

IZJAVA O LASTNOSTIH

DoP Št.: MKT-2.1-701_sl

♦ Enotna identifikacijska oznaka tipa proizvoda: Injekcijski sistem VME plus

Predvidena uporaba: Vbrizgalni sistem za sidranje v betonu,

glej Priloga/Annex B

♦ Proizvajalec: MKT Metall-Kunststoff-Technik GmbH & Co.KG

Auf dem Immel 2 67685 Weilerbach

♦ Sistem ali sistemi ocenjevanja in preverjanja

nespremenljivosti lastnosti:

♦ Evropski ocenjevalni dokument: EAD 330499-01-0601

Evropska tehnična ocena: ETA-19/0483, 12.05.2021

Organ za tehnično ocenjevanje: DIBt, Berlin

Priglašeni organi: NB 2873 – Technische Universität Darmstadt

♦ Navedene lastnosti:

Bistvene značilnosti	Lastnosti
Mehanska odpornost in stabilnost (BWR 1)	
Karakteristični upori pod natezno obremenitvijo (statični in kvazistatični učinki)	Priloga / Annex B3, C1, C3-C6, C9-C11, C13-C15
Karakteristični upori pod prečnim stresom (statični in kvazistatični učinki)	Priloga / Annex C2, C7, C12, C16
Premiki	Priloga / Annex C18 – C21
Karakteristična odpornost in premiki za seizmične zmogljivosti kategorije C1 + C2	Priloga / Annex C8, C17-C19
Higiena, zdravje in okolje (BWR 3)	
Vsebina, emisije in / ali sproščanje nevarnih snovi	Zmogljivost ni ocenjena

Učinkovitost zgornjega izdelka je deklarirana zmogljivost / zmogljivost. Zgornji proizvajalec je izključno odgovoren za sestavo izjave o lastnostih v skladu z Uredbo (EU) št. 305/2011.

Podpisal za in v imenu proizvajalca:

Stefan Weustenhagen (Generalni direktor) Weilerbach, 12.05.2021 **Dipl.-Ing. Detlef Bigalke** (Vodja razvoja izdelkov)



Izvirnik te izjave o uspešnosti je bil napisan v nemščini. Za odstopanja v prevodu velja nemška različica.

Specification of intended use

Static and quasi-static action	working life 50 years	working life 100 years						
Threaded rod Internally threaded anchor rod Rebar	M8 - M30 VMU-IG M6 - VMU-IG M20 Ø8 - Ø32							
	cracked or und	racked concrete						
Base material	strength classes C20/25 to C50/60 compacted, reinforced or unreinforced normal weight concrete (without fibers) acc. to EN 206:2013+A1:2016							
	cracked concrete: hammer drilling / compressed air drilling / vaccum drilling							
Hole drilling	uncracked concrete: hammer drilling / compressed air drilling / vaccum drilling / diamond drilling							
Temperature range 1)	I: -40°C to +40°C II: -40°C to +72°C	I: -40°C to +40°C II: -40°C to +72°C						

Seismic action	performance category C1	performance category C2
Threaded rod Internally threaded anchor rod Rebar	M8 - M30 Ø8 - Ø32	M12 - M24
	cracked or und	racked concrete
Base material	compacted, reinforced or unre	C20/25 to C50/60 inforced normal weight concrete EN 206:2013+A1:2016
Hole drilling	hammer drilling / compresse	ed air drilling / vaccum drilling
Temperature range 1)	I: -40°C to +40°C II: -40°C to +72°C	I: -40°C to +40°C II: -40°C to +72°C

Temperature Range I: max. long term temperature +24°C and max. short term temperature +40°C max. long term temperature +50°C and max. short term temperature +72°C

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Specification of intended use

Use conditions (Environmental conditions):

- · Structures subject to dry internal conditions: all materials
- For all other conditions:
 Intended use of Materials according to Annex A4, Table A1 corresponding corrosion resistance classes CRC according to EN 1993-1-4:2006+A1:2015

Design:

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

Installation:

- Dry or wet concrete or waterfilled drillholes (not seawater)
- Hole drilling by hammer drill, compressed air drill, vacuum drill or diamond drill mode
- Overhead installation allowed
- Anchor installation carried out by appropriately qualified personnel and under the responsibility of the person responsible for technical matters of the site
- Internally threaded anchor rod: Screws and threaded rods (incl. nut and washer) must at least correspond to the material and strength class of the internally threaded anchor rod used

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Table B1: Installation parameters for threaded rods

Threaded rod					M10	M12	M16	M20	M24	M27	M30
Diameter of threaded	rod	d=d _{nom}	[mm]	8	10	12	16	20	24	27	30
Nominal drill hole dian	neter	d_0	[mm]	10	12	14	18	22	28	30	35
Effective anchorage d	onth -	$h_{\text{ef,min}}$	[mm]	60	60	70	80	90	96	108	120
Effective anchorage of	Effective anchorage depth —		[mm]	160	200	240	320	400	480	540	600
Diameter of clearance hole in the	Pre-setting installation	d _f ≤	[mm]	9	12	14	18	22	26	30	33
fixture	Through sett installation	ing d _f ≤	[mm]	12	14	16	20	24	30	33	40
Maximum installation torque max.T _{inst} ≤		[Nm]	10	20	40 (35) ¹⁾	60	100	170	250	300	
Minimum thickness of	member	h_{min}	[mm]	h _{ef} + 3	0mm ≥1	00mm			hef + 2do	ı	
Minimum spacing		Smin	[mm]	40	50	60	75	95	115	125	140
Minimum edge distand	ce	Cmin	[mm]	35	40	45	50	60	65	75	80

¹⁾ max. installation torque for property class 4.6

Table B2: Installation parameters for internally threaded anchor rods

Internally threaded anchor rod			IG-M 6	IG-M 8	IG-M 10	IG-M 12	IG-M 16	IG-M 20
Inner diameter of threaded rod	d ₂	[mm]	6	8	10	12	16	20
Outer diameter of threaded rod1)	d=d _{nom}	[mm]	10	12	16	20	24	30
Nominal drill hole diameter	d_0	[mm]	12	14	18	22	28	35
Effective anchorage depth	$h_{\text{ef},\text{min}}$	[mm]	60	70	80	90	96	120
Effective anchorage depth —	h _{ef,max}	[mm]	200	240	320	400	480	600
Diameter of clearance hole in the fixture	d _f ≤	[mm]	7	9	12	14	18	22
Maximum installation torque ma	x.T _{inst} ≤	[Nm]	10	10	20	40	60	100
Minimum screw-in depth	lıg	[mm]	8	8	10	12	16	20
Minimum thickness of member	h _{min}	[mm]	h _{ef} + 3 ≥ 10			h _{ef} +	- 2d ₀	
Minimum spacing	Smin	[mm]	50	60	75	95	115	140
Minimum edge distance	Cmin	[mm]	40	45	50	60	65	80

¹⁾ with metric thread acc. to EN 1993-1-8:2005+AC:2009

Table B3: Installation parameters for rebar

Rebar			Ø	8	Ø	10	ø.	12	Ø 14	Ø 16	Ø 20	Ø	24	Ø	25	Ø 28	Ø 32
Diameter of rebar	d=d _{nom}	[mm]	8	3	1	0	12	2	14	16	20	2	:4	2	5	28	32
Nominal drill hole diameter 1)	d ₀	[mm]	10	12	12	14	14	16	18	20	25	30	32	30	32	35	40
Effective anchorage	h _{ef,min}	[mm]	6	0	6	0	70)	75	80	90	9	6	1(00	112	128
depth	h _{ef,max}	[mm]	16	60	20	00	24	0	280	320	400	48	30	50	00	560	640
Minimum thickness of member	h _{min}	[mm]		-	- 30 00 r							h _{ef} +	- 2d)			
Minimum spacing	Smin	[mm]	4	0	5	0	60)	70	75	95	12	20	12	20	130	150
Minimum edge distance	e Cmin	[mm]	3	5	4	0	45	5	50	50	60	7	0	7	0	75	85

 $^{^{1)}}$ for $\varnothing 8,$ $\varnothing 10,\! \varnothing 12,$ $\varnothing 24$ and $\varnothing 25$ both nominal drill hole diameter can be used

Intended use

Installation parameters

Table B4: Parameter for cleaning and setting tools

Threaded rod	Internally threaded anchor rod	Rebar	Drill bit Ø	Brush Ø	min. Brush Ø
				d _b	M)
[-]	[-]	Ø [mm]	d ₀ [mm]	d ₅ [mm]	d _{b,min} [mm]
M8		8	10	11,5	10,5
M10	VMU-IG M6	8 / 10	12	13,5	12,5
M12	VMU-IG M8	10 / 12	14	15,5	14,5
		12	16	17,5	16,5
M16	VMU-IG M10	14	18	20,0	18,5
		16	20	22,0	20,5
M20	VMU-IG M12		22	24,0	22,5
		20	25	27,0	25,5
M24	VMU-IG M16		28	30,0	28,5
M27		24 / 25	30	31,8	30,5
		24 / 25	32	34,0	32,5
M30	VMU-IG M20	28	35	37,0	35,5
		32	40	43,5	40,5

