



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 16 January 2020

Bonded fastener for use in concrete

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the
European Technical Assessment:Deutsches Institut für BautechnikTrade name of the construction productB+BTec Injection System BIS-PE GEN3 for concrete

Product family to which the construction product belongs

Manufacturer

B+BTec Munterij 8 4762 AH ZEVENBERGEN NIEDERLANDE

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

B+BTec, Plant 1

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

EAD 330499-01-0601

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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 BIS-PE GEN3 and a steel element. The steel element consists of a commercial threaded rod with washer and hexagon nut in the range of M8 to M30 or reinforcing bar in the range of \emptyset 8 to \emptyset 32 mm or an internal threaded anchor rod IG-M6 to IG-M20.

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 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

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

3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic resistance to tension load (static and quasi-static loading)	See Annex C 1 to C 5, C 7 to C 9, C 11 to C 13
Characteristic resistance to shear load (static and quasi-static loading)	See Annex C 1, C 6, C 10, C 14
Displacements (static and quasi-static 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 25
Durability	See Annex B 1

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

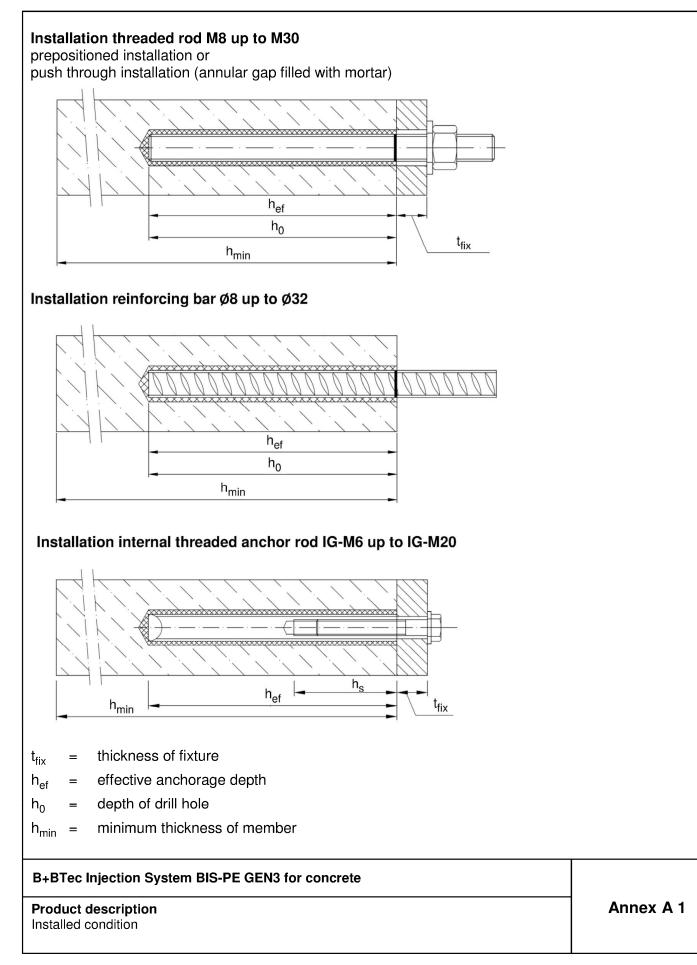
5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable European Assessment Document

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

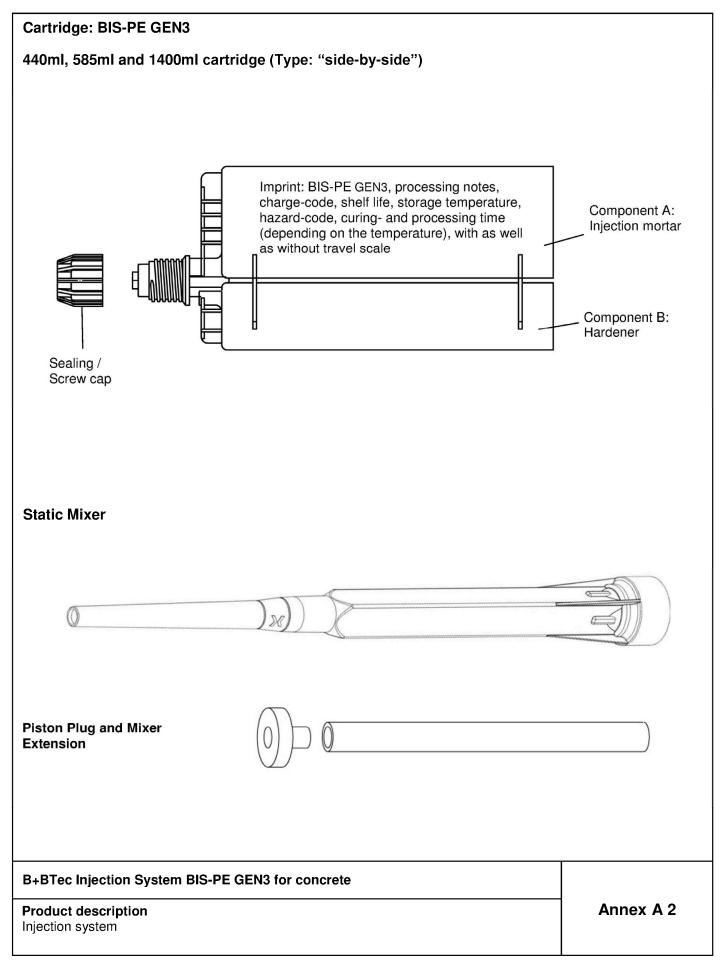
Issued in Berlin on 16 January 2020 by Deutsches Institut für Bautechnik

BD Dipl.-Ing. Andreas Kummerow Head of Department *beglaubigt*: Baderschneider











Threaded rod M8, M10, M12, M16, M	20, M24, M27, M30 with washer and hexag	on nut
	Commercia rod with: - Mater mecha Table - Inspec to EN	ction certificate 3.1 acc. 10204:2004 ng of embedment
Internal threaded anchor rod IG-M6,	IG-M8, IG-M10, IG-M12, IG-M16, IG-M20	$\overline{\mathbf{x}}$
Threaded rod or screw	Mark of the producer	4)
		σ
	Marking: e.g. M8	
	Marking Internal thread	
	Mark	
	M8 Thread size (Internal thread) A4 additional mark for stainless steel HCR additional mark for high-corrosion resi	stance steel
Filling washer and mixer reduction fixture	nozzle for filling the annular gap between a	anchor rod and
B+BTec Injection System BIS-PE GEN3	for concrete	
Product description Threaded rod, internal threaded rod and fi	lling washer	Annex A 3



Та	ble A1: Materi	als				
	Designation	Material				
zi ho	nc plated ≥ 5 ot-dip galvanised ≥ 4	acc. to EN 10087:1998 µm acc. to EN ISO 0 µm acc. to EN ISO 5 µm acc. to EN ISO	4042 146	2:1999 or 1:2009 and EN ISO 10684:	2004+AC:2009 or	
		Property class		Characteristic steel ultimate tensile strength	Characteristic steel yield strength	Elongation at fracture
			4.6	f _{uk} = 400 N/mm ²	$f_{yk} = 240 \text{ N/mm}^2$	A ₅ > 8%
1	Threaded rod		4.8	f _{uk} = 400 N/mm ²	f _{vk} = 320 N/mm ²	A ₅ > 8%
1	Threaded Tod	acc. to		$f_{uk} = 500 \text{ N/mm}^2$	$f_{vk} = 300 \text{ N/mm}^2$	A ₅ > 8%
		EN ISO 898-1:2013		$f_{uk} = 500 \text{ N/mm}^2$	$f_{yk} = 400 \text{ N/mm}^2$	A ₅ > 8%
				f _{uk} = 800 N/mm ²	$f_{vk} = 640 \text{ N/mm}^2$	$A_5 \ge 12\%^{-3}$
			4	for anchor rod class 4.6 o	<u></u>	1.5 - 1270
2	Hexagon nut	acc. to	5	for anchor rod class 5.6 o		
-	linexagen nat	EN ISO 898-2:2012	8	for anchor rod class 8.8		
3a	Washer			galvanised or sherardized N ISO 7089:2000, EN ISC	7093:2000 or EN ISO	7094:2000)
3b	Filling washer			galvanised or sherardized		· · ·
	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/mm ²	f _{yk} = 400 N/mm ²	A ₅ > 8%
		EN ISO 898-1:2013	8.8	f _{uk} = 800 N/mm²	f _{vk} = 640 N/mm ²	A ₅ > 8%
tai	nless steel A4 (Mater	ial 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 Characteristic steel	o EN 10088-1:2014) -1: 2014) Characteristic steel	Elongation at
				ultimate tensile strength	yield strength	fracture
1	Threaded rod ¹⁾⁴⁾	acc. to	50	f _{uk} = 500 N/mm ²	f _{yk} = 210 N/mm ²	A ₅ ≥ 8%
		EN ISO 3506-	70	f _{uk} = 700 N/mm²	f _{yk} = 450 N/mm ²	A ₅ ≥ 12% ³⁾
		1:2009	80	f _{uk} = 800 N/mm ²	$f_{yk} = 600 \text{ N/mm}^2$	A ₅ ≥ 12% ³⁾
		acc. to	50	for anchor rod class 50		
2	Hexagon nut ¹⁾⁴⁾	EN ISO 3506-	70	for anchor rod class 70		
		1:2009	80	for anchor rod class 80		
3a	Washer	A4: Material 1.4401 / HCR: Material 1.4529	1.44 9 or 1	07 / 1.4311 / 1.4567 or 1.4 04 / 1.4571 / 1.4362 or 1.4 I.4565, acc. to EN 10088-1 EN ISO 7089:2000, EN ISC	578, acc. to EN 10088- : 2014	1:2014
3b	Filling washer	Stainless steel A4, H	igh c	orrosion resistance steel		
		Property class		Characteristic steel ultimate tensile strength	Characteristic steel yield strength	Elongation at fracture
	Internal threaded	acc. to	50	f _{uk} = 500 N/mm²	f _{yk} = 210 N/mm ²	A ₅ > 8%
4	anchor rod ¹⁾²⁾	EN ISO 3506- 1:2009	70	f _{uk} = 700 N/mm ²	f _{yk} = 450 N/mm ²	A ₅ > 8%
2) 3)	for IG-M20 only proper A₅ > 8% fracture elong	ty class 50	for pe	and Internal threaded anchor erformance category C2 exis		

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



Reii	Reinforcing bar Ø 8, Ø 10, Ø 12, Ø 14, Ø 16, Ø 20, Ø 24, Ø 25, Ø 28, Ø 32								
₊	h _{ef}								
	• Minimum value of related rip area f _{R,min} a	I ccording 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 he	ight of the bar)							
Tah	le A2: Materials								
		Metavial							
Part	Designation forcing bars	Material							
neilli									
1	Rebar EN 1992-1-1:2004+AC:2010, Annex C	Bars and de-coiled rods class B or C f_{yk} and k according to NDP or NCL of EN $f_{uk} = f_{tk} = k \cdot f_{yk}$	I 1992-1-1/NA						
B+B	Tec Injection System BIS-PE GEN3 for cor	ncrete							
	duct description		Annex A 5						
	erials reinforcing bar								



Specifications of intended use

Anchorages subject to:

- Static and quasi-static loads: M8 to M30, Rebar Ø8 to Ø32, IG-M6 to IG-M20.
- Seismic action for Performance Category C1: M8 to M30, Rebar Ø8 to Ø32.
- Seismic action for Performance Category C2: M12 to M24.

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.
- Non-cracked concrete: M8 to M30, Rebar Ø8 to Ø32, IG-M6 to IG-M20.
- Cracked concrete: M8 to M30, Rebar Ø8 to Ø32, IG-M6 to IG-M20.

