



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

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

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

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

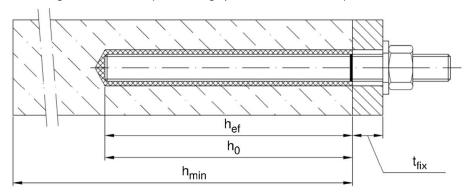
beglaubigt: Baderschneider



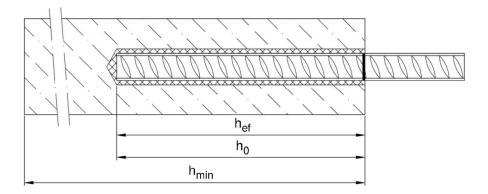
# Installation threaded rod M8 up to M30

prepositioned installation or

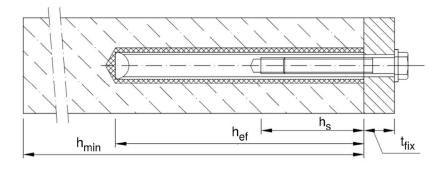
push through installation (annular gap filled with mortar)



## Installation reinforcing bar Ø8 up to Ø32



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



 $t_{fix}$  = thickness of fixture

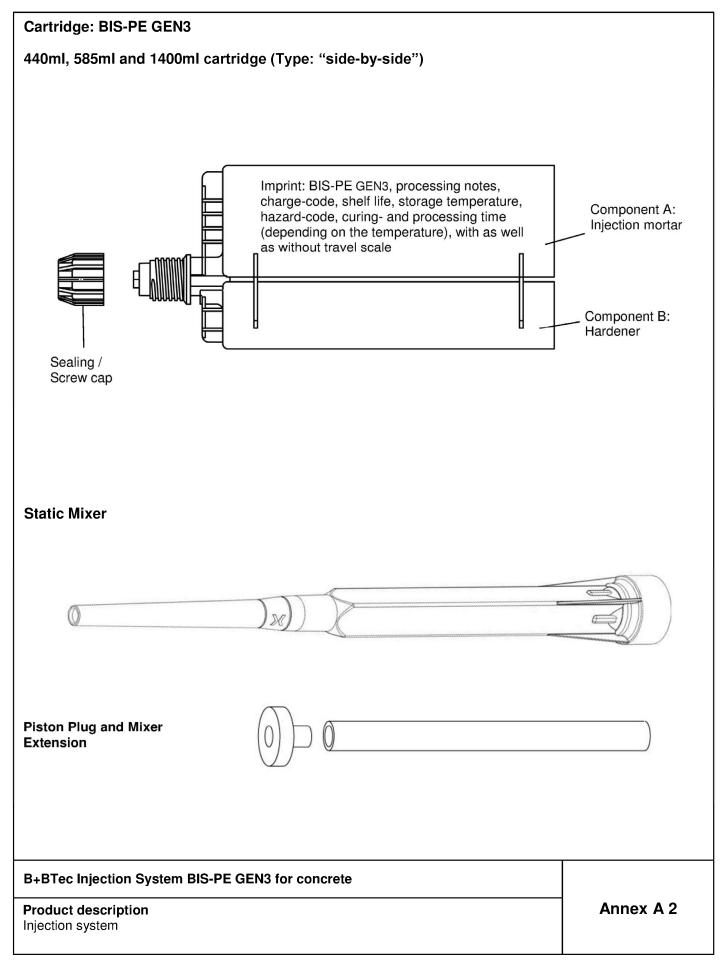
h<sub>ef</sub> = effective anchorage depth

 $h_0$  = depth of drill hole

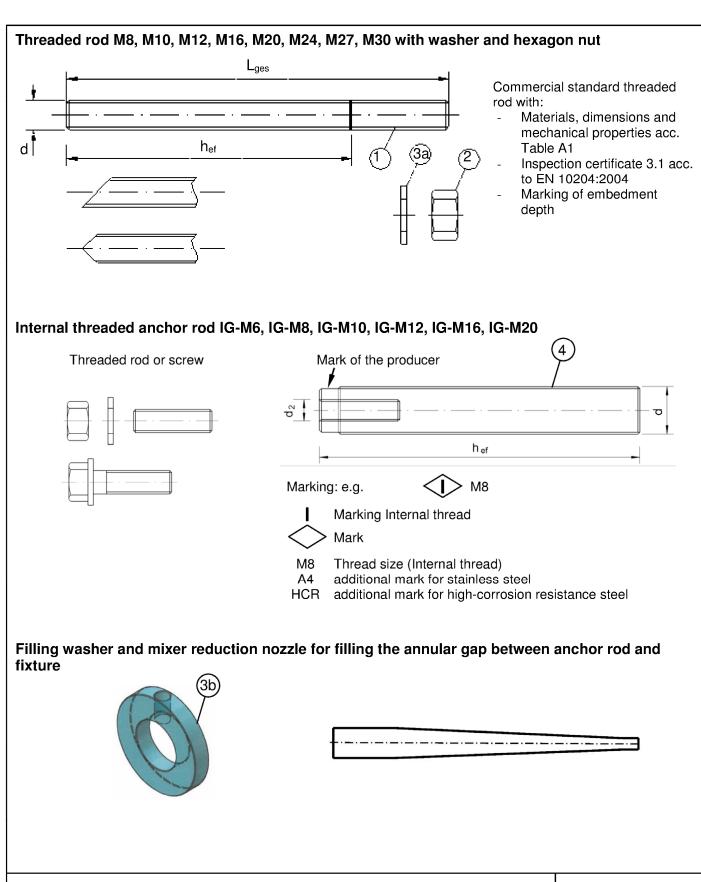
 $h_{min}$  = minimum thickness of member

