



Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments



European Technical Assessment

ETA-19/0850 of 29 November 2021

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the European Technical Assessment:

Trade name of the construction product

Product family to which the construction product belongs

Manufacturer

Manufacturing plant

This European Technical Assessment contains

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

This version replaces

Deutsches Institut für Bautechnik

B+BTec Injection System BIS-PE GEN3 for concrete

Bonded fastener for use in concrete

B+BTec Munterij 8 4762 AH ZEVENBERGEN NIEDERLANDE

B+BTec, Plant 1

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

EAD 330499-01-0601, Edition 04/2020

ETA-19/0850 issued on 17 April 2020



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Specific Part

1 Technical description of the product

The "B+BTec Injection system BIS-PE GEN3 for concrete" is a bonded anchor consisting of a cartridge with injection mortar Injection mortar BIS-PE GEN3 and a steel element according to Annex A3 and A5.

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

The product description is given in Annex A.

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

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

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

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

3.1 Mechanical resistance and stability (BWR 1)

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

3.2 Hygiene, health and the environment (BWR 3)

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



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

In accordance with the European Assessment Document EAD 330499-01-0601 the applicable European legal act is: [96/582/EC].

The system to be applied is: 1

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

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

Issued in Berlin on 29 November 2021 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock Head of Section

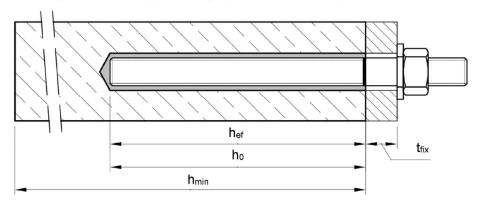
beglaubigt: Baderschneider



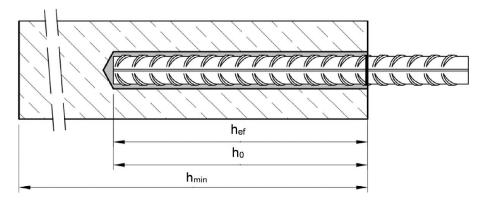
Installation threaded rod M8 up to M30

prepositioned installation or

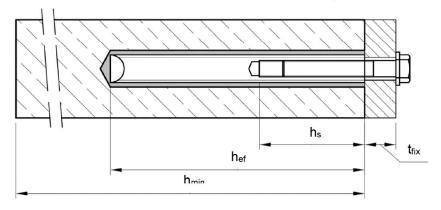
push through installation (annular gap filled with mortar)



Installation reinforcing bar Ø8 up to Ø32



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



 t_{fix} = thickness of fixture

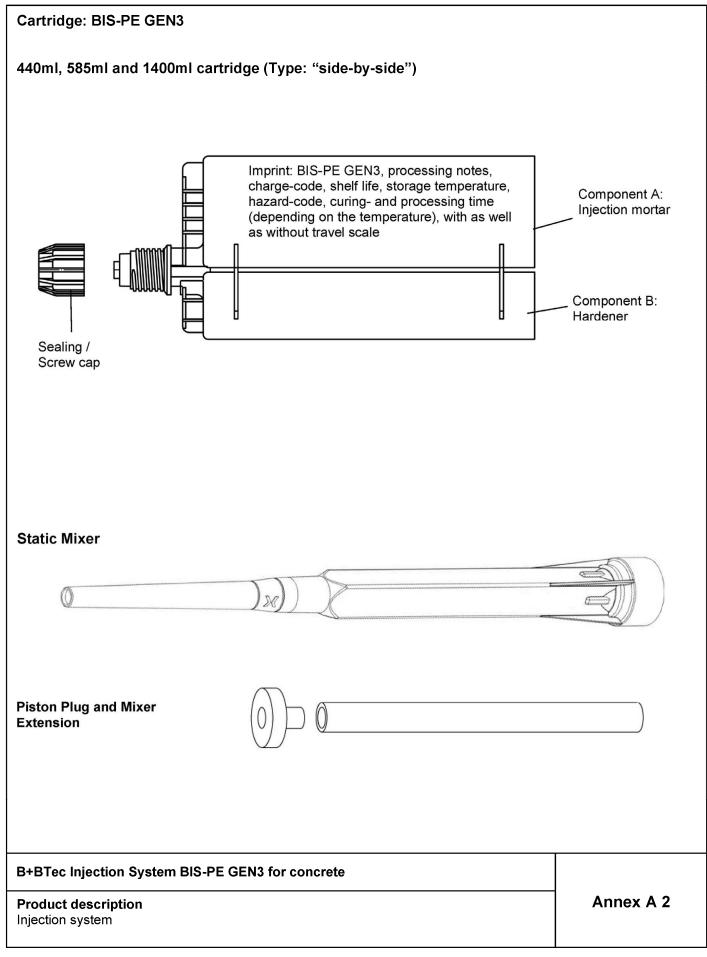
h_{ef} = effective anchorage depth

 h_0 = depth of drill hole

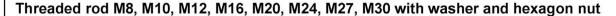
 h_{min} = minimum thickness of member

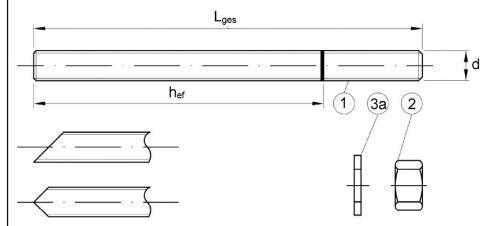
B+BTec Injection System BIS-PE GEN3 for concrete	
Product description Installed condition	Annex A 1







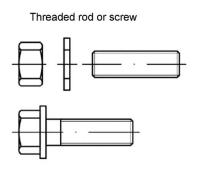


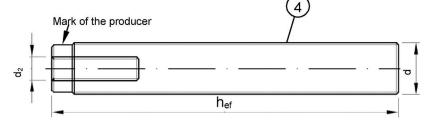


Commercial standard threaded rod with:

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







Marking: e.g. Marking Internal thread

Mark

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

HCR additional mark for high-corrosion resistance steel

Filling washer and mixer reduction nozzle for filling the annular gap between anchor rod and fixture