Temperature Range:

- I: 40 °C to +40 °C (max long term temperature +24 °C and max short term temperature +40 °C)
- II: 40 °C to +72 °C (max long term temperature +50 °C and max short term temperature +72 °C)

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

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 1



Table B1: In											
Anchor size		M8	M10	M12	M16	M20	M24	M27	M30		
Diameter of element d = d			[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 dopth	h _{ef,min}	[mm]	60	60	70	80	90	96	108	120
	n depin	h _{ef,max}	[mm]	160	200	240	320	400	480	540	600
Diameter of	Prepositioned i		[mm]	9	12	14	18	22	26	30	33
clearance hole in the fixture	Push through i	Push through installation d _f		12	14	16	20	24	30	33	40
Maximum torque mo	oment	T _{inst} ≤	[Nm]	10	20	40 ¹⁾	60	100	170	250	300
Minimum thickness of member		h _{min}	[mm]	-	h _{ef} + 30 mm ≥ 100 mm		$h_{ef} + 2d_0$				
Minimum spacing		s _{min}	[mm]	40	50	60	75	95	115	125	140
Minimum edge dista	ince	c _{min}	[mm]	35	40	45	50	60	65	75	80
	moment for M12 w	ith stool Grade	16 is 35	Nm							

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

Table B2: Installation parameters for rebar

Anchor size			Ø 81)	Ø 10 ¹⁾	Ø 121)	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	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	ominal drill hole diameter d ₀ [mm]		10 12	12 14	14 16	18	20	25	32	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	_f + 2d ₀			
Minimum spacing	s _{min}	[mm]	40	50	60	70	75	95	120	120	130	150
Minimum edge distance	c _{min}	[mm]	35	40	45	50	50	60	70	70	75	85
4)			•	•	•	•			•	•		

¹⁾ both nominal drill hole diameter can be used

Table B3: Installation parameters for Internal threaded anchor rod

		IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20
d ₂	[mm]	6	8	10	12	16	20
$d = d_{nom}$	[mm]	10	12	16	20	24	30
d ₀	[mm]	12	14	18	22	28	35
h _{ef,min}	[mm]	60	70	80	90	96	120
		200	240	320	400	480	600
d _f	[mm]	7	9	12	14	18	22
T _{inst} ≤	[Nm]	10	10	20	40	60	100
l _{IG}	[mm]	8/20	8/20	10/25	12/30	16/32	20/40
h _{min}	[mm]				h _{ef} + 2d ₀		
s _{min}	[mm]	50	60	75	95	115	140
C _{min}	[mm]	40	45	50	60	65	80
	$d = d_{nom}$ d_0 $h_{ef,min}$ $h_{ef,max}$ d_f $T_{inst} \leq$ I_{IG} h_{min}	$d = d_{nom} [mm]$ $d_0 [mm]$ $h_{ef,min} [mm]$ $h_{ef,max} [mm]$ $d_f [mm]$ $T_{inst} \le [Nm]$ $ IG [mm]$ $h_{min} [mm]$	$\begin{array}{c ccccc} & & & & & & & \\ \hline d = d_{nom} & [mm] & 10 \\ \hline d = d_{nom} & [mm] & 10 \\ \hline d_0 & [mm] & 12 \\ \hline h_{ef,min} & [mm] & 60 \\ \hline h_{ef,max} & [mm] & 200 \\ \hline d_f & [mm] & 200 \\ \hline d_f & [mm] & 7 \\ \hline T_{inst} \leq & [Nm] & 10 \\ \hline & & & & \\ \hline & & & & \\ \hline & & & & \\ \hline & & & &$	d_2 [mm] 6 8 $d = d_{nom}$ [mm] 10 12 d_0 [mm] 12 14 $h_{ef,min}$ [mm] 60 70 $h_{ef,max}$ [mm] 200 240 d_f [mm] 7 9 $T_{inst} \leq$ [Nm] 10 10 l_{IG} [mm] 8/20 8/20 h_{min} [mm] 50 60	d2 [mm] 6 8 10 d = d_{nom} [mm] 10 12 16 d_0 [mm] 12 14 18 h _{ef,min} [mm] 60 70 80 h _{ef,max} [mm] 200 240 320 d _f [mm] 7 9 12 T _{inst} ≤ [Nm] 10 10 20 l _{IG} [mm] 8/20 8/20 10/25 h _{min} [mm] 50 60 75	d2 [mm] 6 8 10 12 d = d_{nom} [mm] 10 12 16 20 d_0 [mm] 10 12 16 20 d_0 [mm] 10 12 16 20 h_{ef,min} [mm] 60 70 80 90 h_{ef,max} [mm] 200 240 320 400 d_f [mm] 7 9 12 14 Tinst ≤ [Nm] 10 10 20 40 l_IG [mm] 8/20 8/20 10/25 12/30 h_{min} [mm] 50 60 75 95	$\begin{array}{c c c c c c c c c c c c c c c c c c c $

B+BTec Injection System BIS-PE GEN3 for concrete

Intended Use

Installation parameters

Annex B 2



	1111111111111111111		8								
Threaded Rod	Rebar	Internal threaded anchor rod	d ₀ Drill bit - Ø HD, HDB, CD, DD	d Brus		d _{b,min} min. Brush - Ø	Piston plug		on direction f piston plu		
[mm]	[mm]	[mm]	[mm]		[mm]	[mm]			\rightarrow	1	
M8	8		10	RB10	11,5	10,5			II		
M10	8 / 10	IG-M6	12	RB12	13,5	12,5]	N a set of	المتعادية والمتعادية		
M12	10/12	IG-M8	14	RB14	15,5	14,5]	ivo plug	required		
	12		16	RB16	17,5	16,5	1				
M16	14	IG-M10	18	RB18	20,0	18,5	VS18				
-	16		20	RB20	22,0	20,5	VS20	1			
M20	· · ·	IG-M12	22	RB22	24,0	22,5	VS22	1			
	20		25	RB25	27,0	25,5	VS25	1.			
M24		IG-M16	28	RB28	30,0	28,5	VS28	h _{ef} >	h _{ef} >	all	
M27			30	RB30	31,8	30,5	VS20 VS30	250 mm	250 mm	an	
	04/05		32	RB32	34,0	32,5	VS30 VS32	-			
	2/1/25				UH.U	JC.J	1 1002	4		1	
M30	24 / 25							1			
M30	24/25 28 32	IG-M20	35 40	RB35 RB40	37,0 43,5	35,5 40,5	VS35 VS40	-			
CAC - R	28 32 ec. compre	IG-M20	35 40 ol (min 6 b	RB35 RB40	37,0	35,5	VS35		P	~	
CAC - R Drill bit dia HDB – H Drill bit dia The hollow class M va	28 32 ec. compre ameter (d ₀): ameter (d ₀): w drill bit sys	essed air to all diameters bit system all diameters tem contains ninimum neg	35 40 Fol (min 6 b	RB35 RB40 ar)	37,0 43,5	35,5 40,5	VS35 VS40				
CAC - R Drill bit dia HDB – H Drill bit dia The hollow class M va minimum	28 32 ec. compre ameter (d ₀): ameter (d ₀): w drill bit sys acuum with r 150 m ³ /h (42	essed air to all diameters bit system all diameters tem contains ninimum neg	35 40 bol (min 6 b the Heller D lative pressu	RB35 RB40 ar) uster E re of 25	37,0 43,5	35,5 40,5	VS35 VS40				



Installation instruct	ions	
Drilling of the bore	hole (HD, HDB, CD)	
	1a. Hammer (HD) or compressed air drilling (CD) Drill a hole into the base material to the size and embedment dep selected anchor (Table B1, B2, or B3). Proceed with Step 2. In case of aborted drill hole, the drill hole shall be filled with mort	
	1b. Hollow drill bit system (HDB) (see Annex B 3) Drill a hole into the base material to the size and embedment dep selected anchor (Table B1, B2, or B3). This drilling system remo the bore hole during drilling (all conditions). Proceed with Step 3 In case of aborted drill hole, the drill hole shall be filled with mort	ves the dust and cleans
	Attention! Standing water in the bore hole must be removed before	ore cleaning.
CAC: Cleaning for d	ry, wet and water-filled bore holes with all diameter in uncracked a	and cracked concrete
2x	2a. Starting from the bottom or back of the bore hole, blow the hole c compressed air (min. 6 bar) (Annex B 3) a minimum of two times stream is free of noticeable dust. If the bore hole ground is not rea extension must be used.	until return air
	 Check brush diameter (Table B4). Brush the hole with an appropr d_{b,min} (Table B4) a minimum of two times in a twisting motion. If the bore hole ground is not reached with the brush, a brush external 	
2x	2c. Finally blow the hole clean again with compressed air (min. 6 bar) minimum of two times until return air stream is free of noticeable or ground is not reached an extension must be used.	
	After cleaning, the bore hole has to be protected against re-co an appropriate way, until dispensing the mortar in the bore ho the cleaning has to be repeated directly before dispensing the In-flowing water must not contaminate the bore hole again.	ole. If necessary,
B+BTec Injection S	ystem BIS-PE GEN3 for concrete	
Intended Use Installation instruction	าร	Annex B 4



Installation instruct	ions	
Drilling of the bore	hole (DD)	
	1a. Diamond drilling (DD) Drill with diamond drill a hole into the base material to the size a required by the selected anchor (Table B1, B2, or B3). Proceed In case of aborted drill hole, the drill hole shall be filled with mort	with Step 2.
PCAC: Cleaning for	r dry, wet and water-filled bore holes with all diameter in uncracke	ed concrete
	Attention! Standing water in the bore hole must be removed bef	ore cleaning.
	2a. Rinsing with water until clear water comes out.	
	 2b. Check brush diameter (Table B4). Brush the hole with an appropriate provided by the second second	
	2c. Rinsing again with water until clear water comes out.	
2x	2d. Starting from the bottom or back of the bore hole, blow the hole c compressed air (min. 6 bar) (Annex B 3) a minimum of two times stream is free of noticeable dust. If the bore hole ground is not recently extension must be used.	until return air
	 2e. Check brush diameter (Table B4). Brush the hole with an appropriate of the second s	
2x	2f. Finally blow the hole clean again with compressed air (min. 6 bar minimum of two times until return air stream is free of noticeable ground is not reached an extension must be used.	
	After cleaning, the bore hole has to be protected against re-c an appropriate way, until dispensing the mortar in the bore ho the cleaning has to be repeated directly before dispensing the In-flowing water must not contaminate the bore hole again.	ole. If necessary,
B+BTec Injection S	ystem BIS-PE GEN3 for concrete	
ntended Use nstallation instruction	าร	Annex B 5



Installation instructions (continuation)							
	3. Attach the supplied static-mixing nozzle to the cartridge and load the correct dispensing tool. For every working interruption longer than the recommended work well as for new cartridges, a new static-mixer shall be used.						
her_I	4. Prior to inserting the anchor rod into the filled bore hole, the position depth shall be marked on the anchor rods.	on of the embedment					
min. 3 full stroke	5. Prior to dispensing into the anchor hole, squeeze out separately a r strokes and discard non-uniformly mixed adhesive components unt consistent grey or red colour.						
	6. Starting from the bottom or back of the cleaned anchor hole, fill the approximately two-thirds with adhesive. Slowly withdraw the static hole fills to avoid creating air pockets. If the bottom or back of the a reached, an appropriate extension nozzle must be used. Observe t given in Table B5.	mixing nozzle as the nchor hole is not					
	 Piston plugs and mixer nozzle extensions shall be used according a following applications: Horizontal assembly (horizontal direction) and ground erection direction): Drill bit-Ø d₀ ≥ 18 mm and embedment depth h_{ef} > 2 Overhead assembly (vertical upwards direction): Drill bit-Ø d₀ 	(vertical downwards 250mm					
	8. Push the threaded rod or reinforcing bar into the anchor hole while ensure positive distribution of the adhesive until the embedment de The anchor shall be free of dirt, grease, oil or other foreign material	pth is reached.					
	9. After inserting the anchor, the annular gab between anchor rod an push through installation additionally also the fixture, must be com excess mortar is not visible at the top of the hole, the requirement application has to be renewed. For overhead application the anchowedges).	plete filled with mortar. If is not fulfilled and the					
e.g. 20°C 12:00	10. Allow the adhesive to cure to the specified time prior to applying an not move or load the anchor until it is fully cured (attend Table B5)						
	11. After full curing, the add-on part can be installed with up to the mat B3) by using a calibrated torque wrench. In case of prepositioned is gab between anchor and fixture can be optional filled with mortar. washer by the filling washer and connect the mixer reduction nozz The annular gap is filled with mortar, when mortar oozes out of the	nstallation the annular Therefor substitute the le to the tip of the mixer.					
B+BTec Injection S	System BIS-PE GEN3 for concrete						
Intended Use Installation instruction	ons (continuation)	Annex B 6					



Table B5:	Table B5: Maximum working time and minimum curing time												
Concrete	temp	perature	Gelling working time	Minimum curing time in dry concrete	Minimum curing time in wet concrete								
+ 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	O∘C		8 min	4 h	8 h								
Cartridge	temp	perature		+5°C to +40°C									