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









Z2368.20 8.06.01-353/19

Annex A 3

B+BTec Injection System BIS-PE GEN3 for concrete

Threaded rod, internal threaded rod and filling washer

**Product description** 



	Table A1: Materials									
art	Designation	Material								
		acc. to EN 10087:1998								
		5 μm acc. to EN ISC			20004 - A C10000 or					
		45 μm    acc. to EN ISC 45 μm    acc. to EN ISC		1:2009 and EN ISO 10684: 58:2016	2004+AC:2009 or					
		T .	, 1700	Characteristic steel	Characteristic steel	Elongation at				
		Property class		ultimate tensile strength	yield strength	fracture				
			4.6	f <sub>uk</sub> = 400 N/mm <sup>2</sup>	f <sub>yk</sub> = 240 N/mm <sup>2</sup>	A <sub>5</sub> > 8%				
1 Threaded rod		4.8	f <sub>uk</sub> = 400 N/mm <sup>2</sup>	f <sub>yk</sub> = 320 N/mm <sup>2</sup>	A <sub>5</sub> > 8%					
	Timedaea rea	acc. to EN ISO 898-1:2013		f <sub>uk</sub> = 500 N/mm <sup>2</sup>	f <sub>vk</sub> = 300 N/mm <sup>2</sup>	A <sub>5</sub> > 8%				
		EN 150 898-1:2013		f <sub>uk</sub> = 500 N/mm <sup>2</sup>	f <sub>yk</sub> = 400 N/mm <sup>2</sup>	A <sub>5</sub> > 8%				
			8.8	f <sub>uk</sub> = 800 N/mm <sup>2</sup>	f <sub>yk</sub> = 640 N/mm <sup>2</sup>	A <sub>5</sub> ≥ 12% <sup>3)</sup>				
_		1 4-	4	for anchor rod class 4.6 o	1 7					
2	Hexagon nut	acc. to EN ISO 898-2:2012	5 8	for anchor rod class 5.6 o	r 5.8					
				for anchor rod class 8.8						
3a	Washer			galvanised or sherardized	7000 0000 FN 100	7004 0000\				
3b	Filling washer	, ,		N ISO 7089:2000, EN ISC galvanised or sherardized	7093:2000 or EN ISO	7094:2000)				
<u> </u>	Filling washer	·	n-dip	Characteristic steel	Characteristic steel	Elongation at				
4	Internal threaded	Property class		ultimate tensile strength	yield strength	fracture				
	Internal threaded anchor rod	acc. to	5.8	f <sub>uk</sub> = 500 N/mm <sup>2</sup>	f <sub>vk</sub> = 400 N/mm <sup>2</sup>	A <sub>5</sub> > 8%				
anonor rod		EN ISO 898-1:2013		uk = 800 N/mm²		A <sub>5</sub> > 8%				
tai	<b>nless steel A4</b> (Mate		.457	1 / 1.4567 or 1.4541, acc. t 1 / 1.4362 or 1.4578, acc. t	o EN 10088-1:2014)					
ııgı	corrosion resistant		· ^ ^ - ·		-1:2014)					
		ce steel (Material 1.45	529 oı			Florantian at				
			529 oı	Characteristic steel	Characteristic steel	Elongation at				
1	Throughod rod <sup>1)4)</sup>	ce steel (Material 1.45 Property class		Characteristic steel ultimate tensile strength	Characteristic steel yield strength	fracture				
1	Threaded rod <sup>1)4)</sup>	ce steel (Material 1.45 Property class acc. to	50	Characteristic steel ultimate tensile strength f <sub>uk</sub> = 500 N/mm <sup>2</sup>	Characteristic steel yield strength f <sub>yk</sub> = 210 N/mm <sup>2</sup>	fracture A <sub>5</sub> ≥ 8%				
1	Threaded rod <sup>1)4)</sup>	ce steel (Material 1.45 Property class	50 70	Characteristic steel ultimate tensile strength $f_{uk} = 500 \text{ N/mm}^2$ $f_{uk} = 700 \text{ N/mm}^2$	Characteristic steel yield strength f <sub>yk</sub> = 210 N/mm <sup>2</sup> f <sub>yk</sub> = 450 N/mm <sup>2</sup>	fracture $A_5 \ge 8\%$ $A_5 \ge 12\%^{3}$				
1	Threaded rod <sup>1)4)</sup>	Property class acc. to EN ISO 3506- 1:2009	50 70 80	Characteristic steel ultimate tensile strength $f_{uk} = 500 \text{ N/mm}^2$ $f_{uk} = 700 \text{ N/mm}^2$ $f_{uk} = 800 \text{ N/mm}^2$	Characteristic steel yield strength f <sub>yk</sub> = 210 N/mm <sup>2</sup>	fracture A <sub>5</sub> ≥ 8%				
		Property class acc. to EN ISO 3506- 1:2009 acc. to	50 70 80 50	Characteristic steel ultimate tensile strength $f_{uk} = 500 \text{ N/mm}^2$ $f_{uk} = 700 \text{ N/mm}^2$	Characteristic steel yield strength f <sub>yk</sub> = 210 N/mm <sup>2</sup> f <sub>yk</sub> = 450 N/mm <sup>2</sup>	fracture $A_5 \ge 8\%$ $A_5 \ge 12\%^{3}$				
	Threaded rod <sup>1)4)</sup> Hexagon nut <sup>1)4)</sup>	Property class acc. to EN ISO 3506- 1:2009	50 70 80 50	Characteristic steel ultimate tensile strength $f_{uk} = 500 \text{ N/mm}^2$ $f_{uk} = 700 \text{ N/mm}^2$ $f_{uk} = 800 \text{ N/mm}^2$ for anchor rod class 50	Characteristic steel yield strength f <sub>yk</sub> = 210 N/mm <sup>2</sup> f <sub>yk</sub> = 450 N/mm <sup>2</sup>	fracture $A_5 \ge 8\%$ $A_5 \ge 12\%^{3}$				
		ce steel (Material 1.45 Property class acc. to EN ISO 3506- 1:2009 acc. to EN ISO 3506- 1:2009 A2: Material 1.4301 /	50 70 80 50 70 80	Characteristic steel ultimate tensile strength $f_{uk} = 500 \text{ N/mm}^2$ $f_{uk} = 700 \text{ N/mm}^2$ $f_{uk} = 800 \text{ N/mm}^2$ for anchor rod class 50 for anchor rod class 70 for anchor rod class 80 $07 / 1.4311 / 1.4567 \text{ or } 1.4$	Characteristic steel yield strength  f <sub>yk</sub> = 210 N/mm <sup>2</sup> f <sub>yk</sub> = 450 N/mm <sup>2</sup> f <sub>yk</sub> = 600 N/mm <sup>2</sup>	fracture $A_5 \ge 8\%$ $A_5 \ge 12\%^{3}$ $A_5 \ge 12\%^{3}$ $A_5 \ge 12\%^{3}$ 1:2014				
2	Hexagon nut 1)4)	ce steel (Material 1.45  Property class  acc. to EN ISO 3506- 1:2009  acc. to EN ISO 3506- 1:2009  A2: Material 1.4301 / A4: Material 1.4401 /	50 70 80 50 70 80 7 1.43 7 1.44	Characteristic steel ultimate tensile strength $f_{uk} = 500 \text{ N/mm}^2$ $f_{uk} = 700 \text{ N/mm}^2$ $f_{uk} = 800 \text{ N/mm}^2$ 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	Characteristic steel yield strength  fyk = 210 N/mm²  fyk = 450 N/mm²  fyk = 600 N/mm²  541, acc. to EN 10088- 578, acc. to EN 10088-	fracture $A_5 \ge 8\%$ $A_5 \ge 12\%^{3}$ $A_5 \ge 12\%^{3}$ $A_5 \ge 12\%^{3}$ 1:2014				
2		ce steel (Material 1.45  Property class  acc. to EN ISO 3506- 1:2009  acc. to EN ISO 3506- 1:2009  A2: Material 1.4301 / A4: Material 1.4401 / HCR: Material 1.452	50 70 80 50 70 80 7 1.43 7 1.44 9 or 1	Characteristic steel ultimate tensile strength $f_{uk} = 500 \text{ N/mm}^2$ $f_{uk} = 700 \text{ N/mm}^2$ $f_{uk} = 800 \text{ N/mm}^2$ 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 .4565, acc. to EN 10088-1	Characteristic steel yield strength  fyk = 210 N/mm²  fyk = 450 N/mm²  fyk = 600 N/mm²  541, acc. to EN 10088- 578, acc. to EN 10088- : 2014	fracture $A_5 \ge 8\%$ $A_5 \ge 12\%^{3}$ $A_5 \ge 12\%^{3}$ $A_5 \ge 12\%^{3}$ 1:2014 1:2014				
2 3a	Hexagon nut 1)4) Washer	ce steel (Material 1.45  Property class  acc. to EN ISO 3506- 1:2009  acc. to EN ISO 3506- 1:2009  A2: Material 1.4301 / A4: Material 1.4401 / HCR: Material 1.452 (e.g.: EN ISO 887:20	50 70 80 50 70 80 (1.43 (1.44 9 or 1	Characteristic steel ultimate tensile strength $f_{uk} = 500 \text{ N/mm}^2$ $f_{uk} = 700 \text{ N/mm}^2$ $f_{uk} = 800 \text{ N/mm}^2$ 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 .4565, acc. to EN 10088-1 in ISO 7089:2000, EN ISC	Characteristic steel yield strength  fyk = 210 N/mm²  fyk = 450 N/mm²  fyk = 600 N/mm²  541, acc. to EN 10088- 578, acc. to EN 10088- : 2014	fracture $A_5 \ge 8\%$ $A_5 \ge 12\%^{3}$ $A_5 \ge 12\%^{3}$ $A_5 \ge 12\%^{3}$ 1:2014 1:2014				
2 3a	Hexagon nut 1)4)	ce steel (Material 1.45  Property class  acc. to EN ISO 3506- 1:2009  acc. to EN ISO 3506- 1:2009  A2: Material 1.4301 / A4: Material 1.4401 / HCR: Material 1.452 (e.g.: EN ISO 887:20  Stainless steel A4, H	50 70 80 50 70 80 (1.43 (1.44 9 or 1	Characteristic steel ultimate tensile strength $f_{uk} = 500 \text{ N/mm}^2$ $f_{uk} = 700 \text{ N/mm}^2$ $f_{uk} = 800 \text{ N/mm}^2$ for anchor rod class 50 for anchor rod class 70 for anchor rod class 80 $07 / 1.4311 / 1.4567 \text{ or } 1.4$ $04 / 1.4571 / 1.4362 \text{ or } 1.4$ $04 / 1.4571 / 1.4$	Characteristic steel yield strength  fyk = 210 N/mm²  fyk = 450 N/mm²  fyk = 600 N/mm²  541, acc. to EN 10088- 578, acc. to EN 10088- : 2014	fracture $A_5 \ge 8\%$ $A_5 \ge 12\%^{3}$ $A_5 \ge 12\%^{3}$ $A_5 \ge 12\%^{3}$ 1:2014 1:2014 7094:2000)				
1 2 3a	Hexagon nut 1)4) Washer	ce steel (Material 1.45  Property class  acc. to EN ISO 3506- 1:2009  acc. to EN ISO 3506- 1:2009  A2: Material 1.4301 / A4: Material 1.4401 / HCR: Material 1.452 (e.g.: EN ISO 887:20	50 70 80 50 70 80 (1.43 (1.44 9 or 1	Characteristic steel ultimate tensile strength $f_{uk} = 500 \text{ N/mm}^2$ $f_{uk} = 700 \text{ N/mm}^2$ $f_{uk} = 800 \text{ N/mm}^2$ for anchor rod class 50 for anchor rod class 70 for anchor rod class 80 $07/1.4311/1.4567$ or $1.404/1.4571/1.4362$ or $1.404/1.4571/1.4362$ or $1.404/1.4571/1.4362$ or $1.404/1.4571/1.4362$ or $1.404/1.4571/1.4362$ or $1.404/1.4571/1.4362$ or $1.404/1.4565$ , acc. to EN 10088-1 in ISO 7089:2000, EN ISO orrosion resistance steel Characteristic steel ultimate tensile strength	Characteristic steel yield strength  fyk = 210 N/mm²  fyk = 450 N/mm²  fyk = 600 N/mm²  541, acc. to EN 10088-578, acc. to EN 10088-2014  7093:2000 or EN ISO	fracture $A_5 \ge 8\%$ $A_5 \ge 12\%^{3)}$ $A_5 \ge 12\%^{3)}$ $A_5 \ge 12\%^{3)}$ 1:2014 1:2014				
2 3a	Hexagon nut 1)4) Washer	ce steel (Material 1.45  Property class  acc. to EN ISO 3506- 1:2009  acc. to EN ISO 3506- 1:2009  A2: Material 1.4301 / A4: Material 1.4401 / HCR: Material 1.452 (e.g.: EN ISO 887:20  Stainless steel A4, H	50 70 80 50 70 80 (1.43 (1.44 9 or 1	Characteristic steel ultimate tensile strength $f_{uk} = 500 \text{ N/mm}^2$ $f_{uk} = 700 \text{ N/mm}^2$ $f_{uk} = 800 \text{ N/mm}^2$ for anchor rod class 50 for anchor rod class 70 for anchor rod class 80 $07 / 1.4311 / 1.4567$ or $1.4 / 1.4567$ or $1.4 / 1.4565$ , acc. to EN 10088-1 in ISO 7089:2000, EN ISO orrosion resistance steel Characteristic steel	Characteristic steel yield strength $f_{yk} = 210 \text{ N/mm}^2$ $f_{yk} = 450 \text{ N/mm}^2$ $f_{yk} = 600 \text{ N/mm}^2$ $541, \text{ acc. to EN 10088-578, acc. to EN 10088-2014}$ $7093:2000 \text{ or EN ISO}$ Characteristic steel	fracture $A_{5} \ge 8\%$ $A_{5} \ge 12\%^{3}$ $A_{5} \ge 12\%^{3}$ $1:2014$ $1:2014$ $7:094:2000$ Elongation at				