B+BTec Injection System BIS-PE GEN3 for concrete

Product description

Threaded rod, internal threaded rod and filling washer

Annex A 3



Та	ıble A1: Mater	ials				
Parl	Designation	Material				
- z - h	inc plated ≥ 5 ot-dip galvanised ≥ 4	acc. to EN ISO 683-4:25 µm acc. to EN ISO 0 µm acc. to EN ISO 15 µm acc. to EN ISO	4042 146	2:2018 or 1:2009 and EN ISO 10684:	2004+AC:2009 or	
3		Property class	1700	Characteristic steel ultimate tensile strength	Characteristic steel yield strength	Elongation at fracture
			4.6	f _{uk} = 400 N/mm ²	f _{vk} = 240 N/mm ²	A ₅ > 8%
1	Threaded rod		4.8	f _{uk} = 400 N/mm²	f _{yk} = 320 N/mm ²	A ₅ > 8%
	Tinodada roa	acc. to EN ISO 898-1:2013		f _{uk} = 500 N/mm²	f _{yk} = 300 N/mm ²	A ₅ > 8%
		EN 130 696-1.2013	5.8	f _{uk} = 500 N/mm²	f _{yk} = 400 N/mm²	A ₅ > 8%
			8.8	f _{uk} = 800 N/mm²	f _{yk} = 640 N/mm ²	A ₅ ≥ 12% ³⁾
		acc. to	4	for anchor rod class 4.6 o		
2	Hexagon nut	EN ISO 898-2:2012	5	for anchor rod class 5.6 o	r 5.8	
		Steel zinc plated ho	8 t-din	for anchor rod class 8.8 galvanised or sherardized		
3а	Washer			EN ISO 7089:2000, EN ISC	7093:2000 or EN ISO	7094:2000)
3b	Filling washer			galvanised or sherardized	1	
	Internal threaded	Property class		Characteristic steel ultimate tensile strength	Characteristic steel yield strength	Elongation at fracture
4 anchor rod		acc. to	5.8	f _{uk} = 500 N/mm²	f _{yk} = 400 N/mm²	A ₅ > 8%
		EN ISO 898-1:2013	8.8	f _{uk} = 800 N/mm²	f _{yk} = 640 N/mm²	A ₅ > 8%
Stai	inless steel A4 (Mate	rial 1.4401 / 1.4404 / 1	.457	1 / 1.4567 or 1.4541, acc. t 1 / 1.4362 or 1.4578, acc. t r 1.4565, acc. to EN 10088	o EN 10088-1:2014)	
		Property class		Characteristic steel ultimate tensile strength	Characteristic steel yield strength	Elongation at fracture
1	Threaded rod ¹⁾⁴⁾		50	f _{uk} = 500 N/mm²	f _{yk} = 210 N/mm²	A ₅ ≥ 8%
•	Timodada rod	acc. to	70	f = 700 N/mm²	f = 450 N/mm2	
ENIS		EN ISO 3506 1:3030	70	f _{uk} = 700 N/mm ²	f _{yk} = 450 N/mm ²	A ₅ ≥ 12% ³⁾
		EN ISO 3506-1:2020		f _{uk} = 800 N/mm ²	f _{yk} = 450 N/mm ²	$A_5 \ge 12\%^{3}$ $A_5 \ge 12\%^{3}$
2	Hexagon nut 1)4)	EN ISO 3506-1:2020 acc. to EN ISO 3506-1:2020	80 50 70		1	
	Hexagon nut ¹⁾⁴⁾ Washer	acc. to EN ISO 3506-1:2020 A2: Material 1.4301 / A4: Material 1.4401 / HCR: Material 1.4529	80 70 80 1.43 1.44 9 or 1	f _{uk} = 800 N/mm ² for anchor rod class 50 for anchor rod class 70	f _{yk} = 600 N/mm ² 541, acc. to EN 10088- 578, acc. to EN 10088- : 2014	A ₅ ≥ 12% ³⁾ 1:2014 1:2014
2 3a 3b		acc. to EN ISO 3506-1:2020 A2: Material 1.4301 / A4: Material 1.4401 / HCR: Material 1.4529 (e.g.: EN ISO 887:20	80 50 70 80 1.43 1.44 9 or 1 06, E	f _{uk} = 800 N/mm ² for anchor rod class 50 for anchor rod class 70 for anchor rod class 80 107 / 1.4311 / 1.4567 or 1.4 104 / 1.4571 / 1.4362 or 1.4 1.4565, acc. to EN 10088-1 EN ISO 7089:2000, EN ISO orrosion resistance steel	f _{yk} = 600 N/mm ² 541, acc. to EN 10088- 578, acc. to EN 10088- 2014 7093:2000 or EN ISO	$A_5 \ge 12\%^{3}$ 1:2014 1:2014 7094:2000)
3a 3b	Washer Filling washer	acc. to EN ISO 3506-1:2020 A2: Material 1.4301 / A4: Material 1.4401 / HCR: Material 1.4529 (e.g.: EN ISO 887:20	50 70 80 1.43 1.44 9 or 1 06, E	f _{uk} = 800 N/mm ² for anchor rod class 50 for anchor rod class 70 for anchor rod class 80 107 / 1.4311 / 1.4567 or 1.4 104 / 1.4571 / 1.4362 or 1.4 1.4565, acc. to EN 10088-1 EN ISO 7089:2000, EN ISO orrosion resistance steel Characteristic steel ultimate tensile strength	f _{yk} = 600 N/mm ² 541, acc. to EN 10088- 578, acc. to EN 10088- 2014 7093:2000 or EN ISO Characteristic steel yield strength	A ₅ ≥ 12% ³) 1:2014 1:2014 7094:2000) Elongation at fracture
3a	Washer	acc. to EN ISO 3506-1:2020 A2: Material 1.4301 / A4: Material 1.4401 / HCR: Material 1.452! (e.g.: EN ISO 887:20 Stainless steel A4, H	80 50 70 80 1.43 1.44 9 or 1 06, E igh c	f _{uk} = 800 N/mm ² for anchor rod class 50 for anchor rod class 70 for anchor rod class 80 07 / 1.4311 / 1.4567 or 1.4 04 / 1.4571 / 1.4362 or 1.4 1.4565, acc. to EN 10088-1 EN ISO 7089:2000, EN ISO orrosion resistance steel Characteristic steel	f _{yk} = 600 N/mm ² 541, acc. to EN 10088- 578, acc. to EN 10088- 2014 7093:2000 or EN ISO	$A_5 \ge 12\%^{3}$ 1:2014 1:2014 7094:2000)

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

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

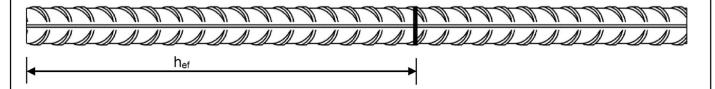
B+BTec Injection System BIS-PE GEN3 for concrete	
Product description Materials threaded rod and internal threaded rod	Annex A 4

²⁾ for IG-M20 only property class 50

 $^{^{3)}\,}A_{5}$ > 8% fracture elongation if \underline{no} use for seismic performance category C2



Reinforcing bar \varnothing 8, \varnothing 10, \varnothing 12, \varnothing 14, \varnothing 16, \varnothing 20, \varnothing 24, \varnothing 25, \varnothing 28, \varnothing 32



- Minimum value of related rip area f_{R,min} according to EN 1992-1-1:2004+AC:2010
- Rib height of the bar shall be in the range 0,05d ≤ h ≤ 0,07d
 (d: Nominal diameter of the bar; h: Rip height of the bar)

Table A2: Materials

Part	Designation				
Reinf	orcing bars				
1	EN 1007_1_1.7002+Δ(7010 ΔnnΔV(Bars and de-coiled rods class B or C f_{yk} and k according to NDP or NCL of EN 1992-1-1/NA $f_{uk} = f_{tk} = k \cdot f_{yk}$			

B+BTec Injection System BIS-PE GEN3 for concrete	
Product description Materials reinforcing bar	Annex A 5



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

Anchorages subject to (Seismic action):

	for Performance Category C1	for Performance Category C2				
Base material	Cracked and und	cracked concrete				
Hammer drilling (HD), Hammer drilling with hollow drill bit (HDB) or compressed air drilling (CD)	M8 to M30, Ø8 to Ø32	M12 to M24				
Diamond drilling (DD)	No performance assessed	No performance assessed				
Temperature Range:	I: - 40 °C to +40 °C ¹⁾ II: - 40 °C to +72 °C ²⁾	I: -40 °C to +40 °C ¹⁾ II: -40 °C to +72 °C ²⁾				

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

Base materials:

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

Use conditions (Environmental conditions):

- Structures subject to dry internal conditions (all materials).
- For all other conditions according to EN 1993-1-4:2006+A1:2015 corresponding to corrosion resistance class:
 - Stainless steel Stahl A2 according to Annex A 4, Table A1: CRC II
 - Stainless steel Stahl A4 according to Annex A 4, Table A1: CRC III
 - High corrosion resistance steel HCR according to Annex A 4, Table A1: CRC V

B+BTec Injection System BIS-PE GEN3 for concrete	
Intended Use Specifications	Annex B 1

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

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Design:

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

Installation:

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

B+BTec Injection System BIS-PE GEN3 for concrete	
Intended Use Specifications	Annex B 2



Table B1: Installation parameters for threaded rod											
Anchor size				M8	M10	M12	M16	M20	M24	M27	M30
Diameter of elemen	t	d = d _{nom}	[mm]	8	10	12	16	20	24	27	30
Nominal drill hole di	ameter	d ₀	[mm]	10	12	14	18	22	28	30	35
Effective embedmer	at donth	h _{ef,min}	[mm]	60	60	70	80	90	96	108	120
Ellective ellibedillei	Effective embedment depth		[mm]	160	200	240	320	400	480	540	600
Diameter of clearance hole in	Prepositioned ins	tallation d _f ≤	[mm]	9	12	14	18	22	26	30	33
the fixture	Push through i	nstallation d _f	[mm]	12	14	16	20	24	30	33	40
Maximum torque mo	oment	max T _{inst} ≤	[Nm]	10	20	40 ¹⁾	60	100	170	250	300
Minimum thickness of member		h _{min}	[mm]	1	_f + 30 m : 100 mr			I	h _{ef} + 2d ₀		
Minimum spacing		s _{min}	[mm]	40	50	60	75	95	115	125	140
Minimum edge distance c _{min}		[mm]	35	40	45	50	60	65	75	80	

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

Table B2: Installation parameters for rebar

Anchor size	Ø 8 ¹⁾	Ø 10 ¹⁾	Ø 12	2 ¹⁾	Ø 14	Ø 16	Ø 20	Ø 24 ¹⁾	Ø 25 ¹⁾	Ø 28	Ø 32		
Diameter of element	d = d _{nom}	[mm]	8	10	12		14	16	20	24	25	28	32
Nominal drill hole diameter	d_0	[mm]	10 12	12 14	14	16	18	20	25	30 32	30 32	35	40
Effective embedment depth	h _{ef,min}	[mm]	60	60	70		75	80	90	96	100	112	128
Effective embedment depth	$h_{ef,max}$	[mm]	160	200	240)	280	320	400	480	500	560	640
Minimum thickness of member	h _{min}	[mm]	h _{ef} + 30 mm ≥ 100 mm						h _e	+ 2d ₀			
Minimum spacing S _{min} [mm] 40 50		50	60		70	75	95	120	120	130	150		
Minimum edge distance	c _{min}	[mm]	35	40	45		50	50	60	70	70	75	85

¹⁾ both nominal drill hole diameter can be used

Table B3: Installation parameters for Internal threaded anchor rod

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

¹⁾ With metric threads according to EN 1993-1-8:2005+AC:2009

B+BTec Injection System BIS-PE GEN3 for concrete	
Intended Use Installation parameters	Annex B 3