Table B5: Retaining washer

Drill bit Ø		Installation direction and use					
d ₀ [mm]	[-]	•	→	1			
10							
12	No wate	ining wa	obou roou	uiro d			
14	No reta	No retaining washer required					
16							
18	VM-IA 18						
20	VM-IA 20						
22	VM-IA 22						
25	VM-IA 25						
28	VM-IA 28	h _{ef} > 250mm	h _{ef} > 250mm	all			
30	VM-IA 30						
32	VM-IA 32						
35	VM-IA 35						
40	VM-IA 40						



Vacuum drill bit

Vacuum drill bit (MKT Hollow drill bit SB, Würth Hammer drill bit with suction or Heller Duster Expert hollow drill bit system) and a vacuum cleaner with minimum negative pressure of 253 hPa and flow rate of minimum 42 l/s (150 m³/h)



Recommended compressed air tool (min 6 bar) Drill bit diameter (d₀): all diameters

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Intended use

Cleaning and setting tools

Table B6: Working time and curing time

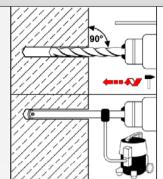
Conor	Concrete temperature		Working time	Minimum (curing time
Conci	ete temp	Derature	Working time	dry concrete	wet concrete
0°C	to	+4°C	90 min	144 h	288 h
+5°C	to	+9°C	80 min	48 h	96 h
+10°C	to	+14°C	60 min	28 h	56 h
+15°C	to	+19°C	40 min	18 h	36 h
+20°C	to	+24°C	30 min	12 h	24 h
+25°C	to	+34°C	12 min	9 h	18 h
+35°C	to	+39°C	8 min	6 h	12 h
	+40°C		8 min	4 h	8 h
Cartrio	dge temp	perature		+5°C to +40°C	

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Working and curing time

Installation instructions

Drilling of the drill hole and cleaning: Hammer drilling, compressed air drilling and vacuum drilling



1

Hammer drilling or compressed air drilling:

Drill with hammer drill or compressed air drill a hole into the base material with prescribed nominal drill hole diameter (Table B1, B2 or B3) and selected drillhole depth. Continue with step 2.

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

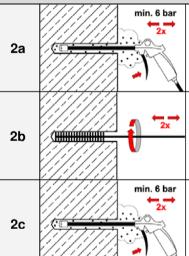
Vacuum drilling: see Annex B4

Drill drillhole with prescribed nominal drill hole diameter (Table B1, B2 or B3) and selected drillhole depth. This drilling method removes dust and cleans the drillhole during drilling. Continue with step 3.

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

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

Cleaning: dry, wet and water-filled drill holes with all diameter in uncracked and cracked concrete (Cleaning not applicable when using vacuum drilling)



Starting from the bottom or back of the drill hole, blow out the hole with compressed air (min. 6 bar) a minimum of **two** times until return air stream is free of noticeable dust.

If the drillhole ground is not reached, an extension must be used.

Check brush diameter (Table B4). Brush the hole with an appropriate sized wire brush $\geq d_{b,min}$ (Table B4) a minimum of **two** times.

If the drillhole ground is not reached with the brush, an appropriate brush extension must be used.

Starting from the bottom or back of the drill hole, blow out the hole with compressed air (min. 6 bar) again a minimum of **two** times until return air stream is free of noticeable dust.

If the drillhole ground is not reached, an extension must be used.

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

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Intended use

Installation instructions - Drilling and cleaning: Hammer drilling, compressed air drilling and vacuum drilling

Installation instructions (continuation)

Drilling of the drill hole and cleaning: Diamond drilling

1

Drill a hole into the base material with prescribed nominal drill hole diameter (Table B1, B2 or B3) and selected drillhole depth. Continue with step 2. In case of aborted drill hole, the drill hole shall be filled with mortar.

Cleaning: dry, wet and water-filled drill holes with all diameter in uncracked concrete



Remove drill core at least up to the nominal drill hole depth and check drill hole depth.



Flush drill hole with water, starting from the bottom until clear water gets out of the drill hole.

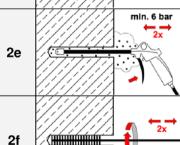


Check brush diameter (Table B4). Brush the hole with an appropriate sized wire brush $\geq d_{b,min}$ (Table B4) a minimum of **two** times.

If the drillhole ground is not reached with the brush, an appropriate brush extension must be used.



Flush drill hole again with water, starting from the bottom until clear water gets out of the drill hole.

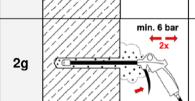


Starting from the bottom or back of the drill hole, blow out the hole with compressed air (min. 6 bar) again a minimum of **two** times until return air stream is free of noticeable dust.

If the drillhole ground is not reached, an extension must be used.

Check brush diameter (Table B4). Brush the hole again with an appropriate sized wire brush $\geq d_{b,min}$ (Table B4) a minimum of **two** times. If the drillhole ground is not reached with the brush, an appropriate brush

extension must be used.



Starting from the bottom or back of the drill hole, blow out the hole with compressed air (min. 6 bar) again a minimum of **two** times until return air stream is free of noticeable dust.

If the drillhole ground is not reached, an extension must be used.

Injection System VME plus

Intended use

Installation instructions - Drilling and cleaning: Diamond drilling

Installation instructions (continuation)

Inject	tion	
3	No. of the last of	Attach the supplied static-mixing nozzle to the cartridge and load the cartridge into the correct dispensing tool. For every working interruption longer than the recommended working time (Table B6) as well as for new cartridges, a new static-mixer shall be used.
4	hef	Prior to inserting the rod into the filled drillhole, the position of the embedment depth shall be marked on the threaded rod or rebar.
5	min.3x	Prior to dispensing into the drill hole, squeeze out separately a minimum of three full strokes and discard non-uniformly mixed adhesive components until the mortar shows a consistent grey or red colour.
6		Starting from the bottom or back of the cleaned drill hole fill the hole up to approximately two-thirds with adhesive. Slowly withdraw the static mixing nozzle as the hole fills to avoid air pockets. If the drill hole ground is not reached, an appropriate extension nozzle shall be used. Observe temperature dependent working times given in Table B6.
7		 Retaining washer and mixer nozzle extensions shall be used according to Table B5 for the following applications: Horizontal installation (horizontal direction) and ground installation (vertical downwards direction): Drill bit-Ø d₀ ≥ 18 mm and anchorage depth hef > 250mm Overhead installation: Drill bit-Ø d₀ ≥ 18 mm

Installation instructions (continuation)

Setting the fastening element Push the threaded rod or reinforcing bar into the hole while turning slightly to ensure proper distribution of the adhesive until the embedment depth is 8 reached. The anchor shall be free of dirt, grease, oil or other foreign material. Make sure that excess mortar is visible at the top of the hole and in case of through-setting installation also in the fixture. If these requirements are not 9 maintained, repeat application before end of working time! For overhead installation, the anchor should be fixed (e.g. by wedges). Allow the adhesive to cure to the specified time prior to applying any load or 10 torque. Do not move or load the anchor until it is fully cured (attend Table B6). 11 Remove excess mortar. $\mathbf{T}_{\mathsf{inst}}$ The fixture can be mounted after curing time. Apply installation torque Tinst 12 according to Table B1 or B2. In case of pre-setting installation the annular gap between anchor rod and fixture can optionally be filled with mortar. Therefore, replace regular washer by 13 washer with drill and plug on reducing adapter on static mixer. Annular gap is completely filled, when excess mortar seeps out.

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Installation instructions – Setting the fastening element

Table C1: Characteristic steel resistance for threaded rods under tension load

Thread	ded rod			М8	M10	M12	M16	M20	M24	M27	M30
Steel f	ailure										
Cross	sectional area	As	[mm²]	36,6	58,0	84,3	157	245	353	459	561
Charac	cteristic resistance under tens	1)									
þe	Property class 4.6 and 4.8	$N_{Rk,s}$	[kN]	15 (13)	23 (21)	34	63	98	141	184	224
Steel, zinc plated	Property class 5.6 and 5.8	$N_{Rk,s}$	[kN]	18 (17)	29 (27)	42	78	122	176	230	280
zir	Property class 8.8	$N_{Rk,s}$	[kN]	29 (27)	46 (43)	67	125	196	282	368	449
teel	A2, A4 and HCR Property class 50	N _{Rk,s}	[kN]	18	29	42	79	123	177	230	281
Stainless steel	A2, A4 and HCR Property class 70	N _{Rk,s}	[kN]	26	41	59	110	171	247	_3)	_3)
Stail	A4 and HCR Property class 80	N _{Rk,s}	[kN]	29	46	67	126	196	282	_3)	_3)
Partial	factors 2)										
	Property class 4.6	γMs,N	[-]				2	,0			
, ted	Property class 4.8	γMs,N	[-]				1	,5			
Steel, zinc plated	Property class 5.6	γMs,N	[-]				2	,0			
zin	Property class 5.8	γMs,N	[-]				1	,5			
	Property class 8.8	γMs,N	[-]				1	,5			
iteel	A2, A4 and HCR Property class 50	[-]				2,	86				
Stainless steel	A2, A4 and HCR Property class 70	γMs,N	[-]	1,87							_3)
Stair	A4 and HCR Property class 80	γMs,N	[-]			1	,6			_3)	_3)

the characteristic resistances apply for all anchor rods with the cross sectional area A_s specified here: VMU-A, V-A, VM-A. For commercial standard threaded rods with a smaller cross sectional area (e.g. hot-dip galvanized threaded rods M8, M10 according to EN ISO 10684:2004 + AC:2009), the values in brackets are valid.

