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European Technical Assessment Body for construction products



European Technical Assessment

ETA-19/0203 of 1 November 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	MUNGO Injection system MIT900RE for concrete
Product family to which the construction product belongs	Bonded fasteners and bonded expansion fasteners for use in concrete
Manufacturer	MUNGO Befestigungstechnik AG Webereiweg 6 4802 Strengelbach SCHWEIZ
Manufacturing plant	Werk 13 / Plant 13
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-19/0203 issued on 2 December 2020



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Specific Part

1 Technical description of the product

The "MUNGO Injection system MIT900RE for concrete" is a bonded anchor consisting of a cartridge with injection mortar Injection mortar MIT700RE / MIT900RE 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



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

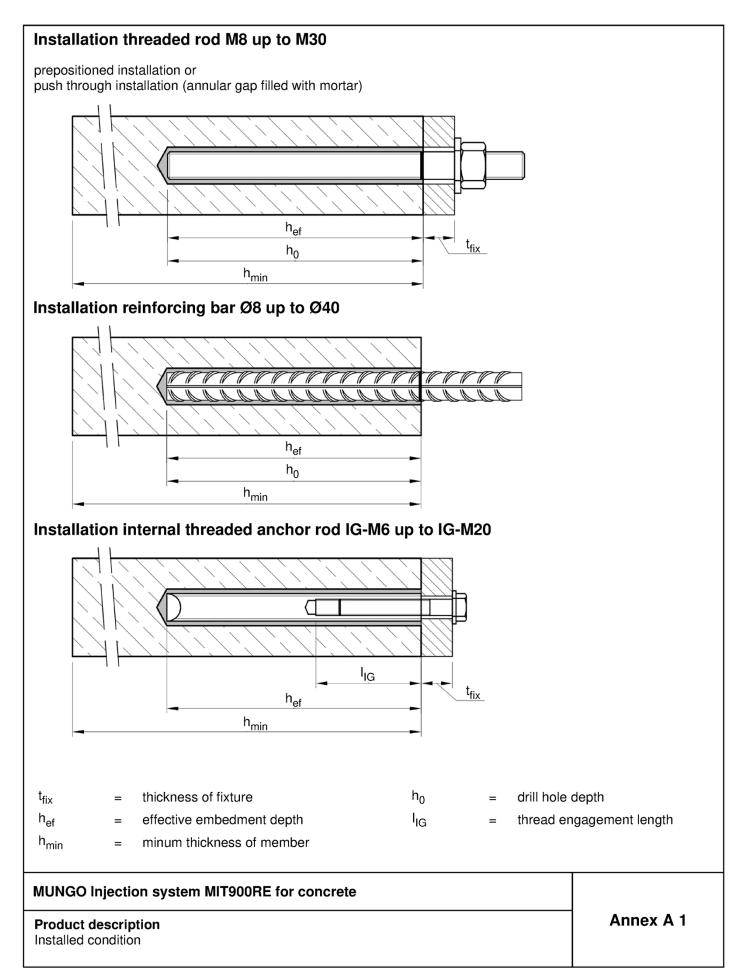
5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable European Assessment Document

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

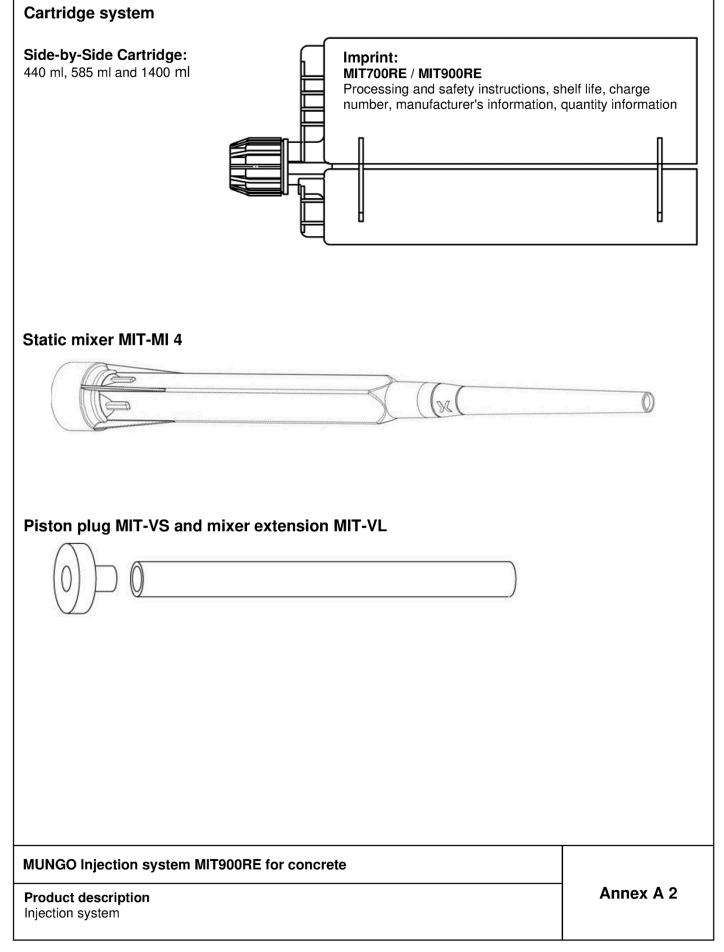
Issued in Berlin on 1 November 2024 by Deutsches Institut für Bautechnik

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

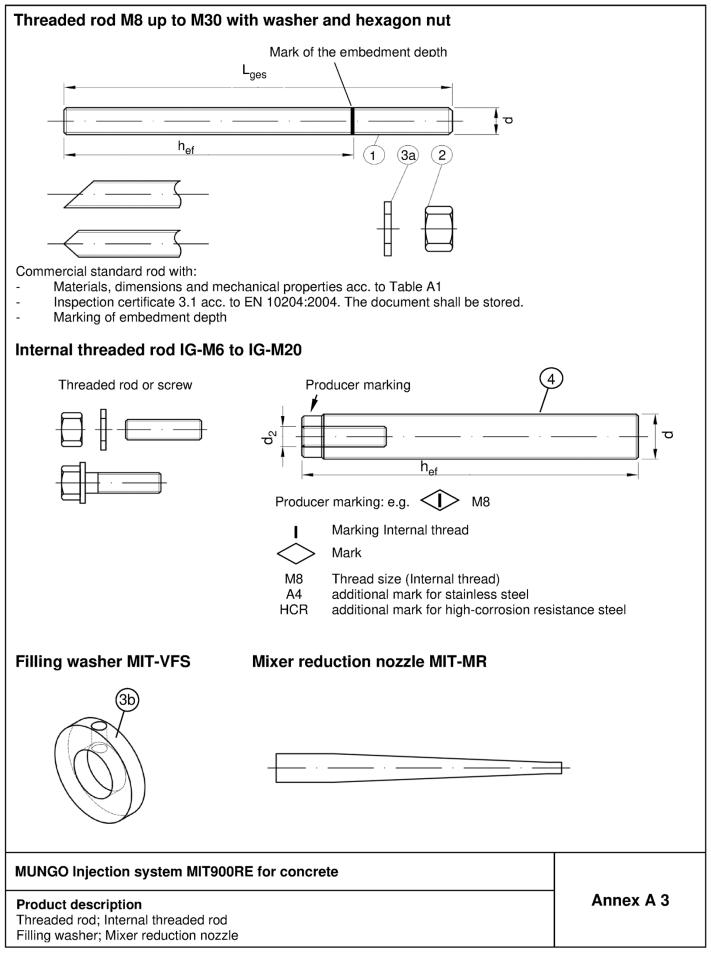














Part	Designation	Material				
		acc. to EN ISO 683-4:	2018	or EN 10263:2017)		
		5 µm acc. to EN ISO				
		40 µm acc. to EN ISO 45 µm acc. to EN ISO		1:2022 and EN ISO 10684: 68:2016	:2004+AC:2009 or	
01		Property class	170	Characteristic steel ultimate tensile strength	Characteristic steel yield strength	Elongation at fracture
			4.6	f _{uk} = 400 N/mm ²	$f_{vk} = 240 \text{ N/mm}^2$	A ₅ > 8%
1	Threaded rod			f _{uk} = 400 N/mm ²	f _{yk} = 320 N/mm ²	A ₅ > 8%
1 Threaded rod	acc. to		$f_{uk} = 500 \text{ N/mm}^2$	f _{vk} = 300 N/mm ²	A ₅ > 8%	
	EN ISO 898-1:2013		$f_{uk} = 500 \text{ N/mm}^2$	$f_{yk} = 400 \text{ N/mm}^2$	A ₅ > 8%	
				$f_{uk} = 800 \text{ N/mm}^2$	$f_{vk} = 640 \text{ N/mm}^2$	A ₅ ≥ 12% ³⁾
			4	for anchor rod class 4.6 o	7	1.5
2	Hexagon nut	acc. to	5	for anchor rod class 5.6 o		
		EN ISO 898-2:2022	8	for anchor rod class 8.8		
3a	Washer			galvanised or sherardized		
				EN ISO 7089:2000, EN ISC		7094:2000)
3b	Filling washer	•	n-aip	galvanised or sherardized Characteristic steel	Characteristic steel	Elongation at
	Intornal threaded	Property class		ultimate tensile strength	yield strength	fracture
4	Internal threaded anchor rod	acc. to	5.8	$f_{uk} = 500 \text{ N/mm}^2$	$f_{vk} = 400 \text{ N/mm}^2$	A ₅ > 8%
		EN ISO 898-1:2013			$f_{vk} = 640 \text{ N/mm}^2$	A ₅ > 8%
Stai	niess steel A2 (Mate			1 / 1.4567 or 1.4541, acc. t	, ···	5
				1 / 1.4362 or 1.4578, acc. t		
High	corrosion resistar	nce steel (Material 1.45	529 o	r 1.4565, acc. to EN 10088		
	Threaded rod ¹⁾⁴⁾	Property class		Characteristic steel	Characteristic steel	Elongation at
			ultimate tensile strengthyield strength50 $f_{uk} = 500 \text{ N/mm}^2$ $f_{vk} = 210 \text{ N/mm}^2$		$f_{vk} = 210 \text{ N/mm}^2$	fracture A ₅ ≥ 8%
1		acc. to EN ISO 3506-1:2020		$f_{uk} = 700 \text{ N/mm}^2$	$f_{yk} = 450 \text{ N/mm}^2$	-
					7	$A_5 \ge 12\%^{3)}$
			80	f _{uk} = 800 N/mm ²	$f_{yk} = 600 \text{ N/mm}^2$	$A_5 \ge 12\%^{(3)}$
•	1)4)	acc. to	50	for anchor rod class 50		
2	Hexagon nut ¹⁾⁴⁾	EN ISO 3506-1:2020	70	for anchor rod class 70		
		Δ2: Material 1 //301 /		for anchor rod class 80 307 / 1.4311 / 1.4567 or 1.4	541 acc to EN 10099	-1.2014
26	Weeher			04 / 1.4571 / 1.4362 or 1.4		
3a	Washer	HCR: Material 1.452	9 or ⁻	1.4565, acc. to EN 10088-1	: 2014	
01				EN ISO 7089:2000, EN ISC	0 7093:2000 or EN ISC	7094:2000)
3b	Filling washer	Stainless steel A4, H	ligh c	orrosion resistance steel	Characteristic stact	Elongotion -
	Intornal threaded	Property class		ultimate tensile strength	Characteristic steel yield strength	Elongation at
4	Internal threaded anchor rod ¹⁾²⁾	acc. to	50	$f_{uk} = 500 \text{ N/mm}^2$	$f_{vk} = 210 \text{ N/mm}^2$	A ₅ > 8%
		EN ISO 3506-1:2020	_	$f_{uk} = 700 \text{ N/mm}^2$	f _{vk} = 450 N/mm ²	A ₅ > 8%
1)	Property class 70 or 80			up to M24 and Internal threade	J ¹	I V
2)	for IG-M20 only property	class 50				
	0	tion if no use for seismic pe		ance category C2		
4)	Property class 80 only fo	or stainless steel A4 and HC	К			
					1	
MU	JNGO Injection sy	stem MIT900RE for	con	crete		
	- •					A
Dre	oduct description					Annex A 4
	terials threaded rod,					