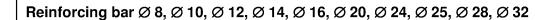
<sup>1)</sup> Property class 70 or 80 for anchor rods up to M24 and Internal threaded anchor rods up to IG-M16,

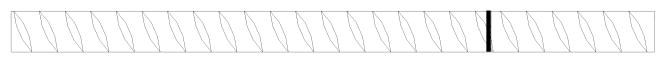
<sup>&</sup>lt;sup>4)</sup> Property class 80 only for stainless steel A4 and HCR

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

<sup>&</sup>lt;sup>2)</sup> for IG-M20 only property class 50

 $<sup>^{3)}</sup>$  A<sub>5</sub> > 8% fracture elongation if  $\underline{no}$  requirement for performance category C2 exists





- h<sub>ef</sub>
- Minimum value of related rip area f<sub>R,min</sub> 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	Material						
Reinf	forcing bars							
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 1992-1-1/NA $f_{uk} = f_{tk} = k \cdot f_{yk}$						

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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 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	Table B1: Installation parameters for threaded rod										
Anchor size				M8	M10	M12	M16	M20	M24	M27	M30
Diameter of element	ţ	d = d <sub>nom</sub>	[mm]	8	10	12	16	20	24	27	30
Nominal drill hole dia	ameter	d <sub>0</sub>	[mm]	10	12	14	18	22	28	30	35
Effective embedmer	Cff - Air		[mm]	60	60	70	80	90	96	108	120
Enective embedmen	п аерті	h <sub>ef,max</sub>	[mm]	160	200	240	320	400	480	540	600
Diameter of clearance hole in	Prepositioned in	repositioned installation d <sub>f</sub>		9	12	14	18	22	26	30	33
the fixture	Push through i	[mm]	12	14	16	20	24	30	33	40	
Maximum torque mo	ment	T <sub>inst</sub> ≤	[Nm]	10	20	40 <sup>1)</sup>	60	100	170	250	300
Minimum thickness	h <sub>min</sub>	[mm]	1	h <sub>ef</sub> + 30 mm ≥ 100 mm			h <sub>ef</sub> + 2d <sub>0</sub>				
Minimum spacing		s <sub>min</sub>	[mm]	40	50	60 75 95 115 125				140	
Minimum edge dista	nce	c <sub>min</sub>	[mm]	35	40	45	50	60	65	75	80