B+BTec Injection System BIS-PE GEN3 for concrete

Intended Use Curing time Annex B 7



Table C1: Characteristic values for steel tension resistance and steel shear resistance of threaded rods Size **M8** M10 M12 M16 M20 M24 M27 M30 A_s 245 353 Cross section area [mm²] 36,6 58 84,3 157 459 561 Characteristic tension resistance, Steel failure 1) N_{Rk,s} Steel, Property class 4.6 and 4.8 23 (21) 224 [kN] 15 (13) 34 63 98 141 184 N_{Rk.s} 42 122 176 230 Steel, Property class 5.6 and 5.8 [kN] 18 (17) 29 (27) 78 280 N_{Rk,s} Steel, Property class 8.8 [kN] 29 (27) 46 (43) 67 125 196 282 368 449 N_{Rk.s} Stainless steel A2, A4 and HCR, class 50 79 177 230 [kN] 18 29 42 123 281 Stainless steel A2, A4 and HCR, class 70 N_{Rk,s} [kN] 26 41 59 110 171 247 _ _ N_{Rk,s} Stainless steel A4 and HCR, class 80 29 46 [kN] 67 126 196 282 _ _ Characteristic tension resistance, Partial factor ²⁾ 2,0 Steel, Property class 4.6 and 5.6 [-] γMs.N 1,5 Steel, Property class 4.8, 5.8 and 8.8 [-] γMs.N Stainless steel A2, A4 and HCR, class 50 2.86 [-] γMs,N Stainless steel A2, A4 and HCR, class 70 1,87 [-] γMs,N Stainless steel A4 and HCR, class 80 [-] 1,6 γMs.N Characteristic shear resistance, Steel failure ¹⁾ V⁰_{Bk.s} [kN] 14 (13) Steel, Property class 4.6 and 4.8 9 (8) 20 38 59 85 110 135 arm Steel, Property class 5.6 and 5.8 V⁰Rk.s [kN] 11 (10) 17 (16) 25 47 74 106 138 168 ē V⁰_{Rk.s} Steel, Property class 8.8 [kN] 15 (13) 23 (21) 34 63 98 141 184 224 <u>@</u> $V^0_{Rk,s}$ Without Stainless steel A2, A4 and HCR, class 50 [kN] 9 15 21 39 61 88 115 140 V⁰Rk,s Stainless steel A2, A4 and HCR, class 70 [kN] 13 20 55 124 30 86 _ _ V⁰Rk,s Stainless steel A4 and HCR, class 80 [kN] 15 23 34 63 98 141 _ -M⁰Rk<u>,s</u> Steel, Property class 4.6 and 4.8 [Nm] 15 (13) 30 (27) 52 133 260 449 666 900 M⁰Rk,s Steel, Property class 5.6 and 5.8 [Nm] 19 (16) 37 (33) 65 166 324 560 833 1123 M⁰_{Rk,s} Steel, Property class 8.8 [Nm] 30 (26) 60 (53) 105 266 519 896 1333 1797 ē Ð M⁰Rk,s Stainless steel A2, A4 and HCR, class 50 [Nm] 19 37 66 167 325 561 832 1125 M⁰Rk,<u>s</u> Stainless steel A2, A4 and HCR, class 70 [Nm] 26 52 92 232 454 784 _ -M⁰_{Rk,s} Stainless steel A4 and HCR, class 80 [Nm] 30 59 105 266 519 896 _ Characteristic shear resistance, Partial factor ²⁾ Steel, Property class 4.6 and 5.6 1,67 γMs.V [-] Steel, Property class 4.8, 5.8 and 8.8 [-] 1.25 γMs,V Stainless steel A2, A4 and HCR, class 50 [-] 2.38 γMs,V Stainless steel A2, A4 and HCR, class 70 [-] 1,56 γMs,V Stainless steel A4 and HCR, class 80 1.33 [-] γMs,V ¹⁾ Values are only valid for the given stress area As. Values in brackets are valid for undersized threaded rods with smaller

stress area As for hot-dip galvanised threaded rods according to EN ISO 10684:2004+AC:2009.

²⁾ in absence of national regulation

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



a	haracteristic valu	ues for Cor	ncrete cone fai	lure and Splitting with all kind of
nchor				All Anchor type and sizes
oncrete cone fa		1		
on-cracked conc	rete	k _{ucr,N}	[-]	11,0
racked concrete		k _{cr,N}	[-]	7,7
dge distance		c _{cr,N}	[mm]	1,5 h _{ef}
xial distance		s _{cr,N}	[mm]	2 c _{cr,N}
plitting	F	1		
	h/h _{ef} ≥ 2,0			1,0 h _{ef}
dge 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}
xial 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



Table C3: Characteristic values of tension loads under static and quasi-static action for a service life of 50 years											
Anchor size threaded ro	d			M8	M10	M12	M16	M20	M24	M27	M30
Steel failure		_	-								
Characteristic tension res	istance	N _{Rk,s}	[kN]			Α _s ・f _ι	_{Jk} (or s	ee Tab	le C1)		
Partial factor		γ _{Ms,N}	[-]	see Table C1							
Combined pull-out and	concrete failure			1							
Characteristic bond resist holes (CD)	ance in non-crack	ed concrete C2	20/25 in har	nmer d	Irilled h	oles (H	ID) and	compr	essed	air drill	ed
I: 40°C/24°C	Dry, wet concrete and flooded bore	^τ Rk,ucr	[N/mm²]	20	20	19	19	18	17	16	16
₩ II: 72°C/50°C	hole			15	15	15	14	13	13	12	12
Characteristic bond resist	ance in non-crack	ed concrete C2	nmer d	Irilled h	oles wi	th hollo	w drill	bit (HD	B)		
୍ରୁ l: 40°C/24°C	Dry, wet			17	16	16	16	15	14	14	13
B II: 72°C/50°C	concrete			14	14	14	13	13	12	12	11
I: 40°C/24°C II: 72°C/50°C II: 72°C/50°C II: 72°C/50°C	flooded bore	^T Rk,ucr	[N/mm ²]	16	16	16	15	15	14	14	13
HI: 72°C/50°C hole				14	14	14	13	13	12	12	11
Characteristic bond resist and with hollow drill bit (H	r drilleo	holes	(HD) ,	compre	essed a	ir drille	d holes	s (CD)			
L: 7°2°C/2°C I: and attraction and a control of the second	Dry, wet concrete and	^τ Rk,cr	[N/mm ²]	7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5
und termination of the second	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	cracked and non-	cracked concre	ete C20/25 i	n hamı	mer dril	led hol	es (HD), comp	oressed	d air dri	lled
holes (CD) and with hollow	w drill bit (HDB)										
I: 40°C/24°C	Dry, wet concrete and flooded bore hole	Ψ^0 sus	[-]	0,80							
на сторо с Н											
		C25/30						02			
Increasing factors for con	crete	C30/37 C35/45					,	04 07			
Ψ _c		C40/50					,	08			
		C45/55						09			
		C50/60						10			
Concrete cone failure											
Relevant parameter							see Ta	uble C2			
Splitting Delevent never stor							T-				
Relevant parameter							see Ta	ible C2			
for dry and wet concrete (1	,0			
for flooded bore hole (HD;		γinst	[-]					, <u>0</u> ,2			
		•	1					·			
B+BTec Injection Syst	tem BIS-PE GEN	13 for concret	te								
Performances Characteristic values of te	nsion loads under	static and quasi	-static action	n				1	Anne	x C 3	



Table C4: Charac for a se	teristic value ervice life of 1		ו loads ו	under	[,] stati	c and	l qua:	si-sta	tic ac	tion		
Anchor size threaded ro	d			M8	M10	M12	M16	M20	M24	M27	M30	
Steel failure		1	1	I								
Characteristic tension res	istance	N _{Rk,s}	[kN]			Α _s ・f _l	ık (or s	ee Tab	le C1)			
Partial factor		γ _{Ms,N}	[-]	see Table C1								
Combined pull-out and o												
Characteristic bond resist holes (CD)	ance in non-crack	ed concrete C2	20/25 in har	nmer d	Irilled h	oles (H	D) and	compr	essed	air drill	ed	
Temperature range I: A0,5/2,05 C/57 C	Dry, wet concrete and flooded bore hole	^τ Rk,ucr	[N/mm²]	20	20	19	19	18	17	16	16	
Characteristic bond resist	ance in non-crack	ed concrete C2	20/25 in har	nmer d	Irilled h	oles wi	th hollo	w drill	bit (HD	B)		
Temperature Temperature I: 40°C/24°C I: 40°C/24°C	Dry, wet concrete		[N/mm²]	17	16	16	16	15	14	14	13	
قرية E I: 40°C/24°C T	flooded bore hole	^τ Rk,ucr		16	16	16	15	15	14	14	13	
Characteristic bond resistand with hollow drill bit (H		oncrete C20/25	in hamme	r drilleo	holes	(HD) ,	compre	essed a	ir drille	d holes	s (CD)	
Temperature range I: 40°C/24°C	Dry, wet concrete and flooded bore hole	^τ Rk,cr	[N/mm²]	6,5	6,5	7,5	7,5	7,5	7,5	7,5	7,5	
Reduction factor ψ^0_{sus} in holes (CD) and with hollow		cracked concre	te C20/25 i	n hamı	mer dril	led hol	es (HD), comp	oressed	l air dri	lled	
Temperature range C/5/2.006 :I ange	Dry, wet concrete and flooded bore hole	Ψ^0 sus	[-]				0,	80				
		C25/30					1,	02				
		C30/37						04				
Increasing factors for con	crete	C35/45						07				
Ψ_{c}		C40/50						08				
		C45/55 C50/60						09 10				
Concrete cone failure		1030/00					١,	10				
Relevant parameter							see Ta	able C2				
Splitting				•								
Relevant parameter							see Ta	able C2				
Installation factor				I								
for dry and wet concrete (γinst	[-]					<u>,0</u>				
for flooded bore hole (HD;	HDB, CD)						1	,2				
B+BTec Injection Syst	em BIS-PE GEN	13 for concret	e									
Performances Characteristic values of te	n					Anne	x C 4					



Table C5: Characteristic values of tension loads under static and quasi-static action for a service life of 50 years											
Anchor size threaded ro	d			M8	M10	M12	M16	M20	M24	M27	M30
Steel failure											
Characteristic tension resi	stance	N _{Rk,s}	[kN]			A _s ∙f _l	_{ık} (or s	ee Tab	le C1)		
Partial factor		γ _{Ms,N}	[-]	see Table C1							
Combined pull-out and c	concrete failure	- 100,14									
Characteristic bond resista		ed concrete C2	20/25 in dia	mond o	drilled h	oles (D)D)				
I: 72°C/20°C	Dry, wet concrete and	^τ Rk,ucr	[N/mm²]	15	14	14	13	12	12	11	11
d ख ⊟ II: 72°C/50°C	flooded bore hole		[]	12	12	11	10	9,5	9,5	9,0	9,0
Reduction factor ψ^0_{sus} in r	non-cracked conc	rete C20/25 in	illed ho	bles (D	D)						
I: 72°C/50°C	Dry, wet concrete and	Ψ ⁰ sus	[-]				0,	77			
II: 72°C/50°C	flooded bore hole					0,	72				
		C25/30					· · · ·	04			
	C30/37						08				
Increasing factors for cond	C35/45					,	12				
Ψ_{c}	C40/50 C45/55	1,15 1,17									
	C45/55 C50/60	1,17									
Concrete cone failure		1030/00					١,	19			
Relevant parameter							see Ta	ble C2			
Splitting				-							
Relevant parameter				see Table C2							
Installation factor											
for dry and wet concrete (I	DD)		[]				1,0				
for flooded bore hole (DD)		γinst	[-]		1,2				1,4		
B+BTec Injection System BIS-PE GEN3 for concrete Performances Characteristic unline of terrains leade under static and superioretation								Anne	x C 5		
Characteristic values of ter	Characteristic values of tension loads under static and quasi-static action										



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 C	1)	
Partial factor	$\gamma_{Ms,V}$	[-]				see	Table C	;1		
Ductility factor	k7	[-]	[-] 1,0							
Steel failure with lever arm	-									
Characteristic bending moment	M ⁰ Rk,s	[Nm]			1,2 • \	W _{el} ∙f _u ⊧	(or see	Table C))	
Elastic section modulus	W _{el}	[mm³]	31	62	109	277	541	935	1387	1874
Partial factor	γ _{Ms,V}	[-]				see	Table C	;1		
Concrete pry-out failure										
Factor	k ₈	[-]					2,0			
Installation factor	γ_{inst}	[-]					1,0			
Concrete edge failure										
Effective length of fastener	۱ _f	[mm]		n	nin(h _{ef} ; 1	2 · d _{nor}	m)		min(h _{ef} ;	300mm)
Outside diameter of fastener	d _{nom}	[mm]	8	10	12	16	20	24	27	30
Installation factor	γ _{inst}	[-]					1,0			

B+BTec Inje	ction System	BIS-PE GE	N3 for concrete
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Performances