Reinforcing bar: ø8 up to ø40		
ANN ANNANANA	N V V V V V V V V V V V V V V V V V V V	TANANA TO
Minimum value of related rip area f _{R,min} acco		
Rib height of the bar shall be in the range 0,0 (d: Nominal diameter of the bar; h _{rib} : Rib heig		
Table A2: Materials Reinforcing	bar	
Part Designation	Material	
Rebar		
1 Reinforcing steel according to EN 1992 1 1:2004+AC:2010, Annex C	Bars and rebars from ring class B or C f_{yk} and k according to NDP or NCI according $f_{uk} = f_{tk} = k \cdot f_{yk}$	to EN 1992-1-1/NA
MUNGO Injection system MIT900RE for Product description Materials reinforcing bar	concrete	Annex A 5
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	Working life	50 years	Working lif	e 100 years		
Base material	uncracked concrete	uncracked concrete	e cracked concrete			
HD: Hammer drilling HDB: Hammer drilling with hollow drill bit CD: Compressed air drilling	M8 to M8 to M8 to M Ø8 to Ø IG-M6 to	Ø 32,	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, ∅8 to ∅40, IG-M6 to IG-M20	No performance assessed	M8 to M30, ∅8 to ∅40, IG-M6 to IG-M20	No performance assessed		
Femperature Range:	II: - 40 C	to $+40 C^{1)}$ to $+72 C^{2)}$ to $+80 C^{3)}$	I: - 40 C II: - 40 C III: - 40 C	to +72 C ²⁾		
Fasteners subject to (seism	ic action):					
	Performance C	Category C1	Performance	e Category C2		
Base material	Cracked and uncr	Cracked and un	nd uncracked concrete			
HD: Hammer drilling HDB: Hammer drilling with hollow drill bit CD: Compressed air drilling	M8 to № Ø8 to 9	,	M12 t	M12 to M24		
DD: Diamond drilling	No performanc	e assessed	No performa	ormance assessed		
emperature Range:	l: - 40 C t ll: - 40 C t ll: - 40 C t lll: - 40 C t		l: - 40 C ll: - 40 C ll: - 40 C	to +72 C ²⁾		
Fasteners subject to (fire ex	posure):					
Base material		Cracked and und	racked concrete			
ID: Hammer drilling IDB: Hammer drilling with hollow drill bit CD: Compressed air drilling		M8 to Ø8 to IG-M6 to	Ø 32 ,			
D: Diamond drilling		No performar	ice assessed			
emperature Range:		I: - 40 C II: - 40 C III: - 40 C	to +72 C ²⁾			
 (max. long-term temperature +24° (max. long-term temperature +50° (max. long-term temperature +60° 	C and max. short-term te	mperature +40°C) mperature +72°C)				
MUNGO Injection system MIT	900RE for concrete					



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.

MUNGO Injection system MIT900RE for concrete

Intended use Specifications (Continued) Annex B 2



Threaded rod						M8	M10	M12	M16	6 M20) M:	24 1	M27	M30
Diameter of element			d = d	nom	[mm]	8	10	12	16	20	2	4	27	30
Nominal drill hole dia	ımeter				[mm]	10	12	14	18	22	2	8	30	35
Effective embedmen			f,min	[mm]	60	60	70	80	90	9	6	108	120	
			,	[mm]	160	200	240	320	400) 48	30 !	540	600	
Diameter of clearance hole in	Preposition	ied inst	tallation	d _f ≤	[mm]	9	12	14	18	22	2	6	30	33
the fixture	Push thre	ough ir	nstallatio	n d _f	[mm]	12	14	16	20	24	3	0	33	40
Maximum installation	n torque		max -	Г _{inst}	[Nm]	10	20	40 ¹⁾	60	100) 17	'0 í	250	300
Minimum thickness o	of member		ł	י _{min}	[mm]		_{ef} + 30 r ≥ 100 m				h _{ef} +	2d₀		
Minimum spacing			5	S _{min}	[mm]	40	50	60	75	95	11	5	125	140
Minimum edge dista	nce		(C _{min}	[mm]	35	40	45	50	60	6	5	75	80
1) Maximum installat	ion toraue fo	or M12	with stee	l Grade	e 4.6 is 3	85 Nm								
Table B2: I	nstallatio	on pa	ramet	ers fo	or rein	forci	ng bar	•						
Reinforcing bar			Ø 8 ¹⁾	Ø 10 ¹⁾	Ø 12 ¹⁾	Ø 14	Ø 16	Ø 20	Ø 24 ¹⁾	Ø 25 ¹⁾	Ø 28	Ø 32	Ø 36	Ø 40
Diameter of element	d = d _{nom}	[mm]	8	10	12	14	16	20	24	25	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	52/55
Effective embedmen	t h _{ef,min}	[mm]	60	60	70	75	80	90	96	100	112	128	144	160
depth	h _{ef,max}	[mm]	160	200	240	280	320	400	480	500	560	640	720	800
Minimum thickness of member	h _{min}	[mm]		30 mm 0 mm	≥		h _{ef} + 20							
Minimum spacing	s _{min}	[mm]	40	50	60	70	75	95	120	120	130	150	180	200
Minimum edge distance	c _{min}		35	40	45	50	50	60	70	70	75	85	180	200
1) both nominal drill I	nole diamete	er can b	be used											
Table B3: I	nstallatio	on pa	ramet	ers fo	or Inte	rnal t	hread	ed an	chor	rod				
Internal threaded a		•				-M6	IG-M8		M10	IG-M1	2 10	G-M16	IG	-M20
Internal diameter of a	anchor rod		d		1] (6	8		10	12		16		20
Outer diameter of an	chor rod1)		d = d _{nor}	n [mm	ı] 1	0	12	-	16	20		24		30
Nominal drill hole dia	Imeter		d	<u> </u>		2	14		18	22		28		35
Effective embedmen	t depth		h _{ef,mi}			60	70		30	90		96		20
Diameter of clearance	•		h _{ef,ma}		1] <u>2</u>	00	240	3	20	400		480		600
hole in the fixture			d _f :	1 -	י [נ	7	9	-	12	14		18		22
Maximum installatior			max T _{ins}	_{st} [Nm	ı] 1	0	10	2	20	40		60	1	00
Thread engagement min/max	length		I _I C	G [mm	-	20	8/20	10)/25	12/30)	16/32	20	0/40
Minimum thickness o	of member		h _{mi}	n [mm	ו]	h _{ef} + 30 ≥ 100				h	_{ef} + 2d	0		
Minimum spacing			s _{mi}	n [mm	ı] 5	50	60	7	75	95		115	1	40
Minimum edge dista			c _{mi}	n [mm	ı] 4	10	45	Ę	50	60		65		80
1) 14/21	s													
1) With metric thread	-													

Installation parameters



	LELELE			oromond	HARABAR						
Threaded Rod	Re- inforcing	Internal threaded	d ₀ Drill bit - Ø HD,	d _b Brush - Ø	d _{b,min} min.	Piston plug		lation direction a of piston plug			
	bar	anchor rod	DD HDB, CD		Brush - Ø		↓	\rightarrow	t		
[mm]	[mm]	[mm]	[mm]	MIT- [mm]	[mm]	MIT-					
<u>M8</u>	8		10	BS10 11,5	10,5	-					
M10	8 / 10	IG-M6	12	BS12 13,5	12,5	-	No plua	required			
M12	10/12	IG-M8	14	BS14 15,5	14,5	-	1				
-	12	-	16	BS16 17,5	16,5	1010					
M16	14	IG-M10	18	BS18 20,0	18,5	VS18	-				
-	16	-	20	BS20 22,0	20,5	VS20	-				
M20	-	IG-M12	22	BS22 24,0	22,5	VS22	-	h _{ef} > al 250 mm			
-	20	-	25	BS25 27,0	25,5	VS25	h _{ef} >				
M24	-	IG-M16	28	BS28 30,0	28,5	VS28	250 mm		all		
M27	24 / 25	-	30	BS30 31,8	30,5	VS30					
-	24 / 25	-	32	BS32 34,0	32,5	VS32					
M30	28	IG-M20	35	BS35 37,0	35,5	VS35					
_	32	-	40	BS40 43,5	40,5	VS40					
			1 1 -								
-	36	-	45	BS45 47,0	45,5	VS45					
-		-	45 52 -	BS45 47,0 BS52 54,0	45,5 52,5	VS45 VS52	all	all	all		
Cleaning	40	allation to	52 - - 55				all	all	all		
Cleaning HDB – Ho	40 g and insta llow drill bit sed air tool	allation to	52 - - 55	BS52 54,0 BS55 58,5	52,5	VS52 VS55 I system ca hoover wit flow rate o	onsists of MI	HP-Clean/ M	HX-Clea		
- Cleaning HDB – Ho Compress (min 6 bar) Brush MIT	40 g and insta llow drill bit sed air tool F-BS	- allation to system	52 - 55 ols	BS52 54,0 BS55 58,5	52,5 55,5 The hollow dril and a class M 253 hPa and a Piston Plug	VS52 VS55	onsists of MI h a minimum of minimum	HP-Clean/ M	HX-Clea		



Table B5:	Worki	ng and curing	y 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	idge 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.

