52 54,0 RB55 58,5	45,5 52,5	VS45 VS52 VS55 I system cr and a class sure of 253	onsists of He	eller Duster E vith a minimu	xpert
- - - Cleaning HDB – Ho Compress min 6 bar)	32 36 40 g and insta llow drill bit	- - - allation to	45 52 - - 55	RB45 47,0 RB52 54,0 RB55 58,5	45,5 52,5 55,5 The hollow dril hollow drill bit a negative press	VS45 VS52 VS55 I system cr and a class sure of 253 's).	onsists of He	eller Duster E vith a minimu	xpert
- - - Cleaning 1DB – Ho Compress min 6 bar)	32 36 40 g and insta llow drill bit	- - - allation to	45 52 - - 55	RB45 47,0 RB52 54,0 RB55 58,5	45,5 52,5 55,5 The hollow dril hollow drill bit a negative press 150 m³/h (42 l/	VS45 VS52 VS55 I system cr and a class sure of 253 's).	onsists of He	eller Duster E vith a minimu	xpert
- - - Cleaning HDB – Ho Compress min 6 bar) Frush RB	32 36 40 g and insta llow drill bit Sed air tool	- - allation to system	45 52 - 55 ols	RB45 47,0 RB52 54,0 RB55 58,5	45,5 52,5 55,5 The hollow dril hollow drill bit a negative press 150 m³/h (42 l/	VS45 VS52 VS55 I system co and a class sure of 253 s).	onsists of He s M hoover v hPa and a f	eller Duster E vith a minimu	xpert



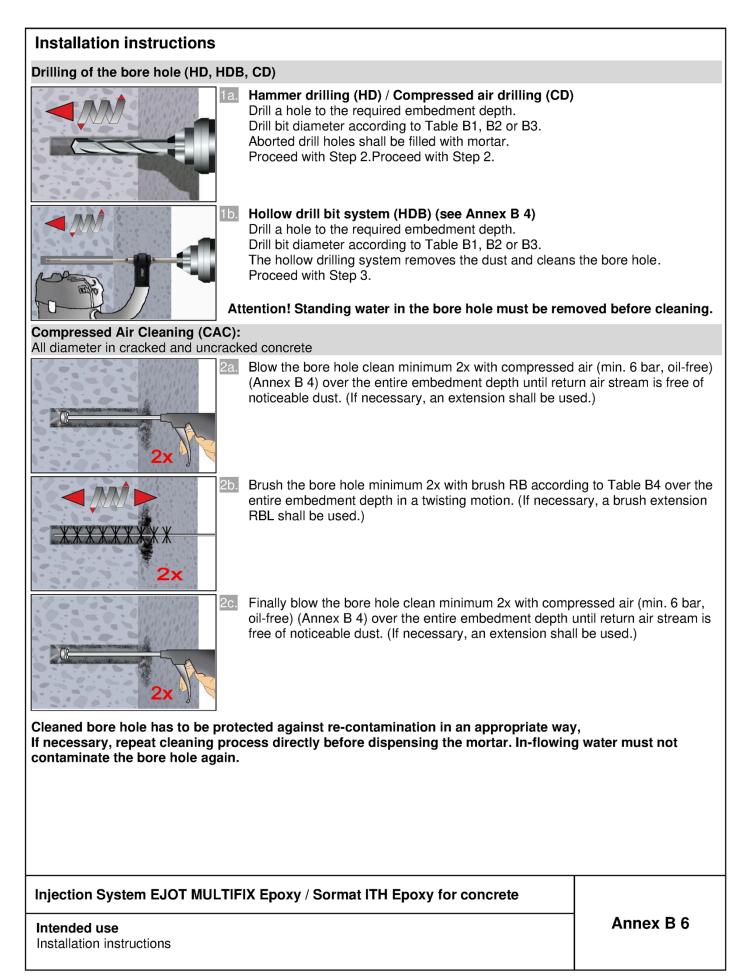
Table B5:	Worki	ng and curing	ı time	
Tempera	ture in bas	e material	Maximum working time	Minimum curing time ¹⁾
	Т		t _{work}	t _{cure}
+ 0°C	to	+ 4 °C	90 min	144 h
+ 5 °C	to	+ 9°C	80 min	48 h
+ 10 °C	to	+ 14 °C	60 min	28 h
+ 15°C	to	+ 19°C	40 min	18 h
+ 20 °C	to	+ 24 °C	30 min	12 h
+ 25 °C	to	+ 34 °C	12 min	9 h
+ 35 °C	to	+ 39 °C	8 min	6 h
	+ 40 °C		8 min	4 h
Cartr	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.

Injection System EJOT MULTIFIX Epoxy / Sormat ITH Epoxy for concrete

Intended use Working time and curing time Annex B 5

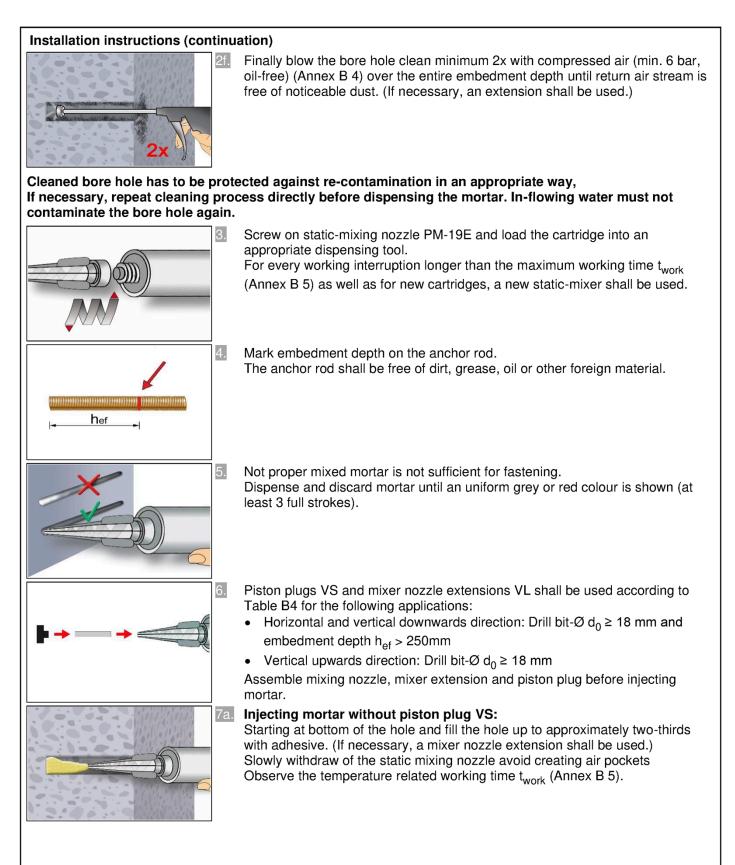






Installation instructions (continu	ation)	
Drilling of the bore hole (DD)		
1a.	Diamond drilling (DD) Drill a hole to the required embedment depth required Drill bit diameter according to Table B1, B2 or B3. Aborted drill holes shall be filled with mortar. Proceed with Step 2.	
Flush & Compressed Air Cleaning All diameter in uncracked concrete	(SPCAC):	
2a.	Flushing with water until clear water comes out.	
2b.	Brush the bore hole minimum 2x with brush RB accordi entire embedment depth in a twisting motion. (If necess RBL shall be used.)	
2c.	Flushing again with water until clear water comes out.	
Attention! Standing water in the	bore hole must be removed before proceeding.	
2d.	Blow the bore hole clean minimum 2x with compressed (Annex B 4) over the entire embedment depth until retu noticeable dust. (If necessary, an extension shall be use	rn air stream is free of
2e.	Brush the bore hole minimum 2x with brush RB accordi entire embedment depth in a twisting motion. (If necess RBL shall be used.)	
Injection System EJOT MULTIF	IX Epoxy / Sormat ITH Epoxy for concrete	
Intended use Installation instructions (continuation	on)	Annex B 7





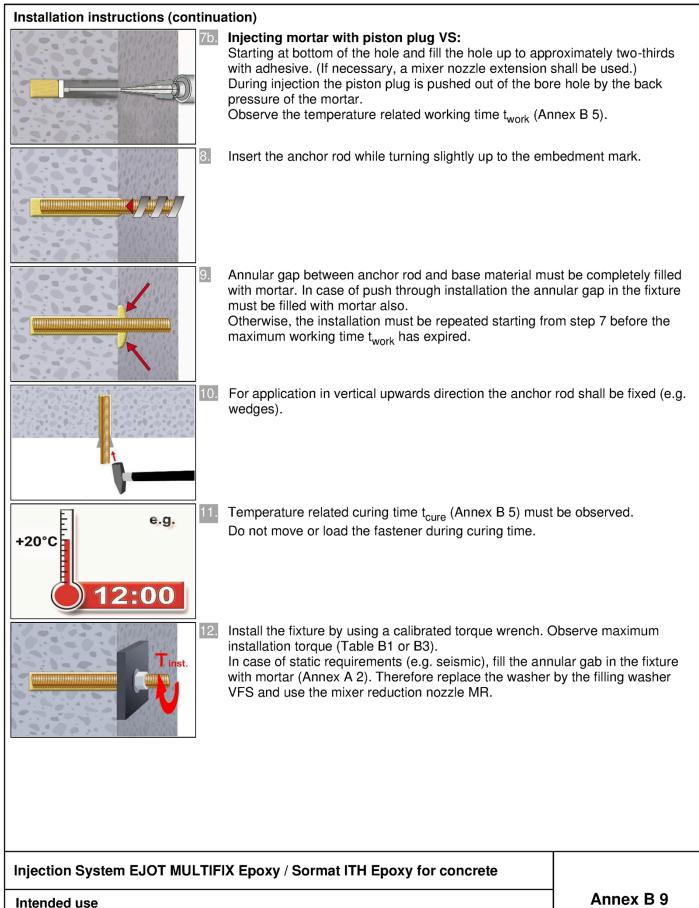
Injection System EJOT MULTIFIX Epoxy / Sormat ITH Epoxy for concrete

Intended use

Installation instructions (continuation)

Annex B 8





Installation instructions (continuation)



Т	Table C1: Characteristic values for steel tension resistance and steel shear resistance of threaded rods										
Tł	nreaded rod			M8	M10	M12	M16	M20	M24	M27	M30
Cr	ross section area	A _s	[mm ²]	36,6	58	84,3	157	245	353	459	561
CI	haracteristic tension resistance, Steel failu	re ¹⁾									
	eel, Property class 4.6 and 4.8	N _{Rk,s}	[kN]	15 (13)	23 (21)	34	63	98	141	184	224
St	eel, Property class 5.6 and 5.8	N _{Rk,s}	[kN]	18 (17)	29 (27)	42	78	122	176	230	280
St	eel, Property class 8.8	N _{Rk,s}	[kN]	29 (27)	46 (43)	67	125	196	282	368	449
St	ainless steel A2, A4 and HCR, class 50	N _{Rk,s}	[kN]	18	29	42	79	123	177	230	281
St	ainless steel A2, A4 and HCR, class 70	N _{Rk,s}	[kN]	26	41	59	110	171	247	_3)	_3)
St	ainless steel A4 and HCR, class 80	N _{Rk,s}	[kN]	29	46	67	126	196	282	_3)	_3)
CI	haracteristic tension resistance, Partial fac	tor ²⁾									
St	eel, Property class 4.6 and 5.6	γ _{Ms,N}	[-]				2,0	0			
St	eel, Property class 4.8, 5.8 and 8.8	γMs,N	[-]				1,5	5			
St	ainless steel A2, A4 and HCR, class 50	γMs,N	[-]				2,8	6			
St	ainless steel A2, A4 and HCR, class 70	γMs,N	[-]				1,8	87			
	ainless steel A4 and HCR, class 80	γ _{Ms,N}	[-]				1,6	6			
CI	naracteristic shear resistance, Steel failure	<u>,</u> 1)									
F	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
evel	Steel, Property class 8.8	V ⁰ Rk,s	[kN]	15 (13)	23 (21)	34	63	98	141	184	224
out	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)
5	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
		M ⁰ Rk,s	[Nm]	30 (26)	60 (53)	105	266	519	896	1333	1797
h lever	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)
CI	haracteristic shear resistance, Partial facto		1					1	1	1	L
	eel, Property class 4.6 and 5.6	γ _{Ms,V}	[-]				1,6	57			
St	eel, Property class 4.8, 5.8 and 8.8	γ _{Ms,V}	[-]				1,2	25			
St	ainless steel A2, A4 and HCR, class 50	γ _{Ms,V}	[-]				2,3	8			
St	ainless steel A2, A4 and HCR, class 70	γMs,V	[-]				1,5	6			
St	ainless steel A4 and HCR, class 80	γ _{Ms,V}	[-]				1,3	3			
1) Values are only valid for the given stress area	A. Value	s in bra	ckets are	e valid for	unders	ized thr	eaded r	ods with	smaller	r

 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) Fastener type not part of the ETA

Injection System EJOT MULTIFIX Epoxy / Sormat ITH Epoxy for concrete

Performances

Characteristic values for steel tension resistance and steel shear resistance of threaded rods

Annex C 1



Table C2: Characteristic values of tension loads under static and quasi-static action for a working life of 50 and 100 years Fastener All Fastener type and sizes Concrete cone failure Uncracked concrete k_{ucr,N} [-] 11,0 7,7 Cracked concrete k_{cr,N} [-] 1,5 h_{ef} Edge distance C_{cr,N} [mm] Axial distance [mm] 2 c_{cr.N} s_{cr,N} Splitting 1,0 h_{ef} $h/h_{ef} \ge 2,0$ 2 · h_{ef} h $2,0 > h/h_{ef} > 1,3$ 2,5 -Edge distance C_{cr,sp} [mm] h_{ef} $h/h_{ef} \le 1,3$ 2,4 h_{ef} 2 c_{cr,sp} Axial distance [mm] s_{cr,sp}

Injection System EJOT MULTIFIX Epoxy / Sormat ITH Epoxy 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