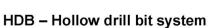


Table B4	Table B4: Parameter cleaning and setting tools									
					and the second s					
Threaded Rod	Rebar	Internal threaded anchor rod	d ₀ Drill bit - Ø HD, HDB, CD, DD	ı	ь h - Ø	d _{b,min} min. Brush - Ø	Piston plug	Installatio of	n directio piston plu	
[mm]	[mm]	[mm]	[mm]		[mm]	[mm]		1	→	1
M8	8		10	RB10	11,5	10,5		•		
M10	8 / 10	IG-M6	12	RB12	13,5	12,5		No plug	roguirod	
M12	10 / 12	IG-M8	14	RB14	15,5	14,5		No plug	required	
	12		16	RB16	17,5	16,5				
M16	14	IG-M10	18	RB18	20,0	18,5	VS18			
	16		20	RB20	22,0	20,5	VS20			
M20		IG-M12	22	RB22	24,0	22,5	VS22			
	20		25	RB25	27,0	25,5	VS25	h _{ef} >	h _{ef} >	
M24		IG-M16	28	RB28	30,0	28,5	VS28			all
M27	24 / 25		30	RB30	31,8	30,5	VS30	250 mm	250 mm	
	24 / 25		32	RB32	34,0	32,5	VS32]		
M30	28	IG-M20	35	RB35	37,0	35,5	VS35]		
	32		40	RB40	43,5	40,5	VS40			

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

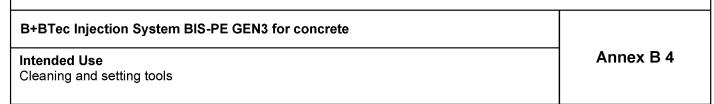
Drill bit diameter (d₀): all diameters





Drill bit diameter (d₀): all diameters

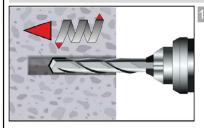
The hollow drill bit system contains the Heller Duster Expert hollow drill bit and a class M vacuum with minimum negative pressure of 253 hPa <u>and</u> flow rate of minimum 150 m³/h (42 l/s).





Installation instructions

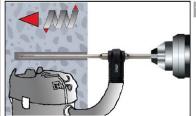
Drilling of the bore hole (HD, HDB, CD)



Hammer (HD) or compressed air drilling (CD)

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

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



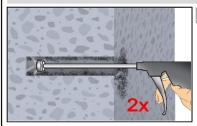
Hollow drill bit system (HDB) (see Annex B 3)

Drill a hole into the base material to the size and embedment depth required by the selected anchor (Table B1, B2 or B3). This drilling system removes the dust and cleans the bore hole during drilling (all conditions). Proceed with Step 3.

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

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

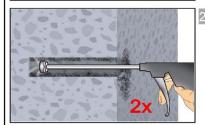
CAC: Cleaning for dry, wet and water-filled bore holes with all diameter in uncracked and cracked concrete



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



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



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

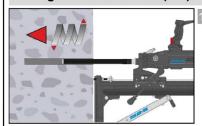
After cleaning, the bore hole has to be protected against re-contamination in an appropriate way, until dispensing the mortar in the bore hole. If necessary, the cleaning has to be repeated directly before dispensing the mortar. In-flowing water must not contaminate the bore hole again.

B+BTec Injection System BIS-PE GEN3 for concrete	
Intended Use Installation instructions	Annex B 5



Installation instructions (continuation)

Drilling of the bore hole (DD)



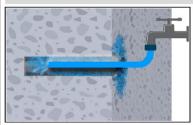
Diamond drilling (DD)

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

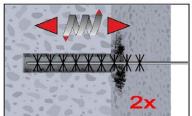
In case of aborted drill hole, the drill hole shall be filled with mortar.

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

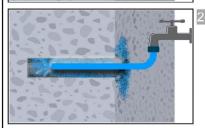
SPCAC: Cleaning for dry, wet and water-filled bore holes with all diameter in uncracked and cracked concrete



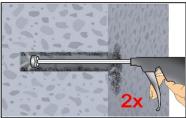
Rinsing with water until clear water comes out.



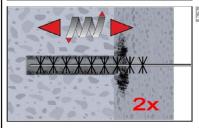
Check brush diameter (Table B4). Brush the hole with an appropriate sized wire brush $> d_{b,min}$ (Table B4) a minimum of two times. If the bore hole ground is not reached with the brush, a brush extension must be used.



Rinsing again with water until clear water comes out.



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



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

B+BTec Injection System BIS-PE GEN3 for concrete

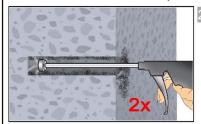
Intended Use

Installation instructions (continuation)

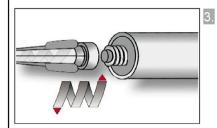
Annex B 6



Installation instructions (continuation)

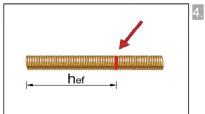


Finally blow the hole clean again with compressed air (min. 6 bar) (Annex B 4) a minimum of two times until return air stream is free of noticeable dust. If the bore hole ground is not reached an extension shall be used.

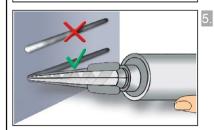


Attach the supplied static-mixing nozzle to the cartridge and load the cartridge into the correct dispensing tool.

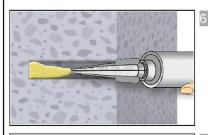
For every working interruption longer than the recommended working time (Table B5) as well as for new cartridges, a new static-mixer shall be used.



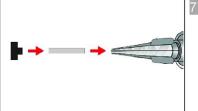
Prior to inserting the anchor rod into the filled bore hole, the position of the embedment depth shall be marked on the anchor rods.



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



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



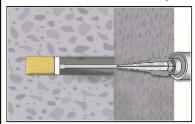
Piston plugs shall be used according to Table B4 for the following applications:

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

B+BTec Injection System BIS-PE GEN3 for concrete Intended Use Installation instructions (continuation) Annex B 7



Installation instructions (continuation)



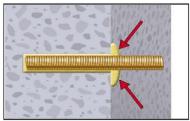
Insert piston plug to back of the hole and inject adhesive. If the bottom or back of the anchor hole is not reached, an appropriate extension nozzle must be used.

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

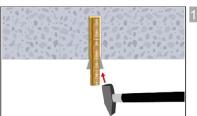


Push the fixing element into the anchor hole while turning slightly to ensure positive distribution of the adhesive until the embedment mark has reached the surface level.

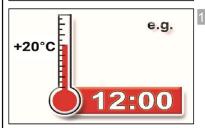
The anchor shall be free of dirt, grease, oil or other foreign material.



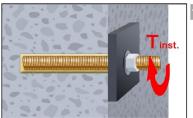
After inserting the anchor, the annular gab between anchor rod and concrete, in case of a push through installation additionally also the fixture, must be complete filled with mortar. If excess mortar is not visible at the top of the hole, the requirement is not fulfilled and the application has to be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



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



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



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

B+BTec Injection System BIS-PE GEN3 for concrete	
Intended Use Installation instructions (continuation)	Annex B 8



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

B+BTec Injection System BIS-PE GEN3 for concrete	
Intended Use Curing time	Annex B 9