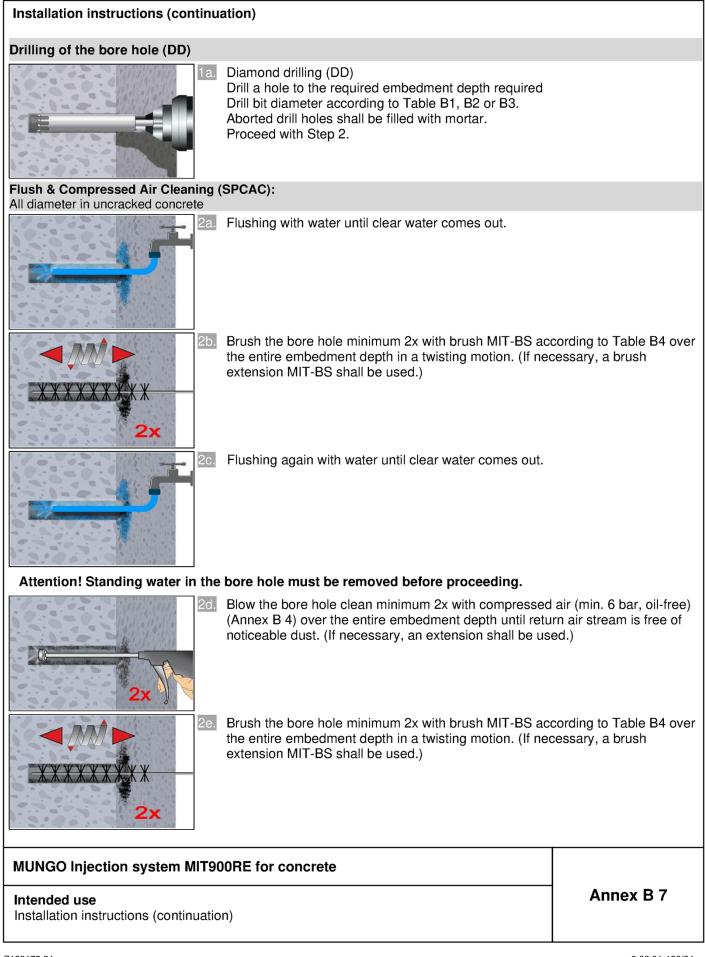
MUNGO Injection system MIT900RE for concrete

Intended use Working time and curing time Annex B 5

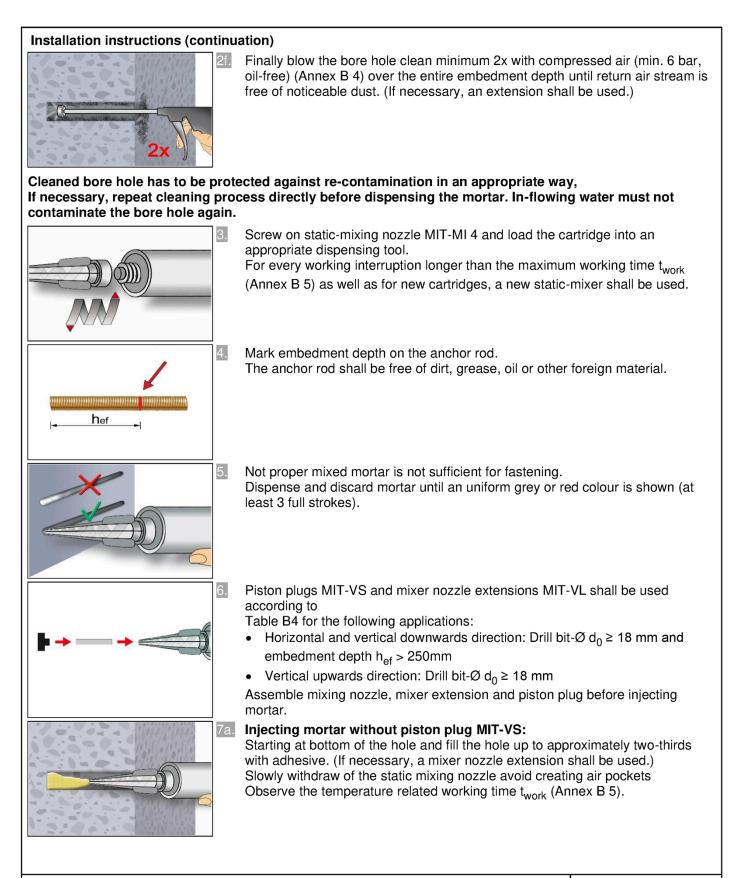


Drilling of the bore hole (HD, H		, ,	
	1a.	Hammer drilling (HD) / Compressed air drilling (CD) Drill a hole to the required embedment depth. Drill bit diameter according to Table B1, B2 or B3. Aborted drill holes shall be filled with mortar. Proceed with Step 2.Proceed with Step 2.	
	1b.	Hollow drill bit system (HDB) (see Annex B 4) Drill a hole to the required embedment depth. Drill bit diameter according to Table B1, B2 or B3. The hollow drilling system removes the dust and cleans Proceed with Step 3.	the bore hole.
		tention! Standing water in the bore hole must be rem	loved before cleaning.
Compressed Air Cleaning (CA All diameter in cracked and unc		ed concrete	
2x	2a.	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
	2b.	Brush the bore hole minimum 2x with brush MIT-BS acc the entire embedment depth in a twisting motion. (If nec extension MIT-BS shall be used.)	
2x	2c.	Finally blow the bore hole clean minimum 2x with comp oil-free) (Annex B 4) over the entire embedment depth free of noticeable dust. (If necessary, an extension shall	until return air stream is
	proc	ected against re-contamination in an appropriate way cess directly before dispensing the mortar. In-flowing	
MUNGO Injection system M	IT90	00RE for concrete	









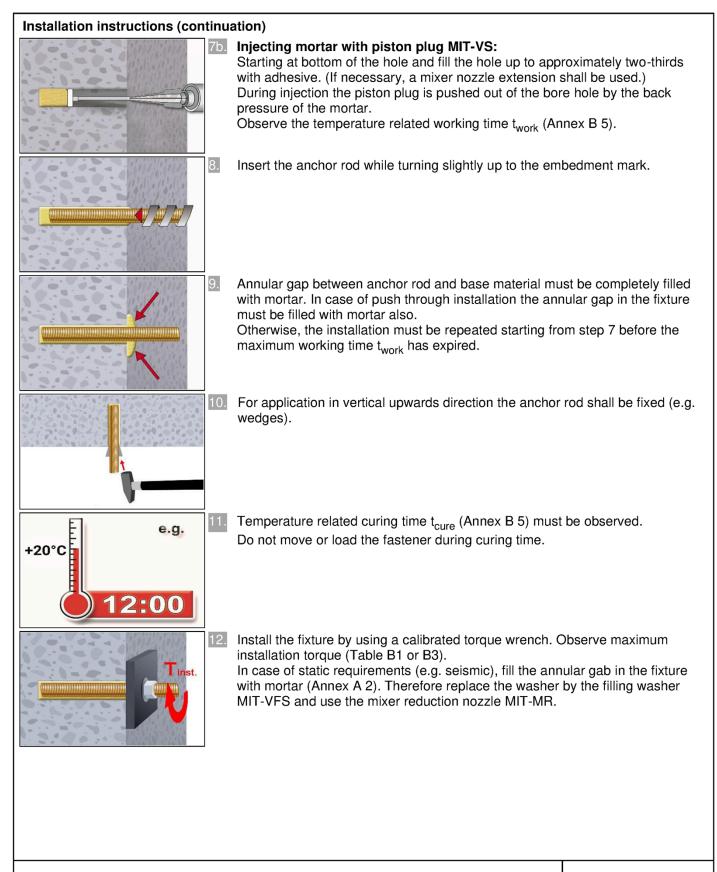
MUNGO Injection system MIT900RE for concrete

Intended use

Installation instructions (continuation)

Annex B 8





MUNGO Injection system MIT900RE for concrete

Intended use Installation instructions (continuation) Annex B 9



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	oss section area	A _s	[mm ²]	36,6	58	84,3	157	245	353	459	561	
CI	naracteristic 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	naracteristic 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				
St	ainless steel A2, A4 and HCR, class 50	γ _{Ms,N}	[-]				2,8	6				
St	ainless steel A2, A4 and HCR, class 70	γ _{Ms,N}	[-]				1,8	37				
St	ainless steel A4 and HCR, class 80	γ _{Ms,N}	[-]	1,6								
CI	naracteristic shear resistance, Steel failure	, 1)										
c	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	
ever	Steel, Property class 8.8	V ⁰ Rk,s	[kN]	15 (13)	23 (21)	34	63	98	141	184	224	
out le	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	
With		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									I		
	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	γMs,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		s in bra	ckets are	e valid for	unders	ized thr	eaded ro	ods with	smaller		

 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

MUNGO Injection system MIT900RE for concrete

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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 $h/h_{ef} \ge 2,0$ 1,0 h_{ef} h $2,0 > h/h_{ef} > 1,3$ 2 · h_{ef} 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}

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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		naracteristic val r a working life			ls uno	der st	atic a	and q	uasi-	static	actio	on
	led rod				M8	M10	M12	M16	M20	M24	M27	M30
Steel f								,				
	teristic tension	resistance	N _{Rk,s}	[kN]			A _s • †		ee Tab	le C1)		
Partial			γMs,N	[-]				see Ta	able C1			
L	•	nd concrete failure) = = = =			, aluilla a	
(CD)	cteristic bond res	sistance in uncracked	a concrete C20	/25 in namr	ner arlı		es (HD) and c	ompres	sed all	arillec	noles
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	[N/mm ²]	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	cteristic bond res	sistance in uncracked	d concrete C20	/25 in hamr	ner dril	led hole	es with	hollow	drill bit	(HDB)		
ge	I: 24°C/40°C				17	16	16	16	15	14	14	13
ranç	II: 50°C/72°C	Dry, wet			14	14	14	13	13	12	12	11
Temperature range	III:60°C/80°C			[N] //may 20	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	[N/mm ²]	16	16	16	15	15	14	14	13
d du	II: 50°C/72°C	flooded bore			14	14	14	13	13	12	12	11
Te	III:60°C/80°C				6,5	6,5	6,5	6,0	6,0	5,5	5,5	5,5
	teristic bond res hammer drilled	5 in hamme	r drilleo	holes	(HD) ,	compre	essed a	ir drille	d hole:	s (CD)		
er	I: 24°C/40°C	Dry, wet	τ _{Rk,cr}		7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5
Temperature range	II: 50°C/72°C	concrete and flooded bore		[N/mm²]	6,0	6,0	7,0	7,0	7,0	7,0	7,0	7,0
Tem	III:60°C/80°C	hole			5,0	5,0	5,0	4,5	4,5	4,5	4,5	4,5
		in cracked and uncr mer drilled holes with			hamme	er drille	d holes	s (HD),	compre	essed a	ir drille	ed
	I: 24°C/40°C	Dry, wet						0,	80			
Temperature range	II: 50°C/72°C	concrete and flooded bore	ψ ⁰ sus	[-]				0,	68			
Tem	III:60°C/80°C	hole						0,	70			
Increas	sing factors for c	concrete	Ψc	[-]				(f _{ck} / 2	20) ^{0,1}			
		sistance depending	τ _{Rk,ucr} =				Ψα	^{• τ} Rk,u	icr,(C20/	25)		
on the	concrete streng	th class	τ _{Rk,cr} =				Ψ	c ^{•τ} Rk,	cr,(C20/2	25)		
	ete cone failure Int parameter)			see Table C2							
Splitti												
	nt parameter			see Table C2								
	ation factor											
		te (HD; HDB, CD)	γinst	[-]					,0			
for floo	ded bore hole (H	HD; HDB, CD)	- 1131					1	,2			
MUN	GO Injection	system MIT900RE	for concrete	e								
Char		s of tension loads u 50 years (threaded r		l quasi-stat	tic actio	on				Anne	x C 3	}