<sup>1)</sup> Maximum Torque moment for M12 with steel Grade 4.6 is 35 Nm

#### Table B2: Installation parameters for rebar

Anchor size	Ø 8 <sup>1)</sup>	Ø 10 <sup>1)</sup>	Ø 12	<sup>1)</sup> Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32		
Diameter of element	d = d <sub>nom</sub>	[mm]	8	10	12	14	16	20	24	25	28	32
Nominal drill hole diameter	d <sub>0</sub>	[mm]	10 12	10 12 12 14		6 18	20	25	32	32	35	40
Effective embedment depth	h <sub>ef,min</sub>	[mm]	60	60	70	75	80	90	96	100	112	128
Effective embedment depth	h <sub>ef,max</sub>	[mm]	160	200	240	280	320	400	480	500	560	640
Minimum thickness of member	h <sub>min</sub>	[mm]	h <sub>ef</sub> + 30 mm ≥ 100 mm			h <sub>ef</sub> + 2d <sub>0</sub>						
Minimum spacing	s <sub>min</sub>	[mm]	40 50		60	70	75	95	120	120	130	150
Minimum edge distance	c <sub>min</sub>	[mm]	35	40	45	50	50	60	70	70	75	85

<sup>1)</sup> both nominal drill hole diameter can be used

#### Installation parameters for Internal threaded anchor rod Table B3:

Anchor size	IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20		
Internal diameter of anchor rod	d <sub>2</sub>	[mm]	6	8	10	12	16	20
Outer diameter of anchor rod1)	$d = d_{nom}$	[mm]	10	12	16	20	24	30
Nominal drill hole diameter	d <sub>0</sub>	[mm]	12	14	18	22	28	35
Effective embedment depth	h <sub>ef,min</sub>	[mm]	60	70	80	90	96	120
Effective embedment depth	h <sub>ef,max</sub>		200	240	320	400	480	600
Diameter of clearance hole in the fixture	d <sub>f</sub>	[mm]	7	9	12	14	18	22
Maximum torque moment	T <sub>inst</sub> ≤	[Nm]	10	10	20	40	60	100
Thread engagement length min/max	l <sub>IG</sub>	[mm]	8/20	8/20	10/25	12/30	16/32	20/40
Minimum thickness of member	h <sub>min</sub>	[mm]		30 mm 0 <b>mm</b>	h <sub>ef</sub> + 2d <sub>0</sub>			
Minimum spacing	s <sub>min</sub>	[mm]	50	60	75	95	115	140
Minimum edge distance	c <sub>min</sub>	[mm]	40	45	50	60	65	80

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

B+BTec Injection Sys	stem BIS-PE GEN	3 for concrete

**Intended Use** 

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Installation parameters

Annex B 2



Table B4	Table B4: Parameter cleaning and setting tools											
mannen 2	THURSTERS											
Threaded Rod	Rebar	Internal threaded anchor rod	d <sub>0</sub> Drill bit - Ø HD, HDB, CD, DD	d <sub>b</sub> d <sub>b,min</sub> min. Brush - Ø Brush - Ø			Piston plug	Installation direction and us of piston plug				
[mm]	[mm]	[mm]	[mm]		[mm]	[mm]		1	<b></b>	1		
M8	8		10	RB10	11,5	10,5						
M10	8 / 10	IG-M6	12	RB12	13,5	12,5		No plua	required			
M12	10 / 12	IG-M8	14	RB14	15,5	14,5		140 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					
M20		IG-M12	22	RB22	24,0	22,5	VS22					
	20		25	RB25	27,0	25,5	VS25	h <sub>ef</sub> >	h <sub>ef</sub> >			
M24		IG-M16	28	RB28	30,0	28,5	VS28	250 mm	250 mm	all		
M27			30	RB30	31,8	30,5	VS30	250 11111	250 111111			
	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 (d<sub>0</sub>): all diameters



#### HDB - Hollow drill bit system

Drill bit diameter (d<sub>0</sub>): all diameters

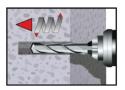
The hollow drill bit system contains the Heller Duster Expert hollow drill bit and a class M vacuum with minimum negative pressure of 253 hPa  $\underline{and}$  flow rate of minimum 150 m³/h (42 l/s).

B+BTec Injection System BIS-PE GEN3 for concrete	
Intended Use Cleaning and setting tools	Annex B 3



#### Installation instructions

#### 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 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.



1b. Hollow drill bit system (HDB) (see Annex B 3)

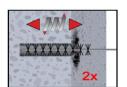
Drill a hole into the base material to the size and embedment depth required by the selected anchor (Table B1, B2, or B3). This drilling system removes the dust and cleans the bore hole during drilling (all conditions). Proceed with Step 3. In case of aborted drill hole, the drill hole shall be filled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



2a. Starting from the bottom or back of the bore hole, blow the hole clean with compressed air (min. 6 bar) (Annex B 3) a minimum of two times until return air stream is free of noticeable dust. If the bore hole ground is not reached an extension must be used.



2b. Check brush diameter (Table B4). Brush the hole with an appropriate sized wire brush > d<sub>b,min</sub> (Table B4) a minimum of two times in a twisting motion.

If the bore hole ground is not reached with the brush, a brush extension must be used.



2c. Finally blow the hole clean again with compressed air (min. 6 bar) (Annex B 3) a minimum of two times until return air stream is free of noticeable dust. If the bore hole ground is not reached an extension must be used.

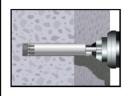
After cleaning, the bore hole has to be protected against re-contamination in an appropriate way, until dispensing the mortar in the bore hole. If necessary, the cleaning has to be repeated directly before dispensing the mortar. In-flowing water must not contaminate the bore hole again.

# B+BTec Injection System BIS-PE GEN3 for concrete Intended Use Installation instructions Annex B 4



#### Installation instructions

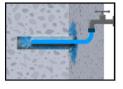
#### Drilling of the bore hole (DD)



#### 1a. Diamond drilling (DD)

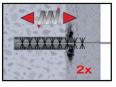
Drill with diamond drill a hole into the base material to the size and embedment depth required by the selected anchor (Table B1, B2, or B3). Proceed with Step 2. In case of aborted drill hole, the drill hole shall be filled with mortar.

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



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

2a. Rinsing with water until clear water comes out.



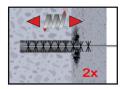
Check brush diameter (Table B4). Brush the hole with an appropriate sized wire brush > d<sub>b,min</sub> (Table B4) a minimum of two times in a twisting motion.
 If the bore hole ground is not reached with the brush, a brush extension must be used.



2c. Rinsing again with water until clear water comes out.



2d. Starting from the bottom or back of the bore hole, blow the hole clean with compressed air (min. 6 bar) (Annex B 3) a minimum of two times until return air stream is free of noticeable dust. If the bore hole ground is not reached an extension must be used.



2e. Check brush diameter (Table B4). Brush the hole with an appropriate sized wire brush > d<sub>b,min</sub> (Table B4) a minimum of two times in a twisting motion.
If the bore hole ground is not reached with the brush, a brush extension must be used.



2f. Finally blow the hole clean again with compressed air (min. 6 bar) (Annex B 3) a minimum of two times until return air stream is free of noticeable dust. If the bore hole ground is not reached an extension must 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**

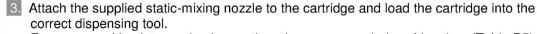
Installation instructions

Annex B 5

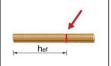


#### Installation instructions (continuation)





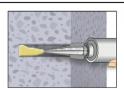
For every working interruption longer than the recommended working time (Table B5) as well as for new cartridges, a new static-mixer shall be used.