Т	Table C1: Characteristic values for steel tension resistance and steel shear resistance of threaded rods											
Si	ze				M8	M10	M12	M16	M20	M24	M27	M30
Cr	oss section area		A _s	[mm²]	36,6	58	84,3	157	245	353	459	561
Cr	naracteristic tensi	on resistance, Steel failu	re 1)			•			•			
Ste	eel, Property class	4.6 and 4.8	N _{Rk,s}	[kN]	15 (13)	23 (21)	34	63	98	141	184	224
Ste	eel, Property class	5.6 and 5.8	N _{Rk,s}	[kN]	18 (17)	29 (27)	42	78	122	176	230	280
Ste	eel, Property class	8.8	N _{Rk,s}	[kN]	29 (27)	46 (43)	67	125	196	282	368	449
Sta	ainless steel A2, A	4 and HCR, class 50	N _{Rk,s}	[kN]	18	29	42	79	123	177	230	281
Sta	ainless steel A2, A4	4 and HCR, class 70	N _{Rk,s}	[kN]	26	41	59	110	171	247	_3)	_3)
Sta	ainless steel A4 an	d HCR, class 80	N _{Rk,s}	[kN]	29	46	67	126	196	282	_3)	_3)
Cr	naracteristic tensi	on resistance, Partial fac	tor ²⁾									
Ste	Steel, Property class 4.6 and 5.6 $\gamma_{Ms,N}$ [-] 2,0											
Ste	eel, Property class	4.8, 5.8 and 8.8	γMs,N	[-]				1,	5			
Sta	ainless steel A2, A	4 and HCR, class 50	$\gamma_{Ms,N}$	[-]				2,8	6			
Sta	Stainless steel A2, A4 and HCR, class 70 $\gamma_{Ms,N}$ [-] 1,87											
\vdash	Stainless steel A4 and HCR, class 80 $\gamma_{Ms,N}$ [-] 1,6											
Cr	naracteristic shear	r resistance, Steel failure						Γ	ı			
ے	Steel, Property cla	ass 4.6 and 4.8	V ⁰ Rk,s	[kN]	9 (8)	14 (13)	20	38	59	85	110	135
arm	Steel, Property cla	ass 5.6 and 5.8	V ⁰ Rk,s	[kN]	11 (10)	17 (16)	25	47	74	106	138	168
eve	Steel, Property cla	ass 8.8	V ⁰ Rk,s	[kN]	15 (13)	23 (21)	34	63	98	141	184	224
l m	Stainless steel A2	2, A4 and HCR, class 50	V ⁰ Rk,s	[kN]	9	15	21	39	61	88	115	140
Without lever	Stainless steel A2	2, A4 and HCR, class 70	V ⁰ Rk,s	[kN]	13	20	30	55	86	124	_3)	_3)
>	Stainless steel A4	and HCR, class 80	V ⁰ Rk,s	[kN]	15	23	34	63	98	141	_3)	_3)
	Steel, Property cla	ass 4.6 and 4.8	M ⁰ Rk,s	[Nm]	15 (13)	30 (27)	52	133	260	449	666	900
arm	Steel, Property cla		M ⁰ Rk,s	[Nm]	19 (16)	37 (33)	65	166	324	560	833	1123
	Steel, Property cla	ass 8.8	M ⁰ Rk,s	[Nm]	30 (26)	60 (53)	105	266	519	896	1333	1797
Vith lever	Stainless steel A2	, A4 and HCR, class 50	M ⁰ Rk,s	[Nm]	19	37	66	167	325	561	832	1125
×	Stainless steel A2	, A4 and HCR, class 70	M ⁰ Rk,s	[Nm]	26	52	92	232	454	784	_3)	_3)
	Stainless steel A4	M ⁰ _{Rk,s}	[Nm]	30	59	105	266	519	896	_3)	_3)	
Cr	naracteristic shea	r resistance, Partial facto	r ²⁾									
Ste	eel, Property class	4.6 and 5.6	$\gamma_{\text{Ms,V}}$	[-]				1,6	7			
Steel, Property class 4.8, 5.8 and 8.8				[-]		1,25						
Sta	ainless steel A2, A	4 and HCR, class 50	$\gamma_{Ms,V}$	[-]				2,3	8			
Sta	ainless steel A2, A	4 and HCR, class 70	$\gamma_{Ms,V}$	[-]				1,5	6			
Sta	Stainless steel A4 and HCR, class 80 $\gamma_{Ms,V}$ [-] 1,33											

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

³⁾ Anchor type not part of the ETA

B+BTec Injection System BIS-PE GEN3 for concrete	
Performances Characteristic values for steel tension resistance and steel shear resistance of threaded rods	Annex C 1

²⁾ in absence of national regulation



Table C2:	Characteristic v	alues for C	oncrete co	ne failure and Splitting with all kind
Anchor				All Anchor type and sizes
Concrete cone f	ailure			
Uncracked concr	ete	k _{ucr,N}	[-]	11,0
Cracked concrete	•	k _{cr,N}	[-]	7,7
Edge distance		c _{cr,N}	[mm]	1,5 h _{ef}
Axial distance		s _{cr,N}	[mm]	2 c _{cr,N}
Splitting			<u> </u>	
	h/h _{ef} ≥ 2,0			1,0 h _{ef}
Edge distance	2,0 > h/h _{ef} > 1,3	c _{cr,sp}	[mm]	$2 \cdot h_{ef} \left(2,5 - \frac{h}{h_{ef}} \right)$
	h/h _{ef} ≤ 1,3			2,4 h _{ef}
Axial distance		s _{cr,sp}	[mm]	2 c _{cr,sp}

B+BTec Injection System BIS-PE GEN3 for concrete	
Performances Characteristic values for Concrete cone failure and Splitting with all kind of action	Annex C 2



	racteristic va on for a work			ls und	der st	atic a	and q	uasi-	static		
Anchor size threaded ro	d			M8	M10	M12	M16	M20	M24	M27	M30
Steel failure					•						
Characteristic tension res	istance	N _{Rk,s}	[kN]	A _s ⋅ f _{uk} (or see Table C1)							
Partial factor		$\gamma_{Ms,N}$	[-]				see Ta	able C1			
Combined pull-out and	concrete failure	_	•								
Characteristic bond resist (CD)	ance in uncracke	d concrete C20	/25 in hamı	mer dril	led hol	es (HD) and c	ompres	ssed ai	r drilled	l holes
Gemperature Gemperature	Dry, wet	^τ Rk,ucr	[N/mm²]	20	20	19	19	18	17	16	16
d g	flooded bore hole	TXX,dGI		15	15	15	14	13	13	12	12
Characteristic bond resist	ance in uncracke	d concrete C20	/25 in hamı	ner dril	led hol	es with	hollow	drill bi	t (HDB))	
ଞ୍ <u></u> l: 40°C/24°C	Dry, wet			17	16	16	16	15	14	14	13
em	concrete		FN1/ 27	14	14	14	13	13	12	12	11
ta es	flooded bore	^τ Rk,ucr	[N/mm²]	16	16	16	15	15	14	14	13
	hole			14	14	14	13	13	12	12	11
Characteristic bond resist	⊥ ance in cracked o	oncrete C20/25	in hamme								
and with hollow drill bit (H		<u> </u>	<u> </u>	1	1		' 				
II: 72°C/24°C	Dry, wet concrete and	^τ Rk,cr	[N/mm²]	7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5
-	flooded bore hole			6,0	6,0	7,0	7,0	7,0	7,0	7,0	7,0
Reduction factor ψ^0_{sus} in holes (CD) and with hollow		racked concrete	: C20/25 in	hamme	er drille	d holes	s (HD),	compre	essed a	air drille	ed
Temperature ange II: 72°C/50°C	Dry, wet concrete and flooded bore	Ψ ⁰ sus [-]		[-] c				.80			
II: 72°C/50°C	hole			0,68							
		C25/30						02			
		C30/37						04			
Increasing factors for con-	crete	C35/45 C40/50						07 08			
[↑] C		C45/55						09			
		C50/60						10			
Concrete cone failure		1 =		I			• ,				
Relevant parameter							see Ta	able C2			
Splitting											
Relevant parameter							see Ta	able C2			
Installation factor		_									
for dry and wet concrete (γ_{inst}	[-]					,0			
for flooded bore hole (HD;	HDB, CD)	- met	''				1	,2			
B+BTec Injection Syst	tem BIS-PE GE	N3 for concret	te								
Performances Characteristic values of te	nsion loads under	static and quasi	-static actio	n					Anne	x C 3	}
								-			



Anchor size threaded r	od			M8	M10	M12	M16	M20	M24	M27	M30
Steel failure		_									
Characteristic tension re	sistance	$N_{Rk,s}$	[kN]			$A_{s} \cdot f_{l}$	_{uk} (or s	ee Tab	le C1)		
Partial factor		$\gamma_{Ms,N}$	[-]				see Ta	able C1			
Combined pull-out and	concrete failure	•	'								
Characteristic bond resis (CD)	stance in uncracke	ed concrete C2	0/25 in hamr	ner dril	led hol	es (HD) and c	ompres	ssed ai	r drilled	l hole
Lemberature range II: 40°C/24°C	Dry, wet concrete and	TDI 400	[N/mm²]	20	20	19	19	18	17	16	16
ac E E II: 72°C/50°C	flooded bore hole	^τ Rk,ucr,100		15	15	15	14	13	13	12	12
Characteristic bond resis	stance in uncracke	ed concrete C2	0/25 in hamr	ner dril	led hol	es with	hollow	drill bit	t (HDB)	
º I: 40°C/24°C	Dry, wet			17	16	16	16	15	14	14	13
H: 40°C/24°C H: 72°C/50°C H: 72°C/50°C H: 72°C/50°C	concrete	^τ Rk,ucr,100	[N/mm²]	14	14	14	13	13	12	12	11
ii: 72°C/50°C	flooded bore			16	16	16	15	15	14	14	13
II: 72°C/50°C hole				14	14	14	13	13	12	12	11
Characteristic bond resis		concrete C20/2	5 in hamme	r drilled	holes	(HD) ,	compre	essed a	air drille	ed holes	s (CD
Temperature I: 40°C/24°C II: 72°C/50°C	Dry, wet concrete and	7	[N/mm²]	6,5	6,5	7,5	7,5	7,5	7,5	7,5	7,5
قر ية E II: 72°C/50°C	flooded bore hole	^τ Rk,cr,100	[(4///////	5,5	5,5	6,5	6,5	6,5	6,5	6,5	6,5
	•	C25/30	•	1,02							
		C30/37					1,	04			
Increasing factors for co	ncrete	C35/45					1,	07			
$\Psi_{\mathbf{c}}$		C40/50					1,	80			
		C45/55					1,	09			
		C50/60					1,	10			
Concrete cone failure											
Relevant parameter							see Ta	ble C2			
Splitting											
Relevant parameter							see Ta	ble C2			
Installation factor		1									
for dry and wet concrete		1				1	,0				
for flooded bore hole (HI	·	— γ _{inst} [-]	1,2								