Tabl	e C4:		acteristic val working life			ls uno	der st	atic a	and q	uasi-	static	actio	on
	led rod					M8	M10	M12	M16	M20	M24	M27	M30
Steel f				N	71 A 17			A . 4	10	00 T-1-			
	teristic tensi	ion resi	stance	N _{Rk,s}	[kN]			A _s • f		ee Tab	le C1)		
Partial				γMs,N	[-]				see Ta	able C1			
	-		oncrete failure	l concrete C20	/25 in hamr	nor dril	led hold) and c	omnros	sed air	driller	holes
(CD)		1051516						55 (ITD) and c	ompres	seu an	unnec	110165
ature	I: 24°C/40	0°C	Dry, wet			20	20	19	19	18	17	16	16
Temperature range	II: 50°C/72	°C	concrete and flooded bore	⁷ 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	l resista	ance in uncracked	concrete C20	/25 in hamr	ner dril	led hole	es with	hollow	drill bit	t (HDB)		
e	I: 24°C/40	0°C				17	16	16	16	15	14	14	13
Temperaturerange	II: 50°C/72	°C	Dry, wet concrete			14	14	14	13	13	12	12	11
nrer	III:60°C/80	°C	concrete			6,5	6,5	6,5	6,0	6,0	5,5	5,5	5,5
erat	I: 24°C/40)°C		^τ Rk,ucr,100	[N/mm ²]	16	16	16	15	15	14	14	13
du	II: 50°C/72	°C	flooded bore hole			14	14	14	13	13	12	12	11
Le l	III:60°C/80	0°C	noie			6,5	6,5	6,5	6,0	6,0	5,5	5,5	5,5
	teristic bond hammer drill	in hamme	r drilleo	holes	(HD) ,	compre	essed a	air drille	d hole:	s (CD)			
nre	I: 24°C/40	°C	Dry, wet concrete and flooded bore	^τ Rk,cr,100		6,5	6,5	7,5	7,5	7,5	7,5	7,5	7,5
Temperature range	II: 50°C/72	°C			[N/mm²]	5,5	5,5	6,5	6,5	6,5	6,5	6,5	6,5
Ter	III:60°C/80	0°C	hole			5,0	5,0	5,0	4,5	4,5	4,5	4,5	4,5
			in cracked and u drilled holes with			5 in har	nmer d	rilled h	oles (H	D), con	npresse	ed air c	drilled
ature	I: 24°C/40	°C	Dry, wet						0,	80			
Temperat range	II: 50°C/72	2°C	concrete and flooded bore	Ψ^0 sus,100	[-]				0,	68			
Ter	III:60°C/80	0°C	hole						0,	70			
Increas	sing factors f	or conc	rete	Ψc	[-]				(f _{ck} / 2	20) ^{0,1}			
Charac	teristic bond	l resista	ance depending	^τ Rk,ucr,100 =				$\psi_{\mathbf{C}}$.	^τ Rk,ucr	,100,(C2	20/25)		
on the	concrete stre	ength c	lass	^τ Rk,cr,100 =				$\psi_{\mathbf{C}}$.	^τ Rk,cr,	100,(C20	0/25)		
	ete cone fai												
	nt paramete	r				see Table C2							
Splittir Beleva	nt paramete		see Table C2										
	ation factor					I			000 10				
			HD; HDB, CD)	2.	[_]				1	,0			
for floo	ded bore hol	le (HD;	HDB, CD)	^γ inst	[-]				1	,2			
	AUNGO Injection system MIT900RE for concrete Performances Annex C 4												
			tension loads ur years (threaded		quasi-stat	ic actio	on						



	values of tens life of 50 years		ls und	der st	atic a	and q	uasi-	static	actio	on			
Threaded rod			M8	M10	M12	M16	M20	M24	M27	M30			
Steel failure													
Characteristic tension resistance	N _{Rk,s}	[kN]			A _s • f	_{uk} (or s	ee Tab	le C1)					
Partial factor	γ _{Ms,N}	[-]				see Ta							
Combined pull-out and concrete fail			I										
Characteristic bond resistance in uncra)/25 in diam	ond dri	lled hol	es (DD))							
L: 24°C/40°C Dry, wet			15	14	14	13	12	12	11	11			
Image: state s		[N/mm ²]	12	12	11	10	9,5	9,5	9,0	9,0			
			5,5	5,5	5,0	4,5	4,5	4,5	4,0	4,0			
Reduction factor ψ^0_{sus} in uncracked co	oncrete C20/25 in d	iamond drill	ed hole	es (DD)									
I: 24°C/40°C Dry, wet						0,	77						
Image: systemImage:		[-]				0,	72						
년 III:60°C/80°C hole						-	72						
Increasing factors for concrete	Ψ_{c}	[-]				(f _{ck} / 2	20) ^{0,2}						
Characteristic bond resistance depend on the concrete strength class	ing τ _{Rk,ucr} =				Ψ	• ^τ Rk,u	cr,(C20/	25)					
Concrete cone failure													
Relevant parameter						see Ta	ıble C2						
Splitting													
Relevant parameter						see Ta	ıble C2						
Installation factor for dry and wet concrete (DD)			1,0										
for flooded bore hole (DD)	γ _{inst}	[-]	1,2				,0	1,4					
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Table C6:Characteristicfor a working		ls und	der st	atic a	and q	uasi-	static	actio	on	
Threaded rod			M8	M10	M12	M16	M20	M24	M27	M30
Steel failure										
Characteristic tension resistance	N _{Rk,s}	[kN]			A _s • f _u	_{uk} (or s	ee Tab	le C1)		
Partial factor	γMs,N	[-]				see Ta	ble C1			
Combined pull-out and concrete fail										
Characteristic bond resistance in uncra		/25 in diam	ond dri	lled hol	es (DD))				
L: 24°C/40°C Dry, wet			15	14	14	13	12	12	11	11
I:24°C/40°CDry, wetII:50°C/72°CConcrete anIII:60°C/80°Chole		[N/mm²]	11	11	10	10	9,5	9,0	8,5	8,5
HII:60°C/80°C			5,5	5,5	5,0	4,5	4,5	4,5	4,0	4,0
Reduction factor $\psi^0_{sus,100}$ in uncracked	d concrete C20/25 i	in diamond	drilled	holes (l	DD)					
Dry, wet						0,	73			
Image: space of the systemImage: space of the system<		[-]				0,	70			
₩ III:60°C/80°C							72			
Increasing factors for concrete	Ψc	[-]				(f _{ck} / 2	20) ^{0,2}			
Characteristic bond resistance dependent on the concrete strength class	ng _{7Rk,ucr,100} =				ψ_{C} .	^τ Rk,ucr	,100,(C2	20/25)		
Concrete cone failure										
Relevant parameter						see Ta	ble C2			
Splitting										
Relevant parameter						see Ta	ible C2			
for dry and wet concrete (DD)					1,0					
for flooded bore hole (DD)	γ _{inst}	[-]		1,2			,0	1,4		
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Characteristic values of tension loads under static and quasi-static action for a working life of 100 years (threaded rod)

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Threaded rod			M8	M10	M12	M16	M20	M24	M27	M30		
Steel failure without lever arm												
Characteristic shear resistance Steel, strength class 4.6, 4.8 and 5.6, 5.8	V ⁰ Rk,s	[kN]			0,6 ·	A _s ∙f _{uk}	(or see	Table C	1)			
Characteristic shear resistance Steel, strength class 8.8 Stainless Steel A2, A4 and HCR, all strength classes	V ⁰ Rk,s	[kN]			0,5 ·	A _s ∙f _{uk}	(or see	Table C	1)			
Partial factor	γ _{Ms,V}	[-]				see	Table C	;1				
Ductility factor	k ₇	[-]					1,0					
Steel failure with lever arm	II											
Characteristic bending moment	M ⁰ Rk,s	[Nm]			1,2 • \	W _{el} • f _{uk}	(or see	Table C	;1)			
Elastic section modulus	W _{el}	[mm ³]	31 62 109 277 541 935 1387 1							1874		
Partial factor	γ _{Ms,V}	[-]	see Table C1									
Concrete pry-out failure												
Factor	k ₈	[-]					2,0					
Installation factor	γ _{inst}	[-]	1,0									
Concrete edge failure												
Effective length of fastener	۱ _f	[mm]] min(h _{ef} ; 12 · d _{nom}) min(h _{ef} ; 300mn									
Outside diameter of fastener	[mm]	8	10	12	16	20	24	27	30			
Installation factor	Installation factor Y _{inst}						1,0					

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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



Internal thread		rking life of	oo yeu		1.0					10
Steel failure ¹⁾	ded anchor rod	S			IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20
	ension resistance	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	121	196
Partial factor. s	trength class 5.8		γMs,N	[-]				,5		
	ension resistance					00		,	110	101
Steel A4 and H	ICR, Strength cla	ass 70 ²⁾	N _{Rk,s}	[kN]	14	26	41	59	110	124
Partial factor			γMs,N	[-]			1,87			2,86
•	I-out and conci									
Characteristic k (CD)	oond resistance	in uncracked co	oncrete C	20/25 in h	ammer dr	illed holes	s (HD) and	compress	sed air dril	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	[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 b	oond resistance	in uncracked co	oncrete C	20/25 in h	ammer dr	illed holes	with hollo	w drill bit	(HDB)	
-	I: 24°C/40°C	Dry, wet			16	16	16	15	14	13
-	II: 50°C/72°C	concrete			14	14	13	13	12	11
Temperature _			TBkuer	[N/mm²]	6,5	6,5	6,0	6,0	5,5	5,5
	I 24°C/40°C	flooded bore	TIK,UCI	[]	16	16	15	15	14	13
-		1	ncrete C20/25 ir		14	14	13	13	12	11
	III:60°C/80°C noie 6,5 6,5 6,0 6,0 5,5 5,5 cteristic bond resistance in cracked concrete C20/25 in hammer drilled holes (HD), compressed air drilled holes (CE									,
	drilled holes wit			23 III Hall			ib), comp		united no	163 (00
	I: 24°C/40°C	Dry, wet	d		7,0	8,5	8,5	8,5	8,5	8,5
Temperature -	II: 50°C/72°C	concrete and	^τ Rk,cr	[N/mm²]	6,0	7,0	7,0	7,0	7,0	7,0
range -	III:60°C/80°C	flooded bore hole			5,0	5,0	4,5	4,5	4,5	4,5
Reduction facto	or ψ^0_{sus} in cracl	1	ked conci	rete C20/2						
	I in hammer drill				5 m nam			b), compre		annea
· · ·	I: 24°C/40°C	Dry, wet					0	80		
Tamanaratura -	II: 50°C/72°C	concrete and	ψ^0 sus	[-]				68		
range -		flooded bore	Ψ sus	[-]			,			
	III:60°C/80°C	hole						70		
Increasing facto	ors for concrete		Ψc	[-]			(^r ck / r	20) ^{0,1}		
	oond resistance	depending on		^τ Rk,ucr =			Ψc ^{•τ} Rk,ι	ıcr,(C20/25)		
the concrete st	rength class			τ _{Rk,cr} =			Ψ c • ^τ Rk,	cr,(C20/25)		
	e failure									
Concrete cone	neter						see Ta	able C2		
Relevant paran										
Relevant paran Splitting failur	'e									
Relevant paran Splitting failur Relevant paran	r e neter						see Ta	able C2		
Relevant paran Splitting failur Relevant paran Installation fac	re neter ctor									
Relevant paran Splitting failur Relevant paran Installation fac for dry and wet	′e neter ctor concrete (HD; ⊦		γinst	[-]			1	,0		
Relevant paran Splitting failur Relevant paran Installation fac for dry and wet for flooded bore	re neter ctor concrete (HD; H e hole (HD; HDE	3, CD)			e materia	l and prope	1	,0 ,2	nal threade	d rod.
Relevant paran Splitting failur Relevant paran Installation fac for dry and wet for flooded bore 1) Fastenings (′e neter ctor concrete (HD; ⊦	3, CD) her) must comp	ly with the	appropriat			1 1 erty class c	,0 ,2 of the interr		d rod.
Relevant paran Splitting failur Relevant paran Installation fac for dry and wet for flooded bore ¹⁾ Fastenings (The characted	re neter ctor concrete (HD; H e hole (HD; HDE (incl. nut and was	B, CD) her) must comp sistance for steel	ly with the	appropriat			1 1 erty class c	,0 ,2 of the interr		d rod.
Relevant paran Splitting failur Relevant paran Installation fac for dry and wet for flooded bore ¹⁾ Fastenings (The characte ²⁾ For IG-M20	re neter ctor concrete (HD; H e hole (HD; HDE (incl. nut and was eristic tension res	B, CD) her) must comp sistance for stee is valid	ly with the failure is	appropriat valid for th			1 1 erty class c	,0 ,2 of the interr		d rod.
Relevant paran Splitting failur Relevant paran Installation fac for dry and wet for flooded bore ¹⁾ Fastenings (The characte ²⁾ For IG-M20	re neter ctor concrete (HD; F e hole (HD; HDE (incl. nut and was eristic tension res strength class 50 ection system	B, CD) her) must comp sistance for stee is valid	ly with the failure is	appropriat valid for th			1 1 erty class c	,0 ,2 If the interr fastening		