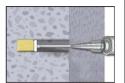
4. Prior to inserting the anchor rod into the filled bore hole, the position of the embedment depth shall be marked on the anchor rods.



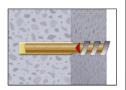
5. Prior to dispensing into the anchor hole, squeeze out separately a minimum of three full strokes and discard non-uniformly mixed adhesive components until the mortar shows a consistent grey or red colour.



6. 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.

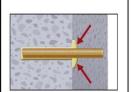


- 7. Piston plugs and mixer nozzle extensions shall be used according to Table B4 for the following applications:
  - Horizontal assembly (horizontal direction) and ground erection (vertical downwards direction): Drill bit-Ø d<sub>0</sub> ≥ 18 mm and embedment depth  $h_{ef}$  > 250mm
  - Overhead assembly (vertical upwards direction): Drill bit-Ø d<sub>0</sub> ≥ 18 mm

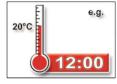


8. Push the threaded rod or reinforcing bar into the anchor hole while turning slightly to ensure positive distribution of the adhesive until the embedment depth is reached.

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



9. 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).



10. 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).



11. 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 6

72368.20 8.06.01-353/19



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Table B5:	Maximum wo	orking time and mini	mum curing time	
Concrete te	mperature	Gelling working time	Minimum curing time in dry concrete	Minimum curing time in wet concrete
+ 5 °C to	o +9°C	80 min	48 h	96 h
+ 10 °C to	o + 14 °C	60 min	28 h	56 h
+ 15 °C to	o + 19 °C	40 min	18 h	36 h
+ 20 °C to	o + 24 °C	30 min	12 h	24 h
+ 25 °C to	o + 34 °C	12 min	9 h	18 h
+ 35 °C to	o + 39 °C	8 min	6 h	12 h
+40 °	C	8 min	4 h	8 h
Cartridge te	mperature		+5°C to +40°C	

B+BTec Injection System BIS-PE GEN3 for concrete	
Intended Use	Annex B 7
Curing time	



Si	resistance of threaded			M8	M10	M12	M16	M20	M24	M27	M30	
	oss section area	A <sub>s</sub>	[mm²]	36,6	58	84,3	157	245	353	459	561	
	naracteristic tension resistance, Steel failu		<u> </u>	1 00,0	1 00	01,0	107		_ 000	100	001	
	eel, Property class 4.6 and 4.8	N <sub>Rk,s</sub>	[kN]	15 (13)	23 (21)	34	63	98	141	184	224	
			[kN]	18 (17)	29 (27)	42	78	122	176	230	280	
Sto	eel, Property class 8.8	N <sub>Rk,s</sub>	[kN]	29 (27)	46 (43)	67	125	196	282	368	449	
Sta	ainless steel A2, A4 and HCR, class 50	N <sub>Rk,s</sub>	[kN]	18	29	42	79	123	177	230	281	
Sta	ainless steel A2, A4 and HCR, class 70	N <sub>Rk,s</sub>	[kN]	26	41	59	110	171	247	-	-	
Sta	ainless steel A4 and HCR, class 80	N <sub>Rk,s</sub>	[kN]	29	46	67	126	196	282	-	-	
Cł	naracteristic tension resistance, Partial fac	tor <sup>2)</sup>	•		•			•				
Ste	eel, Property class 4.6 and 5.6	γ <sub>Ms,N</sub>	[-]				2,0	)				
Ste	eel, Property class 4.8, 5.8 and 8.8	γ <sub>Ms,N</sub>	[-]				1,	5				
Sta	ainless steel A2, A4 and HCR, class 50	γ <sub>Ms,N</sub>	[-]	2,86								
Sta	ainless steel A2, A4 and HCR, class 70	γ <sub>Ms,N</sub>	[-]	1,87								
	ainless steel A4 and HCR, class 80	γ <sub>Ms,N</sub>	[-]	1,6								
Cł	naracteristic shear resistance, Steel failure						Γ	ı	I	ı		
E	Steel, Property class 4.6 and 4.8	V <sup>0</sup> <sub>Rk,s</sub>	[kN]	9 (8)	14 (13)	20	38	59	85	110	135	
r arm	Steel, Property class 5.6 and 5.8	$V^0_{Rk,s}$	[kN]	11 (10)	17 (16)	25	47	74	106	138	168	
lever	Steel, Property class 8.8	$V^{0}_{Rk,s}$	[kN]	15 (13)	23 (21)	34	63	98	141	184	224	
	Stainless steel A2, A4 and HCR, class 50	V <sup>0</sup> <sub>Rk,s</sub>	[kN]	9	15	21	39	61	88	115	140	
Without	Stainless steel A2, A4 and HCR, class 70	V <sup>0</sup> Rk,s	[kN]	13	20	30	55	86	124	-	-	
>	Stainless steel A4 and HCR, class 80	V <sup>0</sup> Rk,s	[kN]	15	23	34	63	98	141	-	-	
	Steel, Property class 4.6 and 4.8	M <sup>0</sup> Rk,s	[Nm]	15 (13)	30 (27)	52	133	260	449	666	900	
arm	Steel, Property class 5.6 and 5.8	M <sup>0</sup> Rk,s	[Nm]	19 (16)	37 (33)	65	166	324	560	833	1123	
	Steel, Property class 8.8	M <sup>0</sup> Rk,s	[Nm]	30 (26)	60 (53)	105	266	519	896	1333	1797	
ith lever	Stainless steel A2, A4 and HCR, class 50	M <sup>0</sup> <sub>Rk,s</sub>	[Nm]	19	37	66	167	325	561	832	1125	
₹	Stainless steel A2, A4 and HCR, class 70	M <sup>0</sup> Rk,s	[Nm]	26	52	92	232	454	784	-	-	
	Stainless steel A4 and HCR, class 80	M <sup>0</sup> Rk,s		30	59	105	266	519	896	-	-	
Cr	naracteristic shear resistance, Partial facto	or <sup>2)</sup>						ı		ı		
Sto	eel, Property class 4.6 and 5.6	γ <sub>Ms,V</sub>	[-]				1,6	57				
Ste	eel, Property class 4.8, 5.8 and 8.8	γ <sub>Ms,V</sub>	[-]				1,2	25				
Sta	ainless steel A2, A4 and HCR, class 50	γ <sub>Ms,V</sub>	[-]				2,3	8				
Sta	ainless steel A2, A4 and HCR, class 70	γ <sub>Ms,V</sub>	[-]				1,5	6				
Sta	ainless steel A4 and HCR, class 80	γ <sub>Ms,V</sub>	[-]			1,33						

<sup>1)</sup> Values are only valid for the given stress area As. 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. <sup>2)</sup> 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



	Characteristic valu	les for Co	ncrete con	e failure and Splitting with all kind of		
Anchor				All Anchor type and sizes		
Concrete cone f	ailure					
Non-cracked con	icrete	k <sub>ucr,N</sub>	[-]	11,0		
Cracked concrete	e	k <sub>cr,N</sub>	[-]	7,7		
Edge distance	Edge distance		[mm]	1,5 h <sub>ef</sub>		
Axial distance	Axial distance		[mm]	2 c <sub>cr,N</sub>		
Splitting						
	h/h <sub>ef</sub> ≥ 2,0			1,0 h <sub>ef</sub>		
Edge distance	$2.0 > h/h_{ef} > 1.3$	C <sub>cr,sp</sub> [mm]		h <sub>ef</sub> > 1,3		$2 \cdot h_{ef} \left( 2,5 - \frac{h}{h_{ef}} \right)$
	h/h <sub>ef</sub> ≤ 1,3			2,4 h <sub>ef</sub>		
Axial distance		s <sub>cr,sp</sub>	[mm]	2 c <sub>cr,sp</sub>		