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

Annex C 6



Table C7: Characteristic values of tension loads under static and quasi-static action for a service life of 50 years												
Anchor size inte	ernal threaded	l anchor rods			IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20		
Steel failure ¹⁾			1	1		1						
Characteristic te			N _{Rk,s}	[kN]	10	17	29	42	76	123		
Steel, strength c	lass	8.8	N _{Rk,s}	[kN]	16	27	46	67	121	196		
Partial factor, str	-		γMs,N	[-]			1	,5				
Characteristic te Steel A4 and HC			N _{Rk,s}	[kN]	14	26	41	59	110	124		
Partial factor			γMs,N	[-]			1,87			2,86		
Combined pull-												
Characteristic bo holes (CD)	ond resistance i		concrete	C20/25 in	hammer	drilled hol	es (HD) ar	nd compre	essed air c	Irilled		
I: Temperature	: 40°C/24°C	Dry, wet concrete and			20	19	19	18	17	16		
	l: 72°C/50°C	flooded bore hole	^τ Rk,ucr	[N/mm²]	15	15	14	13	13	12		
Characteristic bo	ond resistance i	in non-cracked	concrete	C20/25 in	hammer	drilled hol	es with ho	llow drill b	it (HDB)			
	: 40°C/24°C	Dry, wet			16	16	16	15	14	13		
Temperature II		concrete	^τ Rk,ucr	[N/mm²]	14	14	13	13	12	11		
	40°C/24°C	flooded bore	Tik,uci	[]	16	16	15	15	14	13		
	1: 72°C/50°C	hole		(05 in h - m	14	14	13	13	12	11		
Characteristic bo and with hollow of	drill bit (HDB)				imer anne	a noies (F	ט), comp	ressed air	aniiea no			
Temperature	: 40°C/24°C	Dry, wet concrete and	TDI	[N/mm²]	7,0	8,5	8,5	8,5	8,5	8,5		
range II	l: 72°C/50°C	flooded bore hole	^τ Rk,cr		6,0	7,0	7,0	7,0	7,0	7,0		
Reduction factor holes (CD) and			cked cond	crete C20/	25 in harr	imer drille	d holes (H	ID), compi	ressed air	drilled		
Temperature	: 40°C/24°C	Dry, wet concrete and	Ψ ⁰ sus	[-]			0,	80				
range II	: 72°C/50°C	flooded bore hole						0,68				
				5/30				02				
Increasing factor	rs for concrete			0/37 5/45				04 07				
Ψ_{c}				0/50				08				
				5/55			,	09				
			C5	0/60			1,	10				
Concrete cone							-					
Relevant parame Splitting failure							see Ta	ible C2				
Relevant parame							see Ta	ble C2				
Installation fact							366 18					
for dry and wet c		DB, CD)	~				1	,0				
for flooded bore		,	γinst	[-]			1	,2				
 Fastenings (ind The characteri For IG-M20 str 	istic tension resi	stance for steel								d rod.		
B+BTec Inject	tion System E	BIS-PE GEN3	for conc	rete								
Performances Annex C 7 Characteristic values of tension loads under static and quasi-static action Annex C 7									7			



Table C8: Characteristic values of tension loads under static and quasi-static action for a service life of 100 years												
Anchor size internal threade	d anchor rods	-		IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20			
Steel failure ¹⁾												
Characteristic tension resistant		N _{Rk,s}	[kN]	10	17	29	42	76	123			
Steel, strength class	8.8	N _{Rk,s}	[kN]	16	27	46	67	121	196			
Partial factor, strength class 5.3		γMs,N	[-]			1	,5					
Characteristic tension resistand Steel A4 and HCR, Strength cl		N _{Rk,s}	[kN]	14	26	41	59	110	124			
Partial factor		γMs,N	[-]			1,87			2,86			
Combined pull-out and conc			0.0.0.10.0.1									
Characteristic bond resistance holes (CD)	in non-cracked	concrete	C20/25 in	hammer	drilled hol	es (HD) ar	nd compre	essed air c	rilled			
Temperature range I: 40°C/24°C	Dry, wet concrete and flooded bore hole	⁷ Rk,ucr	[N/mm²]	20	19	19	18	17	16			
Characteristic bond resistance	in non-cracked	concrete	C20/25 in	hammer	drilled hol	es with ho	llow drill b	it (HDB)				
Temperature I: 40°C/24°C	Dry, wet concrete		[N/mm²]	16	16	16	15	14	13			
range I: 40°C/24°C	flooded bore hole	^τ Rk,ucr		16	16	15	15	14	13			
Characteristic bond resistance and with hollow drill bit (HDB)	in cracked cond	crete C20	/25 in ham	nmer drille	d holes (H	HD), comp	ressed air	drilled ho	les (CD)			
Temperature range I: 40°C/24°C	Dry, wet concrete and flooded bore hole	⁷ Rk,cr	[N/mm²]	6,5	7,5	7,5	7,5	7,5	7,5			
Reduction factor ψ^0_{sus} in crack holes (CD) and with hollow dri		cked con	crete C20/	25 in han	nmer drille	d holes (H	ID), comp	ressed air	drilled			
Temperature range I: 40°C/24°C	All conditions	Ψ^0 sus	[-]			0,8	80					
			5/30				02					
Increasing factors for concrete			0/37 5/45				04 07					
$\Psi_{\rm C}$			0/50				08					
			5/55				09					
		C5	0/60			1,	10					
Concrete cone failure												
Relevant parameter						see la	ble C2					
Splitting failure							ble C2					
Relevant parameter						See Ta						
for dry and wet concrete (HD; H	HDB, CD)		_			1	,0					
for flooded bore hole (HD; HDB		γinst	[-]				,2					
 ³⁾ Fastenings (incl. nut and was The characteristic tension res ⁴⁾ For IG-M20 strength class 50 	istance for steel								d rod.			
B+BTec Injection System I	BIS-PE GEN3 1	for conc	rete									
Performances Characteristic values of tension				Annex C	8							



Table C9: Characteristic values of tension loads under static and quasi-static action for a service life of 50 years											
Anchor size internal threaded	d anchor rods	-		IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20		
Steel failure ¹⁾			I			I					
Characteristic tension resistanc	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, strength class 5.8	3 and 8.8	γ _{Ms,N}	[-]			1	,5				
Characteristic tension resistance									124		
Steel A4 and HCR, Strength cla		N _{Rk,s}	[kN]	14	14 26 41 59 11						
Partial factor		γ _{Ms,N}	[-]	1,87 2							
Combined pull-out and concr	rete cone failu	re									
Characteristic bond resistance	in non-cracked	concrete	C20/25 in	diamond	drilled ho	les (DD)					
Temperature I: 40°C/24°C	Dry, wet concrete and	τ _{Rk,ucr}	[N/mm²]	14	14	13	12	12	11		
range II: 72°C/50°C	flooded bore hole			12	11	10	9,5	9,5	9,0		
Reduction factor ψ^0_{sus} in non-c	racked concret	e C20/25	in diamon	d drilled h	noles (DD))					
Temperature 1: 40°C/24°C	Dry, wet concrete and	Ju0				0,	77				
range II: 72°C/50°C	flooded bore hole	Ψ ⁰ sus	[-]			0,	72				
	1	C2	5/30			1,	04				
		C3	0/37			1,	08				
Increasing factors for concrete		C3	5/45	1,12							
[/] c		0/50	1,15								
			5/55				17				
Concrete cone failure		C5	0/60			1,	19				
Relevant parameter						500 To	able C2				
Splitting failure						366 12					
Relevant parameter						see Ta	able C2				
Installation factor						00010					
for dry and wet concrete (DD)						1	,0				
for flooded bore hole (DD)		γinst	[-]	1	,2		-	,4			
 ⁵⁾ Fastenings (incl. nut and wash The characteristic tension resi ⁶⁾ For IG-M20 strength class 50 	istance for steel								u roa.		
B+BTec Injection System E Performances Characteristic values of tension				oction				Annex C	9		



Anchor size for internal threade	ed ancho	or rods		IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20
Steel failure without lever arm ¹⁾	I			L	1		1		I
Characteristic shear resistance,	5.8	V ⁰ _{Rk,s}	[kN]	5	9	15	21	38	61
Steel, strength class	8.8	V ⁰ _{Rk,s}	[kN]	8	14	23	34	60	98
Partial factor, strength class 5.8 a	nd 8.8	γ _{Ms,V}	[-]			•	1,25		
Characteristic shear resistance, Stainless Steel A4 and HCR, Strength class 70 ²⁾		V ⁰ Rk,s	[kN]	7	13	20	30	55	40
Partial factor		γ _{Ms,V}	[-]			1,56	•		2,38
Ductility factor		k ₇	[-]				1,0		
Steel failure with lever arm ¹⁾									
Characteristic bending moment,	5.8	M ⁰ Rk,s	[Nm]	8	19	37	66	167	325
Steel, strength class	8.8	M ⁰ Rk,s	[Nm]	12	30	60	105	267	519
Partial factor, strength class 5.8 a	ind 8.8	γ _{Ms,V}	[-]				1,25		
Characteristic bending moment, Stainless Steel A4 and HCR, Strength class 70 ²⁾		M ⁰ Rk,s	[Nm]	11	26	52	92	233	456
Partial factor		γ _{Ms,V}	[-]		1	1,56	1		2,38
Concrete pry-out failure		-	•						
Factor		k ₈	[-]				2,0		
Installation factor		γ _{inst}	[-]				1,0		
Concrete edge failure									
Effective length of fastener		۱ _f	[mm]		min	(h _{ef} ; 12 • c	d _{nom})		min(h _{ef} ; 300mr
Outside diameter of fastener		d _{nom}	[mm]	10	12	16	20	24	30
nstallation factor		γinst	[-]				1,0		
 ¹⁾ Fastenings (incl. nut and washer The characteristic tension resista ²⁾ For IG-M20 strength class 50 is 	ance for s								
B+BTec Injection System BIS	6-PE GE	N3 for co	oncrete						

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



Table C11: Characteristic values of tension loads under static and quasi-static actionfor a service life of 50 years												
Anchor size reinforcing bar	or so yea	13	Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Steel failure			~ ~	12.10	~	~	~	~	~	~ -0	~	~ •=
Characteristic tension resistance	N _{Rk,s}	[kN]					A _s ·	f _{uk} 1)				
Cross section area	A _s	[mm ²]	50	79	113	154	201	314	452	491	616	804
Partial factor	γ _{Ms,N}	[-]						4 ²⁾				
Combined pull-out and concrete fail		[]					.,	•				
Characteristic bond resistance in non- holes (CD)		rete C20/2	25 in h	amme	r drilleo	d holes	s (HD)	and c	ompre	ssed a	ir drille	d
L: 40°C/24°C Dry, wet concrete and flooded bore hole	^τ Rk,ucr	[N/mm²]	16	16	16	16	16	16	15	15	15	15
			12	12	12	12	12	12	12	12	11	11
Characteristic bond resistance in non-	cracked conc	rete C20/2	25 in h	amme				1	drill bi	t (HDE	ŕ	
<u>e</u> <u>I: 40°C/24°C</u> Dry, wet			14	14	13	13	13	13	13	13	13	13
$\begin{array}{c c} \underbrace{\begin{array}{c} \bullet \\ \bullet $	TDIA	[N/mm²]	12	12	12	11	11	11	11	11	11	11
ਿੱਛੇ <u>I: 40°C/24°C</u> flooded bore	^T Rk,ucr		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 resistance in crack and with hollow drill bit (HDB)	C20/25 in	hamm	er drill	ed hol	es (HC	D), con	npress	ed air	drilled	holes	(CD)	
I: 40°C/24°C Dry, wet concrete and flooded bore	τ	[N/mm ²]	7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5	8,5	8,5
I:40°C/24°CDry, wet concrete and flooded bore holeII:72°C/50°Chole			6,0	6,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0
Reduction factor ψ^0_{SUS} in cracked and holes (CD) and with hollow drill bit (HI		concrete (220/25	5 in ha	mmer	drilled	holes	(HD),	compr	essed	air dril	led
L: 40°C/24°C Dry, wet concrete and flooded bore hole	Ψ ⁰ sus	[-]					0,	80				
li: 72°C/50°C flooded bore ⊢ II: 72°C/50°C hole	Ψ sus		0,68									
	C25	/30						02				
	C30							04				
Increasing factors for concrete	C35							07				
Ψ_{c}	C40 C45							08				
	C45							09 10				
Concrete cone failure	000	/00					١,	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)) 2/:	[_]					1	,0				
for flooded bore hole (HD; HDB, CD)	^γ inst	[-]					1	,2				
 ¹⁾ f_{uk} shall be taken from the specificatio ²⁾ in absence of national regulation 	ns of reinforci	ing bars										
B+BTec Injection System BIS-PE	GEN3 for c	oncrete										
Performances Characteristic values of tension loads u	d quasi-sta	tic acti	ion					Α	nnex	C 11		