Performance

Characteristic steel resistance for threaded rods under tension load

²⁾ in absence of national regulation

³⁾ Anchor type not part of the ETA

Table C2: Characteristic steel resistance for threaded rods under shear load

Threa	ded rod			M8	M10	M12	M16	M20	M24	M27	M30
Steel	failure										
Cross	sectional area	As	[mm²]	36,6	58,0	84,3	157	245	353	459	561
Chara	cteristic resistance under shear load ¹)									
Steel	failure <u>without</u> lever arm										
, ted	Property class 4.6 and 4.8	$V^0_{Rk,s}$	[kN]	9 (8)	14 (13)	20	38	59	85	110	135
Steel, zinc plated	Property class 5.6 and 5.8	$V^0_{Rk,s}$	[kN]	11 (10)	17 (16)	25	47	74	106	138	168
<u> </u>	Property class 8.8	$V^0_{Rk,s}$	[kN]	15 (13)	23 (21)	34	63	98	141	184	224
SS	A2, A4 and HCR, property class 50	V^0 Rk,s	[kN]	9	15	21	39	61	88	115	140
Stainless steel	A2, A4 and HCR, property class 70	$V^0_{Rk,s}$	[kN]	13	20	30	55	86	124	-	-
S	A4 and HCR, property class 80	$V^0_{Rk,s}$	[kN]	15	23	34	63	98	141	-	-
Steel	failure <u>with</u> lever arm										
pə	Property class 4.6 and 4.8	$M^0_{Rk,s}$	[Nm]	15 (13)	30 (27)	52	133	260	449	666	900
Steel, zinc plated	Property class 5.6 and 5.8	$M^0_{Rk,s}$	[Nm]	19 (16)	37 (33)	65	166	324	560	833	1123
zin	Property class 8.8	$M^0_{Rk,s}$	[Nm]	30 (26)	60 (53)	105	266	519	896	1333	1797
SS	A2, A4 and HCR, property class 50	$M^0_{Rk,s}$	[Nm]	19	37	66	167	325	561	832	1125
Stainless steel	A2, A4 and HCR, property class 70	$M^0_{Rk,s}$	[Nm]	26	52	92	232	454	784	_3)	_3)
St	A4 and HCR, property class 80	$M^0_{Rk,s}$	[Nm]	30	59	105	266	519	896	_3)	_3)
Partia	l factor 2)										
_	Property class 4.6	γMs,V	[-]				1,6	67			
al, ated	Property class 4.8	γMs,V	[-]				1,2	25			
Steel, nc plated	Property class 5.6	γMs,V	[-]				1,6				
Sinc	Property class 5.8	γMs,V	[-]				1,2				
	Property class 8.8	γMs,V	[-]				1,2	25			
SS	A2, A4 and HCR, property class 50	γMs,V	[-]				2,3	38			
Stainless steel	A2, A4 and HCR, property class 70	γMs,V	[-]	1,56						_3)	
S	A4 and HCR, property class 80	γMs,V	[-]			1,3	3			_3)	_3)

the characteristic resistances apply for all anchor rods with the cross sectional area A_s specified here: VMU-A, V-A, VM-A. For commercial standard threaded rods with a smaller cross sectional area (e.g. hot-dip galvanized threaded rods M8, M10 according to EN ISO 10684:2004 + AC:2009), the values in brackets are valid.

Injection System VME plus

Performance

Characteristic steel resistance for threaded rods under shear load

in absence of national regulation

³⁾ Anchor type not part of the ETA

Table C3: Characteristic values for concrete cone and splitting failure

Threaded rods / Internal	y threaded anchor ro	ods / Rel	bars	all sizes
Concrete cone failure				
Factor k ₁	uncracked concrete	k _{ucr,N}	[-]	11,0
Factor Ki	cracked concrete	k _{cr,N}	[-]	7,7
Edge distance		C _{cr,N}	[mm]	1,5 ⋅ h _{ef}
Spacing		S _{cr,N}	[mm]	2 • C _{cr,N}
Splitting failure				
Characteristic resistance		N^0 Rk,sp	[kN]	min(N _{Rk,p} ;N ⁰ _{Rk,c})
	h/h _{ef} ≥ 2,0			1,0 • h _{ef}
Edge distance	$2.0 > h/h_{ef} > 1.3$	C _{cr,sp}	[mm]	2 • h _{ef} (2,5 - h / h _{ef})
	h/h _{ef} ≤ 1,3			2,4 • h _{ef}
Spacing		S cr,sp	[mm]	2 · C _{cr,sp}

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Table C4: Characteristic values of tension load for threaded rods, static and quasi-static action, working life 50 years

Threaded rod		М8	M10	M12	M16	M20	M24	M27	M30				
Steel failure													
Characteristic resistance	Э	N _{Rk,s}	[kN]	A _s • f _{uk} (or see Table C1)									
Partial factor		γMs,N	[-]	see Table C1									
Combined pull-out and													
Characteristic bond re	Characteristic bond resistance in <u>uncracked</u> concrete												
Temperature range I: 40°C / 24°C	hammer- or compressed air	τ _{Rk,ucr}	[N/mm²]	20	20	19	19	18	17	16	16		
Temperature range II: 72°C / 50°C	drilling	τ _{Rk,ucr}	[N/mm²]	15	15	15	14	13	13	12	12		
Temperature range I: 40°C / 24°C	vacuum drilling	₹Rk,ucr	[N/mm²]	17 (16) ¹⁾	16	16	16 (15) ¹⁾	15	14	14	13		
Temperature range II: 72°C / 50°C	vacuum aniing	τ _{Rk,ucr}	[N/mm²]	14	14	14	13	13	12	12	11		
Characteristic bond re	sistance in <u>cracke</u>	<u>d</u> concr	ete C20/2	5									
Temperature range I: 40°C / 24°C	hammer-, compressed air	τ _{Rk,cr}	[N/mm²]	7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5		
Temperature range II: 72°C / 50°C	or vacuum drilling	TRk,cr	[N/mm²]	6,0	6,0	7,0	7,0	7,0	7,0	7,0	7,0		
Reductionfactor ψ ⁰ sus i	n concrete C20/25												
Temperature range I: 40°C / 24°C	hammer-, compressed air	ψ^0 sus	[-]	0,80									
Temperature range II: 72°C / 50°C	or vacuum drilling	ψ^0 sus	[-]				0,	68					
	C25/30		[-]		1,02								
	C30/37		[-]				1,	04					
Increasing factors for	C35/45	Ψc	[-]				1,	07					
concrete	C40/50	Ψ	[-]					80					
	C45/55		[-]					09					
	C50/60		[-]				1,	10					
Concrete cone failure													
Relevant parameter							see Ta	ble C3					
Splitting failure													
Relevant parameter							see Ta	ble C3					
Installation factor													
dry or wet concrete		γinst	[-]				1	,0					
waterfilled drill hole		γ̃inst	[-]				1	,2					
) value in brackets: chara	cteristic bond resista	nce for w	aterfilled d	Irill holes	3								

Injection System VME plus

Performance

Characteristic values of tension loads for threaded rods, working life 50 years

Table C5: Characteristic values of tension load for threaded rods, static and quasi-static action, working life 100 years

Threaded rod				М8	M10	M12	M16	M20	M24	M27	M30	
Steel failure												
Characteristic resistance)	N _{Rk,s}	[kN]			A _s • f	uk (ors	ee Tabl	e C1)			
Partial factor	γMs,N	[-]				see Ta	able C1					
Combined pull-out and	L concrete failure	71013,14	.,									
Characteristic bond re		cked cor	ncrete C2	0/25								
Temperature range I: 40°C / 24°C	Hammer- or	τ _{Rk,ucr,100}		20	20	19	19	18	17	16	16	
Temperature range II: 72°C / 50°C	compressed air drilling	TRk,ucr,100	[N/mm²]	15	15	15	14	13	13	12	12	
Temperature range I: 40°C / 24°C	Vooruum daillin -	τ _{Rk,ucr,100}	[N/mm²]	17 (16) ¹⁾	16	16	16 (15) ¹⁾	15	14	14	13	
Temperature range II: 72°C / 50°C	Vacuum drilling	TRk,ucr,100	[N/mm²]	14	14	14	13	13	12	12	11	
Characteristic bond re	sistance in <u>crack</u>	ed concr	ete C20/2	5	•	•					•	
Temperature range I: 40°C / 24°C	Hammer-, compressed air	τ _{Rk,cr,100}	[N/mm²]	6,5	6,5	7,5	7,5	7,5	7,5	7,5	7,	
Temperature range II: 72°C / 50°C	or vacuum drilling	TRk,cr,100	[N/mm²]	5,5	5,5	6,5	6,5	6,5	6,5	6,5	6,	
	C25/30		[-]	1,02								
	C30/37		[-]		1,04							
Increasing factors for	C35/45		[-]		1,07							
concrete	C40/50	Ψο	[-]				1,	80				
	C45/55		[-]				1,	09				
	C50/60		[-]				1,	10				
Concrete cone failure												
Relevant parameter							see Ta	able C3				
Splitting failure												
Relevant parameter							see Ta	ıble C3				
Installation factor												
dry or wet concrete		γinst	[-]				1	,0				
waterfilled drill hole		γinst	[-]				1	,2				
1) Value in brackets: chara	acteristic bond resis			drill hol	es							