B+BTec Injection System BIS-PE GEN3 for concrete	
Performances Characteristic values of tension loads under static and quasi-static action	Annex C 4



Table		racteristic va on for a work					atic a	ınd q	uasi-	static			
Ancho	r size threaded ro	d			M8	M10	M12	M16	M20	M24	M27	M30	
Steel fa													
Charac	teristic tension res	istance	N _{Rk,s}	[kN]			A _s ·f _u	_{uk} (or s	ee Tab	le C1)			
Partial 1	factor		γ _{Ms,N}	[-]				see Ta	able C1				
	ned pull-out and	concrete failure			ars								
	teristic bond resist					lled hol	es (DD))					
							(, 					
Temperature range	l: 40°C/24°C	Dry, wet concrete and flooded bore	^T Rk,ucr	[N/mm²]	15	14	14	13	12	12	11	11	
	II: 72°C/50°C	hole			12	12	11	10	9,5	9,5	9,0	9,0	
Reduct	ion factor ψ ⁰ sus in	uncracked concr	ete C20/25 in di	amond drill	ed hole	es (DD)							
nperature range	l: 40°C/24°C					0,	77						
Temperature range	II: 72°C/50°C	flooded bore hole	Ψ ⁰ sus	[-]				0,	72				
		1	C25/30	1				1,	04				
			C30/37					1,	08				
Increas	sing factors for con-	crete	C35/45					1,	12				
Ψс			C40/50					1,	,15				
			C45/55						17				
			C50/60					1,	19				
	ned pull-out and o						(0.0						
	teristic bond resist	ance in uncracke T	ed concrete C20	/25 in diam∈ ⊺	ond dri	lled hol	es (DD)) 		Ι			
Temperature range	I: 40°C/24°C	Dry, wet concrete and	^τ Rk,ucr,100	[N/mm²]	15	14	14	13	12	12	11	11	
Temp	II: 72°C/50°C	flooded bore hole	TXX,dGI, 100	[]	11	11	10	10	9,5	9,0	8,5	8,5	
			C25/30						04				
			C30/37					1,	80				
Increas	sing factors for con-	crete	C35/45						12				
Ψс			C40/50						15				
			C45/55						17				
Comme	ete cone failure		C50/60					1,	19				
	nt parameter							see Ta	hle Ca)			
Splittin	•				<u> </u>			3CC 18	1DIC UZ	•			
	nt parameter							see Ta	ble C2)			
	ation factor				<u> </u>				02	-			
	and wet concrete (DD)	1					1	,0				
	ded bore hole (DD)		^γ inst	[-]		1,2				1,4			
R+RT	ec Injection Syst	em BIS-PF GF	N3 for concre	te.									
Perfor	rmances cteristic values of te				n					Anne	x C 5	,	



Anchor size threaded rod			M8	M10	M12	M16	M20	M24	M27	M30
Steel failure without lever arm		•			•	•				
Characteristic shear resistance Steel, strength class 4.6, 4.8 and 5.6, 5.8	V ⁰ Rk,s	[kN]			0,6 •	A _s ·f _{uk}	(or see	Table C	1)	
Characteristic shear resistance Steel, strength class 8.8 Stainless Steel A2, A4 and HCR, all strength classes	V ⁰ Rk,s	[kN]	0,5 ⋅ A _s ⋅ f _{uk} (or see Table C1)							
Partial factor	$\gamma_{Ms,V}$	[-]	see Table C1							
Ductility factor	k ₇	[-]	1,0							
Steel failure with lever arm		<u> </u>								
Characteristic bending moment	M ⁰ Rk,s	[Nm]			1,2 • \	W _{el} • f _{uk}	(or see	Table C	:1)	
Elastic section modulus	W _{el}	[mm³]	31	62	109	277	541	935	1387	1874
Partial factor	γ _{Ms,V}	[-]				see	Table C	1		
Concrete pry-out failure										
Factor	k ₈	[-]					2,0			
Installation factor	γinst	[-]					1,0			
Concrete edge failure										
Effective length of fastener	I _f	[mm]	nm] min(h _{ef} ; 12 · d _{nom}) min(h _{ef} ; 300mm							300mm)
Outside diameter of fastener	d _{nom}	[mm]	8	10	12	16	20	24	27	30
Installation factor	γinst	[-]					1,0			

B+BTec Injection System BIS-PE GEN3 for concrete	
Performances Characteristic values of shear loads under static and quasi-static action	Annex C 6

Performances



Anchor size	internal threaded	d anchor rods			IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20	
Steel failure1)			<u> </u>			•	1.		1.	
Characteristic	tension resistanc	ce. 5.8	N _{Rk,s}	[kN]	10	17	29	42	76	123	
Steel, strengtl		8.8	N _{Rk,s}	[kN]	16	27	46	67	121	196	
	strength class 5.8		γ _{Ms,N}	[-]		1,5					
	tension resistance										
	HCR, Strength cla		N _{Rk,s}	[kN]	14	26	41	59	110	124	
Partial factor			γ _{Ms,N}	[-]			1,87			2,86	
Combined pu	ull-out and conci	rete cone failu	re								
Characteristion holes (CD)	c bond resistance	e in uncracked	concrete	e C20/25 i	n hamme	r drilled ho	oles (HD) a	and comp	ressed air	drilled	
T	l: 40°C/24°C	Dry, wet			20	19	19	18	17	16	
Temperature range	range II: 72°C/50°C flooded bore hole		^τ Rk,ucr	[N/mm²]	15	15	14	13	13	12	
Characteristic	bond resistance	in uncracked co	oncrete C	20/25 in h	ammer dr	illed holes	with hollo	w drill bit	(HDB)		
	l: 40°C/24°C	Dry, wet			16	16	16	15	14	13	
Temperature	II: 72°C/50°C	concrete	_	[N] /ma ma 21	14	14	13	13	12	11	
range	l: 40°C/24°C	^τ Rk,ucr	[N/mm²]	16	16	15	15	14	13		
	II: 72°C/50°C	hole			14	14	13	13	12	11	
	bond resistance w drill bit (HDB)	in cracked cond	crete C20	/25 in ham	nmer drille	d holes (h	HD), comp	ressed air	r drilled ho	les (CD)	
Temperature	I: 40°C/24°C	Dry, wet concrete and	^τ Rk,cr	[N/mm²]	7,0	8,5	8,5	8,5	8,5	8,5	
range	II: 72°C/50°C	flooded bore hole	r KK,CI	[]	6,0	7,0	7,0	7,0	7,0	7,0	
	$\begin{array}{c} \text{ctor } \psi^0_{\text{sus}} \text{ in crac} \\ \text{nd with hollow dril} \\ \hline \text{I: } 40^{\circ}\text{C}/24^{\circ}\text{C} \\ \hline \text{II: } 72^{\circ}\text{C}/50^{\circ}\text{C} \end{array}$		v ⁰ sus	[-]	0/25 in ha	mmer dril	0,	(HD), com 80 68	pressed a	ir drilled	
			C2	5/30			1,	02			
			C3	0/37			1,	04			
_	ctors for concrete			5/45				07			
Ψc				0/50				08			
				5/55 0/60				09 10			
Concrete cor	ne failure		1 00	0,00			• • • • • • • • • • • • • • • • • • • •	10			
Relevant para	ameter						see Ta	ble C2			
Splitting failu	ıre										
Relevant para	ameter						see Ta	able C2			
Installation f	actor										
	et concrete (HD; F	•	γ _{inst}	[-]				,0			
or flooded bo	re hole (HD; HDB	•						,2			
	(incl. nut and wash	ner) must comply	y with the	appropriate	e material		rty class of od and the			d rod.	