Table C12: Char	acteristic va service life			bads	und	er sta	atic a	nd q	uasi	-stati	c act	tion	
Anchor size reinforci			al 9	ØR	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Steel failure	ing bui			20						0 24	0 20	0 20	202
Characteristic tension	resistance	N _{Rk,s}	[kN]					Α, •	f _{uk} 1)				
Cross section area		A _s	[mm ²]	50	79	113	154	201	314	452	491	616	804
Partial factor		-	[-]			110			4 ²⁾	102	101	010	001
Combined pull-out an	d concrete fail	γMs,N	[-]					Ι,	4				
Characteristic bond res holes (CD)			rete C20/2	5 in h	amme	r drilleo	d holes	s (HD)	and co	ompre	ssed a	ir drille	ed
Temperature range I: 40,05/3,05 Temperature	Dry, wet concrete and flooded bore hole	[⊄] Rk,ucr	[N/mm²]	16	16	16	16	16	16	15	15	15	15
Characteristic bond res	sistance in non-c	racked conc	rete C20/2	5 in h	amme	r drilleo	d holes	s with I	hollow	drill bi	t (HDE	3)	
I: 40°C/24°C	Dry, wet concrete	^T Rk,ucr	[N/mm²]	14	14	13	13	13	13	13	13	13	13
قط تع ا: 40°C/24°C الــــــــــــــــــــــــــــــــــــ	[[N/11111-]	13	13	13	13	13	13	13	13	13	13		
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				
Temperature range I: 40°C/54°C	hole	[₹] Rk,cr	[N/mm²]	6,5	6,5	7,5	7,5	7,5		7,5	7,5	7,5	7,5
Reduction factor ψ^0_{sus}			concrete (220/25	5 in ha	mmer (drilled	holes	(HD), (compr	essed	air dril	led
holes (CD) and with ho	ollow drill bit (HD)B)											
Temperature range I: 40°C/24°C	Dry, wet concrete and flooded bore hole	Ψ^0 sus	[-]					0,	80				
	1	C25/	/30					1,	02				
		C30/	/37					1,	04				
Increasing factors for c	oncrete	C35/							07				
Ψc		C40/							08				
		C45/							09				
Concrete cone failure		C50/	60					Ι,	10				
Relevant parameter	•							see Ta	able C2	>			
Splitting								000 10		-			
Relevant parameter								see Ta	able C2	2			
Installation factor													
for dry and wet concret	te (HD; HDB, CD))	F 1					1	,0				
for flooded bore hole (H	HD; HDB, CD)	γ _{inst}	[-]					1	,2				
¹⁾ f _{uk} shall be taken from ²⁾ in absence of national		ns of reinforci	ng bars										
B+BTec Injection S	ystem BIS-PE	GEN3 for co	oncrete										
Performances Characteristic values o	f tension loads ur	nder static and	d quasi-sta	tic acti	on					A	nnex	C 12	



Table C13: Char				oads	und	er sta	atic a	nd q	uasi	-stati	ic act	tion	
Anchor size reinforci	service life	or so year	ſS	as	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	a 21	Ø 25	<i>(</i> 78	(X 32
Steel failure	ng bai			00	יוש	210	914	010	20	W 24	Ø 25	Ø 20	Ø 32
Characteristic tension	resistance	N _{Rk,s}	[kN]					Α, •	f _{uk} ¹⁾				
Cross section area		A _s	[mm ²]	50	79	113	154	201	314	452	491	616	804
Partial factor		γ _{Ms,N}	[-]		/0				4 ²⁾	102		010	004
Combined pull-out an	d concrete fail	,	[-]					١,	4				
Characteristic bond res			rete C20/2	25 in di	amon	d drille	d hole:	s (DD))				
	Dry, wet							, ,					
l: 40°C/24°C	concrete and	^τ Rk,ucr	[N/mm²]	14	13	13	13	12	12	11	11	11	11
I: 40°C/24°C	flooded bore hole	, indicit		11	11	10	10	10	9,5	9,5	9,5	9,0	9,0
Reduction factor ψ^0_{sus}	in non-cracked o	concrete C20	0/25 in dia	mond	drilled	holes	(DD)				1	1	
l: 40°C/24°C	Dry, wet concrete and			0,77									
$\begin{array}{c c} \begin{array}{c} \begin{array}{c} \bullet \\ \bullet $									72				
	1	C25,	/30					1,	04				
		C30,	/37					1,	08				
Increasing factors for c	oncrete	C35,							12				
Ψc		C40,							15				
		C45,							17 19				
Concrete cone failure	<u> </u>	050	/00					١,	19				
Relevant parameter	·							see Ta	able C2	2			
Splitting													
Relevant parameter								see Ta	able C2	2			
Installation factor													
for dry and wet concret	te (DD)	<u>.</u>						1	,0				
for flooded bore hole (DD)	rinst	[-]		1	,2				1	,4		
B+BTec Injection S Performances Characteristic values o	-			tic acti	on					A	nnex	C 13	6



Table C14: Characteristic va	lues of	shear I	load	s un	der s	tatic	and	l qua	si-sta	tic ac	tion	
Anchor size 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			1		1			1				
Characteristic shear resistance	V ⁰ _{Rk,s}	[kN]					0,5	• A _s •	f _{uk} 1)			
Cross section area	A _s	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial factor	γ _{Ms,V}	[-]		•				1,5 ²⁾	1			
Ductility factor	k ₇	[-]						1,0				
Steel failure with lever arm	•											
Characteristic bending moment	M ⁰ Rk,s	[Nm]					1.2	$\cdot \mathrm{W}_{\mathrm{el}}$	• 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	۱ _f	[mm]			min(h	_{ef} ; 12	• d _{nor}	n)		min(h _{ef} ; 300	mm)
Outside diameter of fastener	d _{nom}	[mm]	8	10	12	14	16	20	24	25	28	32
Installation factor	γ _{inst}	[-]						1,0				
 ¹⁾ f_{uk} shall be taken from the specification ²⁾ in absence of national regulation 	ns of reinfo	rcing bars	3									
B+BTec Injection System BIS-PE	GEN3 for	concret	e									
Performances										Ann	ex C 1	4



Table C15: Displacements under tension load¹⁾ in hammer drilled holes (HD), compressed air drilled holes (CD) and with hollow drill bit (HDB) Anchor size threaded rod **M**8 M10 M12 M16 M20 M27 M30 M24 Non-cracked concrete C20/25 under static and quasi-static action for a service life of 50 years δ_{N0} -factor $[mm/(N/mm^2)]$ 0,028 0,029 0,030 0,033 0,035 0,038 0,039 0,041 Temperature range I: $\delta_{N\infty}$ -factor 40°C/24°C [mm/(N/mm²)] 0,028 0,029 0,030 0,033 0,035 0,038 0,039 0,041 δ_{N0} -factor $[mm/(N/mm^2)]$ 0,038 0,039 0,040 0,044 0,047 0,051 0,052 0,055 Temperature range II: δ_{N∞}-factor 72°C/50°C $[mm/(N/mm^2)]$ 0,047 0.049 0,051 0,055 0,059 0.064 0,067 0,070 Cracked concrete C20/25 under static and quasi-static action for a service life of 50 years δ_{N0} -factor [mm/(N/mm²)] 0,069 0,071 0,072 0,074 0,076 0,079 0,081 0,082 Temperature range I: 40°C/24°C $\delta_{N\infty}$ -factor $[mm/(N/mm^2)]$ 0,193 0,115 0,122 0,128 0,135 0,142 0,155 0,171 δ_{NO} -factor $[mm/(N/mm^2)]$ 0,092 0.095 0.096 0.099 0,102 0,106 0,109 0.110 Temperature range II: 72°C/50°C $\delta_{N\infty}$ -factor $[mm/(N/mm^2)]$ 0,259 0,154 0,163 0,172 0,181 0,189 0,207 0,229 Non-cracked concrete C20/25 under static and quasi-static action for a service life of 100 years δ_{N0} -factor [mm/(N/mm²)] 0,028 0,029 0,030 0,033 0,035 0,038 0,039 0,041 Temperature range I: 40°C/24°C $\delta_{N\infty}$ -factor 0,028 [mm/(N/mm²)] 0,030 0,031 0,033 0,036 0,038 0,040 0,042 Cracked concrete C20/25 under static and guasi-static action for a service life of 100 years δ_{N0} -factor [mm/(N/mm²)] 0.069 0,071 0,072 0,074 0,076 0,079 0,081 0,082 Temperature range I: 40°C/24°C $\delta_{N\infty}$ -factor [mm/(N/mm²)] 0,193 0,115 0,122 0,128 0,135 0,142 0,155 0,171 1) Calculation of the displacement τ: action bond stress for tension $\delta_{N0} = \delta_{N0}$ -factor $\cdot \tau$; $\delta_{N\infty} = \delta_{N\infty}$ -factor $\cdot \tau$; Table C16: Displacements under tension load¹⁾ in diamond drilled holes (DD) М8 Anchor size threaded rod M10 M12 M16 M20 M24 M27 M30 Non-cracked concrete C20/25 under static and quasi-static action for a service life of 50 years δ_{N0} -factor $[mm/(N/mm^2)]$ 0.011 0.012 0.012 0.013 0.014 0.014 0.015 0.015 Temperature range I: 40°C/24°C $\delta_{N\infty}$ -factor [mm/(N/mm²)] 0.018 0.019 0,019 0,020 0.022 0.023 0,024 0,025 δ_{NO} -factor [mm/(N/mm²)] 0,013 0,014 0,014 0,015 0,016 0,016 0,018 0,018 Temperature range II: 72°C/50°C $\delta_{N\infty}$ -factor [mm/(N/mm²)] 0,052 0,053 0,055 0,058 0,062 0.065 0,068 0,070 ¹⁾ Calculation of the displacement $\delta_{N0} = \delta_{N0}$ -factor $\cdot \tau$; τ: action bond stress for tension $\delta_{N\infty} = \delta_{N\infty}$ -factor $\cdot \tau$; Table C17: Displacements under shear load²⁾ for all drilling methods Anchor size threaded rod M8 M10 M12 M16 M20 M24 M27 M30 Non-cracked and cracked concrete C20/25 under static and quasi-static action δ_{V0} -factor [mm/kN] 0,06 0,06 0.05 0.04 0.04 0,03 0,03 0,03 All temperature ranges $\delta_{V\infty}$ -factor [mm/kN] 0,09 0,08 80,0 0,06 0,06 0,05 0,05 0,05 2) Calculation of the displacement V: action shear load $\delta_{V0} = \delta_{V0}$ -factor $\cdot V$; $\delta v_{\infty} = \delta v_{\infty}$ -factor $\cdot V$; **B+BTec Injection System BIS-PE GEN3 for concrete** Annex C 15 Performances Displacements under static and quasi-static action (threaded rods)