¹⁾ Value in brackets: characteristic bond resistance for waterfilled drill holes

Injection	ı System	VME plus
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Performance

Characteristic values of tension loads for threaded rods, working life 100 years

Table C6: Characteristic values of tension load for threaded rods, static and quasi-static action, working life 50 and 100 years, diamond drilling in uncracked concrete

Threaded rod				М8	M10	M12	M16	M20	M24	M27	M30	
Steel failure												
Characteristic resistance	9	$N_{Rk,s}$	[kN]	A _s • f _{uk} (or see Table C1)								
Partial factor		γMs,N	[-]				see Ta	able C1				
Combined pull-out and concrete failure												
Characteristic bond re	ncrete C20	0/25					Workin	g life 50) years			
Temperature range I: 40°C / 24°C	diamand dvilling	τ _{Rk,ucr}	[N/mm²]	15	14	14	13	12	12	11	11	
Temperature range II: 72°C / 50°C	diamond drilling	TRk,ucr	[N/mm²]	12	12	11	10	9,5	9,5	9,0	9,0	
Reduction factor $\psi^0{}_{\text{sus}}$	in <u>uncracked</u> con	crete C2	0/25									
Temperature range I: 40°C / 24°C	diamond drilling	ψ^0 sus	[-]				0,	77				
Temperature range II: 72°C / 50°C	[-]	0,72										
Characteristic bond re	sistance in <u>uncra</u>	<u>cked</u> cor	ncrete C20	20/25 Working life 100 yea								
Temperature range I: 40°C / 24°C		τ _{Rk,ucr,100}	[N/mm²]	15	14	14	13	12	12	11	11	
Temperature range II: 72°C / 50°C	diamond drilling	τ _{Rk,ucr,100}	[N/mm²]	11	11	10	10	9,5	9,0	8,5	8,5	
	C25/30		[-]	1,04								
	C30/37		[-]		1,08							
Increasing factors for	C35/45		[-]				1,	12				
concrete	C40/50	Ψο	[-]				1,	15				
	C45/55		[-]				1,	17				
	C50/60		[-]				1,	19				
Concrete cone failure												
Relevant parameter							see Ta	able C3				
Splitting failure												
Relevant parameter							see Ta	able C3				
Installation factor												
dry or wet concrete		γinst	[-]				1	,0				
waterfilled drill hole		γinst	[-]		1,2				1,4			

Injection	System	VME p	lus
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Performance

Characteristic values of **tension loads** for **threaded rods**, working life **50** and **100 years**, **diamond drilling**

Table C7: Characteristic values of shear loads for threaded rods, static and quasi-static action

Threaded rod			M8	M10	M12	M16	M20	M24	M27	M30
Steel failure without lever arm										
Characteristic shear resistance Steel, property class 4.6, 4.8, 5.6 and 5.8	V^0 Rk,s	[kN]			(0,6 • <i>I</i> or see T	Α _s • f _{uk} Γable C	2		
Characteristic shear resistance Steel, property class 8.8 Stainless steel A2, A4 and HCR (all property classes)	$V^0_{Rk,s}$	[kN]	0,5 ⋅ A _s ⋅ f _{uk} or see Table C2							
Ductility factor	k ₇	[-]				1	,0			
Partial factor	γMs,V	[-]	-] see Table C2							
Steel failure with lever arm										
Characteristic bending resistance	M ⁰ Rk,s	[Nm]			c	1,2 • V or see T	V _{el} • f _{uk} able C	2		
Elastic section modulus	W _{el}	[mm³]	31	62	109	277	541	935	1387	1874
Partial factor	γMs,V	[-]				see Ta	ble C2			
Concrete pry-out failure										
Pry-out factor	k ₈	[-]				2	,0			
Concrete edge failure										
Effective length of anchor	l _f	[mm]	min (h _{ef} ;12 d _{nom}) min (h _{ef} ;300m							
Outside diameter of anchor	d _{nom}	[mm]	8	10	12	16	20	24	27	30
Installation factor	γinst	[-]				1	,0			

Injection System VME plus	
Performance Characteristic values of shear loads for threaded rods	Annex C7

Table C8: Characteristic values of tension load for threaded rods, seismic action (performance category C1 + C2), working life 50 and 100 years

Threaded rod				М8	M10	M12	M16	M20	M24	M27	M30
Tension loads											
Steel failure											
Characteristic resistance	; C1	N _{Rk,s,C1}	[kN]				1,0 •	$N_{Rk,s}$			
Characteristic resistance steel, zinc plated, proper stainless steel A4 and H0 property class ≥ 70	rty class 8.8	N _{Rk,s,C2}	[kN]	_	1)		1,0 •	$N_{Rk,s}$			1)
Partial factor		γMs,N	[-]				see Ta	ıble C1			
Combined pull-out and	concrete failu	re									
Characteristic bond res	sistance in cor	icrete C20/2	5 to C50	/60							
Temperature range I:	hammer-,	τ _{Rk,C1}	[N/mm²]	7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5
40°C / 24°C	compressed	τ _{Rk,C2}	[N/mm ²]	-	1)	5,8	4,8	5,0	5,1	-	1)
Temperature range II:	air or vacuum	τ _{Rk,C1}	[N/mm²]	6,0	6,0	7,0	7,0	7,0	7,0	7,0	7,0
72°C / 50°C	drilling	τ _{Rk,C2}	[N/mm²]	-	1)	5,0	4,1	4,3	4,4	-	1)
Installation factor											
Dry or wet concrete		γinst	[-]				1	,0			
Waterfilled drill hole		γinst	[-]	1,2							

¹⁾ No performance assessed

Table C9: Characteristic values of shear loads for threaded rods, seismic action (performance category C1 + C2)

Threaded roo	t			M8	M10	M12	M16	M20	M24	M27	M30
Shear loads											
Steel failure	without lever arm										
Characteristic resistance C1		$V_{Rk,s,C1}$	[kN]				0,7 •	$V^0_{Rk,s}$			
steel, zinc pla	resistance C2 ted, property class 8.8 I A4 and HCR, s ≥ 70	$V_{Rk,s,C2}$	[kN]	_1)		(),7 • V ⁰ f	Rk,s		_1)	
Partial factor			[-]				see Ta	able C2			
Factor for	actor for without annular gap			1,0		,0			·		
anchorages	with appular and batwaan		[-]	0,5							

¹⁾ No performance assessed

Injection System VME plus	
Performance Characteristic values for threaded rods under seismic action	Annex C8

Table C10: Characteristic values of tension loads for internally threaded anchor rod, static and quasi-static action, working life 50 years