Tabl	le C3:		acteristic val working life			s und	der st	atic a	and q	uasi-	static	actic	n
Thread	ded rod					M8	M10	M12	M16	M20	M24	M27	M30
Steel f	ailure				1						•		
Charac	cteristic tens	ion resis	stance	N _{Rk,s}	[kN]			$A_{s} \cdot f_{u}$	_{uk} (or s	ee Tab	le C1)		
Partial	factor			γ _{Ms,N}	[-]				see Ta	able C1			
	-		oncrete failure	•		•							
Charac (CD)	cteristic bond	d resista	nce in uncracked	concrete C20	25 in hamr	ner dril	led hole	es (HD) and c	ompres	sed air	drilled	holes
Temperature range	I: 24°C/40	0°C	Dry, wet			20	20	19	19	18	17	16	16
mperat range	II: 50°C/72	2°C	concrete and flooded bore	^τ Rk,ucr	[N/mm²]	15	15	15	14	13	13	12	12
	III:60°C/80		hole			6,5	6,5	6,5	6,0	6,0	5,5	5,5	5,5
Charac	cteristic bond	d resista	nce in uncracked	concrete C20	25 in hamr	ner dril	led hole	es with	hollow	drill bit	(HDB)		
e e	I: 24°C/40	D°C				17	16	16	16	15	14	14	13
ranç	II: 50°C/72	2°C	Dry, wet concrete			14	14	14	13	13	12	12	11
l	III:60°C/80	0°C	concrete			6,5	6,5	6,5	6,0	6,0	5,5	5,5	5,5
ratu	I: 24°C/40	D∘C		^τ Rk,ucr	[N/mm ²]	16	16	16	15	15	14	14	13
Temperature range	II: 50°C/72		flooded bore			14	14	14	13	13	12	12	11
Ter	III:60°C/80		hole			6,5	6,5	6,5	6,0	6,0	5,5	5,5	5,5
Charac			nce in cracked c	ncrete C20/25	in hamme	,		,	,	<i>,</i>	^	,	,
			s with hollow drill					(),,	oompre				(02)
ture	원 I: 24°C/40°	0°C	Dry, wet		[N/mm²]	7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5
nperat range	II: 50°C/72	2°C	concrete and flooded bore	^τ Rk,cr		6,0	6,0	7,0	7,0	7,0	7,0	7,0	7,0
Ter	III:60°C/80	0°C	hole			5,0	5,0	5,0	4,5	4,5	4,5	4,5	4,5
			racked and uncra drilled holes with			hamme	er drille	d holes	s (HD),	compre	essed a	ir drille	d
· · · · · ·	I: 24°C/40		Dry, wet						0,	80			
Temperature range	II: 50°C/72	2°C	concrete and flooded bore	Ψ^0 sus	[-]				0,	68			
Ten	III:60°C/80	0°C	hole						0,	70			
Increas	sing factors	for conc	rete	Ψc	[-]				(f _{ck} / 2	20) ^{0,1}			
Charac	cteristic bond	d resista	ince depending	τ _{Rk,ucr} =				Ψc	• ^τ Rk.u	icr,(C20/	25)		
	concrete str			$\tau_{\rm Rk,cr} =$						cr.(C20/2	,		
Concr	ete cone fai	ilure							<u> </u>	51,(020/2	-0)		
	Int paramete								see Ta	able C2			
Splitting													
	int paramete								see Ta	ble C2			
	ation factor			1									
			HDB, CD)	γinst	[-]					,0			
	ded bore ho	ne (HD;	HDB, CD)							,2			
Perfo Char	njection System EJOT MULTIFIX Epoxy / Sormat ITH Epoxy for concrete Performances Characteristic values of tension loads under static and quasi-static action for a working life of 50 years (threaded rod) Annex C 3												



Tabl		racteristic val a working life			ls un	der st	atic a	and q	uasi-	static	actio	on
Thread	led rod				M8	M10	M12	M16	M20	M24	M27	M30
Steel fa	ailure		1									
Charac	teristic tension res	istance	N _{Rk,s}	[kN]			A _s ∙ f	_{uk} (or s	ee Tab	le C1)		
Partial	factor		γ _{Ms,N}	[-]				see Ta	able C1			
	ned pull-out and											
Charac (CD)	teristic bond resist	ance in uncracked	d concrete C20)/25 in hamr	ner dril	led hole	es (HD) and c	ompres	ssed ai	r drillec	l holes
ature	I: 24°C/40°C	Dry, wet			20	20	19	19	18	17	16	16
Temperature range	II: 50°C/72°C	concrete and flooded bore	^τ Rk,ucr,100	[N/mm²]	15	15	15	14	13	13	12	12
Ter	III:60°C/80°C	hole			6,5	6,5	6,5	6,0	6,0	5,5	5,5	5,5
Charac	teristic bond resist	ance in uncracked	d concrete C20)/25 in hamr	ner dril	led hole	es with	hollow	drill bi	t (HDB))	
je	I: 24°C/40°C				17	16	16	16	15	14	14	13
anç	II: 50°C/72°C	Dry, wet			14	14	14	13	13	12	12	11
nrei	III:60°C/80°C				6,5	6,5	6,5	6,0	6,0	5,5	5,5	5,5
erati	I: 24°C/40°C		^τ Rk,ucr,100	[N/mm ²]	16	16	16	15	15	14	14	13
Temperaturerange	II: 50°C/72°C	flooded bore			14	14	14	13	13	12	12	11
Te	III:60°C/80°C	hole			6,5	6,5	6,5	6,0	6,0	5,5	5,5	5,5
	teristic bond resist hammer drilled hol	5 in hamme	r drilleo	holes	(HD) ,	compre	essed a	air drille	d hole:	s (CD)		
lre	I: 24°C/40°C	Dry, wet			6,5	6,5	7,5	7,5	7,5	7,5	7,5	7,5
Temperature range	II: 50°C/72°C	concrete and flooded bore	^τ Rk,cr,100	[N/mm²]	5,5	5,5	6,5	6,5	6,5	6,5	6,5	6,5
Tem	III:60°C/80°C	hole			5,0	5,0	5,0	4,5	4,5	4,5	4,5	4,5
	ion factor $\psi^0_{sus,10}$ CD) and in hamme				5 in har	nmer d	rilled h	oles (H	ID), cor	npress	ed air c	drilled
	I: 24°C/40°C	Dry, wet						0,	80			
Temperature range	II: 50°C/72°C	concrete and flooded bore	Ψ^0 sus,100	[-]				0,	68			
Tem	III:60°C/80°C	hole						0,	70			
Increas	ing factors for con	crete	Ψc	[-]				(f _{ck} / 2	20) ^{0,1}			
Charac	teristic bond resist	ance depending	$\tau_{\text{Rk,ucr,100}} =$				$\psi_{\mathbf{C}}$.	^τ Rk,ucr	,100,(C2	20/25)		
on the	concrete strength	class	^τ Rk,cr,100 =				ψ_{C} .	^τ Rk,cr,	100,(C2	0/25)		
	ete cone failure											
	nt parameter							see Ta	able C2			
Splittin	ig nt parameter							500 Tr	able C2			
	ation factor							566 16				
	and wet concrete ((HD; HDB, CD)						1	,0			
	ded bore hole (HD		γinst	[-]					,2			
Inject	tion System EJ0		poxy / Sorma	at ITH Epo	xy for	conc	rete					
Performances Characteristic values of tension loads under static and quasi-static action for a working life of 100 years (threaded rod)										Anne	x C 4	•



Table C5: Chara for a	uasi-	static	actic	n														
Threaded rod				M8	M10	M12	M16	M20	M24	M27	M30							
Steel failure						A _s • f_{uk} (or see Table C1) see Table C1 see Table C1 ed holes (DD) 14 14 13 12 12 11 11 12 11 10 9,5 9,5 9,0 9,0 5,5 5,0 4,5 4,5 4,0 4,0												
Characteristic tension resis	tance	N _{Rk,s}	[kN]						le C1)									
Partial factor		γMs,N	[-]				see Ta	ble C1										
Combined pull-out and co		l concrete COO	OF in diam.	مرمما مايينا														
Characteristic bond resistan	nce in uncracked	concrete C20/	/25 in diamo				,											
	Dry, wet concrete and		INL/mage 21	15														
□ 0 0 11: 50°C/72°C □ 11: 60°C/80°C □ 11:60°C/80°C	flooded bore hole	^τ Rk,ucr	[N/mm ²]	12 5,5														
						5,0	4,5	4,5	4,5	4,0	4,0							
Reduction factor ψ^0_{sus} in u	ncracked concre	te C20/25 in di	amond drill	ed hole	es (DD)													
L: 24°C/40°C H: 20°C/72°C H: 50°C/72°C HI: 60°C/80°C	Dry, wet concrete and																	
II: 50°C/72°C	flooded bore hole	Ψ ⁰ sus	[-]															
· · · · · · · · · · · · · · · · · · ·							-											
Increasing factors for concr Characteristic bond resista		Ψc	[-]				(^I ck / 2	20) 0,2										
on the concrete strength cla		τ _{Rk,ucr} =				Ψc	• ^τ Rk,u	cr,(C20/	25)									
Concrete cone failure																		
Relevant parameter						see Ta	ble C2											
Splitting						T-	h la 00											
Relevant parameter							see Ta	ble C2										
	ח)			1,0														
for flooded bore hole (DD)	_ /	γinst	[-]		1,2													
Vinet																		
Injection System EJOT MULTIFIX Epoxy / Sormat ITH Epoxy for concrete Performances									Annex C 5									
Characteristic values of t for a working life of 50 ye		n																



Table C6: Chara for a	and q	uasi-	static	actio	on						
Threaded rod				M8	M10	M12	M16	M20	M24	M27	M30
Steel failure		1									
Characteristic tension resis	stance	N _{Rk,s}	[kN]			Α _s ・f	_{uk} (or s	ee Tab	le C1)		
Partial factor		γMs,N	[-]				see Ta	ıble C1			
Combined pull-out and co											
Characteristic bond resista	nce in uncracked	concrete C20/	25 in diamo	ond dril	lled hol	es (DD)				
₽ I: 24°C/40°C	Dry, wet			15	14	14	13	12	12	11	11
	concrete and flooded bore	^τ Rk,ucr,100	[N/mm²]	11	11	10	10	9,5	9,0	8,5	8,5
ص°C/80°C [⊑] III: 60°C	hole			5,5	5,5	5,0	4,5	4,5	4,5	4,0	4,0
Reduction factor $\psi^0_{sus,100}$	in uncracked cor	ncrete C20/25 i	n diamond	drilled	holes (I	DD)					
L: 24°C/40°C H: 20°C/72°C H: 50°C/72°C HI: 60°C/80°C	Dry, wet						0,	73			
II: 50°C/72°C	concrete and flooded bore	$\begin{array}{c c} \psi^{0}_{sus,100} & [-] & 0.70 \\ & 0.72 \\ \hline \psi_{c} & [-] & (f_{ck} / 20)^{0,2} \end{array}$									
[¯] <u>¯</u> III:60°C/80°C	hole										
Increasing factors for conci		Ψc	[-]				(f _{ck} / 2	20) ^{0,2}			
Characteristic bond resista on the concrete strength cla					Ψ_{c} .	^τ Rk,ucr	,100,(C2	20/25)			
Concrete cone failure											
Relevant parameter						see Ta	ble C2				
Splitting							h.l. 00				
Relevant parameter							see Ta	ible C2			
	חו			1,0							
for flooded bore hole (DD)	2)	γ _{inst}	[-]		1,2			,0	1,4		
Installation factor for dry and wet concrete (DD)											
Injection System EJOT MULTIFIX Epoxy / Sormat ITH Epoxy for concrete										x C 6	
	erformances haracteristic values of tension loads under static and quasi-static action r a working life of 100 years (threaded rod))



Threaded rod Steel failure without lever arm Characteristic shear resistance V ⁰ _{Rk,s} [kN Steel, strength class 4.6, 4.8 and 5.6, V ⁰ _{Rk,s} [kN Characteristic shear resistance V ⁰ _{Rk,s} [kN Steel, strength class 8.8 V ⁰ _{Rk,s} [kN Stainless Steel A2, A4 and HCR, all V ⁰ _{Rk,s} [kN Partial factor γ _{Ms,V} [-] Ductility factor k ₇ [-] Steel failure with lever arm Image: state stat	-	M10		M16 A _s • f _{uk} A _s • f _{uk}		M24 Table C Table C		M30							
Characteristic shear resistance Steel, strength class 4.6, 4.8 and 5.6, 5.8V ⁰ _{Rk,s} [kNCharacteristic shear resistance Steel, strength class 8.8 Stainless Steel A2, A4 and HCR, all strength classesV ⁰ _{Rk,s} [kNPartial factor $\gamma_{Ms,V}$ [-]Ductility factork7[-]	-														
Steel, strength class 4.6, 4.8 and 5.6, 5.8V ⁰ _{Rk,s} [kNCharacteristic shear resistance Steel, strength class 8.8 Stainless Steel A2, A4 and HCR, all strength classesV ⁰ _{Rk,s} [kNPartial factorγ _{Ms,V} [-]Ductility factork ₇ [-]	-														
Steel, strength class 8.8 Stainless Steel A2, A4 and HCR, all strength classesV ⁰ _{Rk,s} [kNPartial factor $\gamma_{Ms,V}$ [-]Ductility factork7[-]]		0,5 ·	A _s ∙f _{uk}	(or see	Table C	ble C1) ble C1) ble C1) 035 1387 1874 min(h _{ef} ; 300mm)								
Ductility factor k ₇ [-]	-	see Table C1 1,0													
				see	Table C	;1									
Steel failure with lever arm															
	I														
Characteristic bending moment M ⁰ _{Rk,s} [Nm	1]		1,2 • [•]	W _{el} • f _{uk}	(or see	Table C	C1)								
Elastic section modulus W _{el} [mm	³] 31	62	109	277	541	935	1387	1874							
Partial factor Y _{Ms,V} [-]				see	Table C	;1									
Concrete pry-out failure															
Factor k ₈ [-]		2,0													
Installation factor Yinst [-]					1,0										
Concrete edge failure															
Effective length of fastener I _f [mn	ו]	n	nin(h _{ef} ; 1	l2•d _{nor}	m)		min(h _{ef} ;	300mm)							
Outside diameter of fastener d _{nom} [mn	n] 8	10	12	16	20	24	27	30							
Installation factor γ _{inst} [-]					1,0										