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



Anchor size threaded re	od			М8	M10	M12	M16	M20	M24	M27	M30	
Steel failure		TNI				Α	,					
Characteristic tension res	sistance	N <sub>Rk,s</sub>	[kN]	A <sub>s</sub> · f <sub>uk</sub> (or see Table C1)								
Partial factor		γ <sub>Ms,N</sub>	[-]				see Ta	ble C1				
Combined pull-out and												
Characteristic bond resis holes (CD)	tance in non-crac	ked concrete	C20/25 in har	nmer d	drilled h	oles (H	D) and	compr	essed	air drill	ed	
Temperature range II: 40°C/24°C	Dry, wet concrete and	<sup>τ</sup> Rk,ucr	[N/mm²]	20	20	19	19	18	17	16	16	
요 편 II: 72°C/50°C	flooded bore hole	nk,uci	[, (,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	15	15	15	14	13	13	12	12	
Characteristic bond resis	tance in non-crac	ked concrete	C20/25 in har	nmer d	drilled h	oles wi	th hollo	w drill	oit (HD	B)		
<u> </u> I: 40°C/24°C	Dry, wet			17	16	16	16	15	14	14	13	
ਸੂਬ ਲ Ⅱ: 72°C/50°C	concrete		[B.17] 03	14	14	14	13	13	12	12	11	
I: 40°C/24°C  II: 72°C/50°C  II: 72°C/50°C	flooded bore	TRk,ucr	[N/mm²]	16	16	16	15	15	14	14	13	
ਰ Ⅱ: 72°C/50°C	hole			14	14	14	13	13	12	12	11	
Characteristic bond resis	 tance in cracked o	 concrete C20/	l /25 in hamme									
and with hollow drill bit (F	HDB)											
II: 72°C/24°C	Dry, wet concrete and	ore Rk,cr [N/mm²] 6,0	Rk cr [N/mm²] -	7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5	
д Б Ш: 72°С/50°С Г	flooded bore hole		6,0	6,0	7,0	7,0	7,0	7,0	7,0	7,0		
Reduction factor ${\psi^0}_{ extsf{sus}}$ in holes (CD) and with hollo		-cracked cond	crete C20/25 i	n hamı	mer dril	led hol	es (HD	), comp	ressec	d air dri	illed	
Temperature range II: 40°C/24°C	Dry, wet concrete and flooded bore	Ψ <sup>0</sup> sus	[-]	0,80								
ਜ਼ਿੰ II: 72°C/50°C	hole			0,68								
		C25/30					1,0					
Ingranging factors for our	acrata	C30/37						04				
Increasing factors for cor $\Psi_c$	icrete	C35/45 C40/50					1,0	3 <i>7</i> 38				
ΨC		C40/50 C45/55					1, <u>\</u>					
		C50/60						10				
Concrete cone failure		1					.,					
Relevant parameter							see Ta	ble C2				
Splitting												
Relevant parameter							see Ta	ble C2				
Installation factor												
for dry and wet concrete		$\gamma_{inst}$	[-]				1,					
for flooded bore hole (HD	); HDB, CD)	11100					1,	,2				
B+BTec Injection Sys	stem BIS-PE GE	N3 for concr	rete									
Performances									Anne	x C 3	<b>)</b>	



Anchor size threaded re	od			М8	M10	M12	M16	M20	M24	M27	M30	
Steel failure		TNI				Α .						
Characteristic tension res	sistance	N <sub>Rk,s</sub>	[kN]				ık (or s		le C1)			
Partial factor		γ <sub>Ms,N</sub>	[-]	see Table C1								
Combined pull-out and												
Characteristic bond resis holes (CD)	tance in non-cracl	ked concrete	C20/25 in har	nmer c	drilled h	oles (H	D) and	compr	essed	air drill	ed	
Temperature range :I :C\O. O. O.	Dry, wet concrete and flooded bore hole	<sup>τ</sup> Rk,ucr	[N/mm²]	20	20	19	19	18	17	16	16	
Characteristic bond resis	tance in non-cracl	ked concrete	C20/25 in har	nmer c	rilled h	oles wi	th hollo	w drill	oit (HD	В)		
I: 40°C/24°C	Dry, wet concrete	τ <sub>Rk,ucr</sub>	[N/mm²]	17	16	16	16	15	14	14	13	
Ten I: 40°C/24°C	flooded bore hole		[14/11111]	16	16	16	15	15	14	14	13	
Characteristic bond resis and with hollow drill bit (H		concrete C20/	/25 in hamme	r drilled	d holes	(HD) ,	compre	essed a	ir drille	d holes	s (CD	
Temperature range :I Capperature O.05/5/2000	Dry, wet concrete and flooded bore hole	<sup>τ</sup> Rk,cr	[N/mm²]	6,5	6,5	7,5	7,5	7,5	7,5	7,5	7,5	
Reduction factor $\psi^0_{sus}$ in holes (CD) and with hollo		-cracked cond	crete C20/25 i	n hamı	mer dril	led hol	es (HD	), comp	ressec	d air dri	lled	
Temperature range :I C 2.000 C	Dry, wet concrete and flooded bore hole	$\Psi^0$ sus	[-]				0,8	30				
	-	C25/30	•				1,0	)2				
		C30/37					1,0					
Increasing factors for cor	ncrete	C35/45					1,0					
$\Psi_{\mathbf{C}}$		C40/50					1,0					
		C45/55 C50/60					1,0 1,1					
Concrete cone failure		1030/00					١,	10				
Relevant parameter							see Ta	ble C2				
Splitting												
Relevant parameter							see Ta	ble C2				
Installation factor	<del></del>											
for dry and wet concrete		$\frac{1}{\gamma_{inst}}$	[-]				1,					
for flooded bore hole (HD	); HDB, CD)	Tillot	LJ				1,	2				
B+BTec Injection Sys	stem RIS-PF GF	N3 for conc	rete									
Performances Characteristic values of te									Anne	x C 4		

for flooded bore hole (DD)

English translation prepared by DIBt



Table C5: Chara			n loads ເ	ınder	stati	c and	d qua	si-sta	tic ac	tion			
Anchor size threaded r	ervice life of t	ou years		M8	M10	M12	M16	M20	M24	M27	M30		
Steel failure	ou			IVIO   IVI IO   IVI IZ   IVI IO   IVIZO   IVIZ4   IVIZ7   IVI									
Characteristic tension re	sistance	N <sub>Rk,s</sub>	[kN]	A <sub>s</sub> • f <sub>uk</sub> (or see Table C1)									
Partial factor	γ <sub>Ms,N</sub>	[-]				see Ta							
Combined pull-out and	1												
Characteristic bond resis		ked concrete C2	20/25 in dia	mond o	drilled h	noles (E	DD)						
Temperature range II: 40°C/24°C C	Dry, wet concrete and	T-		15	14	14	13	12	12	11	11		
Ten II: 72°C/50°C	flooded bore hole	<sup>τ</sup> Rk,ucr	[N/mm <sup>2</sup> ]	12	12	11	10	9,5	9,5	9,0	9,0		
Reduction factor $\psi^0_{sus}$ in	non-cracked cond	crete C20/25 in	diamond di	illed ho	oles (D	D)							
nperature range O.575/0.01 :I	Dry, wet concrete and	Ju 0		0,77									
Temperature range II: 40°C/24°C	flooded bore hole	$\Psi^0$ sus	[-]	0,72									
		C25/30	•	1,04									
		C30/37		1,08									
Increasing factors for co	ncrete	C35/45					1,	12					
$\Psi_{C}$		C40/50					1,	15					
		C45/55		1,17									
		C50/60					1,	19					
Concrete cone failure													
Relevant parameter							see Ta	ble C2					
Splitting  Relevant parameter							000 To	bla CO					
Relevant parameter Installation factor				see Table C2									
for dry and wet concrete	(DD)	1	Ι				1	,0					
for flooded bore hole (DE	· ,	γ <sub>inst</sub>	[-]		1,2			,0	1,4				