Internal threa	for a wo	<u> </u>	,		IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20
Steel failure ¹⁾		<u> </u>								
Characteristic	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	121	196
Partial factor,	strength class 5.8	3 and 8.8	γMs,N	[-]			1	,5		1
	tension resistand					00		-	110	101
Steel A4 and I	HCR, Strength cla	ass 70 ²⁾	N _{Rk,s}	[kN]	14	26	41	59	110	124
Partial factor			γMs,N	[-]			1,87			2,86
	III-out and conci									
Characteristic (CD)	bond resistance	in uncracked c	oncrete C20)/25 in hai	nmer drill	led holes	(HD) and	compress	sed air dri	lled 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	in uncracked c	oncrete C20)/25 in hai	nmer drill				, ,	
	I: 24°C/40°C	Dry, wet			16	16	16	15	14	13
_	II: 50°C/72°C	concrete			14	14	13	13	12	11
	III:60°C/80°C		^τ Rk,ucr,100	[N/mm²]	6,5	6,5	6,0	6,0	5,5	5,5
range	I: 24°C/40°C II: 50°C/72°C	flooded bore			16 14	16 14	15 13	15 13	14 12	13 11
	III:60°C/80°C	hole			6,5	6,5	6,0	6,0	5,5	5,5
	bond resistance			5 in hamn	,	,	,	,	,	,
and in namme	r drilled holes wit I: 24°C/40°C	1			6,5	7,5	7,5	7,5	7,5	7,5
Temperature		Dry, wet concrete and		[N]/mmm2]						
range	II: 50°C/72°C III:60°C/80°C	flooded bore	^τ Rk,cr,100	[N/mm ²]	5,5 5,0	6,5 5,0	6,5 4,5	6,5 4,5	6,5 4,5	6,5 4,5
		hole			-					,
	tor ψ ⁰ sus,100 in CD) and in hamm					ammer ar	llied noies	(HD), CO	mpressed	air
	I: 24°C/40°C	Dry, wet					0,	80		
Temperature	II: 50°C/72°C	concrete and flooded bore	Ψ^0 sus,100	[-]			0,	68		
range	III:60°C/80°C	hole					0,	70		
Increasing fac	tors for concrete		Ψc	[-]			(f _{ak} /)	20) ^{0,1}		
the concrete s	bond resistance trength class	depending on		ucr,100 =			/c ^{•τ} Rk,ucr			
Concrete con			∣ ^v Rł	k,cr,100 =			^μ c ^{•τ} Rk,cr,	100,(C20/2	5)	
Relevant para							see Ta	able C2		
Splitting failu							000.10			
Relevant para							see Ta	able C2		
Installation fa	ictor									
	t concrete (HD; H	. ,	γinst	[-]				,0		
	re hole (HD; HDE	. ,						,2		
The charac	(incl. nut and was teristic tension res strength class 50	sistance for stee	ly with the a I failure is va	ppropriate alid for the	material a internal th	and prope readed ro	rty class of d and the	f the interr fastening	al threade element.	ed rod.
MUNGO Inj	ection system	MIT900RE fo	or concret	е						
	ic values of tens	ion loads unders (Internal three			atic actic	on		/	Annex (C 9



	ded anchor rod	S			IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20	
Steel failure ¹⁾											
Characteristic	tension resistanc	ce, <u>5.8</u>	N _{Rk,s}	[kN]	10	17	29	42	76	123	
Steel, strength	l class	8.8	N _{Rk,s}	[kN]	16	27	46	67	121	196	
Partial factor,	strength class 5.8	3 and 8.8	γ _{Ms,N}	[-]			1	,5			
	tension resistand ICR, Strength cla	,	N _{Rk,s}	[kN]	14	26	41	59	110	124	
Partial factor			γ _{Ms,N}	[-]			1,87			2,86	
Combined pu	Ill-out and conci	rete cone failu	re								
Characteristic	bond resistance	in uncracked c	oncrete C2	20/25 in dia	mond dril	led holes	(DD)				
	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	[N/mm ²]	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 factor	or ψ^0_{sus} in uncra	acked concrete	C20/25 in	diamond d	rilled hole	es (DD)					
I: 24°C/40°C Dry, wet 0,77											
Temperature range	II: 50°C/72°C	concrete and flooded bore	Ψ^0 sus	[-]			0,	0,72 0,72			
	III:60°C/80°C	hole					-		42 76 123 67 121 196 59 110 124 59 110 124 12 12 11 9,5 9,5 9,0 4,5 4,5 4,0 0,2 (C20/25)		
ncreasing fact	ors for concrete		Ψc	[-]			(f _{ck} / 2	20) ^{0,2}			
	bond resistance	depending on		τ _{Rk,ucr} =			Ψc·τ _{Bk}	Icr (C20/25)		
the concrete st Concrete con				111,001				.01,(020/20)		
Relevant para							see Ta	able C2			
Splitting failu							000.10				
Relevant para	meter						see Ta	able C2			
Installation fa	ctor										
	t concrete (DD)		γinst	[-]			1	,0			
for flooded bor	. ,				1,				-		
	strength class 50										
MUNGO Injection system MIT900RE for concrete Anne Performances Characteristic values of tension loads under static and quasi-static action for a working life of 50 years (Internal threaded anchor rod) Anne										10	



Table C11		eristic value rking life of			nds und	ler stat	ic and o	quasi-s	tatic ac	tion			
Internal threa	ded anchor rod	S			IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20			
Steel failure ¹⁾													
Characteristic	tension resistance	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			
Partial factor,	strength class 5.8	3 and 8.8	γ _{Ms,N}	[-]			1	,5					
	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	pncrete C20)/25 in dia	mond dril	led holes	(DD)						
T	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 concrete and concr													
Temperature range	II: 50°C/72°C	flooded bore	Ψ^0 sus,100	[-]			0,	70					
	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 tender of t	depending on	^τ Rk,	ucr,100 =		ψ	[′] C ^{•τ} Rk,ucr	,100,(C20/2	25)				
Concrete con	e failure												
Relevant para							see Ta	able C2					
Splitting failu													
Relevant para							see la	able C2					
							1	0					
			γinst	[-]	1.	2			.4				
Installation factor for dry and wet concrete (DD) γ _{inst} [-] 1,2 1,4 for flooded bore hole (DD) γ _{inst} [-] 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													
MUNGO Inj	ection system	MIT900RE fo	or concret	e				_					
	e s ic values of tens g life of 100 year				atic actio	n		Annex C 11					



Internal threaded anchor rods				IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20
Steel failure without lever arm ¹⁾									
Characteristic shear resistance,	5.8	V ⁰ Rk,s	[kN]	5	9	15	21	38	61
Steel, strength class	8.8	V ⁰ Rk,s	[kN]	8	14	23	34	60	98
Partial factor, strength class 5.8 a	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		γinst	[-]				1,0		
Concrete edge failure									
Effective length of fastener		۱ _f	[mm]		min	(h _{ef} ; 12 • d	d _{nom})		min(h _{ef} ; 300mn
Outside diameter of fastener		d _{nom}	[mm]	10	12	16	20	24	30
Installation factor		γ _{inst}	[-]				1,0		•
 Fastenings (incl. nut and washe The characteristic tension resist For IG-M20 strength class 50 is 	ance for								
		E for cor							

Г



Table C13: Characte for a wor					load	s un	der s	tatic	and	qua	si-st	atic a	actio	n
Reinforcing bar			Ø8	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	As	[mm ²]	50	79	113	154	201	314	452	491	616	804	1018	1256
Partial factor	γ _{Ms,N}	[-]						1,4	42)					
Combined pull-out and concre														
Characteristic bond resistance in	n uncracked	d concret	e C20)/25 in	hamm	er (Hl	D) and	comp	resse	d air d	rilled h	noles (CD)	
$ \begin{array}{c} $			16	16	16	16	16	16	15	15	15	15	15	15
تق م concrete م تو ا: 50°C/72°C and flooded	T	[N1/mmm2]	12	10	12	12	12	12	10	12	44	44	44	4.4
flooded	^τ Rk,ucr	[N/mm ²]		12					12		11	11	11	11
E 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	4,5	4,5
Characteristic bond resistance in	n uncracked	d concret	e C20	/25 in	hamm	er dril	led ho	les wi	th holl	ow dri	ll bit (H	HDB)		
			14	14	13	13	13	13	13	13	13	13		
$ \exists 50°0//2°0 _{opporto}$			12	12	12	11	11	11	11	11	11	11	-	
변 원 III: 60°C/80°C Concrete	^τ 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)
I: 50°C/72°C flooded			13	13	13	13	13	13	13	13	13	13	-	
$\frac{11.50^{\circ}C/72^{\circ}C}{\text{III:} 60^{\circ}C/80^{\circ}C}$ bore hole			11 5,5	11 5,5	11 5,5	11 5,5	11 5,5	11 5,5	11 5,0	11 5,0	11 5,0	11 5,0		
	aracteristic bond resistance in cracked conc						· · · ·	<u> </u>	· ·	· ·	, <u>,</u>	,	holes (
	in hammer drilled holes with hollow drill bit (, (I ID)	, comp	10330	u an c	inica	10103	00)
			7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5	8,5	8,5		
$ \begin{array}{c} \overset{0}{\overset{0}{\overset{0}{\overset{0}{\overset{0}{\overset{0}{\overset{0}{0$	^τ Rk,cr [Ν	[N/mm²]		6,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0	3	5)
© ഈ III:60°C/80°C flooded bore hole			4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5		
												,	ا بر مایتالی	4
Reduction factor ψ^0_{SUS} in crack						namm		ieu no	ies (n	D), CO	mpres	seu ai	runne	u
holes (CD) and in hammer drille	a noies with			ו (חטם)									
$ \begin{array}{c} $									80					
ll: 50°C/72°C and flooded	Ψ^0 sus	[-]						0,	68					
E III:60°C/80°C bore hole									70					
Increasing factors for concrete	Ψc	[-]						(f _{ck} / 2	20) ^{0,1}					
Characteristic bond resistance	τ	Rk,ucr =					$\psi_{\textbf{C}}$	• ^τ Rk,u	icr,(C20)/25)				
depending on the concrete strength class		τ _{Rk,cr} =					Ψ_{c}	• ⁷ Rk,	cr,(C20	/25)				
Concrete cone failure														
Relevant parameter							5	see Ta	able C	2				
Splitting														
Relevant parameter			see Table C2											
Installation factor (HD; HDB, CD)														
for dry and wet concrete	γinst	[-]	1,0 1,2											
for flooded bore hole		1,2 3)										5)		
¹⁾ f _{uk} shall be taken from the spe		of reinford	ing ba	ars										
 2) in absence of national regulati 3) no performance assessed 	ion													
MUNGO Injection system	MIT900RE	for co	ncret	е										
							on				Ar	nnex	C 13	5
for a working life of 50 years	(reinforcing	g bar)												