Injection System EJOT MULTIFIX Epoxy / Sormat ITH Epoxy 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 7



	rking life of	00 yeu										
nternal threaded anchor rod	S			IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20			
Steel failure ¹⁾		N	TL-NIT	10	17	00	40	70	100			
Characteristic tension resistance		N _{Rk,s}	[kN]	10	17	29						
Steel, strength class	8.8	N _{Rk,s}	[kN]	16	27	46		121	196			
Partial factor, strength class 5.8		γMs,N	[-]			1	,5					
Characteristic tension resistance	,	N _{Rk,s}	[kN]	14	26	41	59	110	124			
Steel A4 and HCR, Strength cla	ass 70^{2}					1.07			0.00			
Partial factor		γMs,N	[-]			1,87			2,86			
Combined pull-out and conci								! - !!!				
CD)	in uncracked co	oncrete C	20/25 in n	ammer dr	illed holes	s (HD) and	compres	sed air dri	lied hole			
I: 24°C/40°C	Dry, wet			20	19	19	18	17	16			
Temperature II: 50°C/72°C	concrete and	^τ Rk,ucr	[N/mm²]	15	15	14						
range III:60°C/80°C	flooded bore	*RK,UCF		6,5	6,5	6,0						
Characteristic bond resistance	hole	 Decrete C	 20/25 in h	,		,	,	,	5,5			
I: 24°C/40°C				16	16	16		<u>, , , , , , , , , , , , , , , , , , , </u>	13			
II: 50°C/72°C	Dry, wet			14	10	13			11			
Temperature III:60°C/80°C	concrete	6,5	6,5	6,0			5,5					
range I: 24°C/40°C		^τ Rk,ucr	[N/mm ²]	16	16	15	42 76 12 67 121 19 1,5 59 110 12 2,8 2,8 2,8 and compressed air drilled holds 13 13 13 13 13 13 13 6,0 5,5 5,5 bllow drill bit (HDB) 15 14 13 15 14 13 12 1 6,0 5,5 5,5 5,5 5,5 bllow drill bit (HDB) 15 14 13 12 1 6,0 5,5 5,5 5,5 5,5 5,5 5,5 13 12 1 13 12 1 13 12 1 6,0 5,5 5,5 5,5 5,5 5,5 5,5 5,5 5,5 5,5 5,5 mpressed air drilled holes (C 8,5 8,5 8,6 0,70 7,0 7,7 4,5 4,5 4,5 4,5 4,5 4,5 4,5 4,5 4,5 4,5 4,5 4,5					
II: 50°C/72°C	flooded bore hole			14	14	13	13	12	11			
III:60°C/80°C				6,5	6,5	6,0	,	12 IG-M16 IG-M 76 123 121 199 121 199 110 124 2,8 ressed air drilled ho 110 124 13 12 13 12 14 13 12 11 5,5 5,5 bit (HDB) 14 12 11 5,5 5,5 air drilled holes (C 5 8,5 8,5 8,5 0 7,0 7,0 7,0 5 4,5 4,5 4,5 12 11 5,5 5,5 5 4,5 4 air drilled holes (C 5 8,5 6 4,5 9 7,0 7,0 7,0 6 4,5 9 22 2 2 2 2 2 2 2<				
Characteristic bond resistance			/25 in harr	nmer drille	ed holes (H	HD), comp	ressed air	drilled ho	les (CD			
and in hammer drilled holes wit	1			7.0	0.5	0.5	0.5	0.5	0.5			
Temperature I: 24°C/40°C	Dry, wet concrete and	Te		7,0	8,5	8,5						
range	flooded bore	^τ Rk,cr	[N/mm ²]	6,0	7,0	7,0		5,0 5,5 rill bit (HDB) 15 14 13 12 5,0 5,5 15 14 13 12 5,0 5,5 15 14 13 12 5,0 5,5 ed air drilled holes 3,5 8,5 7,0 7,0 4,5 4,5 ompressed air drilled 0,1 :20/25)	7,0			
III:60°C/80°C	hole			5,0	5,0	4,5	4,5	II2 IG-M16 IG- 2 76 1 7 121 1 7 121 1 9 110 1 9 110 1 9 110 1 9 110 1 9 110 1 9 110 1 9 110 1 9 110 1 9 110 1 9 110 1 9 130 2 9 14 1 14 12 1 15 14 1 12 1 1 12 1 1 13 12 1 14 12 1 15 8,5 8 0 7,0 7 5 4,5 2 0 70 7 5 4,5 2 0/25) 2 1	4,5			
Reduction factor $\psi^{0}{}_{sus}$ in cracl	ked and uncrac	ked conc	rete C20/2	5 in hamı	mer drillec	holes (HI	D), compre	essed air o	drilled			
noles (CD) and in hammer drille	ed holes with he	ollow drill	bit (HDB)									
I: 24°C/40°C	Dry, wet					0,	80					
Temperature II: 50°C/72°C	concrete and	Ψ^0 sus	[-]			0,	68					
range	flooded bore hole					0.	70					
ncreasing factors for concrete	1010	Ψc	[-]									
-												
Characteristic bond resistance	depending on		^τ Rk,ucr =									
he concrete strength class			^τ Rk,cr =			Ψc • ^τ Rk,	cr,(C20/25)					
Concrete cone failure						T						
Relevant parameter						see la	able C2					
Splitting failure Relevant parameter						500 To	blo C2					
nstallation factor						366 12						
or dry and wet concrete (HD; F						1	0					
or flooded bore hole (HD; HDE		γinst	[-]				,					
		ly with the	appropriat	te materia	and prope		,	al threade	d rod.			
The characteristic tension res	sistance for stee											
2) For IG-M20 strength class 50	is valid											
				Enovy fo	r concre	to						
Injection System EJOT M		ky / Sorr										



Internal three	ded anchor rod	rking life of			IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20			
Steel failure ¹⁾		5			IG-IND	IG-INO				IG-IVIZU			
	tension resistand	e. 5.8	N _{Rk,s}	[kN]	10	17	29	42	76	123			
Steel, strength		8.8	N _{Rk,s}	[kN]	16	27	46	67		196			
	strength class 5.8		γMs,N	[-]			_	_					
	tension resistand												
	HCR, Strength cla		N _{Rk,s}	[kN]	14	26	41	59	110	124			
Partial factor			γMs,N	[-]			1,87			2,86			
Combined pu	III-out and conci	rete cone failu	re										
Characteristic (CD)	bond resistance	in uncracked c	oncrete C20)/25 in hai	mmer drill	led holes	(HD) and	compress	sed air dri	led hole			
- .	I: 24°C/40°C	Dry, wet			20	19	19	18	17	16			
Temperature range	II: 50°C/72°C	concrete and flooded bore	^τ Rk,ucr,100	[N/mm²]	15	15	14	13	13	12			
range	III:60°C/80°C	hole			6,5	6,5	6,0	6,0	5,5	5,5			
Characteristic	bond resistance I: 24°C/40°C	in uncracked c	oncrete C20)/25 in hai	nmer drill 16				. ,				
	15	14	13										
	II: 50°C/72°C	Dry, wet concrete			14	14							
Temperature range	III:60°C/80°C I: 24°C/40°C		^τ Rk,ucr,100	[N/mm²]	6,5 16	6,5 16	7 29 42 76 121 7 46 67 121 19 1,5 6 41 59 110 12 6 41 59 110 12 1,87 2,8 bles (HD) and compressed air drilled holes 9 19 18 17 16 5 14 13 13 12 11 5 6,0 6,0 5,5 5,5 5 bles with hollow drill bit (HDB) 6 16 15 14 13 5 6,0 6,0 5,5 5,5 5 5 6 15 15 14 13 12 11 5 6,0 6,0 5,5 5,5 5						
range	II: 50°C/72°C	flooded bore			16	14			M12 IG-M16 IG- 42 76 1 57 121 1 59 110 1 59 110 1 59 110 1 59 110 1 59 110 1 59 110 1 50 5 5 18 17 1 13 13 1 $5,0$ 5,5 5 15 14 1 13 12 1 $5,0$ 5,5 5 64 air drilled holes (intrastructure decompressed air (intrastructure decompressed air) $0,1$ (C20/25) (C20/25) $C2$ $C2$ $C2$				
	III:60°C/80°C	hole			6,5	6,5			I12 IG-M16 IG-I 2 76 12 7 121 12 7 121 12 9 110 12 9 110 12 9 110 12 9 110 12 9 110 12 9 110 5,5 9 13 1 0 5,5 5 5 14 1 3 12 1 0 5,5 5 5 14 1 3 12 1 0 5,5 5 13 12 1 0 5,5 5 13 12 1 0 5,5 6 5 7,5 7 5 6,5 6 5 4,5 4 , compressed air 1 1 220/25) 2 22 2 2 <tr< td=""></tr<>				
	bond resistance r drilled holes wit			5 in hamn	,	,	,	,	,	· ·			
	I: 24°C/40°C	Dry, wet			6,5	7,5	7,5	7,5	7,5	7,5			
Temperature II	II: 50°C/72°C	concrete and flooded bore	^τ Rk,cr,100	[N/mm²]	5,5	6,5				6,5			
range	III:60°C/80°C	hole		[]	5,0	5,0			IG-M16 76 121 110 sed air dr 17 13 5,5 (HDB) 14 12 5,5 14 12 5,5 14 12 5,5 14 12 5,5 14 12 5,5 14 25) 25) 25) 25) 13 14 15 16,5 4,5 mpressed 25) 15 16 17 18 19 10 110 12 5,5 16 17 18 19 10 110 12 13 14 </td <td>4,5</td>	4,5			
Reduction fact			ucracked co	ncrete C2	,			,					
	CD) and in hamm							(112), 00	mpresseu	an			
	I: 24°C/40°C	Dry, wet					0.	80					
Temperature	II: 50°C/72°C	concrete and	Ψ^0 sus,100	[-]			,						
range	III:60°C/80°C	flooded bore hole											
Increasing fac		TIOLE		1			,						
	tors for concrete		Ψc	[-]									
	bond resistance	depending on	^τ Rk,	ucr,100 =		Ψ	′c ^{•τ} Rk,ucr	,100,(C20/2	25)				
the concrete s			^τ Rł	k,cr,100 =		1	^μ c ^{•τ} Rk,cr,	100,(C20/2	5)				
Concrete con													
Relevant para Splitting failu							see Ta	able C2					
Relevant para							see Ta	able C2					
Installation fa							000.10						
for dry and we	t concrete (HD; H	IDB, CD)		1 1 1			1	,0					
for flooded bo	re hole (HD; HDE	3, CD)	^γ inst	[-]			1	,2					
The charac		sistance for stee								d rod.			
Injection S	ystem EJOT M	ULTIFIX Epo	xy / Sorm	at ITH Ej	boxy for	concre	te						
	es ic values of tens g life of 100 year			atic actic	on		'	Annex (29				



Table C10		eristic value rking life of			ids und	ler stat	ic and o	quasi-s	tatic ac	tion			
	ded anchor rod	S			IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20			
Steel failure ¹⁾													
	tension resistanc	e, <u>5.8</u>	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			
	strength class 5.8		γMs,N	[-]			1	,5					
1	tension resistand HCR, Strength cla		N _{Rk,s}	[kN]	14	26	41	59	110	124			
Partial factor			γ _{Ms,N}	[-]			1,87			2,86			
	Ill-out and conci												
Characteristic	bond resistance	in uncracked co	oncrete C20	0/25 in dia	mond dril	led holes	(DD)						
Temperature	I: 24°C/40°C	Dry, wet concrete and			14	14	13	12	12	11			
range	II: 50°C/72°C	flooded bore	^τ Rk,ucr	[N/mm²]	12	11	10	9,5	9,5	9,0			
	III:60°C/80°C	hole			5,5	5,0	4,5	4,5	4,5	4,0			
Reduction fact	or ψ^0_{sus} in uncra	acked concrete	C20/25 in o	diamond d	rilled hole	es (DD)							
Temperature I: 24°C/40°C Dry, wet concrete and concre													
Temperature range	II: 50°C/72°C	flooded bore	Ψ^0 sus	[-]			0,	72					
	III:60°C/80°C	hole						72					
	tors for concrete		Ψc	[-]			(f _{ck} / 2	20) ^{0,2}					
Characteristic the concrete st	bond resistance of the tend to	depending on		τ _{Rk,ucr} =			Ψ c [•] ^τRk,ι	ıcr,(C20/25)				
Concrete con	-		I						-				
Relevant para							see Ta	able C2					
Splitting failu													
Relevant para							see Ta	able C2					
Installation fa								0					
	et concrete (DD)		γinst	[-]	1	2	1	,0 1	4				
	()	her) must comp					tv class of			d rod			
The charac	for flooded bore hole (DD) Yinst [-] 1,2 1,4 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												
	ystem EJOT M	ULTIFIX Epo	xy / Sorm	at ITH Ep	ooxy for	concret	e		nnex C	10			
	ces ic values of tens g life of 50 years				atic actic	on							