Z113878.21 8.06.01-305/21

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

Annex C 7



1,2

Table C8:		eristic value er a working				der stat	ic and o	quasi-s	tatic	
Anchor size in	ternal threaded	anchor rods			IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20
Steel failure ¹⁾				I						
Characteristic te	ension resistand	e, 5.8	N _{Rk,s}	[kN]	10	17	29	42	76	123
Steel, strength	class	8.8	N _{Rk,s}	[kN]	16	27	46	67	121	196
Partial factor, st	trength class 5.8	3 and 8.8	γ _{Ms,N}	[-]		I	1	,5		
	ension resistanc CR, Strength cla		N _{Rk,s}	[kN]	14				110	124
Partial factor			γ _{Ms,N}	[-]		•	1,87			2,86
Combined pull	l-out and concr	ete cone failu	re							
Characteristic l	bond resistance	e in uncracked	concrete (C20/25 in	hammer	drilled ho	les (HD) a	nd compr	essed air	drilled
	l: 40°C/24°C	Dry, wet			20	19	19	18	17	16
Temperature – range	range II: 72°C/50°C flooded bore hole		^τ Rk,ucr,100		15	15	14	13	13	12
Characteristic b	ond resistance	in uncracked c	oncrete C20)/25 in hai	mmer dril	led holes	with hollo	w drill bit	(HDB)	
_	I: 40°C/24°C Dry, wet				16	16	16	15	14	13
Temperature _		concrete	τ _{Rk,ucr,100}	[N/mm²]	14	14	13	13	12	11
_	l: 40°C/24°C	flooded bore	rkk,uci, ioo	[[, (), , , , , , , , , , , , , , , , , ,	16	16	15	15	14	13
	II: 72°C/50°C	hole			14	14	13	13	12	11
and with hollow	ond resistance drill bit (HDB)		crete C20/2	5 in hamn	ner drilled	I holes (H	D), compr	essed air	drilled ho	les (CD)
Temperature _	l: 40°C/24°C	Dry, wet concrete and	τ _{Rk,ucr,100}	[N/mm²]	6,5	7,5	7,5	7,5	7,5	7,5
range	II: 72°C/50°C	flooded bore hole			5,5	6,5	6,5	6,5	6,5	6,5
			C25					02		
Increasing facto	are for concrete		C30					04		
_	Increasing factors for concrete C35/45 We C40/50							07 08		
$\Psi_{\mathbf{c}}$	C40					09				
			C50					10		
Concrete cone	failure									
Relevant param	neter						see Ta	able C2		
Splitting failure	е									
Relevant param							see Ta	able C2		
Installation fac										
for dry and wet	concrete (HD; H	DB, CD)	γ _{inst}	[-]			1	,0		

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

 γ_{inst}

[-]

for flooded bore hole (HD; HDB, CD)

B+BTec Injection System BIS-PE GEN3 for concrete	
Performances Characteristic values of tension loads under static and quasi-static action	Annex C 8

²⁾ For IG-M20 strength class 50 is valid



	eristic value or a working				der stat	ic and o	quasi-s	tatic		
Anchor size internal threaded		=		IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20	
Steel failure ¹⁾										
Characteristic tension resistant	ce. 5.8	N _{Rk,s}	[kN]	10	17	29	42	76	123	
Steel, strength class	8.8	N _{Rk,s}	[kN]	16	27	46	67	121	196	
Partial factor, strength class 5.8	3 and 8.8	γ _{Ms,N} [-] 1,5					.5			
Characteristic tension resistant				4.4	00			440	404	
Steel A4 and HCR, Strength cl		N _{Rk,s}	[kN]	14	26	41	59	110	124	
Partial factor		γ _{Ms,N}	[-]			1,87			2,86	
Combined pull-out and conc	rete cone failu	re for a wo	rking life	of 50 yea	ars					
Characteristic bond resistanc		concrete (220/25 in	diamond	drilled ho	les (DD)		T		
Temperature : 40°C/24°C	Dry, wet concrete and flooded bore	τ _{Rk,ucr}	[N/mm²]	14	14	13	12	12	11	
range II: 72°C/50°C	hole	·		12	11	10	9,5	9,5	9,0	
Reduction factor ψ^0_{sus} in uncr		e C20/25 ir	diamond	drilled ho	oles (DD)					
Temperature I: 40°C/24°C	Dry, wet concrete and	Ψ^0 sus	[-]			0,	77			
range II: 72°C/50°C	flooded bore hole						72			
		C25					04			
		C30,					08			
Increasing factors for concrete		C35					12			
Ψc		C40,		1,15 1,17						
		/60				17 19				
Combined pull-out and concr	ete cone failu			of 100 ve	ears	١,	13			
Characteristic bond resistance						les (DD)				
	Dry, wet			14	14	13	12	12	11	
Temperature II: 72°C/50°C	concrete and flooded bore	^τ Rk,ucr,100	[N/mm²]	11	10	10	9,5	9,0	8,5	
	hole	005	/2.0		'			0,0		
		C25					04 08			
Increasing factors for concrete		C35					12			
Ψ_{c}		C40					15			
_		C45	/55				17			
		C50	/60			1,	19			
Concrete cone failure										
Relevant parameter						see Ta	able C2			
Splitting failure Relevant parameter						sec To	able C2			
Installation factor						300 I	ADIC UZ			
for dry and wet concrete (DD)						1	,0			
for flooded bore hole (DD)		γinst	[-]	1,	2	·		,4		
 Fastenings (incl. nut and v rod. The characteristic ten For IG-M20 strength class 	sion resistance			ate materi	al and pro		s of the int	ernal threa		
B+BTec Injection System I	BIS-PE GEN3	for concre	te					Annex C	٠ ۵	
Performances Characteristic values of tension	loads under sta	tic and quas	i-static act	tion				annex C	, y	



Table C10: Character	istic va	alues of	shear	loads	under	static a	nd qua	si-stati	ic action
Anchor size for internal thread	ed anch	or rods		IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20
Steel failure without lever arm ¹⁾)								
Characteristic shear resistance,	5.8	V ⁰ Rk,s	[kN]	5	9	15	21	38	61
Steel, strength class	8.8	V ⁰ Rk,s	[kN]	8	14	23	34	60	98
Partial factor, strength class 5.8 a	and 8.8	γ _{Ms,V}	[-]				1,25		
Characteristic shear resistance, Stainless Steel A4 and HCR, Strength class 70 ²⁾	V ⁰ _{Rk,s}	[kN]	7	13	20	30	55	40	
Partial factor $\gamma_{Ms,V}$ [-] 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	and 8.8	γ _{Ms,} ∨	[-]				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		$\gamma_{Ms,V}$	[-]			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				$[min(h_{ef}; 12 \cdot d_{nom})]$ $[min(h_{ef}; min(h_{ef}; min(h_{ef$					min(h _{ef} ; 300mm
Outside diameter of fastener		d _{nom}	[mm]	10	12	16	20	24	30
Installation factor		γinst	[-]				1,0		•

¹⁾ Fastenings (incl. nut and washer) must comply with the appropriate material and property class of the internal threaded rod. The characteristic tension resistance for steel failure is valid for the internal threaded rod and the fastening element. ²⁾ For IG-M20 strength class 50 is valid

B+BTec Injection System BIS-PE GEN3 for concrete	
Performances Characteristic values of shear loads under static and quasi-static action	Annex C 10



	naracteristic				ds u	nder	stati	c and	d qua	asi-st	atic		
Anchor size reinforci			<u> </u>		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]					A _s ·	f _{uk} 1)				
Cross section area		A _s	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial factor		$\gamma_{Ms,N}$	[-]					1,	4 ²⁾				
Combined pull-out ar			•										
Characteristic bond re	esistance in unc	racked cond	crete C20/	'25 in I	namme	er drille	ed hole	es (HD) and	compr	essed	air dril	led
	Dry, wet			16	16	16	16	16	16	15	15	15	15
Gemperature Head of the control	flooded bore hole	^τ Rk,ucr	[N/mm²]	12	12	12	12	12	12	12	12	11	11
☐ ⊢ Characteristic bond res	l sistance in uncra	l cked concre	<u>l</u> te C20/25	l in han	l nmer d	l Irilled h	l noles v	L vith ho	llow d	l rill bit (HDB)		
	Dry, wet			14	14	13	13	13	13	13	13	13	13
ii: 72°C/50°C	concrete			12	12	12	11	11	11	11	11	11	11
E	flooded bore	^τ Rk,ucr	[N/mm²]	13	13	13	13	13	13	13	13	13	13
	hole			11	11	11	11	11	11	11	11	11	11
	L sistance in cracke	L C20/25 in											
Characteristic bond resistance in cracked concrete C20/25 in hammer drilled holes (HD), compressed air drilled holes (CD) and with hollow drill bit (HDB)													
Li	Dry, wet concrete and	τ	[N/mm²]	7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5	8,5	8,5
ang II: 72°C/50°C	flooded bore hole	TRk,cr [N/i	[[[]]]	6,0	6,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0
Reduction factor ψ ⁰ su	=		concrete	C20/2	5 in h	amme	r drille	d holes	s (HD)	, comp	resse	d air d	illed
holes (CD) and with h	ollow drill bit (HD T	B) I	ı										
nperature ange :: 40°C/24°C	Dry, wet concrete and	Ψ ⁰ sus	[-]					0,	80				
II: 72°C/50°C	flooded bore hole	Ψ sus	[-]	0,68									
	1	C25	/30	1,02									
		C30.	/37	1,02 1,04									
Increasing factors for c	concrete	C35							07				
Ψс		C40							80				
		C45.							09 10				
Concrete cone failure)	L C30.	,	<u> </u>				1,	10				
Relevant parameter								see Ta	able C	2			
Splitting													
Relevant parameter								see Ta	able C	2			
Installation factor													
-	for dry and wet concrete (HD; HDB, CD)								,0				
for flooded bore hole (I								1	,2				
 f_{uk} shall be taken from in absence of national 	n the specificatior al regulation	s of reinforci	ng bars										
B+BTec Injection S	ystem BIS-PE	GEN3 for c	oncrete										
Performances Characteristic values o	Performances Characteristic values of tension loads under static and quasi-sta				on					A	nnex	C 11	