1,2

1,4

B+BTec Injection System BIS-PE GEN3 for concrete	
Performances Characteristic values of tension loads under static and quasi-static action	Annex 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 <sup>0</sup> <sub>Rk,s</sub>	[kN]	0,6 ⋅ A <sub>s</sub> ⋅ f <sub>uk</sub> (or see Table C1)								
Characteristic shear resistance Steel, strength class 8.8 Stainless Steel A2, A4 and HCR, all strength classes	V <sup>0</sup> <sub>Rk,s</sub>	[kN]			0,5 •	A <sub>s</sub> ∙ f <sub>uk</sub>	(or see	Table C	1)		
Partial factor	$\gamma_{Ms,V}$	[-]	see Table C1								
Ductility factor	k <sub>7</sub>	[-]	1,0								
Steel failure with lever arm											
Characteristic bending moment	M <sup>0</sup> Rk,s	[Nm]			1,2 • ١	W <sub>el</sub> • f <sub>uk</sub>	(or see	Table C	(1)		
Elastic section modulus	W <sub>el</sub>	[mm³]	31	62	109	277	541	935	1387	1874	
Partial factor	γ <sub>Ms,V</sub>	[-]				see	Table C	:1			
Concrete pry-out failure											
Factor	k <sub>8</sub>	[-]					2,0				
Installation factor	$\gamma_{inst}$	[-]					1,0				
Concrete edge failure											
Effective length of fastener	I <sub>f</sub>	[mm]	$min(h_{ef}; 12 \cdot d_{nom})$ $min(h_{ef}; 300mm)$								
Outside diameter of fastener	d <sub>nom</sub>	[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



Anchor size internal threaded	d anchor rods			IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20		
Steel failure <sup>1)</sup>									•		
Characteristic tension resistand	ce, 5.8	$N_{Rk,s}$	[kN]	10	17	29	42	76	123		
Steel, strength class	8.8	N <sub>Rk,s</sub>	[kN]	16	27	46	67	121	196		
Partial factor, strength class 5.8	and 8.8	γ <sub>Ms,N</sub>	[-]		1	1.	.5				
Characteristic tension resistand							<u> </u>	4.40	124		
Steel A4 and HCR, Strength cl		$N_{Rk,s}$	[kN]								
Partial factor		$\gamma_{Ms,N}$	[-]	1,87 2							
Combined pull-out and conc	rete cone failu	re									
Characteristic bond resistance holes (CD)	in non-cracked	concrete	C20/25 in	hammer	drilled hol	es (HD) ar	nd compre	essed air d	drilled		
_ I: 40°C/24°C	Dry, wet			20	19	19	18	17	16		
Temperature II: 72°C/50°C	concrete and flooded bore hole	<sup>τ</sup> Rk,ucr	[N/mm <sup>2</sup> ]	15	15	14	13	13	12		
Characteristic bond resistance	1	concrete	C20/25 in	hammer	drilled hol	es with ho	llow drill b	oit (HDB)	l		
l: 40°C/24°C	Dry, wet			16	16	16	15	14	13		
Temperature II: 72°C/50°C	concrete	-	[N1/ma ma 2]	14	14	13	13	12	11		
range I: 40°C/24°C	flooded bore	<sup>τ</sup> Rk,ucr	[N/mm <sup>2</sup> ]	16	16	15	15	14	13		
II: 72°C/50°C	hole			14	14	13	13	12	11		
Characteristic bond resistance	in cracked cond	crete C20	/25 in ham	nmer drille	ed holes (H	HD), comp	ressed air	drilled ho	les (CD)		
and with hollow drill bit (HDB)	Dry, wet										
Temperature : 40°C/24°C	concrete and			7,0	8,5	8,5	8,5	8,5	8,5		
range II: 72°C/50°C	flooded bore hole	<sup>τ</sup> Rk,cr	[N/mm <sup>2</sup> ]	6,0	7,0	7,0	7,0	7,0	7,0		
Reduction factor $\psi^0_{$	ed and non-cra	cked con	crete C20/	25 in han	nmer drille	d holes (H	ID), comp	ressed air	drilled		
holes (CD) and with hollow dri	ll bit (HDB)										
_ I: 40°C/24°C	Dry, wet					0,	80				
Temperature 70°C/E0°C	concrete and flooded bore	$\Psi^0_{sus}$	[-]								
II: 72°C/50°C	hole					0,	68				
	•		5/30			1,	02				
			0/37				04				
Increasing factors for concrete			5/45			1,0					
Ψс			0/50 5/55				08 09				
			0/60				10				
Concrete cone failure						·					
Relevant parameter						see Ta	ble C2				
Splitting failure											
Relevant parameter						see Ta	ble C2				
Installation factor											
for dry and wet concrete (HD; H	,	γ <sub>inst</sub>	[-]			1,					
for flooded bore hole (HD; HDB	( 11)		1			1	.2				

<sup>&</sup>lt;sup>1)</sup> 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.

<sup>2)</sup> For IG-M20 strength class 50 is valid

B+BTec Injection System BIS-PE GEN3 for concrete	
Performances Characteristic values of tension loads under static and quasi-static action	Annex C 7



Anchor size internal threaded	anchor rods			IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20
Steel failure <sup>1)</sup>					•	•		•	
Characteristic tension resistance	e, 5.8	N <sub>Rk,s</sub>	[kN]	10	17	29	42	76	123
Steel, strength class	8.8	N <sub>Rk,s</sub>	[kN]	16	27	46	67	121	196
Partial factor, strength class 5.8	3 and 8.8	γ <sub>Ms,N</sub>	[-]		1,5				
Characteristic tension resistand Steel A4 and HCR, Strength cla		N <sub>Rk,s</sub>	[kN]	14	26	41	59	110	124
Partial factor		$\gamma_{Ms,N}$	[-]			1,87			2,86
Combined pull-out and conci	ete cone failu	re	•						
Characteristic bond resistance holes (CD)	in non-cracked	concrete	C20/25 in	hammer	drilled hol	es (HD) aı	nd compre	essed air o	drilled
Temperature I: 40°C/24°C range	Dry, wet concrete and flooded bore hole	<sup>τ</sup> 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	TDI	[N/mm²]	16	16	16	15	14	13
range I: 40°C/24°C	flooded bore hole	<sup>₹</sup> Rk,ucr	[14/11111]	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	ed holes (H	HD), comp	ressed air	drilled ho	les (CD)
Temperature I: 40°C/24°C range	Dry, wet concrete and flooded bore hole	<sup>τ</sup> Rk,cr	[N/mm²]	6,5	7,5	7,5	7,5	7,5	7,5
Reduction factor $\psi^0_{sus}$ in crack	ed and non-cra	cked cond	crete C20/	⁄25 in han	nmer drille	ed holes (H	ID), comp	ressed air	drilled
holes (CD) and with hollow dril	l bit (HDB)								
Temperature I: 40°C/24°C range	All conditions	Ψ <sup>0</sup> sus	[-]				80		
			5/30				02		
Increasing factors for concrete			0/37 5/45				04 07		
$\Psi_{\text{C}}$			0/50				08		
* C			5/55				09		
			0/60			-	10		
Concrete cone failure		•				•			
Relevant parameter						see Ta	ıble C2		
Splitting failure									
Relevant parameter						see Ta	ıble C2		
Installation factor		_							
	IDD OD)	1	1			-	^		
for dry and wet concrete (HD; F for flooded bore hole (HD; HDB		γ <sub>inst</sub>	[-]				,0 ,2		

<sup>&</sup>lt;sup>3)</sup> 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.