Table C11		eristic value rking life of			ids und	ler stat	ic and o	quasi-s	tatic ac	tion			
	ded anchor rod	S			IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20			
Steel failure ¹⁾		5.0	N	FLAND	10	17	00	40	70	100			
	tension resistand		N _{Rk,s}	[kN]	10	17	29	42	76	123			
Steel, strength		8.8	N _{Rk,s}	[kN]	16	27	46	67	121	196			
	strength class 5.8 tension resistance		γMs,N	[-]			1	,5					
Steel A4 and H	HCR, Strength cla	,	N _{Rk,s}	[kN]	14	26	41	59	110	124			
Partial factor			γMs,N	[-]			1,87			2,86			
	Il-out and conci												
Characteristic	bond resistance	In uncracked co	oncrete C20)/25 in dia			, , , , , , , , , , , , , , , , , , ,						
	I: 24°C/40°C	Dry, wet			14	14	13	12	12	11			
Temperature range	II: 50°C/72°C	concrete and flooded bore	^τ Rk,ucr,100	[N/mm²]	11	10	10	9,5	9,0	8,5			
	III:60°C/80°C	hole			5,5	5,0	4,5	4,5	4,5	4,0			
Reduction fact	or ψ ⁰ sus,100 in ι	uncracked conc	rete C20/2	5 in diamo	ond drilled	holes (D	D)						
	I: 24°C/40°C	Dry, wet					0,	73					
Temperature range	II: 50°C/72°C	concrete and flooded bore	Ψ^0 sus,100	[-]			0,	70					
	III:60°C/80°C	hole						72					
Increasing fact	ors for concrete		Ψc	[-]			(f _{ck} / 2	20) ^{0,2}					
Characteristic the concrete st	bond resistance of the tension of	depending on	^τ Rk,	ucr,100 =		ψ	c ^{•τ} Rk,ucr	r,100,(C20/2	25)				
Concrete con													
Relevant para							see Ta	able C2					
Splitting failu Relevant para							see Ta	able C2					
Installation fa							000 10						
for dry and we	t concrete (DD)			[]			1	,0					
for flooded bor	re hole (DD)		γinst	[-]	1,	2		1,	,4				
The charac	(incl. nut and was teristic tension res strength class 50	sistance for stee								u 10a.			
Performanc Characteristi	/stem EJOT M es ic values of tens g life of 100 year	ion loads unde	er static and	d quasi-st	-		e	A	nnex C	11			



Internal threaded anchor rods				IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20
Steel failure without lever arm ¹⁾								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	nd 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 arm ¹⁾									
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	nd 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		γ _{inst}	[-]				1,0		
Concrete edge failure			1						
Effective length of fastener		۱ _f	[mm]		min	(h _{ef} ; 12 • d	d _{nom})		min(h _{ef} ; 300mm
Outside diameter of fastener		d _{nom}	[mm]	10	12	16	20	24	30
Installation factor		γinst	[-]		1		1,0		1
 Fastenings (incl. nut and washe The characteristic tension resist For IG-M20 strength class 50 is 	ance for	omply with steel failure	the app e is valid	ropriate m for the in	aterial an ternal thre	d property eaded rod	r class of t and the fa	he interna Istening el	I threaded rod. ement.
Injection System EJOT MULTIFIX Epoxy / Sormat ITH Epoxy for concrete Annex C 12 Performances Annex C 12 Characteristic values of shear loads under static and quasi-static action for a working life of 50 and 100 years (Internal threaded anchor rod)							inex C 12		



	Characte for a wor					load	s un	der s	tatic	and	qua	si-st	atic a	actio	n
Reinforcing bar				Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32	Ø 36	Ø 40
Steel failure															
Characteristic tension resistance	on	N _{Rk,s}	[kN]						A _s ·	f _{uk} 1)			_		
Cross section area		A _s	[mm ²]	50	79	113	154	201	314	452	491	616	804	1018	1256
Partial factor		γMs,N	[-]						1,4	42)					
Combined pull-out	t and concre	ete failure													
Characteristic bond		n uncracked	d concret	e C20	/25 in	hamm	ner (Hl	D) and	comp	resse	d air d	rilled I	noles (CD)	
Lemberature I: 24°C/40°C II: 50°C/72°C III:60°C/80°C	Dry, wet concrete			16	16	16	16	16	16	15	15	15	15	15	15
ຍິດ ຍິດ ຍິດ ຍິດ ຍິດ ຍິດ ຍິດ ຍິດ ຍິດ ຍິດ	and	^τ Rk,ucr	[N/mm²]	12	12	12	12	12	12	12	12	11	11	11	11
-	bore hole			5,5	5,5	5,5	5,5	5,5	5,5	5,0	5,0	5,0	5,0	4,5	4,5
Characteristic bond	resistance in	n uncracked	d concret	e C20	/25 in			-				<u>`</u>	<u>, </u>		
Δ <u>I: 24°C/40°C</u>	Dry, wet			14	14	13	13	13	13	13	13	13	13		
	concrete			12	12	12	11	11	11	11	11	11	11		
1: 24°C/40°C		⁷ Rk,ucr	[N/mm ²]	5,5	5,5	5,5	5,5	5,5	5,5	5,0	5,0	5,0	5,0	3	3)
E 0 1: 24°C/40°C ■ II: 50°C/72°C	flooded	,		13 11	13 11	13 11	13 11	13 11	13 11	13 11	13 11	13 11	13 11	-	
H: 60°C/80°C	bore hole			5,5	5,5	5,5	5,5	5,5	5,5	5,0	5,0	5,0	5,0		
Characteristic bond	resistance ir	i n cracked c	oncrete (,					, <u> </u>	,	, <u>,</u>	,	<u> </u>	noles (CD)
and in hammer drille					/		annoc		, (112)	, oonip		a an c		10100 (00,
	1: 24°C/40°C Dry, wet concrete 7,0 7,0 8,5 8,5 8,5 8,5 8,5 8,5														
ll: 50°C/72°C	and flooded	^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	3	3)
ခ် III:60°C/80°C	bore hole			4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5		
Reduction factor ψ^0)	ed and unc	racked co	oncret	e C20	/25 in	hamm	er dril	led ho	les (H	D), co	mpres	sed ai	r drille	d
holes (CD) and in h	000									,	,,				
<u>, , , , , , , , , , , , , , , , , , , </u>	Dry, wet					/			0,	80					
Display the second seco	concrete	Ψ^0 sus	[-]						0,	68					
E 0°C/80°C	flooded bore hole								0,	70					
Increasing factors for	or concrete	Ψc	[-]						(f _{ck} / 2	20) ^{0,1}					
Characteristic bond		τ	Rk,ucr =					Ψc	• τ _{Bk I}	cr,(C20)/25)				
depending on the co strength class	oncrete		$\tau_{\rm Rk,cr} =$							cr,(C20					
Concrete cone fail	ure		,						,		,				
Relevant parameter	ſ							5	see Ta	ble C	2				
Splitting															
Relevant parameter	ŕ							5	see Ta	ble C	2				
Installation factor		CD)													
for dry and wet cond		γinst	[-]					1							,2
for flooded bore hol								1	,2					3	5)
¹⁾ f _{uk} shall be taker			of reinford	ing ba	rs										
 in absence of national 3⁽¹⁾ no performance and a second se		on													
Injection Syster	m EJOT Ml	JLTIFIX E	poxy / S	Sorma	at ITH	Epo	xy fo	r cone	crete						
	jection System EJOT MULTIFIX Epoxy / Sormat ITH Epoxy for concrete Annex C 13 erformances Annex C 13 haracteristic values of tension loads under static and quasi-static action r a working life of 50 years (reinforcing bar)														



	eristic va rking life		of tension loads under static and quasi-static action 00 years Ø 8 Ø 10 Ø 12 Ø 14 Ø 16 Ø 20 Ø 24 Ø 25 Ø 28 Ø 32 Ø 36 Ø 4											
Reinforcing bar			Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32	Ø 36	Ø 40
Steel failure		_												
Characteristic tension resistance	N _{Rk,s}	[kN]						A _s ·	f _{uk} 1)					
Cross section area	A _s	[mm ²]	50	79	113	154	201	314		491	616	804	1018	1256
Partial factor	γ _{Ms,N}	[-]						1,	4 ²⁾					
Combined pull-out and concr	ete failure													
Characteristic bond resistance	in uncracked	d concret	e C20)/25 in	hamm	ner (Hl	D) and	comp	presse	d air d	Irilled I	noles (CD)	
L: 24°C/40°C Dry, wet concrete and flooded bore hole			16	16	16	16	16	16	15	15	15	15	15	15
Concrete a c II: 50°C/72°C and flooded	^τ Rk,ucr,100	[N/mm ²]	12	12	12	12	12	12	12	12	11	11	11	11
			5,5	5,5	5,5	5,5	5,5	5,5	5,0	5,0	5,0	5,0	4,5	4,5
Characteristic bond resistance i	in uncracked	d concret									· ` `	<u> </u>		
$\underline{\mathfrak{G}} = \frac{1: 24^{\circ}\text{C}/40^{\circ}\text{C}}{11: 50^{\circ}\text{C}/72^{\circ}\text{C}}$ Dry, wet			14	14	13	13	13	13	13	13	13	13		
II: 50°C/72°C Dry, wet			12	12	12	11	11	11	11	11	11	11		
te e til: 60°C/80°C concrete	^τ Rk,ucr,100	[N/mm ²]	5,5 13	5,5 13	5,5 13	5,5 13	5,5 13	5,5 13	5,0 13	5,0 13	5,0 13	5,0 13	3	3)
			11	11	11	11	11	11	11	11	11	11		
$\frac{11.50 \text{ C}/72 \text{ C}}{\text{III: 60°C/80°C}}$ bore hole			5,5	5,5	5,5	5,5	5,5	5,5	5,0	5,0	5,0	5,0		
Characteristic bond resistance			220/2						, comp		d air c	drilled I	holes ((CD)
and in hammer drilled holes wit	h hollow dril	l bit (HDE	3)											
End to the second secon			6,5	6,5	7,5	7,5	7,5	7,5	7,5	7,5	7,5	7,5		
li: 50°C/72°C and flooded	^τ Rk,cr,100	[N/mm ²]	5,5	5,5	6,5	6,5	6,5	6,5	6,5	6,5	6,5	6,5	3	3)
الا:60°C/80°C bore hole			4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5		
Reduction factor ψ^0 _{sus,100} in a drilled holes (CD) and in hamm							amme	r drille	ed hole	es (HD), com	press	ed air	
						,		0.	80					
tion of the second seco	Ψ^0 sus,100	[-]							68					
en per l: 24°C/40°C Dry, wet concrete and flooded bore hole	000,100							0,	70					
Increasing factors for concrete	Ψc	[-]						(f _{ck} / 2	20) ^{0,1}					
Characteristic bond resistance	^τ Rk,ι						Ψ _c •1	Rk.ucr	,100,(C	20/25)				
depending on the concrete strength class		,cr,100 =							100,(C					
Concrete cone failure														
Relevant parameter							\$	see Ta	able C	2				
Splitting														
Relevant parameter							5	see Ta	able C	2				
Installation factor (HD; HDB,	CD)	1												
for dry and wet concrete γ _{inst} [-] 1.0													,2	
for flooded bore hole					1	,2					3	3)		
¹⁾ f_{uk} shall be taken from the sp			ang pa	115										
 ²⁾ in absence of national regula ³⁾ no performance assessed 	lion													
Injection System EJOT M	ULTIFIX E	poxy / S	Sorma	at ITH	l Epo	xy fo	r con	crete						
Performances Characteristic values of tension loads under static and quasi-static action for a working life of 100 years (reinforcing bar)									Annex C 14					



		ristic va king life				load	s un	der s	tatic	and	qua	si-sta	atic a	actio	n	
Reinforcing bar				Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32	Ø 36	Ø 40	
Steel failure																
Characteristic tension Nresistance		N _{Rk,s}	[kN]						A _s ·					1		
Cross section area		A _s	[mm ²]	50	79	113	154	201	314		491	616	804	1018	1256	
Partial factor		γ _{Ms,N}	[-]						1,4	4 ²⁾						
Combined pull-out and concrete failure																
Characteristic bond resistance in uncracked concre			te C20/25 in diamond drilled holes (DD)													
L: 24°C/40°C Dry, wet concrete and flooded flooded flooded flooded				14	13	13	13	12	12	11	11	11	11	11	10	
	[⊤] Rk,ucr	[N/mm²]		11	10	10	10	9,5	9,5	9,5	9,0	9,0	8,5	8,5		
		ked concr	ete C20/2	5,0 25 in c	5,0	5,0	4,5 ed hol	4,5 es (DI	4,5 ור	4,0	4,0	4,0	4,0	4,0	4,0	
Reduction factor ψ^0_{sus} in uncracked concrete C20/25 in diamond drilled holes (DD) \blacksquare I: 24°C/40°C Dry, wet 0,77																
co the second se	-	Ψ ⁰ sus	[-]	0,77												
emperative floor f	Joued	Ψ sus		0,72												
Increasing factors for		Ψc	[-]	0,72 (f _{ck} / 20) ^{0,2}												
Characteristic bond resistance depending on the concrete strength class $\tau_{Rk,ucr} =$				Ψc [•] ^τ Rk,ucr,(C20/25)												
Concrete cone failure																
Relevant parameter					see Table C2											
Splitting				T + + - 0												
Relevant parameter				see Table C2												
Installation factor (D	-		1	1,0 1,2												
for dry and wet concrete for flooded bore hole		γinst	[-]	1,0 1,2 1,4 3)												
(1) f _{uk} shall be taken from the specifications of reinform			l vina ba		,2				1	,4				·)		
²⁾ in absence of natio ³⁾ no performance as	nal regulati				15											
Injection System EJOT MULTIFIX Epoxy / Sormat ITH Epoxy for concrete											-		• •			
Performances Characteristic values of tension loads under static and quasi-static action for a working life of 50 years (reinforcing bar)										Ar	inex	C 15				