Anchor size reinforci	ng bar			Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 3	
Steel failure											ı			
Characteristic tension	resistance	N _{Rk,s}	[kN]					A _s •	f _{uk} 1)					
Cross section area		A _s	[mm²]	50	79	113	154	201	314	452	491	616	804	
Partial factor		γ _{Ms,N}	[-]					1,	4 ²⁾		ı		ı	
Combined pull-out ar	nd concrete failu			ı										
Characteristic bond re	esistance in unc	racked cond	rete C20/	′25 in I	namme	er drille	ed hole	s (HD) and	compr	essed	air dril	led	
II: 40°C/24°C	Dry, wet concrete and	TDI: 400	[N/mm²]	16	16	16	16	16	16	15	15	15	15	
	flooded bore hole	^τ Rk,ucr,100		12	12	12	12	12	12	12	12	11	11	
Characteristic bond res		cked concre	te C20/25	in han	nmer d		noles v	vith ho		rill bit (HDB)			
စ္ <u>l: 40°C/24°C</u>	Diy, wot			14	14	13	13	13	13	13	13	13	13	
1: 40°C/24°C 1: 72°C/50°C 1: 7	concrete	TDI	 [N/mm²]	12	12	12	11	11	11	11	11	11	11	
ਵੂੰ ਫ਼ੌ ।: 40°C/24°C	flooded bore	^τ Rk,ucr,100	[IN/IIIII-] 	13	13	13	13	13	13	13	13	13	13	
[©] II: 72°C/50°C	hole			11	11	11	11	11	11	11	11	11	11	
Characteristic bond res		ed concrete	C20/25 in	hamm	er drill	ed hol	es (HD), con	npress	ed air	drilled	holes	(CD	
and with hollow drill bit	(HDB)									1	1			
con-	concrete and	TRk or 100	[N/mm²]	6,5	6,5	7,5	7,5	7,5	7,5	7,5	7,5	7,5	7,	
E II: 72°C/50°C	flooded bore hole	^T Rk,cr,100 [N/	[[, , , , , ,]	5,5	5,5	6,5	6,5	6,5	6,5	6,5	6,5	6,5	6,	
									02					
	1 -	C30.		1,04 1,07										
Increasing factors for c	concrete	C35,												
Ψс		C40,							08 09					
		C50							10					
Concrete cone failure)			<u> </u>										
Relevant parameter							;	see Ta	ble C	2				
Splitting														
Relevant parameter				•			;	see Ta	ble C	2				
Installation factor														
for dry and wet concret	· · · · · ·	γinst	[-]					1	,0					
for flooded bore hole (F	HD; HDB, CD)	'IIISt	r 1					1	,2					
1) f _{uk} shall be taken from 2) in absence of nationa		s of reinforci	ng bars											



Anchor size reinforcir	ng bar			Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 3
Steel failure										I			
Characteristic tension r	esistance	$N_{Rk,s}$	[kN]					A _s ·	f _{uk} 1)				
Cross section area		A_s	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial factor		$\gamma_{Ms,N}$	[-]					1,	4 ²⁾				
Combined pull-out an													
Characteristic bond re	sistance in unci	acked cond	rete C20/	25 in	diamo	nd drill	ed hol	es (DD))		ı	ı	
I: 40°C/24°C — Lange II: 72°C/50°C	Dry, wet concrete and flooded bore	[₹] Rk,ucr	[N/mm²]	14	13	13	13	12	12	11	11	11	11
등 II: 72°C/50°C	hole			11	11	10	10	10	9,5	9,5	9,5	9,0	9,0
Reduction factor ${\psi^0}_{ extsf{sus}}$	in uncracked c	oncrete C2	0/25 in dia	mond	drilled	holes	(DD)			I			
I: 40°C/24°C II: 72°C/50°C	Dry, wet concrete and flooded bore	Ψ^0 sus	[-]				· · ·	0,	77				
II: 72°C/50°C	hole							0,	72				
		C25/							04				
navagaina faatava far a		C30/							08				
ncreasing factors for c	oncrete		1,12 40/50 1,15										
rc	C45/							17					
		C50,							19				
Combined pull-out an	d concrete failu	re for a wo	rking life	of 100) year:	S							
Characteristic bond re	sistance in unc	acked cond	rete C20/	25 in	diamo	nd drill	ed hol	es (DD))	1	1		
I: 40°C/24°C II: 72°C/50°C	Dry, wet concrete and flooded bore	^τ Rk,ucr,100	[N/mm²]	14	13	13	13	12	12	11	11	11	11
हिं । II: 72°C/50°C	hole			11	10	10	10	9,5	9,0	9,0	9,0	8,5	8,5
		C25				•			04			•	
		C30,							80				
ncreasing factors for c	oncrete	C35/							12 15				
r c		C45/							17				
		C50							19				
Concrete cone failure													
Relevant parameter							;	see Ta	ble C2	2			
Splitting				I						_			
Relevant parameter							;	see Ta	ble C2	2			
nstallation factor	o (DD)		Ι	<u> </u>					0				
or dry and wet concret or flooded bore hole (E	· ,	γinst	[-]		1	,2		1	,0	1	,4		
1) f _{uk} shall be taken from		e of roinforci	na hare	<u> </u>	ı	, _				- 1	,-		
²⁾ in absence of nationa		s of reillioici	ng bars										
B+BTec Injection Sy	/stem BIS-PE (GEN3 for co	oncrete										



Table C14: Characteris	tic values	of she	ar lo	ads ı	unde	r sta	itic a	nd q	uasi-	static	actio	า
Anchor size reinforcing bar			Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Steel failure without lever arm			•	•						•		•
Characteristic shear resistance	V ⁰ Rk,s	[kN]					0,5	· A _s ·	f _{uk} 1)			
Cross section area	A _s	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial factor	γ _{Ms,V}	[-]		•	•	•	•	1,5 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
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	I _f	[mm]	min(h _{ef} ; 12 · d _{nom}) min(h _{ef} ; 300mm						mm)			
Outside diameter of fastener	d _{nom}	[mm]	8	10	12	14	16	20	24	25	28	32
Installation factor	γinst	[-]						1,0				

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

B+BTec Injection System BIS-PE GEN3 for concrete	
Performances Characteristic values of shear loads under static and quasi-static action	Annex C 14



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

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

¹⁾ Calculation of the displacement

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

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

Anchor size threaded ro	od		M8	M10	M12	M16	M20	M24	M27	M30
Uncracked concrete un	der static and	d quasi-static act	ion for a	workin	g life of	50 years	S			
Temperature range I:	δ_{N0} -factor	[mm/(N/mm²)]	0,011	0,012	0,012	0,013	0,014	0,014	0,015	0,015
40°C/24°C	$\delta_{ extsf{N}\infty}$ -factor	[mm/(N/mm²)]	0,018	0,019	0,019	0,020	0,022	0,023	0,024	0,025
Temperature range II:	δ_{N0} -factor	[mm/(N/mm²)]	0,013	0,014	0,014	0,015	0,016	0,016	0,018	0,018
72°C/50°C	$\delta_{ extsf{N}\infty}$ -factor	[mm/(N/mm²)]	0,052	0,053	0,055	0,058	0,062	0,065	0,068	0,070
Uncracked concrete un	der static an	d quasi-static act	ion for a	workin	g life of	100 yea	rs			
Temperature range I:	$\delta_{ extsf{N0}}$ -factor	[mm/(N/mm²)]	0,011	0,012	0,012	0,013	0,014	0,014	0,015	0,015
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,020	0,021	0,021	0,023	0,024	0,025	0,026	0,027
Temperature range II:	$\delta_{ extsf{N0}}$ -factor	[mm/(N/mm²)]	0,013	0,014	0,014	0,015	0,016	0,016	0,018	0,018
72°C/50°C	$\delta_{ extsf{N}\infty}$ -factor	[mm/(N/mm²)]	0,038	0,039	0,040	0,043	0,045	0,047	0,049	0,051

¹⁾ Calculation of the displacement

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

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

Anchor size thread	M8	M10	M12	M16	M20	M24	M27	M30		
Uncracked and crac	cked concrete unde	er static and qua	asi-stati	caction						
All temperature	$\delta_{ extsf{V0}}$ -factor	[mm/kN]	0,06	0,06	0,05	0,04	0,04	0,03	0,03	0,03
ranges	$\delta_{ extsf{V}\infty}$ -factor	[mm/kN]	0,09	0,08	0,08	0,06	0,06	0,05	0,05	0,05

¹⁾ Calculation of the displacement

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

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

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Performances

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

Annex C 15



Table C18:	Displacements under tension load ¹⁾ in hammer drilled holes (HD),
	compressed air drilled holes (CD) and with hollow drill bit (HDB)