Steel, zinc plated, property class 8.8 Nie.s [kN] 16 27 46 67 121 19	Internally threaded and	chor rod				VMU-IG M 6	VMU-IG M 8	VMU-IG M 10	VMU-IG M 12	VMU-IG M 16	VMU-IG M 20
Steel, zinc plated, property class 8.8 N _{Rk,8} [KN] 16 27 46 67 121 19	Steel failure 1)										
Partial factor 5.8 and 8.8 YMs.N E 1.5	Characteristic resistance	e,	5.8	$N_{Rk,s}$	[kN]	10	17	29	42	76	123
Characteristic resistance, Stainless steel A4 / HCR, property class 70 NRs,s [kN] 14 26 41 59 110 124 124 126 147 59 110 124 124 126 147 59 110 124 124 126 147 124 126 147 124 126 147 124 128 124 128	steel, zinc plated, prope	rty class	8.8	$N_{Rk,s}$	[kN]	16	27	46	67	121	196
Stainless steel A4 / HCR, property class 70 N _{Rk,S} [kN] 14 26 41 59 110 124	Partial factor 5.8 and 8.8	В		γMs,N	[-]			1.	,5		
Combined pull-out and concrete failure Characteristic bond resistance in uncracked ocncrete C20/25	Stainless steel A4 / HCF			$N_{Rk,s}$	[kN]	14	26	41	59	110	124 ²⁾
Characteristic bond resistance in uncreased concrete C20/25 Temperature range Cay°C / 24°C Tenkuor Tenkuor	Partial factor			γMs,N	[-]			1,87			2,86
Temperature range Factor Compressed air drilling Tells, usr	Combined pull-out and	d concrete fa	ilure	•							
Mammer- of compressed air drilling Tells, uor N/mmr 20 19 19 18 17 16 17 17 18 17 18 17 18 17 18 18	Characteristic bond re	sistance in <u>u</u>	ıncra	acked c	oncrete	C20/25					
Temperature range 1	40°C / 24°C		- 1	₹Rk,ucr	[N/mm²]	20	19	19	18	17	16
Telk,uor [N/mm²] 16	72°C / 50°C		an e	τ _{Rk,ucr}	[N/mm²]	15	15	14	13	13	12
TRILLIUM TAN		vacuum drilli	na	TRk,ucr	[N/mm²]	16	16	16 (15) ³⁾	15	14	13
Temperature range 1:		e II:			[N/mm²]	14	14	13	13	12	11
TRIK.CF IN/mmF 7,0 8,5 4,5 4,	Characteristic bond re	sistance in <u>c</u>	crack	<u>ked</u> con	crete C2	20/25					
Temperature range Compressed air or vacuum drilling Value Val	40°C / 24°C			τ _{Rk,cr}	[N/mm²]	7,0	8,5	8,5	8,5	8,5	8,5
Temperature range 1:			1	τ _{Rk,cr}	[N/mm²]	6,0	7,0	7,0	7,0	7,0	7,0
40°C / 24°C compressed air or vacuum drilling ψ°sus [-] 0,60 Temperature range II: 72°C / 50°C Compressed air or vacuum drilling ψ°sus [-] 0,68 Increasing factor for concrete Ψ°sus [-] 0,68 C25/30 1,02 C30/37 1,04 C35/45 1,07 C40/50 1,08 C45/55 1,09 C50/60 1,10 Concrete cone failure Relevant parameter see Table C3 Splitting failure Relevant parameter see Table C3 Installation factor dry or wet concrete γ'inst [-] 1,0	Reduction factor ψ^0_{sus}										
T2°C / 50°C drilling Ψ'sus Γ U,68	40°C / 24°C			ψ^0_{sus}	[-]			0,	80		
Increasing factor for concrete $ \psi_c = \begin{bmatrix} C30/37 & 1,04 \\ C35/45 & 1,07 \\ \hline C40/50 & 1,08 \\ \hline C45/55 & 1,09 \\ \hline C50/60 & 1,10 \\ \hline \end{bmatrix} $ Concrete cone failure Relevant parameter see Table C3 Splitting failure Relevant parameter see Table C3 Installation factor dry or wet concrete $ \psi_c = \begin{bmatrix} C30/37 & 1,04 \\ \hline C40/50 & 1,08 \\ \hline C50/60 & 1,09 \\ \hline C50/60 & 1,10 \\ \hline \end{bmatrix} $			ו	ψ^0_{sus}							
Increasing factor for concrete $\psi_{c} = \begin{cases} \frac{\text{C35/45}}{\text{C40/50}} & 1,07\\ \frac{\text{C40/50}}{\text{C45/55}} & 1,09\\ \frac{\text{C50/60}}{\text{C50/60}} & 1,10 \end{cases}$ $\frac{\text{Concrete cone failure}}{\text{Relevant parameter}} = \frac{\text{See Table C3}}{\text{See Table C3}}$ $\frac{\text{Installation factor}}{\text{dry or wet concrete}} = \frac{\gamma_{\text{inst}}}{\text{Installation factor}} = \frac{1,0}{1,0}$											
Increasing factor for concrete $\frac{\psi_{c}}{C40/50} = \frac{1,08}{1,09}$ $\frac{C45/55}{C50/60} = \frac{1,09}{1,10}$ Concrete cone failure Relevant parameter see Table C3 Splitting failure Relevant parameter see Table C3 Installation factor $\frac{\partial}{\partial x} = \frac{1,0}{1,0}$ $\frac{\partial}{\partial x} = \frac{1,0}{1,0}$ $\frac{\partial}{\partial x} = \frac{1,0}{1,0}$											
C40/50	Increasing factor for cor	ncrete		Ψс							
C50/60 1,10 Concrete cone failure Relevant parameter see Table C3 Splitting failure Relevant parameter see Table C3 Installation factor dry or wet concrete γ _{inst} [-] 1,0 dry or wet concrete γ _{inst} [-] 1,0	_										
Concrete cone failure Relevant parameter see Table C3 Splitting failure Relevant parameter see Table C3 Installation factor dry or wet concrete γ _{inst} [-] 1,0 Installation factor 1,0 1,0											
Relevant parameter see Table C3 Splitting failure Relevant parameter see Table C3 Installation factor dry or wet concrete γ _{inst} [-] 1,0	Concrete cone failure				300/00			١,	1.0		
Splitting failure Relevant parameter see Table C3 Installation factor dry or wet concrete γ _{inst} [-] 1,0 1,0 1,0 1,0								see Ta	ble C3		
Relevant parameter see Table C3 Installation factor dry or wet concrete γ_{inst} [-] 1,0	·							200 10			
Installation factor dry or wet concrete γ_{inst} [-] 1,0 1,0 1,0	<u> </u>							see Ta	ble C3		
dry or wet concrete γ_{inst} [-] 1,0	•								-		
				γ̃inst	[-]			1	,0		
,	waterfilled drill hole				[-]						

¹⁾Fastening screws or threaded rods (incl. nut and washer) must comply with the appropriate material and property class of the internally threaded anchor rod. The characteristic tension resistance for steel failure of the given strength class are valid for the internally threaded anchor rod and the fastening element.

Performance

Characteristic values of **tension loads** for **internally threaded anchor rod,** working life **50 years**

²⁾ for VMÚ-IG M20: property class 50

³⁾ value in bracket is valid for waterfilled drill hole

Table C11: Characteristic values of tension loads for internally threaded anchor rod static and quasi-static action, working life 100 years

Internally threaded ar	nchor rod				VMU-IG M 6	VMU-IG M 8	VMU-IG M 10	VMU-IG M 12	VMU-IG M 16	VMU-IG M 20
Steel failure 1)										
Characteristic resistance	ce,	5.8	N _{Rk,s}	[kN]	10	17	29	42	76	123
steel, zinc plated, prope	erty class	8.8	$N_{Rk,s}$	[kN]	16	27	46	67	121	196
Partial factor 5.8 and 8	.8		γ̃Ms,N	[-]			1	,5		
Characteristic resistand Stainless steel A4 / HC property class 70			$N_{Rk,s}$	[kN]	14	26	41	59	110	124 ²⁾
Partial factor			γ̃Ms,N	[-]			1,87			2,86
Combined pull-out an	d concrete fa	ailure	e							
Characteristic bond re	esistance in <u>ı</u>	uncr	acked c	oncrete	C20/25					
Temperature range I: 40°C / 24°C	hammer- c		TRk,ucr,100	[N/mm²]	20	19	19	18	17	16
Temperature range II: 72°C / 50°C	drilling	an	TRk,ucr,100	[N/mm²]	15	15	14	13	13	12
Temperature range I: 40°C / 24°C	vacuum drill	ina	TRk,ucr,100	[N/mm²]	16	16	16 (15) ³⁾	15	14	13
Temperature range II: 72°C / 50°C	vacuum um	irig	TRk,ucr,100	[N/mm²]	14	14	13	13	12	11
Characteristic bond re	esistance in g	crac	ked con	crete C2	0/25					
Temperature range I: 40°C / 24°C	hammer-, compressed		τ _{Rk,cr,100}	[N/mm²]	6,5	7,5	7,5	7,5	7,5	7,5
Temperature range II: 72°C / 50°C	or vacuun drilling	า	τ _{Rk,cr,100}	[N/mm²]	5,5	6,5	6,5	6,5	6,5	6,5
				C25/30			1,	02		
				C30/37			1,	04		
Increasing factor for as	narata			C35/45			1,	07		
Increasing factor for co	ncrete		Ψc	C40/50			1,	08		
				C45/55			1,	09		
				C50/60			1,	10		
Concrete cone failure										
Relevant parameter							see Ta	ble C3		
Splitting failure										
Relevant parameter							see Ta	ble C3		
Installation factor										
dry or wet concrete			γinst	[-]			1	,0		
waterfilled drill hole			γinst	[-]			1	,2		

¹⁾ fastening screws or threaded rods (incl. nut and washer) must comply with the appropriate material and property class of the internally threaded anchor rod. The characteristic tension resistance for steel failure of the given strength class are valid for the internally threaded anchor rod and the fastening element.

Performance

Characteristic values of **tension loads** for **internally threaded anchor rod**, working life **100 years**

²⁾ for VMU-IG M20: property class 50

³⁾ value in bracket is valid for waterfilled drill hole

Table C12: Characteristic values of tension loads for internally threaded anchor rod, static and quasi-static action, working life 50 and 100 years, diamond drilling