Table C16:	Characte for a wor					load	s une	der s	tatic	and	qua	si-sta	atic a	actio	n	
Reinforcing bar			Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32	Ø 36	Ø 40		
Steel failure																
Characteristic tension resistance		N _{Rk,s}	[kN]							f _{uk} 1)	r	1				
Cross section area		A _s	[mm ²]	50	79	113	154	201	314		491	616	804	1018	1256	
Partial factor		γ _{Ms,N}	[-]						1,	4 ²⁾						
Combined pull-out and concrete failure																
Characteristic bond	n uncracked	d concret	e C20	/25 in	diamo	nd dri	lled ho	oles (E)D)							
einte en l: 24°C/40°C Dry, conc		^τ Rk,ucr,100		14	13	13	13	12	12	11	11	11	11	11	10	
Lemberature II: 24°C/40°C III: 50°C/72°C III: 60°C/80°C	Incoaca		[N/mm ²]	11 5,0	10 5,0	10 5,0	10 4,5	9,5 4,5	9,0 4,5	9,0 4,0	9,0 4,0	8,5 4,0	8,5 4,0	8,0 4,0	8,0 4,0	
Reduction factor $\psi^{(0)}$		ncracked c	oncrete (-				4,0	4,0	4,0	4,0	, ,0	
	Dry, wet									73						
Lemberature II: 24°C/40°C ande III: 50°C/72°C III:60°C/80°C	concrete and flooded	Ψ ⁰ sus,100	[-]	0,70												
	bore hole			0,72												
Increasing factors f		Ψc	[-]						(f _{ck} / 2	20) ^{0,2}						
Characteristic bond resistance depending on the concrete strength class			icr,100 =	Ψc ^{• τ} Rk,ucr,100,(C20/25)												
Concrete cone fai	T ++ 00															
Relevant parameter				see Table C2												
Splitting				see Table C2												
Relevant parameter Installation factor (DD)																
for dry and wet con	. ,			1,0 1,2												
for flooded bore hole		γinst	[-]		1	,2			,0	1	.4			3		
for flooded bore hole III 1,2 1,4 3) 1) f _{uk} shall be taken from the specifications of reinforcing bars 2) in absence of national regulation 3) no performance assessed									<u>.</u>							
Injection System EJOT MULTIFIX Epoxy / Sormat ITH Epoxy for concrete										Annex C 16						
Performances Characteristic values of tension loads under static and quasi-static action for a working life of 100 years (reinforcing bar)										Ar	mex					



Table C17: Characteristic values of shear loads under static and quasi-static action for a working life of 50 and 100 years														
Reinforcing bar				Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32	Ø 36	Ø 40
Steel failure without lever arm														
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	1018	1256
Partial factor	γMs,V	[-]							1,5 ²⁾					
Ductility factor	k ₇	[-]							1,0					
Steel failure with lever arm														
Characteristic bending moment	M 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	4580	6283
Partial factor	γ _{Ms,V}	[-]							1,5 ²⁾					
Concrete pry-out failure														
Factor	k ₈	[-]							2,0					
Installation factor	γinst	[-]		1,0										
Concrete edge failure														
Effective length of fastener	۱ _f	[mm]	min(h _{ef} ; 12 · d _{nom})							min(h _{ef} ; 300mm)				
Outside diameter of fastener	d _{nom}	[mm]	8	10	12	14	16	20	24	25	28	32	36	40
Installation factor	γinst	[-]							1,0					
Installation factor First [-] 1,0 1) f _{uk} shall be taken from the specifications of reinforcing bars 2) in absence of national regulation														
Injection System EJOT MULTIFIX Epoxy / Sormat ITH Epoxy for concrete										-		• • •	_	
Performances Characteristic values of shear loads under static and quasi-static action for a working life of 50 and 100 years (reinforcing bar)								Annex C 17						



Table C20: Displacements under tension load¹) in hammer drilled holes (HD), comp. air drilled holes (CD) and in hammer drilled holes with hollow drill bit (HDB) Threaded rod **M**8 M10 M12 M16 M20 M24 M27 M30 Uncracked concrete under static and quasi-static action for a working life of 50 and 100 years [mm/(N/mm²)] δ_{N0} -factor 0,028 0,029 0,030 0,033 0,035 0,038 0,039 0,041 Temperature range I: $\delta_{N\infty}$ -factor 24°C/40°C [mm/(N/mm²)] 0,028 0,029 0,030 0,033 0,035 0,038 0,039 0,041 δ_{NO} -factor 0.038 0.039 0.040 0.044 0.047 0.051 0.052 0.055 [mm/(N/mm²)] Temperature range II: 50°C/72°C $\delta_{N\infty}\text{-factor}$ $[mm/(N/mm^2)]$ 0,047 0.049 0,051 0.055 0.059 0,064 0,067 0,070 δ_{N0} -factor [mm/(N/mm²)] 0,038 0,039 0,040 0,044 0,047 0,051 0,052 0,055 Temperature range III: 60°C/80°C $\delta_{N\infty}$ -factor 0.047 0.049 0.051 0.055 0.059 0.064 0.067 0,070 [mm/(N/mm²)] Cracked concrete under static and quasi-static action for a working life of 50 and 100 years δ_{N0} -factor $[mm/(N/mm^2)]$ 0.069 0.071 0,072 0.074 0,076 0,079 0,081 0,082 Temperature range I: 24°C/40°C $\delta_{N\infty}$ -factor 0.122 [mm/(N/mm²)] 0.100 0.115 0.128 0.135 0.142 0.155 0.171 $\delta_{\text{N0}}\text{-factor}$ [mm/(N/mm²)] 0,092 0,095 0.096 0,099 0,102 0,106 0,109 0,110 Temperature range II: 50°C/72°C $\delta_{N\infty}$ -factor [mm/(N/mm²)] 0,134 0,154 0,163 0,172 0,181 0,189 0,207 0,229 δ_{N0} -factor 0,092 0,096 0,095 0,099 0,102 0,106 0,109 0,110 [mm/(N/mm²)] Temperature range III: 60°C/80°C $\delta_{N\infty}$ -factor 0,154 0,163 0,172 0,181 0,189 0.207 0.229 $[mm/(N/mm^2)]$ 0,134 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 Displacements under tension load¹⁾ in diamond drilled holes (DD) Table C18: Threaded rod M8 M10 M16 M20 M24 M12 M27 M30 Uncracked concrete under static and quasi-static action for a working life of 50 years δ_{N0} -factor $[mm/(N/mm^2)]$ 0.011 0.012 0.012 0.013 0.014 0.014 0.015 0.015 Temperature range I: $\delta_{N\infty}$ -factor 24°C/40°C 0,020 [mm/(N/mm²)] 0.018 0.019 0.019 0.022 0.023 0.024 0.025 δ_{N0} -factor 0,013 0,014 0,014 0,015 0,016 0,016 0,018 0,018 [mm/(N/mm²)] Temperature range II: 50°C/72°C $\delta_{N\infty}$ -factor 0,052 0,053 0,055 0,058 0,062 0,065 0,068 0,070 [mm/(N/mm²)] δ_{NO} -factor $[mm/(N/mm^2)]$ 0,013 0,014 0,014 0.015 0,016 0,016 0.018 0,018 Temperature range III: 60°C/80°C $\delta_{N\infty}$ -factor 0,055 0,065 $[mm/(N/mm^2)]$ 0,052 0,053 0,058 0,062 0,068 0,070 Uncracked concrete under static and quasi-static action for a working life of 100 years δ_{N0} -factor [mm/(N/mm²)] 0,011 0,012 0,012 0,013 0,014 0.014 0,015 0,015 Temperature range I: 24°C/40°C $\delta_{N\infty}$ -factor [mm/(N/mm²)] 0.020 0.021 0.021 0.023 0.024 0.025 0.026 0.027 δ_{N0} -factor $[mm/(N/mm^2)]$ 0.013 0.014 0.014 0.015 0.016 0.016 0.018 0.018 Temperature range II: 50°C/72°C 0,038 0,045 0,051 $\delta_{N\infty}$ -factor 0,039 0,040 0.043 0,047 0,049 [mm/(N/mm²)] δ_{N0} -factor 0,013 $[mm/(N/mm^2)]$ 0,014 0,014 0,015 0,016 0,016 0,018 0,018 Temperature range III: 60°C/80°C $\delta_{N\infty}$ -factor 0.038 0.039 0.040 0.043 0.045 0.047 0.049 0.051 [mm/(N/mm²)] 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 Displacements under shear load¹⁾ for all drilling methods Table C19: 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 0,04 δ_{V0}-factor 0,06 0,06 0,05 0,04 0,03 [mm/kN] 0,03 0,03 All temperature ranges $\delta_{V_{\infty}}$ -factor 0.05 [mm/kN] 0.09 0.08 0.08 0.06 0.06 0.05 0.05 1) Calculation of the displacement $\delta v_0 = \delta v_0$ -factor $\cdot V$; $\delta v_{\infty} = \delta v_{\infty} \text{-factor} \cdot V;$ V: action shear load Injection System EJOT MULTIFIX Epoxy / Sormat ITH Epoxy for concrete