Anchor size Inte	rnal thr	eaded anch	or rod		IG-M6	IG-M	- <u>-</u> 1	VI10	IG-M12	IG-M16	IG-M20
Non-cracked cor				guasi-s		-					
Temperature ra		δ _{N0} -factor		I/mm²)]	0,029	0,030)33	0,035	0,038	0,041
40°C/24°C		$\delta_{N\infty}$ -factor		I/mm²)]	0,029	0,030)33	0,035	0,038	0,041
Temperature ra		δ _{N0} -factor	[mm/(N	/-	0,039	0,040)44	0,047	0,051	0,055
72°C/50°C		δ _{N∞} -factor		/-	0,049	0,05)55	0,059	0,064	0,070
Cracked concret	e C20/2		- (/-					· ·		1 0,070
Temperature ra		δ_{N0} -factor	•	l/mm²)]	0,071	0,072)74	0,076	0,079	0,082
40°C/24°C		δ _{N∞} -factor	[mm/(N	//mm²)]	0,115	0,12	2 0,	28	0,135	0,142	0,171
Temperature rai	nae II:	δ _{N0} -factor		//mm²)]	0,095	0,090)99	0,102	0,106	0,110
72°C/50°C		δ _{N∞} -factor	[mm/(N	[/mm²)]	0,154	0,16		72	0,181	0,189	0,229
Non-cracked cor	ncrete C	20/25 unde	er static and	quasi-s	tatic actio	on for a s	service	ife of	100 years	; ;	
Temperature ra		δ _{N0} -factor			0,029	0,030)33	0,035	0,038	0,041
40°C/24°C		δ _{N∞} -factor	- `	//mm²)]	0,030	0,03)33	0,036	0,038	0,042
Cracked concret	e C20/2		- ,	si-static	action fo	r a servi	ce life o	f 100	years		
Temperature ra	nge I:	δ _{N0} -factor	[mm/(N	l/mm²)]	0,071	0,072	2 0,0)74	0,076	0,079	0,082
່40°C/24°C		δ _{N∞} -factor	[mm/(N	l/mm²)]	0,115	0,122	2 0,	28	0,135	0,142	0,171
	tor τ; D isplac		under ten		tress for te bad ¹⁾ in IG-M6			led I V110	holes (D	D)	IG-M2
δ _{N∞} = δ _{N∞} -fact Table C19: D Anchor size Inte	tor τ;)isplac rnal thre	eaded ancl	under ten	sion Ic	oad ¹⁾ in IG-M6	diamo IG-M	8 IG-	M 10	IG-M12	-	IG-M2
$\delta_{N\infty} = \delta_{N\infty}$ -fact Table C19: D Anchor size Inte Non-cracked cor Temperature ra	tor τ; Displac rnal thre ncrete C nge I:	eaded ancl	under ten	sion Ic _{quasi-s}	oad ¹⁾ in IG-M6	diamo IG-M	8 IG- service	M 10	IG-M12	-	I
δ _{N∞} = δ _{N∞} -fact Table C19: D Anchor size Inte Non-cracked cor	tor τ; Displac rnal thre ncrete C nge I:	eaded anch 20/25 unde	under ten for rod er static and [mm/(N	sion Ic quasi-s I/mm²)]	oad ¹⁾ in IG-M6 tatic actio	diamo IG-M on for a s	8 IG- service 2	M10 ife of	IG-M12 50 years	IG-M16	0,015
$\delta_{N\infty} = \delta_{N\infty}$ -fact Table C19: D Anchor size Inte Non-cracked cor Temperature ra 40° C/24°C Temperature ra	tor τ; Pisplac rnal thro ncrete C nge I: C	eaded anch 20/25 unde δ _{N0} -factor δ _{N∞} -factor δ _{N0} -factor	under ten for rod er static and [mm/(N [mm/(N	sion Ic quasi-s I/mm ²)] I/mm ²)]	oad ¹⁾ in IG-M6 tatic actio 0,012	diamo IG-M on for a s 0,012	8 IG- service 2 2 0,0 9 0,0	V10 ife of	IG-M12 50 years 0,014	IG-M16	0,015
$\delta_{N\infty} = \delta_{N\infty}$ -fact Table C19: D Anchor size Inte Non-cracked cor Temperature ra 40°C/24°C Temperature rat 72°C/50°C	tor τ; Pisplac rnal thre ncrete C nge I: C nge II:	eaded anch 20/25 unde δ_{N0} -factor $\delta_{N\infty}$ -factor δ_{N0} -factor $\delta_{N\infty}$ -factor	under ten for rod er static and [mm/(N [mm/(N	sion Ic quasi-s I/mm ²)] I/mm ²)]	IG-M6 Id-M6 tatic actio 0,012 0,019	diamo IG-M on for a s 0,012 0,013	8 IG- service 2 2 0,9 9 0,9 4 0,9	V10 ife of 013	IG-M12 50 years 0,014 0,022	IG-M16 0,014 0,023	0,015 0,025 0,018
$\delta_{N\infty} = \delta_{N\infty}$ -fact Table C19: D Anchor size Inte Non-cracked cor Temperature ra 40°C/24°C Temperature ra 72°C/50°C ¹⁾ Calculation or $\delta_{N0} = \delta_{N0}$ -fact $\delta_{N\infty} = \delta_{N\infty}$ -fact Table C20:	tor τ ; Pisplac rnal thre ncrete C nge I : C nge II: C f the disp or τ ; tor τ ; Displa	eaded anch 20/25 unde δ_{N0} -factor δ_{N0} -factor δ_{N0} -factor δ_{N0} -factor lacement	under ten	sion lo quasi-s I/mm ²)] I/mm ²)] I/mm ²)] I/mm ²)]	IG-M6 tatic actio 0,012 0,019 0,014 0,053	diamo IG-M on for a s 0,012 0,014 0,014 0,055	8 IG- service 2 2 0,0 9 0,0 4 0,0 5 0,0	W10 ife of 013 020 015 058 ethc	IG-M12 50 years 0,014 0,022 0,016 0,062	IG-M16 0,014 0,023 0,016	IG-M2 0,015 0,025 0,018 0,070
$\delta_{N\infty} = \delta_{N\infty}$ -fact Table C19: D Anchor size Intender Non-cracked correst Temperature rate 40°C/24°C Temperature rate 72°C/50°C ¹⁾ Calculation of $\delta_{N0} = \delta_{N0}$ -fact $\delta_{N\infty} = \delta_{N\infty}$ -fact Table C20: Anchor size Intender	tor τ ; Pisplac rnal thre ncrete C ncrete C nge I : c nge II : c f the disp or τ ; tor τ ; Displa rnal thre	eaded anch 20/25 unde δ_{N0} -factor $\delta_{N\infty}$ -factor δ_{N0} -factor δ_{N0} -factor lacement	under ten	sion lo quasi-s l/mm ²)] l/mm ²)] l/mm ²)] n bond st near loa	IG-M6 tatic actio 0,012 0,019 0,014 0,053 tress for te ad ²⁾ for M6	diamo IG-M on for a s 0,012 0,014 0,014 0,055 nsion all dril	8 IG- service 2 9 0,0 4 0,0 5 0,0 1ing m	W10 ife of 013 020 015 058 ethc	IG-M12 50 years 0,014 0,022 0,016 0,062	IG-M16 0,014 0,023 0,016	0,015 0,025 0,018 0,070
$\delta_{N\infty} = \delta_{N\infty}$ -fact Table C19: D Anchor size Inte Non-cracked cor Temperature ra 40°C/24°C Temperature ran 72°C/50°C ¹⁾ Calculation or $\delta_{N0} = \delta_{N0}$ -fact $\delta_{N\infty} = \delta_{N\infty}$ -fact	tor τ ; Pisplac rnal thre ncrete C nge I : C nge II: C f the disp or τ ; tor τ ; Displa rnal thre d cracke	eaded anch 20/25 under δ_{N0} -factor δ_{N0} -factor δ_{N0} -factor δ_{N0} -factor lacement eaded anch ed concrete	under ten for rod r static and [mm/(N [mm/(N [mm/(N [mm/(N] t: actio	sion Ic quasi-s [/mm²)] [/mm²)] [/mm²)] [/mm²)] n bond st near Ioa near Ioa	IG-M6 tatic actio 0,012 0,019 0,014 0,053 tress for te ad ²⁾ for M6 IC and qua	diamo IG-M on for a s 0,012 0,014 0,014 0,055 nsion all dril G-M8 si-static	8 IG- service 0,0 2 0,0 3 0,0 4 0,0 5 0,0 Iing m IG-M10 action IG-M10	W10 ife of 013 020 015 058 ethc	IG-M12 50 years 0,014 0,022 0,016 0,062	IG-M16 0,014 0,023 0,016 0,065	0,015 0,025 0,018
$\delta_{N\infty} = \delta_{N\infty}$ -fact Table C19: D Anchor size Intender Non-cracked correst Temperature rate 40°C/24°C Temperature rate 72°C/50°C ¹⁾ Calculation of $\delta_{N0} = \delta_{N0}$ -fact $\delta_{N\infty} = \delta_{N\infty}$ -fact Table C20: Anchor size Intender Non-cracked and All temperature	tor τ ; Pisplac rnal thre ncrete C ncrete C nge I : c nge II : c f the disp or τ ; tor τ ; Displa rnal thre	eaded anch 20/25 under δ_{N0} -factor δ_{N0} -factor δ_{N0} -factor δ_{N0} -factor lacement eaded anch ed concrete	under ten	sion lo quasi-s l/mm ²)] l/mm ²)] l/mm ²)] n bond st near loa	IG-M6 tatic actio 0,012 0,019 0,014 0,053 tress for te ad ²⁾ for M6 IC and qua	diamo IG-M on for a s 0,012 0,014 0,014 0,055 nsion all dril	8 IG- service 2 9 0,0 4 0,0 5 0,0 1ing m	W10 ife of 013 020 015 058 ethc	IG-M12 50 years 0,014 0,022 0,016 0,062	IG-M16 0,014 0,023 0,016 0,065	0,015 0,025 0,018 0,070
$δ_{N\infty} = \delta_{N\infty}$ -fact Table C19: D Anchor size Inte Ion-cracked cor Temperature ra 40°C/24°C Temperature ra 72°C/50°C ¹⁾ Calculation or $\delta_{N0} = \delta_{N0}$ -fact $\delta_{N\infty} = \delta_{N\infty}$ -fact Table C20: Anchor size Inte Ion-cracked and All temperature	tor τ ; Pisplac rnal thre ncrete C nge I : C nge II: C f the disp or τ ; tor τ ; Displa rnal thre d cracke	eaded anch 20/25 unde δ_{N0} -factor $\delta_{N\infty}$ -factor $\delta_{N\infty}$ -factor $\delta_{N\infty}$ -factor lacement eaded anch eaded anch ed concrete actor	under ten for rod r static and [mm/(N [mm/(N [mm/(N [mm/(N] t: actio	sion Ic quasi-s [/mm²)] [/mm²)] [/mm²)] [/mm²)] n bond st near Ioa near Ioa	IG-M6 tatic action 0,012 0,012 0,014 0,053 tress for te ad ²⁾ for M6 10 207	diamo IG-M on for a s 0,012 0,014 0,014 0,055 nsion all dril G-M8 si-static	8 IG- service 0,0 2 0,0 3 0,0 4 0,0 5 0,0 Iing m IG-M10 action IG-M10	W10 ife of 013 020 015 058 ethc	IG-M12 50 years 0,014 0,022 0,016 0,062	IG-M16 0,014 0,023 0,016 0,065	0,015 0,025 0,018 0,070
$\delta_{N\infty} = \delta_{N\infty}$ -fact Table C19: D Anchor size Intender Non-cracked correst Temperature rate 40°C/24°C Temperature rate 72°C/50°C ¹⁾ Calculation of $\delta_{N0} = \delta_{N0}$ -fact $\delta_{N\infty} = \delta_{N\infty}$ -fact Table C20: Anchor size Intender	tor τ ; Pisplac rnal thre ncrete C nge I : The disp or τ ; tor τ ; Displa rnal thre d cracke δ_{V0} -fa $\delta_{V\infty}$ -fa f the disp or V ; tor V ;	eaded anch 20/25 unde δ_{N0} -factor $\delta_{N\infty}$ -factor $\delta_{N\infty}$ -factor lacement eaded anch ed concrete actor lacement V:	under ten or rod r static and [mm/(N [mm/(N [mm/(N τ: actio action shear	sion lo quasi-s I/mm ²)] I/mm ²)] I/mm ²)] n bond st near lo ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig ig 	IG-M6 tatic action 0,012 0,019 0,014 0,053 tress for te ad ²⁾ for M6 IC and qua 07 0 0 0	diamo IG-M on for a s 0,012 0,014 0,014 0,055 nsion all dril a-M8 si-static	8 IG- service 0, 2 0, 9 0, 4 0, 5 0, IIng m IG-M10 action 0,06	W10 ife of 013 020 015 058 ethc	IG-M12 50 years 0,014 0,022 0,016 0,062	IG-M16 0,014 0,023 0,016 0,065 IG-M16	0,015 0,025 0,018 0,070 IG-M20 0,04



Table C21: Displacements under tension load¹⁾ 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
Non-cracked cond	•	under static an		-static	action	for a se		fe of 50	years			
Temp range I:	δ_{N0} -factor	[mm/(N/mm ²)]	0,028	0,029	0,030	0,031	0,033	0,035	0,038	0,038	0,040	0,043
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,028	0,029	0,030	0,031	0,033	0,035	0,038	0,038	0,040	0,043
Temp range II:	δ_{N0} -factor	[mm/(N/mm ²)]	0,038	0,039	0,040	0,042	0,044	0,047	0,051	0,051	0,054	0,058
72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,047	0,049	0,051	0,053	0,055	0,059	0,065	0,065	0,068	0,072
Cracked concrete	C20/25 und	er static and qu	asi-stat	ic actio	n for a	service	e life of	50 yea	rs			
Temp range I:	δ_{N0} -factor	[mm/(N/mm ²)]	0,069	0,071	0,072	0,073	0,074	0,076	0,079	0,079	0,081	0,084
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,115	0,122	0,128	0,135	0,142	0,155	0,171	0,171	0,181	0,194
Temp range II:	δ_{N0} -factor	[mm/(N/mm²)]	0,092	0,095	0,096	0,098	0,099	0,102	0,106	0,106	0,109	0,113
72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,154	0,163	0,172	0,181	0,189	0,207	0,229	0,229	0,242	0,260
Non-cracked cond	rete C20/25	under static an	d quasi	-static	action	for a se	rvice li	fe of 10	0 years	;		
Temp range I:	δ_{N0} -factor	[mm/(N/mm ²)]	0,028	0,029	0,030	0,031	0,033	0,035	0,038	0,038	0,040	0,043
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,028	0,030	0,031	0,032	0,033	0,036	0,039	0,039	0,041	0,043
Cracked concrete	C20/25 und	er static and qu	asi-stat	ic actio	n for a	service	e life of	100 yea	ars			
Temp range I:	δ_{N0} -factor	[mm/(N/mm ²)]	0,069	0,071	0,072	0,073	0,074	0,076	0,079	0,079	0,081	0,084
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,115	0,122	0,128	0,135	0,142	0,155	0,171	0,171	0,181	0,194