Table C14:	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 tensi- 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		γ _{Ms,N}	[-]						1,4	42)					
Combined pull-out	t and concre	ete failure													
Characteristic bond		n uncracked	d concret	e C20	/25 in	hamm	er (Hl	D) and	comp	resse	d air d	rilled h	noles (CD)	
Lemberature II: 24°C/40°C II: 50°C/72°C III:60°C/80°C	concrete			16	16	16	16	16	16	15	15	15	15	15	15
ຍິດ ອີດ ແມ່ນ ແມ່ນ ເຊິ່ມ: 50°C/72°C	and flooded	^τ Rk,ucr,100	[N/mm ²]		12	12	12	12	12	12	12	11	11	11	11
<u></u>	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									· · · ·	<u> </u>		
u I: 24°C/40°C	Dry, wet			14	14	13	13	13	13	13	13	13	13		
[Ξ II: 50°0/72°0	concrete			12 5,5	12 5,5	12 5,5	11 5,5	11 5,5	11 5,5	11 5,0	11 5,0	11 5,0	11 5,0		
E 24°C/40°C		⁷ Rk,ucr,100	[N/mm ²]	13	13	13	13	13	13	13	13	13	13	3	5)
<u>E</u> <u></u> <u>II: 50°C/72°C</u>	flooded			11	11	11	11	11	11	11	11	11	11		
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	1	
Characteristic bond					5 in ha	mmer	drilled	holes	s (HD)	, comp	oresse	d air c	drilled I	holes	CD)
and in hammer drill		hollow dril	I bit (HDE	3)			I				1			1	
l: 24°C/40°C	concrete	^τ Rk,cr,100 [Ν		6,5	6,5	7,5	7,5	7,5	7,5	7,5	7,5	7,5	7,5	-	
Lemberature I: 24°C/40°C II: 50°C/72°C III:60°C/80°C	and flooded		[N/mm ²]	5,5	5,5	6,5	6,5	6,5	6,5	6,5	6,5	6,5	6,5	3	;)
ص208/C°08:III ق	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 c	racked and	uncrack	ed cor	ncrete	C20/2	5 in h	amme	r drille	d hole	s (HD), com	presse	ed air	
drilled holes (CD) a															
l: 24°C/40°C	Dry, wet								0,	80					
Binder and a second se	concrete and	Ψ^0 sus,100	[-]						0,	68					
E ■ III:60°C/80°C	flooded bore hole								0,	70					
Increasing factors for		Ψc	[-]						(f _{ck} / 2	20) ^{0,1}					
Characteristic bond		^τ Rk,u	ucr,100 =						Rk,ucr						
depending on the castrength class	Uncrete	^τ Rk,	,cr,100 =					$\psi_{\mathbf{C}}$.	^τ Rk,cr,	100,(C2	20/25)				
Concrete cone fail	ure														
Relevant parameter	r							5	see Ta	ble C	2				
Splitting															
Relevant parameter								5	see Ta	ble C	2				
Installation factor	•	CD)	1												
for dry and wet con for flooded bore hol		γinst	[-]						,0					1	,2
¹⁾ f _{uk} shall be take				l ling bo	r0			I	,2						·)
 ²⁾ in absence of na ³⁾ no performance 	tional regulati			ang ba	15										
MUNGO Injectio	on system	MIT900RE	E for co	ncret	e										
Performances												Ar	nnex	C 14	
Characteristic va for a working life				lic and	a quas	si-stat	c acti	on							



Table C15: 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	N _{Rk,s}	[kN]		1	T	I			f _{uk} 1)			I			
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 concre				· ·											
Characteristic bond resistance in	n uncracked	d concret	e C20	/25 in I	diamo	ond dri	lled ho	oles (E)D)						
L: 24°C/40°C Dry, wet concrete and flooded II: 60°C/80°C bore hole		[N]/mm21	14	13	13	13	12	12	11	11	11	11	11	10	
flooded iii: 50°C/72°C and flooded iii: 60°C/80°C bore hole	^τ Rk,ucr	[N/mm ²]	11 5,0	11 5,0	10 5,0	10 4,5	10 4,5	9,5 4,5	9,5 4,0	9,5 4,0	9,0 4,0	9,0 4,0	8,5 4,0	8,5 4,0	
Reduction factor ψ^0_{sus} in uncra	l Icked concr	l ete C20/2							-,-	.,.	-,-	-,-	-,-	-,-	
을 I: 24°C/40°C Dry, wet				0,77											
the end of	Ψ^0 sus	[-]	0,72												
·			0,72 (f / 20) 0.2												
Increasing factors for concrete Characteristic bond resistance	Ψc	[-]	(f _{ck} / 20) ^{0,2}												
depending on the concrete $\tau_{Rk,ucr} =$			Ψc ^{• τ} Rk,ucr,(C20/25)												
Concrete cone failure										_					
Relevant parameter							9	see Ta	able C	2					
Splitting Relevant parameter								see Ta		2					
Installation factor (DD)										۷					
for dry and wet concrete							1	,0					1	,2	
for flooded bore hole	^γ inst	[-]	1,2 1,4											3)	
¹⁾ f _{uk} shall be taken from the spe	ecifications	of reinford	ing ba	ırs											
 ²⁾ in absence of national regulati ³⁾ no performance assessed 	ion														
MUNGO Injection system	MIT900RE	E for col	ncret	e							_		•		
Performances Characteristic values of tensi for a working life of 50 years			tic and	d quas	si-stati	c acti	on				Ar	inex	C 15		



1		ristic val 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 resistance		N _{Rk,s}	[kN]				I		A _s ·							
Cross section area		A _s	[mm ²]	50	79	113	154	201	314		491	616	804	1018	1256	
Partial factor		γMs,N	[-]						1,4	42)						
Combined pull-out a										-						
Characteristic bond re		n uncrackeo	d concret	e C20	/25 in	diamo	ond dri	lled ho	oles (D)D)						
ຍີ່ຍີ່ II: 50°C/72°C an E	ncrete Id Ioded	⁷ Rk,ucr,100	[N/mm²]	14 11	13 10	13 10	13 10	12 9,5	12 9,0	11 9,0	11 9,0	11 8,5	11 8,5	11 8,0	10 8,0	
lll:60°C/80°C bo	ore hole			5,0	5,0	5,0	4,5	4,5	4,5	4,0	4,0	4,0	4,0	4,0	4,0	
Reduction factor $\psi_{sus,100}^{0}$ in uncracked concrete C20/25 in diamond drilled hole								d hole:	s (DD)							
emperative floor f				0,73												
co an de ال: 50°C/72°C an flo	oucu	Ψ^0 sus,100	[-]	0,70												
				0,72												
Increasing factors for		Ψc	[-]	(f _{ck} / 20) ^{0,2}												
Characteristic bond resistance depending on the concrete strength class $\tau_{Rk,ucr,100} =$			icr,100 =	Ψc [•] ^τ Rk,ucr,100,(C20/25)												
Concrete cone failur	е															
Relevant parameter				see Table C2												
Splitting				see Table C2												
Relevant parameter	ח)															
for dry and wet concre				1,0 1,2												
for flooded bore hole		γinst	[-]	1,2 1,4											3)	
¹⁾ f _{uk} shall be taken fi	om the spe	ecifications of	of reinford	ing ba	rs	,					,					
 ²⁾ in absence of natio ³⁾ no performance as 		on														
MUNGO Injection	system	MIT900RE	for co	ncret	e											
Performances Characteristic value for a working life of				ic and	d quas	si-stati	c acti	on				Ar	nex	C 16	5	



Table C17: Character a working						unc	ler s	tatio	and	qua	si-sta	tic a	ction	for		
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 without lever arm																
Characteristic shear resistance	V ⁰ Rk,s	[kN]						0,5	• A _s • f	i 1) uk						
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]		r	nin(h	_{əf} ; 12	• d _{nor}	n)			min(ł	n _{ef} ; 300	Omm)			
Outside diameter of fastener	d _{nom}	[mm]	8	10	12	14	16	20	24	25	28	32	36	40		
Installation factor	γinst	[-]							1,0							
 f_{uk} shall be taken from the spec in absence of national regulatio 		f reinforc	bing ba	ars												
MUNGO Injection system M	IIT900RE	for co	ncret	e									•	_		
Performances Characteristic values of shear loads under static and quasi-static action for a working life of 50 and 100 years (reinforcing bar)									А	nnex	C 17	1				