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



24°C/40°C δ _{Nu} -factor [mm/(N/mm ²)] 0.029 0.030 0.033 0.035 0.038 0.04 Temperature range II: δ _{Nu} -factor [mm/(N/mm ²)] 0.039 0.040 0.044 0.047 0.051 0.055 50°C/72°C δ _{Nu} -factor [mm/(N/m ²)] 0.039 0.040 0.044 0.047 0.051 0.055 60°C/80°C δ _{Nu} -factor [mm/(N/m ²)] 0.049 0.051 0.055 0.059 0.064 0.077 Creaced concrete under static and quasi-static action for a working life of 50 and 100 years Temperature range II: δ _{Nu} -factor [mm/(N/m ²)] 0.171 0.072 0.074 0.076 0.079 0.08 24°C/0°C δ _{Nu} -factor [mm/(N/m ²)] 0.154 0.163 0.172 0.181 0.189 0.22 Temperature range III: δ _{Nu} -factor [mm/(N/m ²)] 0.154 0.163 0.172 0.181 0.189 0.22 1 Calculation of the displacement: δ _{Nu} -factor [mm/(N/m ²)] 0.154 0.163 0.17	Internal threaded	l ancho	r rods				IG-M6	IG-I	M 8	IG-M10	IG-M1	2 IG-M16	IG-M20	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Uncracked conci	rete und	der static	and q	uasi-stati	c actio	n for a	vorking	life of	f 50 and	100 year	s	-	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Temperature rai	nge I:	δ_{N0} -facto	r	[mm/(N/ı	mm²)]	0,029	0,0	30	0,033	0,035	0,038	0,041	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	24°C/40°C	U	$\delta_{N\infty}$ -facto	r	[mm/(N/ı	mm²)]	0,029	0,0	30	0,033	0,035	0,038	0,041	
$\begin{split} \begin{array}{c c c c c c c c c c c c c c c c c c c $	Temperature rar	nge II:	δ_{N0} -facto	r	[mm/(N/ı	mm²)]	0,039	0,0	40	0,044	0,047	0,051	0,055	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	50°C/72°C		$\delta_{N\infty}$ -facto	r	[mm/(N/ı	mm²)]	0,049	0,0	51	0,055	0,059	0,064	0,070	
$\begin{aligned} & \text{Tarked concrete under static and quasi-static action for a working life of 50 and 100 years \\ & \text{Temperature range I:} \\ & \delta_{ND}^{-factor} [mm/(Nmm]] 0.115 0.122 0.128 0.102 0.106 0.111 \\ & \delta_{ND}^{-factor} [mm/(Nmm]] 0.115 0.122 0.128 0.135 0.142 0.177 \\ & Temperature range III \\ & \delta_{ND}^{-factor} [mm/(Nmm]] 0.154 0.163 0.172 0.181 0.199 0.22 \\ & \delta_{ND}^{-factor} [mm/(Nmm]] 0.154 0.163 0.172 0.181 0.199 0.22 \\ & \delta_{ND}^{-factor} [mm/(Nmm]] 0.154 0.163 0.172 0.181 0.199 0.22 \\ & \delta_{ND}^{-factor} [mm/(Nmm]] 0.154 0.163 0.172 0.181 0.199 0.22 \\ & \delta_{ND}^{-factor} [mm/(Nmm]] 0.154 0.163 0.172 0.181 0.199 0.22 \\ & \delta_{ND}^{-factor} [mm/(Nmm]] 0.154 0.163 0.172 0.181 0.199 0.22 \\ & \delta_{ND}^{-factor} [mm/(Nmm]] 0.154 0.163 0.172 0.181 0.199 0.22 \\ & \delta_{ND}^{-factor} [mm/(Nmm]] 0.154 0.163 0.172 0.181 0.199 0.22 \\ & \delta_{ND}^{-factor} [mm/(Nmm]] 0.154 0.163 0.172 0.181 0.199 0.22 \\ & \delta_{ND}^{-factor} [mm/(Nmm]] 0.154 0.163 0.172 0.181 0.199 0.22 \\ & \delta_{ND}^{-factor} [mm/(Nmm]] 0.154 0.163 0.172 0.181 0.199 0.22 \\ & \delta_{ND}^{-factor} [mm/(Nmm]] 0.012 0.012 0.013 0.014 0.014 0.014 \\ & \delta_{ND}^{-factor} [mm/(Nmm]] 0.012 0.019 0.019 0.020 0.022 0.023 0.02 \\ & \delta_{ND}^{-factor} [mm/(Nmm]] 0.014 0.014 0.011 0.016 0.016 0.016 \\ & \delta_{ND}^{-factor} [mm/(Nmm]] 0.014 0.014 0.014 0.016 0.016 0.016 \\ & \delta_{ND}^{-factor} [mm/(Nmm]] 0.014 0.014 0.014 0.015 0.016 0.016 0.016 \\ & \delta_{ND}^{-factor} [mm/(Nmm]] 0.012 0.02 0.022 0.023 0.02 \\ & \delta_{ND}^{-factor} [mm/(Nmm]] 0.012 0.012 0.012 0.013 0.014 0.014 0.014 \\ & \delta_{ND}^{-factor} [mm/(Nmm]] 0.014 0.014 0.014 0.015 0.016 0.016 0.016 \\ & \delta_{ND}^{-factor} [mm/(Nmm]] 0.014 0.014 0.015 0.016 0.016 0.016 \\ & \delta_{ND}^{-factor} [mm/(Nmm]] 0.021 0.021 0.022 0.024 0.025 0.025 \\ & \delta_{ND}^{-factor} [mm/(Nmm]] 0.021 0.021 0.023 0.044 0.045 0.047 0.05 \\ & \delta_{ND}^{-factor} [mm/(Nmm]] 0.039 0.040 0.043 0.045 0.047 0.05 \\ & \delta_{ND}^{-factor} [mm/(Nmm]] 0.039 0.040 0.043 0.045 0.047 0.05 \\ & \delta_{ND}^{-factor} [mm/(Nmm]] 0.039 0.040 0.043 0.045 0.047 0.05 \\ & \delta_{ND}^{-factor} [mm/(Nmm]] 0.039 0.040 0.043 $	Temperature ran	ige III:	δ_{N0} -facto	r	[mm/(N/ı	mm²)]	0,039	0,0	40	0,044	0,047	0,051	0,055	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	60°C/80°C		$\delta_{N\infty}$ -facto	r	[mm/(N/ı	mm²)]	0,049	0,0	51	0,055	0,059	0,064	0,070	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Cracked concret	e under	static an	d qua	si-static a	action	for a wo	rking lif	e of 50	0 and 10	0 years			
$\begin{array}{c c c c c c c c c c c c c c c c c c c $			δ_{N0} -facto	r	[mm/(N/ı	mm²)]	0,071	0,0	72	0,074	0,076	0,079	0,082	
	24°C/40°C				[mm/(N/ı	mm²)]	0,115	0,1	22	0,128	0,135	0,142	0,171	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$					[mm/(N/ı	mm²)]	0,095	0,0	96	0,099	0,102	. 0,106	0,110	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	50°C/72°C				[mm/(N/ı	mm²)]	0,154	0,1	63	0,172	0,181	0,189	0,229	
1) Calculation of the displacement: $\delta_{N0} = \delta_{N0}$ -factor · τ; $\delta_{Nw} = \delta_{Nw}$ -factor · τ; t: action bond stress for tension Table C22: Displacements under tension load ¹) in diamond drilled holes (DD) Internal threaded anchor rods IG-M6 IG-M10					· `	·-	-			-			0,110	
Table C22: Displacements under tension load ¹⁾ in diamond drilled holes (DD) Internal threaded anchor rods IG-M6 IG-M10 IG-M10 IG-M11 IG-M12 IG-M16 IG-M16 IG-M12 IG-M16 IG-M12 IG-M16 IG-M12 IG-M12 IG-M16 IG-M16 IG-M16 IG-M12 IG-M16 IG-M12 IG-M16 IG-M12 IG-M12 IG-M12 IG-M14 O,014 O,015 O,016 O,017 Temperature range III: δ_{N0} -factor [mm/(N/mm²]] O,012 O,013 O,014 O,014 <th co<="" td=""><td>60°C/80°C</td><td></td><td>$\delta_{N\infty}$-facto</td><td>r</td><td>[mm/(N/ı</td><td>mm²)]</td><td>0,154</td><td>0,1</td><td>63</td><td>0,172</td><td>0,181</td><td>0,189</td><td>0,229</td></th>	<td>60°C/80°C</td> <td></td> <td>$\delta_{N\infty}$-facto</td> <td>r</td> <td>[mm/(N/ı</td> <td>mm²)]</td> <td>0,154</td> <td>0,1</td> <td>63</td> <td>0,172</td> <td>0,181</td> <td>0,189</td> <td>0,229</td>	60°C/80°C		$\delta_{N\infty}$ -facto	r	[mm/(N/ı	mm²)]	0,154	0,1	63	0,172	0,181	0,189	0,229
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	1) Calculation of the	ne displa	cement:	δ _{N0} =	δ_{N0} -factor	·τ;	$\delta_{N\infty} = \delta_{N\infty}$	-factor ·	τ; τ	: action b	ond stress	for tension		
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Table C22	Disn	laceme	nts u	inder te	nsior	ı load¹) in dia	mor	nd drill	ed hole			
Uncracked concrete under static and quasi-static action for a working life of 50 years Temperature range I: δ_{N0} -factor [mm/(N/mm²)] 0,012 0,013 0,014 0,014 0,014 0,014 0,014 0,012 0,013 0,014 0,014 0,014 0,014 0,014 0,014 0,014 0,014 0,014 0,014 0,014 0,016 0,014 0,014 0,014 0,014 0,016 0,017 Carcor [mm/(N/mm?]]		-									-			
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $				and a	uggi stati	o ootio							IG-IMZU	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $					1					-		0.014	0.015	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $						/-								
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $					· ·	/-	,	,		,	· ·		,	
Temperature range III: h_{NO}^{-1} factor $[mm/(N/mm^2)]$ $0,014$ $0,014$ $0,015$ $0,066$ $0,066$ $0,014$ $0,012$			<u> </u>											
$\begin{array}{c c c c c c c c c c c c c c c c c c c $					<u> </u>	·-					· ·		0,018	
Uncracked concrete under static and quasi-static action for a working life of 100 years Temperature range I: δ_{N0} -factor [mm/(N/mm ²)] 0,012 0,012 0,014 0,015 0,016 0,011 24°C/40°C δ_{N0} -factor [mm/(N/mm ²)] 0,021 0,023 0,024 0,025 0,021 Temperature range III: δ_{N0} -factor [mm/(N/mm ²)] 0,039 0,040 0,045 0,047 0,055 0,016 0,016 0,017 0,066 <th< td=""><td></td><td></td><td><u> </u></td><td></td><td>· `</td><td>·-</td><td></td><td></td><td></td><td></td><td></td><td></td><td>0,070</td></th<>			<u> </u>		· `	·-							0,070	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Uncracked concr	rete und			• •	/-						0,000	0,070	
$\frac{24^{\circ}\text{C}/40^{\circ}\text{C}}{5\text{N}_{N\infty}} = \frac{1}{5\text{ctor}} [\text{mm}/(\text{N/mm}^2)] 0,021 0,021 0,023 0,024 0,025 0,02 0,02 0,02 0,02 0,02 0,02 0,0$			1									0,014	0,015	
Temperature range II: δ_{N0} -factor [mm/(N/mm ²)] 0,014 0,014 0,015 0,016 0,016 0,016 0,017 Temperature range III: δ_{N0} -factor $[mm/(N/mm^2)]$ 0,039 0,040 0,043 0,045 0,047 0,05 δ_{00} C/80°C δ_{N0} -factor $[mm/(N/mm^2)]$ 0,014 0,014 0,015 0,016 0,016 0,017 δ_{00} C/80°C δ_{N0} -factor $[mm/(N/mm^2)]$ 0,039 0,040 0,043 0,045 0,047 0,05 1) Calculation of the displacement: δ_{N0} -factor $[mm/(N/mm^2)]$ 0,039 0,040 0,043 0,045 0,047 0,05 1) Calculation of the displacement: δ_{N0} = δ_{N0} -factor + τ ; $\delta_{N\infty}$ = δ_{N0} -factor + τ ; τ : action bond stress for tension Table C23: Displacements under shear load ¹) for all drilling methods Uncracked and cracked concrete under static and quasi-static action for a working life of 50 and 100 years All temperature ranges δ_{V0} -factor [mm/kN] 0,07 0,06 0,06 0,03 0,04 0,04 1) Calculation of the displacement $\delta_{V0} = \delta_{$							0,021	0,0	21	0,023	0,024	0,025	0,027	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Temperature rar	nae II:			[mm/(N/ı	mm²)]	0,014	0,0	14	0,015	0,016	0,016	0,018	
$\frac{100}{60^{\circ}} \text{C}/80^{\circ} \text{C}} \qquad \boxed{\delta_{N\infty}} \text{-factor} [\text{mm}/(\text{N/mm}^2)]} 0,039 0,040 0,043 0,045 0,047 0,05 0,04 0,047 0,05 0,047 0,05 0,047 0,05 0,047 0,05 0,047 0,05 0,047 0,05 0,047 0,05 0,047 0,05 0,04 0,047 0,05 0,047 0,05 0,04 0,047 0,05 0,04 0,047 0,05 0,04 0,05 0,06 0,05 0,04 0,0$					[mm/(N/ı	mm²)]	0,039	0,0	40	0,043	0,045	0,047	0,051	
$60^{\circ}C/80^{\circ}C$ $\delta_{N\infty}$ -factor [mm/(N/mm ²)] $0,039$ $0,040$ $0,043$ $0,045$ $0,047$ $0,05$ 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 C23: Displacements under shear load ¹⁾ for all drilling methods Internal threaded anchor rods IG-M6 IG-M8 IG-M10 IG-M12 IG-M16 IG-M2 Uncracked and cracked concrete under static and quasi-static action for a working life of 50 and 100 years All temperature ranges δ_{V0} -factor [mm/kN] $0,07$ $0,06$ $0,06$ $0,05$ $0,04$ $0,04$ 1) Calculation of the displacement δ_{V0} = δ_{V0} -factor \cdot V; $\delta_{V\infty}$ = $\delta_{V\infty}$ -factor \cdot V; V: action shear load	Temperature ran	ige III:	δ _{N0} -facto	r	[mm/(N/ı	mm²)]	0,014	0,0	14	0,015	0,016	0,016	0,018	
Table C23: Displacements under shear load 1) for all drilling methodsInternal threaded anchor rodsIG-M6IG-M8IG-M10IG-M12IG-M16IG-M2Uncracked and cracked concrete under static and quasi-static action for a working life of 50 and 100 yearsAll temperature ranges δ_{V0} -factor[mm/kN]0,070,060,060,050,040,04 $\delta_{V\infty}$ -factor[mm/kN]0,100,090,080,080,060,061) Calculation of the displacement $\delta_{V0} = \delta_{V0}$ -factor · V; $\delta_{V\infty}$ -factor · V;V: action shear load			$\delta_{N\infty}$ -facto	r	[mm/(N/ı	mm²)]	0,039	0,0	40	0,043	0,045	0,047	0,051	
Internal threaded anchor rods IG-M6 IG-M8 IG-M10 IG-M12 IG-M16 IG-M16 IG-M2 IG-M16 IG-M2 IG-M16 IG-M2 IG-M16 IG-M2 IG-M16 IG-M2 IG-M16 IG-M2 IG-M16 IG-M2 IG-M16 IG-M2 IG-M16 IG-M2 IG-M16 IG-M2 IG-M16 IG-M2 IG-M16 IG-M2 IG-M16 IG-M2 IG-M16 IG-M2 IG-M16 IG-M2 IG-M16 IG-M2 IG-M16 IG-M2 IG-M16 IG-M2 IG-M2 IG-M2 IG-M2 IG-M2	1) Calculation of th	ne displa	cement:	δ _{N0} =	δ _{N0} -factor	·τ;	δ _{N∞} = δ _{N∞}	-factor ·	τ; τ	: action b	ond stress	for tension	•	
Internal threaded anchor rods IG-M6 IG-M8 IG-M10 IG-M12 IG-M16 IG-M16 IG-M2 IG-M16 IG-M2 IG-M16 IG-M2 IG-M16 IG-M2 IG-M16 IG-M2 IG-M16 IG-M2 IG-M16 IG-M2 IG-M16 IG-M2 IG-M16 IG-M2 IG-M16 IG-M2 IG-M16 IG-M2 IG-M16 IG-M2 IG-M16 IG-M2 IG-M16 IG-M2 IG-M16 IG-M2 IG-M16 IG-M2 IG-M16 IG-M2 IG-M16 IG-M2 IG-M2 IG-M2 IG-M2 IG-M2	T 1 000	. .					.1)							
Uncracked and cracked concrete under static and quasi-static action for a working life of 50 and 100 years All temperature ranges δ_{V0} -factor [mm/kN] 0,07 0,06 0,06 0,05 0,04 0,04 1) Calculation of the displacement δ_{V0} = δ_{V0} -factor · V; $\delta_{V\infty}$ = $\delta_{V\infty}$ -factor · V; $V_{V\infty}$ = $\delta_{V\infty}$ -factor · V; V: action shear load	Table C23:	Disp	laceme	nts u	inder sr	near I	oad '' f	or all o	arillin	ng met	hods	,		
All temperature ranges δ_{V0} -factor[mm/kN]0,070,060,060,050,040,04 $\delta_{V\infty}$ -factor[mm/kN]0,100,090,080,080,060,061) Calculation of the displacement $\delta_{V0} = \delta_{V0}$ -factor $\cdot V$; $\delta_{V\infty} = \delta_{V\infty}$ -factor $\cdot V$;V: action shear load	Internal threaded	ancho	r rods			IG-N	/ 6	G-M8	IG-	M10	IG-M12	IG-M16	IG-M20	
tranges $\delta_{V\infty}$ -factor[mm/kN]0,100,090,080,080,060,061) Calculation of the displacement $\delta_{V0} = \delta_{V0}$ -factor · V; $\delta_{V\infty} = \delta_{V\infty}$ -factor · V;V: action shear load	Uncracked and c	1		under	r static an	d quas	si-static	action f	oraw	orking l	ife of 50	and 100 yea	rs	
¹⁾ Calculation of the displacement $\delta_{V0} = \delta_{V0}$ -factor · V; $\delta_{V\infty} = \delta_{V\infty}$ -factor · V; V: action shear load	All temperature	δ_{V0} -fa	ctor	[n	nm/kN]	0,0	7	0,06	0,	,06	0,05	0,04	0,04	
	ranges	δ _{V∞-} fa	ctor	[n	nm/kN]	0,1	0	0,09	0,	,08	0,08	0,06	0,06	
Injection System EJOT MULTIFIX Epoxy / Sormat ITH Epoxy for concrete	1) Calculation of th	ne displa	cement	δνο = δ	δvo-factor	·V; 8	$\delta_{V\infty} = \delta_{V\infty}$	-factor	V; V	: action s	hear load			
Performances Annex C 19	Injection Syste	em EJC	DT MULT	IFIX E	Epoxy / S	Sorma	t ITH Ep	ooxy fo	r con	crete				