¹⁾ Calculation of the displacement

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

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

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

Anchor size rein												
Anonor Size len	forcing bar		Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Non-cracked cor	ncrete C20/25	i under static a	nd quas	i-static	action	for a se	rvice li	fe of 50	years			
Temp range I:	δ_{N0} -factor	[mm/(N/mm ²)]	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/mm ²)]	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/mm ²)]	0,009	0,011	0,011	0,012	0,013	0,014	0,015	0,015	0,016	0,018
72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/mm ²)]	0,048	0,051	0,054	0,058	0,061	0,068	0,076	0,076	0,081	0,088
	tor · τ;	τ: action bonc				ll drilli	ng me	ethod	s			
Anchor size rein	forcing bar		Ø 8	Ø 10	Ø 12			Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Anchor size rein For concrete C2		atic and quasi-			Ø 12					Ø 25	Ø 28	Ø 32
		atic and quasi-		ction	Ø 12 0,05					Ø 25 0,03	Ø 28 0,03	Ø 32 0,03
For concrete C2	0/25 under st		static a	ction 0,05		Ø 14	Ø 16	Ø 20	Ø 24			
For concrete C2 All temperature	0/25 under st δ_{V0} -factor $\delta_{V\infty}$ -factor f the displacem or \cdot V;	[mm/kN] [mm/kN]	static ac 0,06 0,09	ction 0,05	0,05	Ø 14 0,04	Ø 16	Ø 20 0,04	Ø 24 0,03	0,03	0,03	0,03



Table C24: Charact (perform	eristic value nance catego										
Anchor size threaded rod				M8	M10	M12	M16	M20	M24	M27	M30
Steel failure			1								
Characteristic tension resis (Seismic C1)	tance	N _{Rk,s,eq,C1}	[kN]				1,0•	N _{Rk,s}			
Characteristic tension resis (Seismic C2) Steel, strength class 8.8 Stainless Steel A4 and HCI Strength class ≥70		N _{Rk,s,eq,C2}	[kN]	N	PA		1,0 •	N _{Rk,s}		NI	PA
Partial factor		γ _{Ms,N}	[-]				see Ta	able C1			
Combined pull-out and co	ncrete failure Ice in cracked and non-cracked concrete C20/25 in hammer drilled										
Characteristic bond resistand drilled holes (CD) and with			d concrete (C20/25	in han	nmer dr	rilled ho	oles (Hl	D), com	presse	ed air
₽I: 40°C/24°C	Durant	^τ Rk,eq,C1	[N/mm ²]	7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5
range	Dry, wet concrete and	^τ Rk,eq,C2	[N/mm ²]	N	PA	5,8	4,8	5,0	5,1	N	PA
I: 40°C/24°C	flooded bore hole	^τ Rk,eq,C1	[N/mm²]	6,0	6,0	7,0	7,0	7,0	7,0	7,0	7,0
\vdash 1.72°C/50°C		^τ Rk,eq,C2	[N/mm ²]	N	PA	5,0	4,1	4,3	4,4	N	PA
Reduction factor ψ^0_{sus} in c holes (CD) and with hollow		-cracked conci	rete C20/25	in ha	mmer c	Irilled h	noles (H	HD), co	mpress	ed air	drilled
I: 40°C/24°C	Dry, wet concrete and	Ψ ⁰ sus	[-]				0,	80			
© 02°C/50°C ₩ II: 72°C/50°C	flooded bore hole	- 303					0,	68			
Increasing factors for concr	rete ψ_{C}	C25/30 to	C50/60				1	,0			
Concrete cone failure											
Relevant parameter							see Ta	able C2			
Splitting Relevant parameter							500 Tr	able C2			
Installation factor							366 12				
	D; HDB, CD)						1	,0			
for flooded bore hole (HD; H	HDB, CD)	^γ inst	[-]								
for dry and wet concrete (HD; HDB, CD)											
B+BTec Injection Syste	em BIS-PE GEN	13 for concret	e								
Performances Characteristic values of ten	sion loads under	seismic action (performance	e categ	ory C1+	-C2)		'	Annex	x C 18	3



Table C25: Characte (perform	eristic value nance catego										
Anchor size threaded rod				M8	M10	M12	M16	M20	M24	M27	M30
Steel failure											
Characteristic tension resist (Seismic C1)	tance	N _{Rk,s,eq,C1}	[kN]				1,0 •	N _{Rk,s}			
Characteristic tension resis (Seismic C2) Steel, strength class 8.8 Stainless Steel A4 and HCF		N _{Rk,s,eq,C2}	[kN]	NI	PA		1,0 •	N _{Rk,s}		N	PA
Strength class ≥70	,										
Partial factor		γMs,N	[-]				see Ta	ıble C1			
Combined pull-out and co	oncrete failure										
Characteristic bond resistar drilled holes (CD) and with			d concrete (C20/25	in harr	nmer dr	illed ho	oles (H	D), com	presse	ed air
Temperature range range C/24,0 C/54,0 C	Dry, wet concrete and	^τ Rk,eq,C1	[N/mm²]	6,5	6,5	7,5	7,5	7,5	7,5	7,5	7,5
	flooded bore hole	⁷ Rk,eq,C2	[N/mm²]	N	PA	5,8	4,8	5,0	5,1	NF	PA
Reduction factor ψ^0_{sus} in c holes (CD) and with hollow		-cracked concr	rete C20/25	in har	nmer c	Irilled h	ioles (H	ID), co	mpres	sed air	drilled
Temperature range Tamperature C/24°C	Dry, wet concrete and flooded bore hole	Ψ^0 sus	[-]				0,	80			
Increasing factors for concr	ete ψ_{c}	C25/30 to	C50/60				1	,0			
Concrete cone failure											
Relevant parameter							see Ta	ble C2			
Splitting											
Relevant parameter							see Ta	ble C2			
Installation factor		1	1								
· · · · · · · · · · · · · · · · · · ·	,	γinst	[-]								
	ыр, ср)							,2			
for dry and wet concrete (HD: HDB_CD)											
B+BTec Injection Syste	m BIS-PE GEN	13 for concret	te								
Performances Characteristic values of tens	sion loads under	seismic action (performance	e categ	ory C1+	-C2)			Anne	x C 19	9



Anchor size threaded rod			M8	M10	M12	M16	M20	M24	M27	M30
Steel failure without lever arm		I		I	I		1	II		
Characteristic shear resistance (Seismic C1)	V _{Rk,s,eq,C1}	[kN]				0,70)∙V ⁰ _{Rk}	,S		
Characteristic shear resistance (Seismic C2), Steel, strength class 8.8 Stainless Steel A4 and HCR, Strength class ≥70	V _{Rk,s,eq,C2}	[kN]	Ν	PA		0,70 ·	V ⁰ Rk,s		N	PA
Partial factor	γ _{Ms} ,v	[-]] see Table C1							
Ductility factor	k ₇	[-]] 1,0							
Steel failure with lever arm		1 1								
Characteristic handing memory	M ⁰ _{Rk,s,eq,C1}	[Nm]			No Pe	forman	ce Asse	essed (N	PA)	
Characteristic bending moment	M ⁰ Rk,s,eq,C2				No Pe	forman	ce Asse	essed (N	PA)	
Concrete pry-out failure										
Factor	k ₈	[-]					2,0			
Installation factor	γinst	[-]					1,0			
Concrete edge failure										
Effective length of fastener	I _f	[mm]		r	nin(h _{ef} ; 1	2 · d _{no}	m)		min(h _{ef} ;	300mm
Outside diameter of fastener	d _{nom}	[mm]	8	10	12	16	20	24	27	30
Installation factor	γinst	[-]					1,0			
Factor for annular gap	α _{gap}	[-]				0,	5 (1,0) ¹⁾			
Factor for annular gap ¹⁾ Value in brackets valid for filled ar Annex A 3 is required	α _{gap} nular gab betwee		or and c	learance	e hole in				al filling wa	asher

B+BTec Injection System BIS-PE GEN3 for concrete

Performances

Characteristic values of shear loads under seismic action (performance category C1+C2)

Annex C 20



Table C27: Characteristic values of tension loads under seismic action (performance category C1) for a service life of 50 yearsAnchor size reinforcing barØ 8Ø 10Ø 12Ø 14Ø 16Ø 20Ø 24Ø 25Ø 24														
Anchor size	ze reinforcing	bar		-	Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Steel failu	re									•				
Characteri	stic tension resi	istance	N _{Rk,s,eq}	[kN]					1,0 • A	∖ _s •f _{uk}	1)			
Cross sect	ion area		A _s	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial fact	or		γ _{Ms,N}	[-]					1,	4 ²⁾				
	I pull-out and o													
	stic bond resistants s (CD) and wit			cracked co	ncrete	e C20/2	25 in h	amme	r drille	d hole	s (HD)	, comp	oresse	d air
Temperature range ::1	40°C/24°C	Dry, wet concrete and	[⊤] Rk,eq	[N/mm ²]	7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5	8,5	8,5
Temp II ra	72°C/50°C	flooded bore hole	[⊄] Rk,eq	[N/mm²]	6,0	6,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0
Reduction factor ψ^0_{sus} in cracked and non-cracked concrete C20/25 in hammer drilled holes (H holes (CD) and with hollow drill bit (HDB)									(HD),	compr	essed	air dril	led	
Dry, wet concrete 0,8										80				
Tempera range :=	72°C/50°C	flooded bore hole	Ψ sus	[-]					0,	68				
Increasing	factors for cond	crete ψ _C	C25/30 to	C50/60					1	,0				
Concrete	cone failure													
Relevant p	arameter								see Ta	able C	2			
Splitting					1									
Relevant p									see Ta	able C	2			
Installatio			1	T										
-	wet concrete (bore hole (HD;	,	γ _{inst}	[-]						,0 ,2				
	be taken from th	. ,	l Is of reinforci	l na hars						, ∠				
²⁾ in abser	nce of national re	egulation												
	Injection Syst	tem BIS-PE	GEN3 for c	oncrete							•		0.01	
Character	nces istic values of te	nsion loads un	der seismic a	action (perf	orman	ce cate	egory C	21)			Α	nnex	C 21	



Table C28: Charac (perfor	teristic va mance cat												
Anchor size reinforcing	bar		-	Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Steel failure						•	•		•	•			
Characteristic tension resi	istance	N _{Rk,s,eq}	[kN]					1,0 • A	∖ _s •f _{uk}	1)			
Cross section area		A _s	[mm ²]	50	79	113	154	201	314	452	491	616	804
Partial factor		γ _{Ms,N}	[-]					1,	4 ²⁾				
Combined pull-out and o	concrete failu												
Characteristic bond resista drilled holes (CD) and wit			cracked co	oncrete	C20/2	25 in h	iamme	r drille	d hole	s (HD)	, comp	oresse	d air
Temperature range I: 40°C/24°C	Dry, wet concrete and flooded bore hole	^τ Rk,eq	[N/mm²]	6,5	6,5	7,5	7,5	7,5	7,5	7,5	7,5	7,5	7,5
Reduction factor ψ^0_{sus} in (cracked and r	on-cracked	concrete (C20/25	in ha	mmer	drilled	holes	(HD),	compr	essed	air dril	led
holes (CD) and with hollo	w drill bit (HD Dry, wet	B)											
Temperature range I: 40,05/54,05 Costante Costan	[-]					0,	.80						
Increasing factors for cond	crete ψ_{C}	C25/30 to	C50/60					1	,0				
Concrete cone failure													
Relevant parameter								see Ta	able C	2			
Splitting				1									
Relevant parameter								see Ta	able C	2			
Installation factor		1	1	-									
for dry and wet concrete (γ _{inst}	[-]						,0				
for flooded bore hole (HD;								1	,2				
¹⁾ f _{uk} shall be taken from th ²⁾ in absence of national re													
B+BTec Injection Syst	tem BIS-PE (GEN3 for c	oncrete							_			
Performances Characteristic values of te	nsion loads un	der seismic a	action (perf	orman	ce cate	egory (C1)			A	nnex	C 22	2



Table C29: Characteristic (performance c			oads	und	er se	eismi	ic ac	tion				
Anchor size 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 _{Rk,s,eq}	[kN]					0,35	• A _s •	f _{uk} 1)			
Cross section area	A _s	[mm ²]	50	79	113	154	201	314	452	491	616	804
Partial factor	γMs,V	[-]						1,5 ²⁾				
Ductility factor	k ₇	[-]						1,0				
Steel failure with lever arm												
Characteristic bending moment	M ⁰ _{Rk,s,eq}	[Nm]			N	o Perf	orman	ce As	sesse	d (NPA)	ł	
Concrete pry-out failure												
Factor	k ₈	[-]						2,0				
Installation factor	γ _{inst}	[-]						1,0				
Concrete edge failure												
Effective length of fastener	۱ _f	[mm]		I	min(h _e	_{ef} ; 12 ·	• d _{nom})		min(h _{ef} ; 300	mm)
Outside diameter of fastener	d _{nom}	[mm]	8	10	12	14	16	20	24	25	28	32
Installation factor	γinst	[-]						1,0				
Factor for annular gap	α_{gap}	[-]					0,	5 (1,0) ³⁾			