Internally threaded an	chor rod				VMU-IG	VMU-IG	VMU-IG	VMU-IG	VMU-IG	VMU-IG			
					M 6	M 8	M 10	M 12	M 16	M 20			
Steel failure 1)													
Characteristic resistance	,	5.8	N _{Rk,s}	[kN]	10	17	29	42	76	123			
steel, zinc plated, prope	•	8.8	N _{Rk,s}	[kN]	16	27	46	67	121	196			
Partial factor 5.8 and 8.			γ̃Ms,N	[-]		Γ	1	,5					
Characteristic resistand stainless steel A4 / HCI property class 70			$N_{Rk,s}$	[kN]	14	26	41	59	110	124 ²⁾			
Partial factor			γMs,N	[-]			1,87			2,86			
Combined pull-out an	d concrete fai	ilure	•										
Characteristic bond re	esistance in <u>u</u>	ncra	acked c	oncrete	C20/25			W	orking life	50 years			
Temperature range I: 40°C / 24°C	diamond drillir	na	τ _{Rk,ucr}	[N/mm²]	14	14	13	12	12	11			
Temperature range II: 72°C / 50°C	diamona amin	''9	τ _{Rk,ucr}	[N/mm²]	12	11	10	9,5	9,5	9,0			
Reduktions faktor ψ^0_{su}	s												
Temperature range I: 40°C / 24°C	diamond drillin	na	ψ^0_{sus}	[-]		0,77							
Temperature range II: 72°C / 50°C	diamond drillin	ng [ψ^0_{sus}	[-]			0,	72					
Characteristic bond re	esistance in <u>u</u>	ncra	acked c	oncrete	C20/25			Wo	rking life	100 years			
Temperature range I: 40°C / 24°C	diamond drilli		₹Rk,ucr,100	[N/mm²]	14	14	13	12	12	11			
Temperature range II: 72°C / 50°C	diamond drilli		Rk,ucr,100	[N/mm²]	11	10	10	9,5	9,0	8,5			
				C25/30				04					
				C30/37				08					
Increasing factor for τ_{Rk}	cuer		Ψc	C35/45				12					
J				C40/50				15					
				C45/55				17					
Concrete cone failure				C50/60			1,	19					
							600 To	blo C2					
Relevant parameter							see Ta	DIE C3					
Splitting failure							A T-	bla CC					
Relevant parameter							see Ta	DIE U3					
Installation factor				F 3									
dry or wet concrete	γinst	[-]			1	,0							
waterfilled drill hole			γ̃inst	[-]	1,	2		1,	4				

¹⁾ fastening screws or threaded rods (incl. nut and washer) must comply with the appropriate material and property class of the internally threaded anchor rod. The characteristic tension resistance for steel failure of the given strength class are valid for the internally threaded anchor rod and the fastening element.

Performance

Characteristic values of **tension loads** for **internally threaded anchor rod**, working life **50 and 100 years, diamond drilling**

²⁾ for VMÚ-IG M20: property class 50

³⁾ value in bracket is valid for waterfilled drill hole

Table C13: Characteristic values of shear loads for internally threaded anchor rod, static and quasi-static action

Interna	lly threaded anchor rod				VMU-IG M 6	VMU-IG M 8	VMU-IG M 10	VMU-IG M 12	VMU-IG M 16	VMU-IG M 20	
Steel fa	ailure <u>without</u> lever arm 1)										
, ted	Characteristic resistance,	5.8	$V^0_{Rk,s}$	[kN]	6	10	17	25	45	74	
Steel, zinc plated	property class	8.8	$V^0_{Rk,s}$	[kN]	8	14	23	34	60	98	
Zir	Partial factor 5.8 and 8.8		γMs,V	[-]			1,	25			
Stainless steel	Characteristic resistance, A4 / HCR, property class 70		V ⁰ Rk,s	[kN]	7	13	20	30	55	62 ²⁾	
Sta	Partial factor		γMs,V	[-]			1,56			2,38	
Ductility	/ factor		k ₇	[-]			1	,0			
Steel fa	ailure <u>with</u> lever arm 1)										
pe	Characteristic bending resistance,	5.8	M ⁰ Rk,s	[Nm]	8	19	37	66	167	325	
Steel, zinc plated	property class	8.8	M ⁰ Rk,s	[Nm]	12	30	60	105	267	519	
zin	Partial factor 5.8 and 8.8		γMs,V	[-]		1,25					
Stainless steel	Characteristic bending resista A4 / HCR, property class 70	ance	M ⁰ Rk,s	[Nm]	11	26	53	92	234	643 ²⁾	
Sta	Partial factor		γMs,V	[-]			1,56			2,38	
Concre	ete pry-out failure										
Pry-out	factor		k ₈	[-]			2	,0			
Concre	ete edge failure										
Effectiv	e length of anchor		lf	[mm]	min (h _{ef} ;12 d _{nom})					min (h _{ef} ; 300mm)	
Outside	e diameter of anchor		d _{nom}	[mm]	10	12	16	20	24	30	
Installa	tion factor		γ̃inst	[-]			1	,0			

¹⁾ fastening screws or threaded rods (incl. nut and washer) must comply with the appropriate material and property class of the internally threaded anchor rod (exception: VMU-IG M20). The characteristic shear resistance for steel failure of the given strength class are valid for the internally threaded anchor rod and the fastening element.

Injection System VME plus	
Performance Characteristic values of shear loads for internally threaded anchor rod	Annex C12

²⁾ for VMU-IG M20: Internally threaded rod: property class 50; Fastening screws or threaded rods (incl. nut and washer): property class 70

Table C14: Characteristic values of tension loads for rebar, static and quasi-static action, working life 50 years

Reinforcing bar				Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Steel failure				1.0 0	10 10	1.5		10 10	T				,,,
Characteristic tension	resistance	N _{Rk,s}	[kN]					A _s •	f _{uk} 1)				
Cross sectional area		As	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial factor		γMs,N	[-]	1,4 2)									
Combined pull-out an	ad aamarata failur	•						1,-	*				
Characteristic bond r			onerete C	20/25									
	esistance in <u>unci</u>	ackeu c		20/23	1					1			
Temperature range I: 40°C / 24°C	hammer- and	τ _{Rk,ucr}	[N/mm²]	16	16	16	16	16	16	15	15	15	15
Temperature range II: 72°C / 50°C	compressed air drilling	τ _{Rk,ucr}	[N/mm²]	12	12	12	12	12	12	12	12	11	11
Temperature range I: 40°C / 24°C		τ _{Rk,ucr}	[N/mm²]	14 (13) ³⁾	14 (13) ³⁾	13	13	13	13	13	13	13	13
Temperature range II: 72°C / 50°C	vacuum drilling	τRk,ucr	[N/mm²]	12 (11) ³⁾	12 (11) ³⁾	12 (11) ³⁾	11	11	11	11	11	11	11
Characteristic bond r	esistance in <u>crac</u>	ked con	crete C20	/25		•		•	•	•			
Temperature range I: 40°C / 24°C	hammer-, compressed air	τRk,cr	[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: 72°C / 50°C	or vacuum drilling	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
Reductionfactor ψ ⁰ sus													
Temperature range I: 40°C / 24°C	hammer-, compressed air	ψ^0 sus	[-]					0,	80				
Temperature range II: 72°C / 50°C	or vacuum drilling	ψ^0 sus	[-]					0,	68				
			C25/30						02				
			C30/37						04				
Increasing factor for co	ncrete	Ψc	C35/45 C40/50						07 08				
			C45/55						08 09				
			C50/60						10				
Concrete cone failure													
Relevant parameter								see Ta	ıble C	3			
Splitting failure													
Relevant parameter							(see Ta	ıble C	3			
Installation factor													
dry or wet concrete		γinst	[-]						,0				
waterfilled drill hole		γinst	[-]					1	,2				
) fuk shall be taken from t	he specifications of	reinforcir	ng bars										

fuk shall be taken from the specifications of reinforcing bars

Performance

Characteristic values of tension loads for rebar, working life 50 years

in absence of national regulation
 value in brackets: characteristic bond resistance for waterfilled drill holes

Table C15: Characteristic values of tension loads for rebar, static and quasi-static action, working life 100 years

Reinforcing bar				Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32		
Steel failure					<u> </u>										
Characteristic tension	resistance	N _{Rk,s}	[kN]	As • fuk ¹⁾											
Cross sectional area		As	[mm²]	50	79	113	154	201	314	452	491	616	804		
Partial factor		γMs,N	[-]					1,4	4 ²⁾						
Combined pull-out ar	nd concrete failu	re													
Characteristic bond r	esistance in <u>unc</u>	cracked co	oncrete C	20/25											
Temperature range I: 40°C / 24°C	hammer- and compressed	τ _{Rk,ucr,100}	[N/mm²]	16	16	16	16	16	16	15	15	15	15		
Temperature range II: 72°C / 50°C	[N/mm²]	12	12	12	12	12	12	12	12	11	11				
Temperature range I: 40°C / 24°C	[N/mm²]	14 (13) ³⁾	14 (13) ³⁾	13	13	13	13	13	13	13	13				
Temperature range II: 72°C / 50°C	vacuum drilling	τ _{Rk,ucr,100}	[N/mm²]	12 (11) ³⁾	12 (11) ³⁾	12 (11) ³⁾	11	11	11	11	11	11	11		
Characteristic bond r	esistance in <u>cra</u>	cked con	crete C20	/25		•	•		•						
Temperature range I: 40°C / 24°C	hammer-, compressed	TRk,cr,100	[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: 72°C / 50°C	air or vacuum drilling	TRk,cr,100	[N/mm²]	5,5	5,5	6,5	6,5	6,5	6,5	6,5	6,5	6,5	6,5		
			C25/30	1,02											
			C30/37						04						
Increasing factor for co	ncrete	Ψс	C35/45	1,07											
		40	C40/50						80						
			C45/55						09						
			C50/60					1,	10						
Concrete cone failure				Τ											
Relevant parameter							:	see Ta	able C	3					
Splitting failure															
Relevant parameter				see Table C3											
Installation factor	Installation factor														
dry or wet concrete		γinst	[-]					1	,0				_		
waterfilled drill hole		γinst	[-]					1	,2						
) fuk shall be taken from t	he specifications	of reinforcir	ng bars												