Table C24:	•	cements un holes (CD)									•			
Reinforcing bar	r		Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32	Ø 36	Ø 40
Uncracked con	crete under	static and qua	si-sta	tic acti	ion for	a wor	king li	fe of 5	0 and	100 ye	ars			
Temp range	δ_{N0} -factor	[mm/(N/mm ²)]	0,028	0,029	0,030	0,031	0,033	0,035	0,038	0,038	0,040	0,043	0,045	0,047
l: 24°C/40°Č	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,028	0,029	0,030	0,031	0,033	0,035	0,038	0,038	0,040	0,043	0,045	0,047
Temp range	δ_{N0} -factor	[mm/(N/mm ²)]	0,038	0,039	0,040	0,042	0,044	0,047	0,051	0,051	0,054	0,058	0,060	0,063
II: 50°C/72°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	0,074	0,079
Temp range	δ_{N0} -factor	[mm/(N/mm ²)]	0,038	0,039	0,040	0,042	0,044	0,047	0,051	0,051	0,054	0,058	0,060	0,063
III: 60°C/80°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	0,074	0,079
Cracked concre	ete under st	atic and quasi-	static	action	for a	workir	ng life	of 50 a	nd 100) years	3			
Temp range	δ_{N0} -factor	[mm/(N/mm ²)]	0,069	0,071	0,072	0,073	0,074	0,076	0,079	0,079	0,081	0,084		
l: 24°C/40°Č	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,115	0,122	0,128	0,135	0,142	0,155	0,171	0,171	0,181	0,194]	
Temp range	δ_{N0} -factor	[mm/(N/mm ²)]	0,092	0,095	0,096	0,098	0,099	0,102	0,106	0,106	0,109	0,113		
II: 50°C/72°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,154	0,163	0,172	0,181	0,189	0,207	0,229	0,229	0,242	0,260		2)
Temp range	δ_{N0} -factor	[mm/(N/mm ²)]	0,092	0,095	0,096	0,098	0,099	0,102	0,106	0,106	0,109	0,113	1	
III: 60°C/80°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,154	0,163	0,172	0,181	0,189	0,207	0,229	0,229	0,242	0,260	1	
 ¹⁾ Calculation of ²⁾ No performan Table C25: 	ce assessed	ment: $\delta_{N0} = \delta_{N}$				_{δ∾} -fac Id ¹⁾ ir			ction bo drille					
Reinforcing bar	•		Ø8	1	-			-	Ø 24		``	, ,	Ø 36	Ø 40
Uncracked con		static and qua												
Temp range	δ_{N0} -factor	[mm/(N/mm ²)]						1			0.014	0.015	0.016	0.017
I: 24°C/40°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]			-		-	-	-			-		
Temp range	δ_{N0} -factor	[mm/(N/mm ²)]				<u> </u>		· ·		· ·				
II: 50°C/72°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]				<u> </u>				· ·				
Temp range	δ _{N0} -factor	[mm/(N/mm ²)]				<u> </u>				<u> </u>				
III: 60°C/80°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]				· ·	-							
Uncracked con		static and qua	si-stat	tic acti	on for	a wor	king li	fe of 1	00 yea	rs		-		
Temp range		[mm/(N/mm ²)]					-		-		0,014	0,015	0,016	0,017
I: 24°C/40°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]												
Temp range	δ_{N0} -factor	[mm/(N/mm ²)]				<u> </u>								
II: 50°C/72°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,035	0,037	0,040	0,042	0,045	0,049	0,055	0,055	0,059	0,064	0,066	0,070
Temp range	δ_{N0} -factor	[mm/(N/mm ²)]	-	-	-	-	-		-	-	-			
III: 60°C/80°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	· ·			<u> </u>		<u> </u>	· ·	· ·	· ·			
1) Calculation of		ment: $\delta_{N0} = \delta_{N0}$	-factor	· τ;	δ _{N∞} =	δ _{N∞} -fac	tor · τ;	τ: a	ction bo	nd stre	ess for t	ension		
Table C26:	Displa	cements un	der s	hear	load	¹⁾ for	all dı	rilling	metl	hods				
Reinforcing bar	r	Ø	8 Ø	10 Ø	i 12 🖉	\$ 14 Q	ð 16 🗴	ð 20 🗴	ð 24 🔇	ð 25 🛛	Ø 28	Ø 32	Ø 36	Ø 40
Uncracked and	cracked co	ncrete under s	tatic a	nd qua	asi-sta	tic act	ion fo	r a woi	rking li	fe of 5	0 and	100 ye	ars	
All temperature	δ_{V0} -factor	[mm/kN] 0,	06 0,	05 0,	,05 0	,04 0	,04 (),04	0,03	0,03	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	0,04	0,04
1) Calculation of	the displace	ment $\delta v_0 = \delta v_0$	-factor	• V;	δ _{V∞} = 6	δv∞-fac	tor · V;	V: a	iction sl	near loa	ad			
Injection Sys		MULTIFIX Ep	oxy / :	Sorma	at ITH	Ерох	y for	concr	ete			\		
Performances	S										4	Annex	CC 20	U

Performances Displacements under static and quasi-static action for a working life of 50 and 100 years (reinforcing bar)



Table C27: Characteristic values of tension loads under seismic action (performance category C1) for a working life of 50 years M27 Threaded rod M8 M10 M12 M16 M20 M24 M30 Steel failure 1,0 • N_{Rk,s} Characteristic tension resistance N_{Rk,s,eq,C1} [kN] Partial factor [-] see Table C1 γMs,N Combined pull-out and concrete failure 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) [N/mm²] I: 24°C/40°C 7,0 7,0 8,5 8,5 8,5 8,5 8,5 8,5 ^τRk,eq,C1 Dry, wet Temperatui range concrete and 7,0 II: 50°C/72°C 7,0 7,0 7,0 [N/mm²] 6,0 6,0 7,0 7,0 ^τRk,eq,C1 flooded bore hole 4,5 4,5 III:60°C/80°C [N/mm²] 5,0 5,0 5,0 4,5 4,5 4,5 ^τRk,eq,C1 Increasing factors for concrete 1,0 Ψ_{c} [-] Characteristic bond resistance depending $\tau_{Rk,eq,C1} =$ Ψc [•] ^τRk,eq,C1,(C20/25) on the concrete strength class Installation factor for dry and wet concrete (HD; HDB, CD) 1,0 γinst [-] for flooded bore hole (HD; HDB, CD) 1.2

Injection System EJOT MULTIFIX Epoxy / Sormat ITH Epoxy for concrete

Performances

Characteristic values of tension loads under seismic action (performance category C1) for a working life of 50 years (threaded rod)



Characteristic values of tension loads under seismic action Table C28: (performance category C1) for a working life of 100 years M10 M12 M16 M20 M24 Threaded rod M8 M30 M27 Steel failure 1,0 • N_{Rk,s} Characteristic tension resistance N_{Rk,s,eq,C1} [kN] Partial factor see Table C1 [-] γMs,N Combined pull-out and concrete failure 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) I: 24°C/40°C [N/mm²] 6,5 6,5 7,5 7,5 7,5 7,5 7,5 7,5 ^τRk,eq,C1 Dry, wet **Femperatu** range concrete and II: 50°C/72°C [N/mm²] 5,5 5,5 6,5 6,5 6,5 6,5 6,5 6,5 ^τRk,eq,C1 flooded bore hole III:60°C/80°C [N/mm²] 5.0 5.0 5.0 4.5 4.5 4,5 4.5 4.5 ^τRk,eq,C1 Increasing factors for concrete 1,0 Ψ_{c} [-] Characteristic bond resistance depending $\tau_{Rk,eq,C1} =$ Ψc • ^τRk,eq,C1,(C20/25) on the concrete strength class Installation factor for dry and wet concrete (HD; HDB, CD) 1,0 γinst [-] for flooded bore hole (HD; HDB, CD) 1.2

Injection System EJOT MULTIFIX Epoxy / Sormat ITH Epoxy for concrete

Performances

Characteristic values of tension loads under seismic action (performance category C1) for a working life of 100 years (threaded rod)



		C1) fc				ismic of 50 a		n)0 yea	rs	
nreaded rod			M8	M10	M12	M16	M20	M24	M27	M30
eel failure										
haracteristic shear resistance eismic C1)	V _{Rk,s,eq,C1}	[kN]				0,70	0∙V ⁰ Rk	,s		
artial factor	γ _{Ms,V}	[-]				see	Table (01		
actor for annular gap	α_{gap}	[-]				0,	5 (1,0) ¹⁾)		

Performances

Characteristic values of shear loads under seismic action (performance category C1) for a working life of 50 and 100 years (threaded rod)



Table		aracteristic rformance o									n			
Deinfer			Jacogory								~ ~ ~	~ 05	~ ~ ~	~ ~ ~
Steel fa	cing bar nilure				68	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
	teristic tension re	esistance	N _{Rk,s,eq,C1}	[kN]				-	1,0 • A	s•f _{uk} 1)			
Cross s	ection area		A _s	[mm ²]	50	79	113	154	201	314	452	491	616	804
Partial f			γ _{Ms,N}	[-]						4 ²⁾				
Combir	ned pull-out and	d concrete failu												
	eristic bond resisioles (CD) and in						in har	nmer o	drilled	holes ((HD), (compre	essed	air
iure	I: 24°C/40°C	Dry, wet	^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
Temperature range	II: 50°C/72°C	concrete and flooded bore	^τ Rk,eq,C1	[N/mm²]	6,0	6,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0
Ter	III:60°C/80°C	hole	^τ Rk,eq,C1	[N/mm²]	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5
Increasi	ing factors for co	ncrete	Ψc	[-]					1	,0				
	teristic bond resisting on the concre		τ _R	k,eq,C1 =				ψ_{c} .	^τ Rk,eq	,C1,(C2	20/25)			
	tion factor		1											
for dry a	and wet concrete	e (HD; HDB,	Vinet	[-]					1	,0				
<u> </u>	led bore hole (H	D; HDB, CD)	γinst						1	,2				
1) f _{uk} s	hall be taken from	n the specificatio	ns of reinford	ing bars						*				
Inject	ion System E.	JOT MULTIFIX	(Epoxy/S	Sormat IT	Н Ер	oxy f	or coi	ncrete)					
	rmances cteristic values	of tension load	s under sei:	smic actio	n (per	forma	nce ca	ategor	y C1)		Α	nnex	C 24	ŀ

for a working life of 50 years (reinforcing bar)



Deinter	aina kar				<u>~</u>	Q 10	a 10	<i>α</i>	<u> </u>	<i>a</i>	<u>a</u>	a 0-	<u>a a a</u>	<i>a</i>
Steel fai	cing bar ilure				08	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
	eristic tension re	sistance	N _{Rk,s,eq,C1}	[kN]					.0 • A	s•f _{uk} 1)			
	ection area		A _s	[mm ²]	50	79	113	154	201	з [.] uк 314	452	491	616	804
Partial fa			γ _{Ms,N}	[-]	00	10	110	104		4 ²⁾	-102		010	004
	ed pull-out and	d concrete failu		[]]					۰,۰	T '				
Characte	eristic bond resisoles (CD) and in	stance in cracke	ed and uncra				in han	nmer c	Irilled	holes (HD), c	compre	ssed	air
ure	I: 24°C/40°C	Dry, wet	^τ Rk,eq,C1	[N/mm²]	6,5	6,5	7,5	7,5	7,5	7,5	7,5	7,5	7,5	7,5
Temperature range	II: 50°C/72°C	concrete and flooded bore	^τ Rk,eq,C1	[N/mm²]	5,5	5,5	6,5	6,5	6,5	6,5	6,5	6,5	6,5	6,5
Ter	III:60°C/80°C	hole	^τ Rk,eq,C1	[N/mm²]	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5
Increasi	ng factors for co	ncrete	Ψc	[-]					1	,0				
	eristic bond resising on the concre			k,eq,C1 =				ψ_{c} .	^τ Rk,eq	,C1,(C2	20/25)			
	tion factor		1											
for dry a CD)	nd wet concrete	e (HD; HDB,	A/-						1	,0				
,	ed bore hole (H	D: HDB, CD)	^γ inst	[-]					1	,2				
	nall be taken from		ns of reinford	ing bars					-	,				
Injecti	on System E.		(Epoxy / S	Sormat IT	Ή Εр	oxy fo	or cor	ncrete	•					



Table C32:	Characteristic (performance										ears		
Reinforcing bar				Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Steel failure													
Characteristic shea	ar resistance	V _{Rk,s,eq,C1}	[kN]					0,35	• A _s •	f _{uk} 1)			
Cross section area	1	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	α_{gap}	[-]					0,	5 (1,0) ³⁾			
²⁾ in absence of na	ts valid for filled annu				d clear	ance h	nole in	the fix	ture. l	Jse of	special f	illing wa	sher