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

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 required

B+BTec Injection System BIS-PE GEN3 for concrete

Performances

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

Annex C 23



Anchor size threa	aded ro	od				M8	M1	0	M12	Ν	116	М2	0	M24	M27	M30
Non-cracked and	l cracke	ed con	ncrete C	20/25 u	nder se	ismic C	1 actio	n for	r a ser	vice	e life o	of 50	yea	rs	I	
Temperature ran	ude I.	δ _{N0} -fa	actor	[mm/(N	/mm²)]	0,069	0,07	71 (0,072	0.0	074	0,07	76	0,079	0,081	0,082
40°C/24°C Temperature range II: 72°C/50°C		δ _{N∞} -factor		[mm/(N/mm ²)]		0,193	3 0,1		0,122	0.	128	0,13		0,142	0,155	0,17
		δ _{N0} -factor		[mm/(N/mm ²)]		0,092			0,096		099	0,10		0,106	0,109	0,110
		δ _{N∞} -factor		[mm/(N/mm ²)]		0,259			0,163		172	0,18		0,189	0,207	0,22
Non-cracked and	l cracke								•	vice	e life d			ars	,	,
Temperature ran	nae I:	δ _{N0} -fa	actor	[mm/(N	/mm²)]	0,069	0,07	71 (0,072	0,0	074	0,07	76	0,079	0,081	0,08
40°C/24°C		δ _{N∞} -fa	actor	[mm/(N	/mm²)]	0,193	3 0,1-	15 (0,122	0,	128	0,13	35	0,142	0,155	0,17
Anchor size reinf Non-cracked and Temperature range I: 40°C/24°C Temperature range II: 72°C/50°C Non-cracked and Temperature	forcing l cracke δ_{N0} -fi $\delta_{N\infty}$ -fi δ_{N0} -fi $\delta_{N\infty}$ -fi	bar ed con actor actor actor actor actor	[mm/(N [mm/(N [mm/(N [mm/(N	20/25 u l/mm²)] l/mm²)] l/mm²)] l/mm²)] 20/25 u	Ø 8 nder se 0,069 0,115 0,092 0,154	Ø 10 ismic C 0,071 0,122 0,095 0,163	Ø 12 1 actio 0,072 0,128 0,096 0,172	Ø 1 0,0 0,0 0,1 0,0 0,1 0,0 0,1 0,1	14 Ø a ser 73 0,1 35 0, 98 0,1 98 0,1 0,1 0,1 81 0,2 0,1 0,1 • a ser • a ser 0,1 0,1	074 142 099 189	0,07 0,15 0,10 0,20	of 50 6 0 5 0 2 0 7 0 of 10	,079 ,171 ,106 ,229	rs 0,079 0,171 0,106 0,229 ars	0,081 0,181 0,109 0,242	Ø 3 0,08 0,19 0,11 0,26
range I: 40°C/24°C ¹⁾ Calculation of the $\delta_{N0} = \delta_{N0}$ -factor $\cdot \tau$; $\delta_{N\infty} = \delta_{N\infty}$ -factor $\cdot \tau$;	cemen		/mm²)]	0,115		0,128	- ·		142	0,15	5 0	9,171	0,171		0,19
$\frac{40^{\circ}C/24^{\circ}C}{^{1)} \text{ Calculation of th}}$ $\frac{\delta_{N0} = \delta_{N0} \text{-factor} \cdot \tau;}{\delta_{N\infty} = \delta_{N\infty} \text{-factor} \cdot \tau}$ $Table C32:$	le displa ; τ; (τ: acti Displ a	cemen ion bon acem	t	I/mm²)] for tensi	0,115	0,122	0,128 (thre	0,1:	35 0, d roc	(৮					0,181	0,19
$\frac{40^{\circ}C/24^{\circ}C}{^{1)} \text{ Calculation of th}}$ $\frac{\delta_{N0} = \delta_{N0} \text{-factor} \cdot \tau;}{\delta_{N\infty} = \delta_{N\infty} \text{-factor} \cdot \tau}$ Table C32: Anchor size threat	le displa ; ; t; (τ: acti Displa aded ro	cemen ion bon acem od	t nd stress	I/mm²)] for tensi	0,115 ion) shear	0,122	0,128 (thre	0,13 ade	35 0,	(৮	0,15	5 0 M2		0,171 M24		
$40^{\circ}C/24^{\circ}C$ ¹⁾ Calculation of the $\delta_{N0} = \delta_{N0}$ -factor $\cdot \tau$; $\delta_{N\infty} = \delta_{N\infty}$ -factor $\cdot \tau$ Table C32: Anchor size threat Non-cracked and	Displa aded ro	cemen ion bon acem ad ed con	t nd stress nents L ncrete C	I/mm ²)] for tensi Inder 20/25 u	0,115 ion) shear	0,122 load ²⁾ M8 ismic C	0,128 (thre M1 1 actio	0,1: eade 10	35 0, d roc M12	(k ∧	116	M2	0	M24	0,181 M27	M30
$40^{\circ}C/24^{\circ}C$ ¹⁾ Calculation of the $\delta_{N0} = \delta_{N0}$ -factor $\cdot \tau$; $\delta_{N\infty} = \delta_{N\infty}$ -factor $\cdot \tau$ Table C32: In Anchor size threat Non-cracked and All temperature	Displa ; ; aded rc i cracke	cemen ion bon acem ad ad con -factor	t nd stress nents u ncrete C	I/mm ²)] for tensi Jnder 20/25 u [mm/l	0,115 ion) shear nder se	0,122 Ioad²⁾ M8 ismic C 0,06	0,128 (thre M1 1 actio 5 0,0	ade 10 06	35 0, d roc M12 0,05	(k ₪ _	,04	M2	10	M24 0,03	0,181 M27 0,03	M3(0,03
$40^{\circ}C/24^{\circ}C$ ¹⁾ Calculation of the $\delta_{N0} = \delta_{N0}$ -factor $\cdot \tau$; $\delta_{N\infty} = \delta_{N\infty}$ -factor $\cdot \tau$ Table C32: I Anchor size threat Non-cracked and All temperature ranges	Displated of the second secon	cemen ion bon acem od ed con -factor -factor	t nd stress nents u ncrete C	I/mm²)] for tens Inder 20/25 u [mm/l [mm/l	0,115 ion) shear nder se kN] kN]	0,122 IOad²⁾ M8 ismic C 0,06 0,09	0,128 (thre M1 1 actio 5 0,0 9 0,0	ade 10 06 08	35 0, d roc M12	(k ₪ _	116	M2	10	M24	0,181 M27	0,19 M30 0,03
$40^{\circ}C/24^{\circ}C$ ¹⁾ Calculation of the $\delta_{N0} = \delta_{N0}$ -factor $\cdot \tau$; $\delta_{N\infty} = \delta_{N\infty}$ -factor $\cdot \tau$ Table C32: I Anchor size threat Non-cracked and All temperature ranges Table C33: I	Displa ; ; ; (τ: acti aded ro i cracke δ _{V0} δ _{Vα} Displa	cemen ion bon acem od ed con -factor -factor acem	t nd stress nents u ncrete C	I/mm²)] for tens Inder 20/25 u [mm/l [mm/l	0,115 ion) shear shear kN] kN] hear le	0,122 0,122 0,02 0,06 0,00	(thre M1 1 actio 3 0,0 9 0,0 rebar	ade 10 06 08	35 0, d roc M12 0,05 0,08	(k M 0 0	,04	M2 0,0 0,0	10	M24 0,03	0,181 M27 0,03	M30 0,03
$40^{\circ}C/24^{\circ}C$ ¹⁾ Calculation of the $\delta_{N0} = \delta_{N0}$ -factor $\cdot \tau$; $\delta_{N\infty} = \delta_{N\infty}$ -factor $\cdot \tau$ Table C32: I Anchor size threat Non-cracked and All temperature ranges	Displa ; ; (τ: acti aded ro d cracke δ _{V0} δ _{Vα} Displa	cemen ion bon acem ad ed con -factor -factor acem bar	t nd stress nents L ncrete C	I/mm ²)] for tensi Inder 20/25 u [mm/l [mm/l nder s	0,115 ion) shear nder se kN] kN] hear lo Ø 8	0,122 0,122 0,02 0,06 0,00	(thre M1 1 actio 3 0,0 9 0,0 rebar	eade 10 06 08	35 0, d roc M12 0,05 0,08	(k M 0 0	116 ,04 ,06	M2 0,0 0,0	0 4 6	M24 0,03 0,05	0,181 M27 0,03 0,05	M30 0,03 0,05
$40^{\circ}C/24^{\circ}C$ ¹⁾ Calculation of the $\delta_{N0} = \delta_{N0}$ -factor $\cdot \tau$; $\delta_{N\infty} = \delta_{N\infty}$ -factor $\cdot \tau$ Table C32: I Anchor size threat Non-cracked and All temperature ranges Table C33: I Anchor size reinf For concrete C20	Displation of the second seco	cemen ion bon acem ad con -factor -factor acem bar der se	t nd stress nents L ncrete C	I/mm ²)] for tensi under 20/25 u [mm/l [mm/l nder s 1 actior	ion) shear nder se kN] kN] hear lo Ø 8	0,122 10ad ²⁾ M8 ismic C 0,06	0,128 (thre M1 1 actio 0 0,0 0 0,0 rebar Ø 12	0,1: ade 10 06 08 08 0 08	35 0, od roc M12 0,05 0,08 4	d)	116 ,04 ,06 Ø 20	M2 0,0 0,0	0 4 6 5 24	M24 0,03 0,05	0,181 M27 0,03 0,05 Ø 28	M30 0,03 0,05
$40^{\circ}C/24^{\circ}C$ ¹⁾ Calculation of the $\delta_{N0} = \delta_{N0}$ -factor $\cdot \tau$; $\delta_{N\infty} = \delta_{N\infty}$ -factor $\cdot \tau$ Table C32: I Anchor size threat Non-cracked and All temperature ranges Table C33: I Anchor size reinf For concrete C20 All temperature	Displa is cracked $(\tau: actions)$ $(\tau: actions)$ $(\tau: actions)$ δ_{V0} δ_{V0} δ_{V0} δ_{V0} δ_{V0} -factions) δ_{V0} -factions)	cemen ion bon acem od ed con -factor -factor acem bar der se	t nd stress nents u ncrete C r nent ur ismic C [mm/kN	I/mm ²)] for tensi under 20/25 u [mm/l [mm/l nder s 1 actior]	0,115 ion) shear shear kN] kN] hear lo Ø 8 n 0,06	0,122 0,122 0,02 0,06 0,06 0,06 0,05 0,05	(thre M1 1 actio 5 0,0 9 0,0 7 rebar Ø 12 0,05	eade 10 0,1: ade 10 0 0 0 0 14 0,04	35 0, 35 0, 35 0, 12 0,05 0,08 1 Ø · ↓ 0,0	d) N 0 16 0 1	116 ,04 ,06 Ø 20 0,04	0,0 0,0 0,0	0 4 6 5 24	M24 0,03 0,05 Ø 25 0,03	0,181 M27 0,03 0,05 Ø 28 0,03	M3 (0,0(0,0) Ø 3 0,0)
$40^{\circ}C/24^{\circ}C$ ¹⁾ Calculation of the $\delta_{N0} = \delta_{N0}$ -factor $\cdot \tau$; $\delta_{N\infty} = \delta_{N\infty}$ -factor $\cdot \tau$ Table C32: I Anchor size threat Non-cracked and All temperature ranges Table C33: I Anchor size reinf For concrete C20 All temperature	Displation of the displation	cemen ion bon acem ad ed con -factor -factor -factor bar der se etor ctor	t nd stress nents L ncrete C r nent ur ismic C [mm/kN [mm/kN it	I/mm ²)] for tensi under 20/25 u [mm/l [mm/l nder s 1 actior]	0,115 ion) shear shear kN] kN] hear lo Ø 8 n 0,06	0,122 0,122 0,02 0,06 0,06 0,06 0,05 0,05	0,128 (thre M1 1 actio 0 0,0 0 0,0 rebar Ø 12	0,1: ade 10 06 08 08 0 08	35 0, 35 0, 35 0, 12 0,05 0,08 1 Ø · ↓ 0,0	d) N 0 16 0 1	116 ,04 ,06 Ø 20	0,0 0,0 0,0	0 4 6 5 24	M24 0,03 0,05	0,181 M27 0,03 0,05 Ø 28	M30 0,00 0,00



Table C34: D	-	s under tens								
Anchor size threa			M8	M10	M12	M16	M20	M24	M27	M3
Non-cracked and		e C20/25 under s	seismic C2	action	0,21		1	1		
All temperature	$\delta_{N,eq(DLS)}$	[mm]	— N	NPA		0,24	0,27	0,36	N	PA
ranges	δ _{N,eq(ULS)}	[mm]			0,54	0,51	0,54	0,63		
Table C35: D	Displacement	s under shea	ar load (ti	hreade	d rod)					
Anchor size threa	ded rod		M8	M10	M12	M16	M20	M24	M27	M3
Non-cracked and		e C20/25 under s	seismic C2	action		I				
All temperature	$\delta_{V,eq(DLS)}$	[mm]			3,1	3,4	3,5	4,2	_	_ /
ranges	δ _{V,ep} (ULS)	[mm]	— N	NPA		7,6	7,3	10,9	NPA	