Performance

Characteristic values of tension loads for rebar, working life 100 years

f_{uk} shall be taken from the specifications of reinforcing bars
 in absence of national regulation
 value in brackets: characteristic bond resistance for waterfilled drill holes

Table C16: Characteristic values of tension loads for rebar, static and quasi-static action, working life 50 and 100 years, diamond drilling

Reinforcing bar				Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32	
Steel failure														
Characteristic tension re	esistance	$N_{Rk,s}$	[kN]	As • fuk ¹⁾										
Cross sectional area		As	[mm²]	50	50 79 113 154 201 314 452 491 616 8									
Partial factor		γMs,N	[-]	1,4 2)										
Combined pull-out an	d concrete failu	ıre												
Characteristic bond re	esistance in <u>un</u>	cracked c	oncrete C	20/25						Worl	king li	fe 50 y	year	
Temperature range I: 40°C / 24°C	diamond	TRk,ucr	[N/mm²]	14	13	13	13	12	12	11	11	11	11	
Temperature range II: 72°C / 50°C	drilling	TRk,ucr	[N/mm²]	11	11	10	10	10	9,5	9,5	9,5	9,0	9,0	
Reductionfactor ψ ⁰ sus		•			•									
Temperature range I: 40°C / 24°C	diamond	ψ ⁰ sus	[-]					0,	77					
Temperature range II: 72°C / 50°C	mperature range II: drilling0					0,72								
Characteristic bond re	esistance in <u>un</u>	<u>cracked</u> c	oncrete C	20/25						Worki	ing life	e 100 y	year	
Temperature range I: 40°C / 24°C	diamond	TRk,ucr,100	[N/mm²]	14	13	13	13	12	12	11	11	11	11	
Temperature range II: 72°C / 50°C	drilling	TRk,ucr,100	[N/mm²]	11	10	10	10	9,5	9,0	9,0	9,0	8,5	8,5	
			C25/30					1,	04					
			C30/37						80					
Increasing factor for co	ncrete	Ψс	C35/45						12					
3		7.	C40/50						15					
			C45/55						17					
Concrete cone failure			C50/60					1,	19					
Relevant parameter								SOO To	able C3	2				
Splitting failure							•	366 16	ible O					
Relevant parameter								see Ta	able C	3				
Installation factor							•	500 16						
dry or wet concrete		γinst	[-]					1	,0					
waterfilled drill hole		γinst	[-]		1	,2		Τ.	, =	1	,4			
) fuk shall be taken from the	ne specifications					,_								

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

Performance

Characteristic values of tension loads for rebar, working life 50 and 100 years, diamond drilling

Table C17: Characteristic values of shear loads for rebar, static and quasi-static action

Reinforcing bar			Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Steel failure without lever arm					'							
Characteristic shear resistance	$V^0_{Rk,s}$	[kN]					0,50 • /	A _s • f _{uk} 1)				
Cross sectional area	As	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial factor	γMs,V	[-]					1,	5 ²⁾				
Ductility factor	k ₇	[-]					1	,0				
Steel failure with lever arm												
Characteristic bending resistance	M ⁰ _{Rk,s}	[Nm]					1,2 • W	/ el ∙ f _{uk} ¹)				
Elastic section modulus	Wel	[mm³]	50	98	170	269	402	785	1357	1534	2155	3217
Partial factor	γMs,V	[-]					1,	5 ²⁾				
Concrete pry-out failure												
Pry-out factor	k ₈	[-]					2	,0				
Concrete edge failure												
Effective length of rebar	lf	[mm]	min (h _{ef} ;12 d _{nom}) min (h _{ef} ; 300mi)mm)			
Outside diameter of rebar	d _{nom}	[mm]	8	10	12	14	16	20	24	25	28	32
Installation factor	γinst	[-]					1	,0				

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

Table C18: Characteristic values of tension load for rebar, seismic action (performance category C1), working life 50 and 100 years

Reinforcing bar				Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32		
Steel failure															
Characteristic resistance N _{Rk,s,C1} [kN]					$A_s \cdot f_{uk}^{1)}$										
Cross sectional area		As	[mm²]	50	79	113	154	201	314	452	491	616	804		
Partial factor		γMs,N	[-]					1,4	1 ²⁾						
Combined pull-out an	d concrete failure														
Characteristic bond re	esistance in conc	rete C20	/25 to C5	0/60											
Temperature range I: 40°C / 24°C	hammer-, compressed air	τ _{Rk,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: 72°C / 50°C	or vacuum drilling	TRk,C1	[N/mm²]	6,0	6,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0		
Installation factor															
dry or wet concrete		γinst	[-]					1,	0						
waterfilled drill hole		γinst	[-]					1,	2						

f_{uk} shall be taken from the specifications of reinforcing bars
 in absence of national regulation

Table C19: Characteristic values of shear loads for rebar, seismic action (performance category C1)

Reinforcing bar			Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Steel failure without lever are	m											
Characteristic resistance	$V_{\text{Rk},s,\text{C1}}$	[kN]					0,35 · A	∆s • f _{uk} ¹)				
Cross sectional area	As	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial factor	γMs,V	[-]					1,5	5 ²⁾				
Ductility factor	k ₇	[-]					1,	,0				

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

Characteristic values for rebar under seismic action

²⁾ in absence of national regulation

Threaded rod			M8	M10	M12	M16	M20	M24	M27	M30
Hammer-, compresse	ed air or vac	uum drilling								
Displacement factor ¹⁾ Uncracked concrete, s	static and gu	asi-static actio	on, work	ina life 5	50 and 1	00 vears	3			
Temperature range I:	δ _{N0} - factor		0,028	0,029	0,030	0,033	0,035	0,038	0,039	0,041
40°C / 24°C	δ _{N∞} - factor	mm 1	0,028	0,029	0,030	0,033	0,035	0,038	0,039	0,041
Temperature range II:	δ_{N0} - factor	$\left[\frac{\mathrm{mm}}{N/mm^2}\right]$	0,038	0,039	0,040	0,044	0,047	0,051	0,052	0,055
72°C / 50°C	δ _{N∞} - factor		0,047	0,049	0,051	0,055	0,059	0,064	0,067	0,070
Displacement factor ¹⁾ Cracked concrete, sta	tic and guas	i-static action	working	a life 50	and 100	voore				
Temperature range I:	δ_{N0} - factor	-static action,	0,069	0,071	0,072	0,074	0,076	0,079	0,081	0,082
40°C / 24°C	δ _{N∞} - factor	_ mm _	0,100	0,115	0,122	0,128	0,135	0,142	0,155	0,171
Temperature range II:	δ _{N0} - factor	<u> </u>	0,092	0,095	0,096	0,099	0,102	0,106	0,109	0,110
72°C / 50°C	δ _{N∞} - factor		0,134	0,154	0,163	0,172	0,181	0,189	0,207	0,229
Displacement Uncracked and cracke	nd concrete	soismis action	· (C2)							
All temperature	δN,C2 (DLS)	seisinic action			0,21	0,24	0,27	0,36		
ranges	δn,c2 (ULS)	[mm]	-	_2)		0,51	0,54	0,63	-	2)
Diamond drilling										
Displacement factor ¹⁾ Uncracked concrete, s	otatia and au	oni atatia aati	an wark	ing life f	=0 vooro					
	δ_{N0} - factor	asi-static action	0,011	0,012	0,012	0,013	0,014	0,014	0,015	0,015
Temperature range I: _ 40°C / 24°C	δ _{N∞} - factor	_ mm _	0,018	0,019	0,019	0,020	0,022	0,023	0,024	0,025
Temperature range	δ _{N0} - factor	$\left[\frac{mn}{N/mm^2}\right]$	0,013	0,014	0,014	0,015	0,016	0,016	0,018	0,018
II: 72°C / 50°C	δ _{N∞} - factor		0,052	0,053	0,055	0,058	0,062	0,065	0,068	0,070
Displacement factor ¹⁾		! -t-t'		in a 116 - 1	100					
Uncracked concrete, s	$\frac{\text{static and qu}}{\delta_{\text{No}}}$	asi-static action	on, work 0,011	0,012	0,012	0,013	0,014	0,014	0,015	0,015
Temperature range I: _ 40°C / 24°C	δ _{N∞} - factor	mm	0,020	0,021	0,021	0,023	0,024	0,025	0,026	0,027
	SINO IGOTOI	[<u>mm</u>]	5,520	5,521	5,521	5,520	J,J_ 1	0,320	5,520	5,027
Temperature range	δ _{N0} - factor	$\lfloor \frac{N}{Nm^2} \rfloor$	0,013	0,014	0,014	0,015	0,016	0,016	0,018	0,018

0,038

0,039

0,040

0,043

0,045

0,047

 $\delta_{N0} = \delta_{N0}$ -factor $\cdot \tau$; τ : acting bond stress under tension load

 $\delta_{\text{N}\infty}\text{-}$ factor

Injection System VME plus

Performance

II: 72°C / 50°C

Displacements (threaded rod under tension load)

Annex C18

0,049

0,051

¹⁾ Calculation of the displacement

 $[\]begin{array}{l} \delta_{N\infty} = \delta_{N\infty} \text{-factor} \cdot \tau; \\ ^{2)} \ \ \text{No Performance assessed} \end{array}$