Injection System EJOT MULTIFIX Epoxy / Sormat ITH Epoxy for concrete

Performances

Characteristic values of shear loads under seismic action (performance category C1) for a working life of 50 and 100 years (reinforcing bar)



hreaded rod				M12	M16	M20	M24
Steel failure			I		11	I	
Characteristic tension resi	stance,						
teel, strength class 8.8		N _{Rk,s,eq,C2}	[kN]		1,0 •	N _{Rk.s}	
tainless Steel A4 and H0 trength class ≥70	νR,	,-,-,,				,-	
artial factor		γ _{Ms,N}	[-]		see Ta	ble C1	
ombined pull-out and o	oncrete failure	,					
haracteristic bond resist illed holes (CD) and in h	ance in cracked	and uncracked			mer drilled hole	es (HD), comp	ressed air
e I: 24°C/40°C	Dry, wet	^τ Rk,eq,C2	[N/mm ²]	5,8	4,8	5,0	5,1
L: 24°C/40°C 	concrete and flooded bore	^τ Rk,eq,C2	[N/mm ²]	5,0	4,1	4,3	4,4
E III:60°C/80°C	hole	^τ Rk,eq,C2	[N/mm ²]	1,9	1,6	1,6	1,7
creasing factors for cond	crete	Ψc	[-]		1,	0	
haracteristic bond resistant the concrete strength c			Rk,eq,C2 =		Ψc ^{• τ} Rk,eq	C2,(C20/25)	
stallation factor		1	I				
or dry and wet concrete (,	Vinet	[-]		1,		
r flooded bore hole (HD;	HDB, CD)	⁻ ^γ inst	[-]		1,	2	
Table C34: Char (perf	acteristic va ormance ca			king life o	ismic actio of 50 and 10	n)0 years	M24
Table C34: Char (perf					ismic actio	n	M24
Table C34: Char (perf hreaded rod teel failure	ormance ca			king life o	ismic actio of 50 and 10	n)0 years	M24
Table C34: Char (perf hreaded rod teel failure haracteristic shear resistieel, strength class 8.8 tainless Steel A4 and HO	ormance ca			king life o	ismic actio of 50 and 10	n)0 years ^{M20}	M24
Table C34: Char (perf nreaded rod teel failure haracteristic shear resistivel, strength class 8.8 cainless Steel A4 and HC rength class ≥70	ormance ca	tegory C2)	for a wor	king life o	ismic actio of 50 and 10 M16	n)0 years M20 V ⁰ _{Rk,s}	M24
Table C34: Char (perf hreaded rod (teel failure haracteristic shear resist (teel, strength class 8.8 tainless Steel A4 and HC (trength class ≥70 artial factor (teor for annular gap	ormance ca ance CR,	tegory C2) V _{Rk,s,eq,C2} γ _{Ms,V} α _{gap}	for a wor [kN] [-] [-]	M12	ismic actio of 50 and 10 M16 0,70 • see Ta 0,5 (1	n D0 years M20 $V^0_{Rk,s}$ ble C1 $(,0)^{1)}$	
Table C34: Char (perf (perf c)) nreaded rod (perf c) nreaded rod (perf c) neel failure (perf c) naracteristic shear resist (perf c) naracteristic shear re	ormance ca ance CR, or filled annular (tegory C2) V _{Rk,s,eq,C2} γ _{Ms,V} α _{gap}	for a wor [kN] [-] [-]	M12	ismic actio of 50 and 10 M16 0,70 • see Ta 0,5 (1	n D0 years M20 $V^0_{Rk,s}$ ble C1 $(,0)^{1)}$	
Table C34: Char (perf hreaded rod teel failure haracteristic shear resist teel, strength class 8.8 tainless Steel A4 and HC trength class ≥70 artial factor actor for annular gap 1) Value in brackets valid f	ormance ca ance R, or filled annular (ded.	tegory C2) V _{Rk,s,eq,C2} γ _{Ms,V} α _{gap} gab between fas	for a wor	king life of M12	ismic actio of 50 and 10 0,70 · see Ta 0,5 (7 in the fixture. Us	n 00 years M20 $V^0_{\text{Rk,s}}$ ble C1 $I,0)^{1)}$ se of special fill	



Threaded rod			M12	M16	M20	M24
Jncracked and cracked cor or a working life of 50 and		ion (perform	ance catego	ory C2)	1	1
	$\delta_{\text{N,eq,C2(50\%)}} = \delta_{\text{N,eq,C2(DLS)}}$	[mm]	0,21	0,24	0,27	0,36
All temperature ranges	$\delta_{\text{N,eq,C2(100\%)}} = \delta_{\text{N,eq,C2(ULS)}}$	[mm]	0,54	0,51	0,54	0,63
Table C36: Displac	ements under shea	r load (th	readed ro	d)		
Threaded rod			M12	M16	M20	M24
Jncracked and cracked cor	crete under seismic act	ion (perform				
or a working life of 50 and	$\frac{\delta_{V,eq,C2(50\%)} = \delta_{V,eq,C2(DLS)}}{\delta_{V,eq,C2(DLS)}}$	[mm]	3,1	3,4	3,5	4,2
All temperature ranges	$\frac{\delta_{V,eq,C2(100\%)}}{\delta_{V,eq,C2(ULS)}} =$	[mm]	6,0	7,6	7,3	10,9

Performances Displacements under seismic action (performance category C2) for a working life of 50 and 100 years (threaded rod)



Threaded rod					M8	M10	M12	M16	M20	M24	M27	M30
Steel failure							1			1		
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	KK,S,T		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 resist given temperature θ	ance in cra	cked a	and uncra	cked con	crete C	:20/25 ι	up to C	50/60 u	nder fi	re cono	ditions	for a
			θ < 2	23°C				1	,0			
Temperature reduction	k _{fi,p} (θ)	[-]	23°C ≤ θ				150		, <u>,</u> -1,598 ≤	1.0		
factor	II,p ()		$\theta > 2$,	,0	. 1,0		
_												
Beduction Factor kⁱⁱⁱ(B) [-]	50	100		150	200		250		300		350	
0,0	50	100		150 Temperatur			250		300		350	
0,0 0 Characteristic bond resistance for a given	$\tau_{\rm Rk,fi}(\theta)$	100		Temperatur				θ)•τ _{Rk}	300 s,cr,(C20/	(25) ¹⁾	350	
Characteristic bond resistance for a given temperature (θ)	τ _{Rk,fi} (θ)	100		Temperatur 2]	eθ[°C]		k _{fi,p} (s,cr,(C20/			
Characteristic bond resistance for a given temperature (θ) Steel failure without lever Characteristic shear	τ _{Rk,fi} (θ)	100		Temperatur 2] 30	reθ[°C]	1,7	k _{fi,p} (3,0	5,7	s,cr,(C20/	12,7	16,5	
Characteristic bond resistance for a given temperature (θ) Steel failure without lever Characteristic shear resistance; Steel, Stainless Steel A2, A4 and HCR,	τ _{Rk,fi} (θ) arm	100	[N/mm ² Fire exposure	Temperatur 2] 30 60	eθ[°C] 1,1 0,9	1,4	k _{fi,p} (3,0 2,3	5,7 4,2	8,8 6,6	12,7 9,5	16,5 12,4	20,2
Characteristic bond resistance for a given temperature (θ) Steel failure without lever Characteristic shear resistance; Steel, Stainless Steel A2, A4 and HCR, strength class 5.8 resp. 50	τ _{Rk,fi} (θ)		[N/mm ²	Temperatur 2] 30 60 90	1 ,1 0,9 0,7	1,4 1,0	k _{fi,p} (3,0 2,3 1,6	5,7 4,2 3,0	8,8 6,6 4,7	12,7 9,5 6,7	16,5 12,4 8,7	15,1 10,7
Characteristic bond resistance for a given temperature (θ) Steel failure without lever Characteristic shear resistance; Steel, Stainless Steel A2, A4 and HCR, strength class 5.8 resp. 50 and higher	$[\tau_{Rk,fi}(\theta)]$ arm $V_{Rk,s,fi}$		[N/mm ² Fire exposure time	Temperatur 2] 30 60	eθ[°C] 1,1 0,9	1,4	k _{fi,p} (3,0 2,3	5,7 4,2	8,8 6,6	12,7 9,5	16,5 12,4	
Characteristic bond resistance for a given temperature (θ) Steel failure without lever Characteristic shear resistance; Steel, Stainless Steel A2, A4 and HCR, strength class 5.8 resp. 50 and higher Steel failure with lever arm	$[\tau_{Rk,fi}(\theta)]$ arm $V_{Rk,s,fi}$		[N/mm ² Fire exposure time [min]	Temperatur 2] 30 60 90	1 ,1 0,9 0,7	1,4 1,0	k _{fi,p} (3,0 2,3 1,6	5,7 4,2 3,0	8,8 6,6 4,7	12,7 9,5 6,7	16,5 12,4 8,7	15,1 10,7 7,9
0,0 0 0 0 Characteristic bond resistance for a given temperature (θ) Steel failure without lever 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	$[\tau_{\rm Rk,fi}(\theta)]$	[kN]	[N/mm ² Fire exposure time [min] Fire	Temperatur 2] 30 60 90 120	1 ,1 0,9 0,7 0,5	1,4 1,0 0,8	k _{fi,p} (3,0 2,3 1,6 1,2	5,7 4,2 3,0 2,2	8,8 6,6 4,7 3,4	12,7 9,5 6,7 4,9	16,5 12,4 8,7 6,4	15,1 10,7
0,0 0 0 0 Characteristic bond resistance for a given temperature (θ) Steel failure without lever 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	$[\tau_{Rk,fi}(\theta)]$ arm $V_{Rk,s,fi}$		[N/mm ² Fire exposure time [min] Fire exposure time	Temperatur 2] 30 60 90 120 30	eeθ[°C] 1,1 0,9 0,7 0,5 1,1	1,4 1,0 0,8 2,2	k _{fi,p} (3,0 2,3 1,6 1,2 4,7	5,7 4,2 3,0 2,2 12,0	8,8 6,6 4,7 3,4 23,4	12,7 9,5 6,7 4,9 40,4	16,5 12,4 8,7 6,4 59,9	15,1 10,7 7,9 81,0
Characteristic bond resistance for a given temperature (θ) Steel failure without lever 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	$[\tau_{\rm Rk,fi}(\theta)]$	[kN]	[N/mm ² Fire exposure time [min] Fire exposure	Temperatur 2] 30 60 90 120 30 60	e θ [°C] 1,1 0,9 0,7 0,5 1,1 0,9	1,4 1,0 0,8 2,2 1,8	k _{fi,p} (3,0 2,3 1,6 1,2 4,7 3,5	5,7 4,2 3,0 2,2 12,0 9,0	8,8 6,6 4,7 3,4 23,4 17,5	12,7 9,5 6,7 4,9 40,4 30,3	16,5 12,4 8,7 6,4 59,9 44,9	15,1 10,7 7,9 81,0 60,7



Table C38: 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 30 0,3 1,1 1,7 3,0 5,7 8,8 Characteristic tension Fire 0,2 60 0,9 1,4 2,3 4,2 6,6 resistance; Steel, Stainless exposure N_{Rk,s,fi} [kN] Steel A4 and HCR, strength time 90 0.2 0.7 1,0 1,6 4.7 3,0 class 5.8 and 8.8 resp. 70 [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 $\theta < 23^{\circ}C$ 1,0 Temperature reduction $150,28 \cdot \theta^{-1,598} \le 1,0$ k_{fi,p}(θ) [-] $23^{\circ}C \le \theta \le 278^{\circ}C$ factor θ > 278°C 0,0 1,0 0,8 Reduction Factor k_{ii}(0) [-] 0,6 0,4 0,2 0,0 0 100 150 200 300 50 250 350 Temperature θ [°C] Characteristic bond $k_{fi,p}(\theta) \cdot \tau_{Rk,cr,(C20/25)}^{1}$ resistance for a given $\tau_{\mathsf{Rk,fi}}(\theta)$ [N/mm²] temperature (θ) Steel failure without lever arm 30 0,3 1,1 1,7 3,0 5,7 8,8 Characteristic shear Fire 60 0,2 0,9 1,4 2.3 4,2 6,6 resistance: Steel, Stainless exposure V_{Rk,s,fi} [kN] Steel A4 and HCR, strength time 0,2 90 0,7 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 30 0,2 1,1 2,2 4,7 12,0 23,4 Characteristic bending Fire 0.2 0.9 1,8 60 3,5 9,0 17,5 moment: Steel, Stainless exposure M⁰_{Rk,s,fi} [Nm] Steel A4 and HCR, strength time 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 4,7 9,1 1) TRk,cr,(C20/25) characteristic bond resistance for cracked concrete for concrete strength class C20/25 for the relevant temperature range Injection System EJOT MULTIFIX Epoxy / Sormat ITH Epoxy for concrete Annex C 30 Performances Characteristic values of tension and shear loads under fire exposure (internal threaded anchor rod)



Table C39: 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) **Reinforcing bar** Ø 8 Ø 10 Ø 12 Ø 14 Ø 16 Ø 20 Ø 24 Ø 25 Ø 28 Ø 32 Steel failure 12,3 30 0,5 1,2 2,3 3,1 4,0 6,3 9,0 9,8 16,1 Fire 2,3 60 0,5 1,0 1,7 4,7 7,4 9,2 12,1 3,0 6,8 Characteristic tension N_{Rk,s,fi} [kN] exposure resistance; BSt 500 90 0.4 0.8 1,5 2.0 2,6 10,5 4,1 5,9 6.4 8,0 time [min] 120 0,3 0,6 1,1 1,5 2,0 4,5 4,9 8,0 3,1 6,2 Characteristic bond resistance in cracked and uncracked concrete C20/25 up to C50/60 under fire conditions for a given temperature θ θ < 25°C 1.0 Temperature reduction $176,37 \cdot \theta^{-1,598} \le 1,0$ $k_{fi,p}(\theta)$ [-] $25^{\circ}C \le \theta \le 278^{\circ}C$ factor θ > 278°C 0.0 1,0 0,8 Reduction Factor k_{ii}(0) [-] 0,6 0,4 0,2 0,0 0 50 100 150 200 250 300 350 Temperature θ [°C] Characteristic bond $k_{fi,p}(\theta) \cdot \tau_{Rk,cr,(C20/25)}^{1}$ resistance for a given [N/mm²] $\tau_{\mathsf{Rk},\mathsf{fi}}(\theta)$ temperature (θ) Steel failure without lever arm 30 0,5 1,2 2,3 3,1 4,0 6,3 9,0 9,8 12,3 16,1 Fire 60 0.5 1.0 1.7 2.3 3.0 4.7 6.8 7.4 9,2 12,1 Characteristic shear V_{Rk,s,fi} [kN] exposure resistance: BSt 500 0,4 1,5 90 0,8 2,0 2,6 4,1 5,9 6,4 8,0 10,5 time [min] 120 0,3 0,6 1,1 1,5 2,0 3,1 4,5 4,9 6,2 8,0 Steel failure with lever arm 0,6 4,1 9,7 18,8 32,6 36,8 51,7 77,2 30 1,8 6,5 Fire 60 0.5 1,5 3,1 4.8 7,2 14,1 24,4 27,6 38.8 57,9 Characteristic bending M⁰Rk,s,fi [Nm] exposure moment: BSt 500 90 0.4 1,2 2.6 4,2 6,3 12,3 21,2 23.9 33.6 50.2 time [min] 120 0,3 0,9 2,0 3,2 4,8 9,4 16,3 18,4 25,9 38.6 1) TRk,cr,(C20/25) characteristic bond resistance for cracked concrete for concrete strength class C20/25 for the relevant temperature range Injection System EJOT MULTIFIX Epoxy / Sormat ITH Epoxy for concrete Annex C 31 Performances Characteristic values of tension and shear loads under fire exposure (reinforcing bar)