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)

ar	llied noies (CD) and in ha	mmer	ariilea	noles	with r	IOIIOW	ariii b	IT (HDE	3)
Threaded rod			M8	M10	M12	M16	M20	M24	M27	M30
Uncracked concrete	under static and	d quasi-static act	tion for a	workin	g life of	50 and	100 yea	rs		
Temperature range I:	δ_{N0} -factor	[mm/(N/mm ²)]	0,028	0,029	0,030	0,033	0,035	0,038	0,039	0,041
24°C/40°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,028	0,029	0,030	0,033	0,035	0,038	0,039	0,041
Temperature range II	: δ _{N0} -factor	[mm/(N/mm ²)]	0,038	0,039	0,040	0,044	0,047	0,051	0,052	0,055
50°C/72°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,047	0,049	0,051	0,055	0,059	0,064	0,067	0,070
Temperature range III	: δ _{N0} -factor	[mm/(N/mm ²)]	0,038	0,039	0,040	0,044	0,047	0,051	0,052	0,055
່60°C/80°Cັ	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,047	0,049	0,051	0,055	0,059	0,064	0,067	0,070
Cracked concrete un	der static and q	uasi-static actio	n for a w	orking I	ife of 50	and 10) years	•		
Temperature range I:	δ_{N0} -factor	[mm/(N/mm ²)]	0,069	0,071	0,072	0,074	0,076	0,079	0,081	0,082
24°C/40°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,100	0,115	0,122	0,128	0,135	0,142	0,155	0,171
Temperature range II	: δ _{N0} -factor	[mm/(N/mm ²)]	0,092	0,095	0,096	0,099	0,102	0,106	0,109	0,110
50°C/72°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,134	0,154	0,163	0,172	0,181	0,189	0,207	0,229
Temperature range III	: δ _{N0} -factor	[mm/(N/mm ²)]	0,092	0,095	0,096	0,099	0,102	0,106	0,109	0,110
60°C/80°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,134	0,154	0,163	0,172	0,181	0,189	0,207	0,229
1) Calculation of the dis		$0 = \delta_{\text{N0}} - \text{factor} \cdot \tau;$	δ _{N∞} = δι	v∞-factor	τ; τ:	action be	ond stres	s for tens	sion	-
	splacements	s under tensio	1					1		
Threaded rod			M8	M10	M12	M16	M20	M24	M27	M30
Uncracked concrete		d quasi-static act	tion for a	workin	g life of	50 year	s			
Temperature range I: 24°C/40°C	δ_{N0} -factor	[mm/(N/mm ²)]	0,011	0,012	0,012	0,013	0,014	0,014	0,015	0,015
	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,018	0,019	0,019	0,020	0,022	0,023	0,024	0,025
Temperature range II: 50°C/72°C	: δ _{N0} -factor	[mm/(N/mm ²)]	0,013	0,014	0,014	0,015	0,016	0,016	0,018	0,018
	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,052	0,053	0,055	0,058	0,062	0,065	0,068	0,070
Temperature range III	δ_{N0} -factor	[mm/(N/mm ²)]	0,013	0,014	0,014	0,015	0,016	0,016	0,018	0,018
60°C/80°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,052	0,053	0,055	0,058	0,062	0,065	0,068	0,070
Uncracked concrete	under static an	d quasi-static act	tion for a	workin	g life of	100 yea	rs			_
Temperature range I:	δ_{N0} -factor	[mm/(N/mm ²)]	0,011	0,012	0,012	0,013	0,014	0,014	0,015	0,015
24°C/40°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,020	0,021	0,021	0,023	0,024	0,025	0,026	0,027
Temperature range II	δ_{N0} -factor	[mm/(N/mm ²)]	0,013	0,014	0,014	0,015	0,016	0,016	0,018	0,018
50°C/72°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,038	0,039	0,040	0,043	0,045	0,047	0,049	0,051
Temperature range III	δ_{N0} -factor	[mm/(N/mm ²)]	0,013	0,014	0,014	0,015	0,016	0,016	0,018	0,018
60°C/80°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,038	0,039	0,040	0,043	0,045	0,047	0,049	0,051
1) Calculation of the dis	splacement: δ _N	$\sigma = \delta_{N0}$ -factor $\cdot \tau$;	$\delta_{N\infty} = \delta_{I}$	l∞-factor	· τ; τ:	action be	ond stres	s for tens	sion	
Table C19: Dis	enlacomente	s under shear	load ¹⁾	for all	drillin	a met	hode			
Threaded rod	spiacements	s under Snear			M12	M16	1	MOA	1407	
Uncracked and crack	ad apparata un	dor static and au	M8	M10			M20	M24	M27	M30
				1	1		1		<u> </u>	0.00
	V0-factor	[mm/kN]	0,06	0,06	0,05	0,04	0,04	0,03	0,03	0,03
	V_{∞} -factor	[mm/kN]	0,09	0,08	0,08	0,06	0,06	0,05	0,05	0,05
1) Calculation of the dis	splacement δvo	$b = \delta v_0$ -factor · V;	$\delta v_{\infty} = \delta v_{\infty}$	/∞-factor	$\cdot V; V$	action s	hear load	b		
MUNGO Injection	system MIT90	0RE for concre	te							
Performances Displacements unde	r static and qua	si-static action						Anı	nex C	18
for a working life of 5										



Internal threaded and	hor rods			IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20
Uncracked concrete	under static a	nd quasi-sta	tic actio	n for a wo	rking life	of 50 and	100 years	1	1
Temperature range I	: δ _{N0} -factor	 [mm/(N	J/mm²)]	0,029	0,030	0,033	0,035	0,038	0,041
24°C/40°C	$\delta_{N\infty}$ -factor	[mm/(N	J/mm²)]	0,029	0,030	0,033	0,035	0,038	0,041
Temperature range I	: δ _{N0} -factor	[mm/(N	J/mm²)]	0,039	0,040	0,044	0,047	0,051	0,055
່50°C/72°Cັ	$\delta_{N\infty}$ -factor	[mm/(N	J/mm²)]	0,049	0,051	0,055	0,059	0,064	0,070
Temperature range II	l: δ _{N0} -factor	[mm/(N	J/mm²)]	0,039	0,040	0,044	0,047	0,051	0,055
60°C/80°C	$\delta_{N\infty}$ -factor	[mm/(N	J/mm²)]	0,049	0,051	0,055	0,059	0,064	0,070
Cracked concrete un	der static and	quasi-static	action f	or a work	ing life of	50 and 10	0 years	-	
Temperature range I	: δ _{N0} -factor	[mm/(N	J/mm²)]	0,071	0,072	0,074	0,076	0,079	0,082
24°C/40°C	$\delta_{N\infty}$ -factor	[mm/(N	J/mm²)]	0,115	0,122	0,128	0,135	0,142	0,171
Temperature range I	: δ _{N0} -factor	[mm/(N	J/mm²)]	0,095	0,096	0,099	0,102	0,106	0,110
50°C/72°C	$\delta_{N\infty}$ -factor	[mm/(N	J/mm²)]	0,154	0,163	0,172	0,181	0,189	0,229
Temperature range II	l: δ _{N0} -factor	[mm/(N	J/mm²)]	0,095	0,096	0,099	0,102	0,106	0,110
່60°C/80°Cັ	$\delta_{N\infty}$ -factor	[mm/(N	J/mm²)]	0,154	0,163	0,172	0,181	0,189	0,229
1) Calculation of the dis		$\delta_{N0} = \delta_{N0}$ -facto		δ _{N∞} = δ _{N∞} -fa			ond stress f		
Table C22: Di	splacemer	its under t	ensior	IG-M6	In diamo	IG-M10	IG-M12	(DD) IG-M16	IG-M20
Uncracked concrete		nd quasi-sta	tic actio						
Temperature range I	0		J/mm²)]	0,012	0,012	0,013	0,014	0,014	0,015
24°C/40°C	$\delta_{N\infty}$ -factor		J/mm²)]	0,019	0,019	0,020	0,022	0,023	0,025
Temperature range I	0.4		J/mm²)]	0,014	0,014	0,015	0,016	0,016	0,018
50°C/72°C	$\delta_{N\infty}$ -factor	[mm/(N	J/mm²)]	0,053	0,055	0,058	0,062	0,065	0,070
Temperature range II	l: δ _{N0} -factor	[mm/(N	J/mm²)]	0,014	0,014	0,015	0,016	0,016	0,018
່60°C/80°Cັ	$\delta_{N\infty}$ -factor	[mm/(N	J/mm²)]	0,053	0,055	0,058	0,062	0,065	0,070
Uncracked concrete	under static a	nd quasi-sta	tic actio	n for a wo	orking life	of 100 yea	irs		
Temperature range I	: δ _{N0} -factor	[mm/(N	J/mm²)]	0,012	0,012	0,013	0,014	0,014	0,015
24°C/40°C	$\delta_{N\infty}$ -factor	[mm/(N	J/mm²)]	0,021	0,021	0,023	0,024	0,025	0,027
Temperature range I		- · ·	J/mm²)]	0,014	0,014	0,015	0,016	0,016	0,018
50°C/72°C	$\delta_{N\infty}$ -factor	[mm/(N	J/mm²)]	0,039	0,040	0,043	0,045	0,047	0,051
Temperature range II	l: δ _{N0} -factor	[mm/(N	J/mm²)]	0,014	0,014	0,015	0,016	0,016	0,018
60°C/80°C	$\delta_{N\infty}$ -factor		//mm²)]	0,039	0,040	0,043	0,045	0,047	0,051
				δ _{N∞} = δ _{N∞} -fa			ond stress f	or tension	
1) Calculation of the dis	splacemer	its under s					IG-M12		
Table C23: Di	harrada		IG-N					IG-M16	IG-M20
Table C23: Di		undor statio	200 00000	si-static at				0,04	
Table C23: Di Internal threaded and Uncracked and crack	ed concrete u			7 0		0,06	0,05	0,04	0,04
Table C23: Di Internal threaded and Internal threaded and Uncracked and crack All temperature	ed concrete u -factor	[mm/kN]	0,0			0.00	a a a	0.00	
Table C23: Diana Internal threaded and Incracked and crack Jncracked and crack δ_{VG} All temperature anges δ_{VG}	ed concrete u ₁ -factor ₂₋ factor	[mm/kN] [mm/kN]	0,0	0 0	,09	0,08 V: action s	0,08	0,06	0,06
Table C23: Di nternal threaded and Incracked and crack Jncracked and crack δνα All temperature δνα	ed concrete u _r -factor _{p-} factor placement	$[mm/kN]$ $[mm/kN]$ $\delta_{V0} = \delta_{V0}$ -factor	0,0 0,1 r · V; &		,09	0,08 V: action s	,	0,06	0,06



Table C24:		cements u holes (CD									•			
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
Uncracked con	crete under	static and q	uasi-sta	tic acti	ion for	a wor	king li	ife 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	8 0,035	0,038	0,038	0,040	0,043	0,045	0,047
l: 24°C/40°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)] 0,028	0,029	0,030	0,031	0,033	8 0,035	0,038	0,038	0,040	0,043	0,045	0,04
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	0,06
II: 50°C/72°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)] 0,047	0,049	0,051	0,053	0,055	5 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 qua	si-static	action	for a	workir	ng life	of 50 a	nd 100) years	S	-		
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		
I: 24°C/40°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)] 0,115	0,122	0,128	0,135	0,142	20,155	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		2)
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		-)
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		
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		
 Calculation of 2) No performan Table C25: 	ce assessed	ment: $\delta_{N0} = \delta$	δNO-factor			δ _{N∞} -fac						tension חר)		
Reinforcing bar	•		Ø8					Ø 20			· · ·	· · ·	Ø 36	Ø 40
Uncracked con		static and o									0 20	0 52	2 30	2 40
Temp range	δ_{N0} -factor	[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	/• ·			· ·	<u> </u>		· ·	· ·	· ·			
Temp range	δ_{N0} -factor	[mm/(N/mm ²							-					
II: 50°C/72°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²		-					-				-	
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	/• ·			<u> </u>	<u> </u>				-			
Uncracked con		- 、	/• ·								10,001	10,000	0,000	0,00
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>	<u> </u>		· ·	<u> </u>	<u> </u>			,
II: 50°C/72°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²	/-											
Temp range	δ_{N0} -factor	[mm/(N/mm ²		-	-	-	-	-	-	-	-			
III: 60°C/80°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²	/ -			· ·								,
¹⁾ Calculation of	the displacer	ment: $\delta_{N0} = \delta$	SN0-factor	•τ;	δ _{N∞} = 0	δ _{N∞} -fac	tor · τ;	τ: a	ction bo	ond stre	ess for t			0,00
Table C26: Reinforcing bar		cements u						7 11 11 1 <u>0</u> Ø 20 Ø				a 20	and	<i>α</i> 40
Uncracked and														Ø 40
	δ _{V0} -factor											0,03	0,03	0,03
All temperature ranges			· · ·			·	·	·				0,03	0,03	0,03
¹⁾ Calculation of	$\delta_{V\infty}$ -factor the displacer		$5,09 \mid 0,$ 5_{V0} -factor		, 	,06 0 δ _{v∞} -fac	,	,	lction sl	,	,	0,04	0,04	0,04
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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) I: 24°C/40°C [N/mm²] 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 II: 50°C/72°C 7,0 7,0 7,0 [N/mm²] 6,0 6,0 7,0 7,0 7,0 ^τRk,eq,C1 flooded bore hole 4,5 III:60°C/80°C [N/mm²] 5,0 5,0 5,0 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