Table C21: Displacements under shear load, threaded rod

Threaded rod		M8	M10	M12	M16	M20	M24	M27	M30		
All drilling method	ls										
Displacement factor Uncracked and cracked		e, static and qua	si-static	action							
All temperature	δ _{vo} - factor	[mm//kN]\]	0,06	0,06	0,05	0,04	0,04	0,03	0,03	0,03	
ranges	δ _{V∞} - factor	[mm/(kN)]	0,09	0,08	0,08	0,06	0,06	0,05	0,05	0,05	
Displacement Uncracked and cra	Displacement Uncracked and cracked concrete, seismic action (C2)										
All temperature	δv,c2 (DLS)	[mm]		2)	3,1	3,4	3,5	4,2	_:	2)	
ranges	$\delta_{\text{V,C2 (ULS)}}$	[IIIIII]	_=,		6,0	7,6	7,3	10,9	_	,	

¹⁾ Calculation of the displacement

 $\delta_{V0} = \delta_{V0}$ - factor \cdot V; V: acting shear load

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

2) No Performance assessed

Injection System VME pl	JS
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Table C22: Displacement factors¹⁾ under tension load, internally threaded anchor rod

Internally threaded anch	nor rod		VMU-IG M 6	VMU-IG M 8	VMU-IG M 10	VMU-IG M 12	VMU-IG M 16	VMU-IG M 20
Hammer-, compressed	air or vaccu	m drilling						
Uncracked concrete, sta	atic and quasi	-static action,	working li	fe 50 and 1	100 years			
Temperature range I:	δ _{N0} - factor		0,029	0,030	0,033	0,035	0,038	0,041
40°C / 24°C	δ _{N∞} - factor	$\left[\frac{\mathrm{mm}}{\mathrm{N/mm}^2}\right]$	0,029	0,030	0,033	0,035	0,038	0,041
Temperature range II:	δ_{N0} - factor	^L N/mm ² J	0,039	0,040	0,044	0,047	0,051	0,055
72°C / 50°C	δ _{N∞} - factor		0,049	0,051	0,055	0,059	0,064	0,070
Cracked concrete, static	and quasi-st	atic action, we	orking life	50 and 100) years			
Temperature range I:	δ _{N0} - factor		0,071	0,072	0,074	0,076	0,079	0,082
40°C / 24°C	δ _{N∞} - factor	$\left[\frac{\mathrm{mm}}{\mathrm{N/mm}^2}\right]$	0,115	0,122	0,128	0,135	0,142	0,171
Temperature range II:	δ _{N0} - factor	N/mm ²	0,095	0,096	0,099	0,102	0,106	0,110
72°C / 50°C	δ _{N∞} - factor		0,154	0,163	0,172	0,181	0,189	0,229
Diamond drilling								
Uncracked concrete, sta	atic and quasi	-static action,	working li	fe 50 years	S			
Temperature range I:	δ _{N0} - factor		0,012	0,012	0,013	0,014	0,014	0,015
40°C / 24°C	δ _{N∞} - factor	$\left[\frac{\mathrm{mm}}{\mathrm{N/mm^2}}\right]$	0,019	0,019	0,020	0,022	0,023	0,025
Temperature range II:	δ _{N0} - factor	^l N/mm ²	0,014	0,014	0,015	0,016	0,016	0,018
72°C / 50°C	δ _{N∞} - factor		0,053	0,055	0,058	0,062	0,065	0,070
Cracked concrete, static	and quasi-st	atic action, we	orking life	100 years				
Temperature range I:	δ_{N0} - factor		0,012	0,012	0,013	0,014	0,014	0,015
40°C / 24°C	δ _{N∞} - factor	$\left[\frac{\mathrm{mm}}{\mathrm{N/mm}^2}\right]$	0,021	0,021	0,023	0,024	0,025	0,027
Temperature range II:	δ_{N0} - factor	^{l'} N/mm ^{2J}	0,014	0,014	0,015	0,016	0,016	0,018
72°C / 50°C	δ _{N∞} - factor	 	0,039	0,040	0,043	0,045	0,047	0,051

¹⁾ Calculation of the displacement

 $\delta_{\text{N0}} = \delta_{\text{N0-}} \text{ factor } \cdot \tau; \hspace{1cm} \tau\text{: acting bond stress under tension load}$

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

Table C23: Displacement factors¹⁾ under shear load, internally threaded anchor rod

Internally threaded anch	VMU-IG M 6	VMU-IG M 8	VMU-IG M 10	VMU-IG M 12	VMU-IG M 16	VMU-IG M 20					
Uncracked and cracked concrete, static and quasi-static action											
All tomporative ranges	δ _{V0} - factor		0,07	0,06	0,06	0,05	0,04	0,04			
All temperature ranges	δ _{V∞} - factor	[mm/(kN)]	0,10	0,09	0,08	0,08	0,06	0,06			

¹⁾ Calculation of the displacement

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

V: acting shear load

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

Injection System VME plus

Performance

Displacements (internally threaded anchor rod)

Table C24: Displa	acement f	actors ¹⁾ u	nder t	ensio	n load	d (reba	ar)					
Reinforcing bar			Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Hammer-, compress	ed air or va	ccum drilli	ng									
Uncracked concrete,	static and o	uasi-static a	ction,	working	g life 50) and 1	00 year	'S				
Temperature range I:	δ_{N0} - factor		0,028	0,029	0,030	0,031	0,033	0,035	0,038	0,038	0,040	0,043
40°C / 24°C	$\delta_{\text{N}\infty}\text{-}$ factor	mm1	0,015	0,015	0,016	0,017	0,017	0,019	0,020	0,020	0,021	0,023
Temperature range II:	$\delta_{\text{N0}}\text{-}$ factor	$\lfloor \frac{1}{N/mm^2} \rfloor$	0,038	0,039	0,040	0,042	0,044	0,047	0,051	0,051	0,054	0,058
72°C / 50°C	$\delta_{\text{N}\infty^-}$ factor		0,047	0,049	0,051	0,053	0,055	0,059	0,065	0,065	0,068	0,072
Cracked concrete, static and quasi-static action, working life 50 and 100 years												
Temperature range I:	δ _{N0} - factor		0,069	0,071	0,072	0,073	0,074	0,076	0,079	0,079	0,081	0,084
40°C / 24°C	$\delta_{\text{N}\infty^-}$ factor	[<u>mm</u>]	0,115	0,122	0,128	0,135	0,142	0,155	0,171	0,171	0,181	0,194
Temperature range II:	δ_{N0} - factor $\frac{[N/mm^2]}{N}$		0,092	0,095	0,096	0,098	0,099	0,102	0,106	0,106	0,109	0,113
72°C / 50°C	0,154	0,163	0,172	0,181	0,189	0,207	0,229	0,229	0,242	0,260		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$												
Uncracked concrete, static and quasi-static action, working life 50 years												
Temperature range I:	$\delta_{\text{N0}}\text{-}$ factor	mm , (0,008	0,009	0,009	0,010	0,011	0,012	0,013	0,013	0,014	0,015
40°C / 24°C	$\delta_{\text{N}\infty}\text{-}$ factor		0,018	0,018	0,019	0,020	0,021	0,024	0,027	0,027	0,028	0,031
Temperature range II:	$\delta_{\text{N0}}\text{-}$ factor	$\lfloor \frac{N/\text{mm}^2}{N} \rfloor$	0,009	0,011	0,011	0,012	0,013	0,014	0,015	0,015	0,016	0,018
72°C / 50°C	δ _{N∞} - factor		0,048	0,051	0,054	0,058	0,061	0,068	0,076	0,076	0,081	0,088
Uncracked concrete,	static and o	uasi-static a	ction,	working	g life 10	00 year	s					
Temperature range I:	δ_{N0} - factor		0,008	0,009	0,009	0,010	0,011	0,012	0,013	0,013	0,014	0,015
40°C / 24°C	$\delta_{\text{N}\infty^-}$ factor		0,018	0,020	0,021	0,022	0,024	0,026	0,029	0,029	0,031	0,034
Temperature range II:	δ _{NO} - factor	$\left[\frac{N/\text{mm}^2}{N}\right]$	0,009	0,011	0,011	0,012	0,013	0,014	0,015	0,015	0,016	0,018
72°C / 50°C	$\delta_{\text{N}\infty^-}$ factor		0,035	0,037	0,040	0,042	0,045	0,049	0,055	0,055	0,059	0,064
1) Calculation of the displacement $\delta_{N0} = \delta_{N0}$ - factor $\cdot \tau$; τ : acting bond stress under tension load $\delta_{N\infty} = \delta_{N\infty}$ - factor $\cdot \tau$; Table C25: Displacement factors ¹⁾ under shear load (rebar)												
Reinforcing bar	Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32		
Uncracked and crack	ed concrete	, static and	quasi-s	tatic a	ction							
All temperature _	δ_{V0} - factor	[mm/(kN)]	0,06	0,05	0,05	0,04	0,04	0,04	0,03	0,03	0,03	0,03
ranges	δ _{V∞} - factor	[11111/(KIN)]	0,09	0,08	0,08	0,06	0,06	0,05	0,05	0,05	0,04	0,04
1) Calculation of the dis	splacement											

Injection System VME plus

Performance

Displacements (rebar)