Anchor size Internal thre	eaded anchor r	od	IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20
Uncracked concrete und	der static and o	uasi-static actio	n for a wo	rking life o	of 50 and 1	00 years		
Temperature range I:	δ_{N0} -factor	[mm/(N/mm²)]	0,029	0,030	0,033	0,035	0,038	0,041
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,029	0,030	0,033	0,035	0,038 0,038 0,051 0,064 0,079 0,142 0,106	0,041
Temperature range II:	δ_{N0} -factor	[mm/(N/mm²)]	0,039	0,040	0,044	0,047	0,051	0,055
72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,049	0,051	0,055	0,059	0,064	0,070
Cracked concrete under	static and qua	si-static action	for a work	ing life of	50 and 100	years		
Temperature range I:	δ_{N0} -factor	[mm/(N/mm²)]	0,071	0,072	0,074	0,076	0,079	0,082
40°C/24°C	$\delta_{ extsf{N}\infty}$ -factor	[mm/(N/mm²)]	0,115	0,122	0,128	0,135	0,142	0,171
Temperature range II:	δ _{N0} -factor	[mm/(N/mm²)]	0,095	0,096	0,099	0,102	0,106	0,110
72°C/50°C	$\delta_{ extsf{N}\infty}$ -factor	[mm/(N/mm²)]	0,154	0,163	0,172	0,181	0,189	0,229

¹⁾ Calculation of the displacement

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

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

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

¹⁾ Calculation of the displacement

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

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

Anchor size Inter	IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20					
Uncracked and cracked concrete under static and quasi-static action											
All temperature	δ_{V0} -factor	[mm/kN]	0,07	0,06	0,06	0,05	0,04	0,04			
ranges	$\delta_{ m V}$ -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 · V; V: action shear load

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

B+BTec Injection System BIS-PE GEN3 for concrete

Performances

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

Annex C 16



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

Anchor size reinfo	orcing bar		Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Uncracked concrete under static and quasi-static action for a working life of 50 and 100 years												
Temp range I:	$\delta_{ extsf{N0}}$ -factor	[mm/(N/mm²)]	0,028	0,029	0,030	0,031	0,033	0,035	0,038	0,038	0,040	0,043
40°C/24°C	$\delta_{ extsf{N}\infty}$ -factor	[mm/(N/mm²)]	0,028	0,029	0,030	0,031	0,033	0,035	0,038	0,038	0,040	0,043
Temp range II:	$\delta_{ extsf{N0}}$ -factor	[mm/(N/mm²)]	0,038	0,039	0,040	0,042	0,044	0,047	0,051	0,051	0,054	0,058
72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,047	0,049	0,051	0,053	0,055	0,059	0,065	0,065	0,068	0,072
Cracked concrete	under statio	and quasi-stat	ic actio	n for a	workin	g life of	50 and	l 100 ye	ears			
Temp range I:	$\delta_{ extsf{N0}}$ -factor	[mm/(N/mm²)]	0,069	0,071	0,072	0,073	0,074	0,076	0,079	0,079	0,081	0,084
40°C/24°C	$\delta_{ extsf{N}\infty}$ -factor	[mm/(N/mm²)]	0,115	0,122	0,128	0,135	0,142	0,155	0,171	0,171	0,181	0,194
Temp range II:	δ_{N0} -factor	[mm/(N/mm²)]	0,092	0,095	0,096	0,098	0,099	0,102	0,106	0,106	0,109	0,113
72°C/50°C	$\delta_{ extsf{N}\infty}$ -factor	[mm/(N/mm²)]	0,154	0,163	0,172	0,181	0,189	0,207	0,229	0,229	0,242	0,260

¹⁾ Calculation of the displacement

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

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

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

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

¹⁾ Calculation of the displacement

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

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

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

Anahay aina yain	α.	Ø 10	Ø 12	~ 4.4	C 40	~ 00	Ø 24	Ø 25	Ø 28	Ø 32		
Anchor size rein	Ø 8	w 10	W 12	لا لا	Ø 16	Ø 20	W 24	Ø 25	Ø 28	Ø 32		
Uncracked and cracked concrete under static and quasi-static action												
All temperature	δ_{V0} -factor	[mm/kN]	0,06	0,05	0,05	0,04	0,04	0,04	0,03	0,03	0,03	0,03
ranges	$\delta_{V\infty}$ -factor	[mm/kN]	0,09	0,08	0,08	0,06	0,06	0,05	0,05	0,05	0,04	0,04

¹⁾ Calculation of the displacement

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

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

B+BTec Injection System BIS-PE GEN3 for concrete

Performances

Displacements under static and quasi-static action (rebar)

Annex C 17

Increasing factors for concrete $\psi_{\mathbf{C}}$

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

for flooded bore hole (HD; HDB, CD)

Installation factor



1,0

1,0

1,2

Table C24:	Table C24: Characteristic values of tension loads under seismic action (performance category C1) for a working life of 50 and 100 years											
Anchor size threaded rod												
Steel failure												
Characteristic tension resistance N _{Rk,s,eq,C1} [kN] 1,0 • N _{Rk,s}												
Partial factor			γ _{Ms,N}	[-]				see Ta	ble C1			
Combined pull-	out and co	ncrete failure										
Characteristic bodrilled holes (CD				concrete C2	20/25 in	hamm	er drille	ed hole	s (HD)	, comp	ressed	air
I: 40°C/2	24°C	Dry, wet concrete and	^τ Rk,eq,C1	[N/mm²]	7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5
He in the interest of the inte	<u>ម</u> II: 72°C/50°C flooded bore hole								7,0			

[-]

C25/30 to C50/60

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

 γ_{inst}

		•								
Anchor size threaded rod		M8	M10	M12	M16	M20	M24	M27	M30	
Steel failure										
Characteristic shear resistance (Seismic C1)	$V_{Rk,s,eq,C1}$	[kN]] 0,70 • V ⁰ _{Rk,s}							
Partial factor	$\gamma_{Ms,V}$	[-]	see Table C1							
Factor for annular gap	$\alpha_{\sf gap}$	[-]	0,5 (1,0) ¹⁾							

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

B+BTec Injection System BIS-PE GEN3 for concrete	
Performances Characteristic values of tension and shear loads under seismic action (performance category C1) for a working life of 50 and 100 years (threaded rod)	Annex C 18



1,2

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

Ancho	r size reinforcir	ng bar			Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Steel f	ailure											1		
Charac	cteristic tension re	esistance	N _{Rk,s,eq,C1}	[kN]					1,0 • A	s · f _{uk}	1)			
Cross	section area		A _s	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial	factor		$\gamma_{Ms,N}$	[-]					1,	4 ²⁾		•	•	•
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 with hollow drill bit (HDB)									air 					
rature ge	l: 40°C/24°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: 72°C/50°C	flooded bore hole	^τ Rk,eq,C1	[N/mm²]	²] 6,0 6,0 7,0 7,0 7,0 7,0 7,0 7,0 7,0 7,0 7,0 7							7,0		
Increas	sing factors for co	oncrete ψ _C	C25/30 to	C50/60					1	,0		•	•	
Install	ation factor		•											
for dry and wet concrete (HD; HDB, CD)									1	,0				
for floo	ded bore hole (H	ID: HDB CD)	^γ inst	[-]	12									

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

for flooded bore hole (HD; HDB, CD)

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

Anchor size reinforcing bar	Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32		
Steel failure												
Characteristic shear resistance	V _{Rk,s,eq,C1}	[kN]	0,35 • A _s • f _{uk} ¹⁾									
Cross section area	A _s	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial factor	γ _{Ms,} ∨	[-]	1,5 ²⁾									
Factor for annular gap	$lpha_{\sf gap}$	[-]	0,5 (1,0) ³⁾									

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

B+BTec Injection System BIS-PE GEN3 for concrete	
Performances Characteristic values of tension and shear loads under seismic action (performance category C1) for a working life of 50 and 100 years (rebar)	Annex C 19

²⁾ in absence of national regulation

²⁾ in absence of national regulation

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

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

for flooded bore hole (HD; HDB, CD)

English translation prepared by DIBt



1,0

1,2

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

Anchor size threaded rod		M12	M16	M20	M24	
Steel failure		•				
Characteristic tension 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 Table C1			
Combined pull-out and concrete fa	ilure					
Characteristic bond resistance in crac drilled holes (CD) and with hollow dri		concrete C20	/25 in hamm	er drilled hole	s (HD), comp	ressed air
be a li 40°C/24°C Dry, wet concrete flooded to hole	1 (0) 00 00	[N/mm²]	5,8	4,8	5,0	5,1
flooded by hole	oore T _{Rk,eq,C2}	[N/mm²]	5,0	4,1	4,3	4,4
ncreasing factors for concrete ψ _C	C25/30 to	C50/60	1,0			

[-]

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

 γ_{inst}

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

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

B+BTec Injection System BIS-PE GEN3 for concrete	
Performances Characteristic values of tension and shear loads under seismic action (performance category C2) for a working life of 50 and 100 years (threaded rod)	Annex C 20



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

Table C31: Displacements under shear load (threaded rod)

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

B+BTec Injection System BIS-PE GEN3 for concrete	
Performances Displacements under seismic action (performance category C2) (threaded rods)	Annex C 21