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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 1,0 Increasing factors for concrete 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

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



Table C29: Characteristi (performance									ſS	
Threaded rod			M8	M10	M12	M16	M20	M24	M27	M30
Steel failure				1						
Characteristic shear resistance (Seismic C1)	V _{Rk,s,eq,C1}	[kN]				0,7	0∙V ⁰ Rk	.,S		
Partial factor	γ _{Ms,V}	[-]	[-] see Table C1							
Factor for annular gap	α_{gap}	[-]				0,	5 (1,0) ¹⁾			

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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									n			
	••	rformance o	category	C1) for							1			
Reinfor Steel fa	cing bar				Ø 8	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]					1 O • A	s • f _{uk})			
L	ection area	.515141100	A _s	[mm ²]	50	79	113	154	201	<u>s 'uк</u> 314	452	491	616	804
Partial factor γ _{Ms,N} [-]						70	110	104		4 ²⁾	102	401	010	004
	ned pull-out and	l concrete failu							.,	•				
Charact	acked cond hollow drill			in har	nmer o	drilled	holes	(HD), c	compre	essed	air			
ture	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/mm ²]	6,0	6,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0
Ten	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	1			
	eristic bond resising on the concre		τ _R	k,eq,C1 =				ψ_{c} .	^τ Rk,eq	I,C1,(C2	20/25)			
	tion factor													
for dry a CD)	and wet concrete	(HD; HDB,	γ _{inst}	[-]					1	,0				
<u> </u>	led bore hole (HI	D; HDB, CD)	, inst						1	,2				
¹⁾ f _{uk} s	hall be taken from	the specificatio	ns of reinford	ing bars										
MUNG	O Injection sy	/stem MIT900	RE for co	ncrete										
	r mances 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)



Tab		aracteristic rformance o									n			
Beinfo	orcing bar								-		Ø 24	Ø 25	Ø 28	Ø 32
L	failure				20	210	212			2 20	~	2020	2 20	
Chara	cteristic tension re	esistance	N _{Rk,s,eq,C1}	[kN]				-	1,0 • A	• f _{uk}	1)			
Cross	section area		A _s	[mm ²]	50	79	113	154	201	314	452	491	616	804
Partia	factor		γ _{Ms,N}	[-]					1.	42)				I
Comb	ined pull-out and	d concrete failu							,					
	cteristic bond resine holes (CD) and in						in har	nmer o	drilled	holes	(HD), d	compre	essed	air
ature	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/mm ²]	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
	sing factors for co		Ψc	[-]					1	,0				
	cteristic bond resident concreasion of the concreas		τ _F	k,eq,C1 =				ψ_{c} .	^τ Rk,ec	I,C1,(C2	20/25)			
	ation factor													
for dry CD)	and wet concrete	e (HD; HDB,	γ _{inst}	[-]					1	,0				
for floo	oded bore hole (H	D; HDB, CD)							1	,2				
MUN	IGO Injection s	ystem MIT900	RE for co	ncrete										
	ormances acteristic values	of tension load	s under sei	smic actio	on (per	forma	nce ca	ategor	y C1)		Α	nnex	C 25	5

for a working life of 100 years (reinforcing bar)



	eristic values o nance category									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 shear resistance	e V _{Rk,s,eq,C1}	[kN]					0,35	• A _s •	f _{uk} 1)			
Cross section area	A _s	[mm ²]	50	79	113	154	201	314	452	491	616	804
Partial factor	γ _{Ms} ,v	[-]		1				1,5 ²⁾			1	
Factor for annular gap	α_{gap}	[-]					0	,5 (1,0) ³⁾			
¹⁾ f _{uk} shall be taken from the s	pecifications of reinfor	rcing bars	3									
²⁾ in absence of national regula												
³⁾ Value in brackets valid for fill Annex A 3 is recommended.		een fastei	ner an	d clear	ance h	nole in	the fix	ture. l	Jse of	special	filling wa	sher

MUNGO Injection system MIT900RE 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)



(performance ca			ge			
Threaded rod			M12	M16	M20	M24
Steel failure				•		
Characteristic tension resistance, Steel, strength class 8.8 Stainless Steel A4 and HCR, Strength class ≥70	N _{Rk,s,eq,C2}	[kN]		1,0 •	N _{Rk,s}	
Partial factor	γ _{Ms,N}	[-]		see Ta	ıble C1	
Combined pull-out and concrete failure	;	I				
Characteristic bond resistance in cracked drilled holes (CD) and in hammer drilled h				nmer drilled hol	es (HD), comp	ressed air
₽ I: 24°C/40°C Dry, wet	^τ Rk,eq,C2	[N/mm ²]	5,8	4,8	5,0	5,1
ll: 50°C/72°C concrete and flooded bore	^τ Rk,eq,C2	[N/mm ²]	5,0	4,1	4,3	4,4
ឝ៑៍ III:60°C/80°C ^{hole}	^τ Rk,eq,C2	[N/mm ²]	1,9	1,6	1,6	1,7
Increasing factors for concrete	Ψc	[-]		1	,0	
Characteristic bond resistance depending on the concrete strength class		Rk,eq,C2 =		Ψc ^{• τ} Rk,eq	,C2,(C20/25)	
Installation factor	-					
for dry and wet concrete (HD; HDB, CD) for flooded bore hole (HD; HDB, CD)	γinst	[-] -			,0	
Table C34: Characteristic v	alues of sh		under se		,2 	
Table C34: Characteristic v (performance ca		ear loads	king life	eismic actio	n 00 years	M24
(performance ca		ear loads		eismic actio	n	M24
(performance ca Threaded rod Steel failure Characteristic shear resistance Steel, strength class 8.8 Stainless Steel A4 and HCR,		ear loads	king life	eismic actio of 50 and 10 M16	n 00 years	M24
(performance ca Threaded rod Steel failure Characteristic shear resistance Steel, strength class 8.8	itegory C2)	ear loads for a wor	king life	eismic actio of 50 and 10 M16	on 00 years M20	M24
(performance ca Threaded rod Steel failure Characteristic shear resistance Steel, strength class 8.8 Stainless Steel A4 and HCR, Strength class ≥70	v _{Rk,s,eq,C2}	ear loads for a wor	king life	eismic actio of 50 and 10 M16 0,70 • see Ta	on 00 years M20 V ⁰ _{Rk,s}	M24
(performance ca Threaded rod Steel failure Characteristic shear resistance Steel, strength class 8.8 Stainless Steel A4 and HCR, Strength class ≥70 Partial factor	v _{Rk,s,eq,C2} γ _{Ms,V} α _{gap}	ear loads for a wor [kN] [-]	king life M12	eismic actio of 50 and 10 M16 0,70 • see Ta 0,5 (V^0 years V^0 k,s able C1 $1,0)^{1)}$	



0,63
0,36 0,63 M24
0,63
M24
M24
M24
M24
4,2
10,9
10,0

MUNGO Injection system MIT900RE for concrete

Performances

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



hamme	teristic v r drilled noles wit	hole	s (HD), c	compres	ssed							mer
Threaded rod					M8	M10	M12	M16	M20	M24	M27	M30
Steel failure												
Characteristic tension			Fire	30	1,1	1,7	3,0	5,7	8,8	12,7	16,5	20,2
resistance; Steel, Stainless Steel A2, A4 and HCR,	N=	[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	N _{Rk,s,fi}		time	90	0,7	1,0	1,6	3,0	4,7	6,7	8,7	10,7
and higher			[min]	120	0,5	0,8	1,2	2,2	3,4	4,9	6,4	7,9
Characteristic bond resista given temperature θ	ance in cra	cked a	and uncra	cked con	crete C	20/25 ι	ip to C	50/60 u	nder fi	re conc	litions	for a
<u> </u>			θ < 2	23°C				1	,0			
Temperature reduction factor	k _{fi,p} (θ)	[-]	23°C ≤ θ	≤ 278°C			150	, 28 • θ	-1,598 <u>≤</u>	1,0		
lactor	1		θ > 2	78°C				0	,0			
Reduction Factor k _{fi} (θ) [-]												
0,0	50	100		150 Temperatur	200 e θ [°C]		250		300		350	
Characteristic bond resistance for a given temperature (θ)	τ _{Rk,fi} (θ)		[N/mm²]			k _{fi,p} ([θ) • τ _{Rk}	.,cr,(C20/	(25) ¹⁾		
Steel failure without lever a	arm											
Characteristic shear resistance; Steel, Stainless			Fire	30	1,1	1,7	3,0	5,7	8,8	12,7	16,5	20,2
Steel A2, A4 and HCR,	V _{Rk,s,fi}	[kN]	exposure time	60	0,9	1,4	2,3	4,2	6,6	9,5	12,4	15,1
strength class 5.8 resp. 50 and higher			[min]	90 120	0,7	1,0	1,6	3,0	4,7	6,7	8,7	10,7
Steel failure with lever arm				120	0,5	0,8	1,2	2,2	3,4	4,9	6,4	7,9
Characteristic bending				30	1,1	2,2	4,7	12,0	23,4	40,4	59,9	81,0
moment; Steel, Stainless			Fire exposure	60	0,9	1,8	3,5	9,0	17,5	30,3	44,9	60,7
Steel A2, A4 and HCR, strength class 5.8 resp. 50	M ⁰ _{Rk,s,fi}	[Nm]	time	90	0,7	1,3	2,5	6,3	12,3	21,3	31,6	42,7
and higher			[min]	120	0,5	1,0	1,8	4,7	9,1	15,7	23,3	31,5
¹⁾ ^T Rk,cr,(C20/25) characteristi temperature range	c bond resis	stance	for cracked	concrete	for conc	crete stre	ength cl	ass C20)/25 for 1	the relev	/ant	
MUNGO Injection syste Performances Characteristic values of te					oosure	(thread	led rod)		Anne	x C 2	9



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 $\tau_{\mathsf{Rk},\mathsf{fi}}(\theta)$ [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 MUNGO Injection system MIT900RE 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 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 4,7 7,4 9,2 12,1 2,3 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 3,1 6,2 8,0 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 4,0 6,3 9,0 9,8 12,3 16,1 3,1 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 9,7 18,8 32,6 36,8 51,7 77,2 30 1,8 4,1 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 MUNGO Injection system MIT900RE for concrete Annex C 31 Performances Characteristic values of tension and shear loads under fire exposure (reinforcing bar)