 $<sup>^{</sup>m 4)}$  For IG-M20 strength class 50 is valid

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



	ristic values		sion loa	ads und	ler stati	c and q	uasi-sta	atic acti	on		
Anchor size internal threade	d anchor rods			IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20		
Steel failure <sup>1)</sup>											
Characteristic tension resistan	ce, <u>5.8</u>	N <sub>Rk,s</sub>	[kN]	10	17	29	42	76	123		
Steel, strength class	8.8	N <sub>Rk,s</sub>	[kN]	16	27	46	67	121	196		
Partial factor, strength class 5.	γ <sub>Ms,N</sub>	[-]			1	,5					
Characteristic tension resistand Steel A4 and HCR, Strength cl	N <sub>Rk,s</sub>	[kN]	14	26	41	59	110	124			
Partial factor	γ <sub>Ms,N</sub>	[-]			1,87			2,86			
Combined pull-out and conc	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	TDI	[N/mm²]	14	14	13	12	12	11		
range II: 72°C/50°C	flooded bore hole	<sup>τ</sup> Rk,ucr	[N/mm²]	12	11	10	9,5	9,5	9,0		
Reduction factor ψ <sup>0</sup> sus in non-	cracked concret	e C20/25	in diamon	nd drilled h	noles (DD)	)					
TemperatureI: 40°C/24°C	Dry, wet concrete and	Ψ <sup>0</sup> sus	r 1	0,77							
range II: 72°C/50°C	flooded bore hole	Ψ sus	[-]	0,72							
		C2	5/30	1,04							
			0/37	1,08							
Increasing factors for concrete		-	5/45			1,	12				
Ψc			0/50				15				
			5/55				17				
		C50	0/60			1,	19				
Concrete cone failure			Т				-1-1-00				
Relevant parameter						see Ta	able C2				
Splitting failure						<b>T</b>	-1-1- 00				
Relevant parameter Installation factor						see 1a	able C2				
for dry and wet concrete (DD)		1		1,0							
for flooded bore hole (DD)		γinst	[-]	1	,2	<u> </u>	•	,4			
.cccaca boro rioro (DD)		1		'	,_	l		, .			

<sup>&</sup>lt;sup>5)</sup> 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.

B+BTec Injection System BIS-PE GEN3 for concrete	
Performances Characteristic values of tension loads under static and quasi-static action	Annex C 9

<sup>&</sup>lt;sup>6)</sup> For IG-M20 strength class 50 is valid



Table C10: Characteris	tic val	ues of s	hear I	oads u	nder s	tatic an	d quas	i-static	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 <sup>1)</sup>	)				•	•	•	•	
Characteristic shear resistance,	5.8	V <sup>0</sup> Rk,s	[kN]	5	9	15	21	38	61
Steel, strength class	8.8	V <sup>0</sup> <sub>Rk,s</sub>	[kN]	8	14	23	34	60	98
Partial factor, strength class 5.8 a	γ <sub>Ms,V</sub>	[-]				1,25			
Characteristic shear resistance, Stainless Steel A4 and HCR, Strength class 70 <sup>2)</sup>		V <sup>0</sup> Rk,s	[kN]	7	13	20	30	55	40
Partial factor		γ <sub>Ms,V</sub>	[-]			1,56			2,38
Ductility factor		k <sub>7</sub>	[-]				1,0		
Steel failure with lever arm1)									
Characteristic bending moment,	5.8	M <sup>0</sup> Rk,s	[Nm]	8	19	37	66	167	325
Steel, strength class	8.8	M <sup>0</sup> <sub>Rk,s</sub>	[Nm]	12	30	60	105	267	519
Partial factor, strength class 5.8 a	ınd 8.8	γ <sub>Ms,V</sub>	[-]	1,25					
Characteristic bending moment, Stainless Steel A4 and HCR, Strength class 70 <sup>2)</sup>		M <sup>0</sup> Rk,s	[Nm]	11	26	52	92	233	456
Partial factor		γ <sub>Ms,V</sub>	[-]			1,56			2,38
Concrete pry-out failure									
Factor		k <sub>8</sub>	[-]				2,0		
Installation factor		γinst	[-]				1,0		
Concrete edge failure		•							
Effective length of fastener		I <sub>f</sub>	[mm]		min(	(h <sub>ef</sub> ; 12 • o	d <sub>nom</sub> )		min(h <sub>ef</sub> ; 300mm
Outside diameter of fastener		d <sub>nom</sub>	[mm]	10	12	16	20	24	30
Installation factor		γ <sub>inst</sub>	[-]				1,0		

<sup>1)</sup> 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



Anchor size reinforc		of 50 yea		Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Steel failure									•				
Characteristic tension	resistance	N <sub>Rk,s</sub>	[kN]					A <sub>s</sub> •	$f_{uk}^{1)}$				
Cross section area		A <sub>s</sub>	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial factor		γ <sub>Ms,N</sub>	[-]					1,	<b>4</b> <sup>2)</sup>	•			
Combined pull-out a		ure	•										
Characteristic bond re holes (CD)	sistance in non-c	cracked cond	crete C20/2	:5 in ha	ammei	r drilled	d holes	(HD)	and co	ompre	ssed a	ir drille	ed
II: 72°C/50°C	Dry, wet concrete and	<sup>τ</sup> Rk,ucr	[N/mm²]	16	16	16	16	16	16	15	15	15	15
B II: 72°C/50°C	flooded bore hole	T IX,GOI		12	12	12	12	12	12	12	12	11	11
Characteristic bond re		racked cond	crete C20/2	5 in ha	ammei	r drilled	holes			drill bi	t (HDE	3)	
မ္ <u>I: 40°C/24°C</u>				14	14	13	13	13	13	13	13	13	13
ta ed II: 40°C/24°C	40°C/24°C flooded bore	TDI	[N/mm²]	12	12	12	11	11	11	11	11	11	11
1: 40°C/24°C   1: 72°C/50°C   1: 72°C/50°C   1: 72°C/50°C		<sup>⊤</sup> Rk,ucr		13	13	13	13	13	13	13	13	13	13
11: 72 0/00 0				11	11	11	11	11	11	11	11	11	11
Characteristic bond re and with hollow drill bi		ed concrete	C20/25 in	hamm	er drill	ed hol	es (HD	), con	npress	ed air	drilled	holes	(CD
II: 40°C/24°C	Dry, wet concrete and		FN1/ OI	7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5	8,5	8,
φ Ē —————		<sup>τ</sup> Rk,cr	[N/mm²]									7.0	
е II: 72°С/50°С	flooded bore hole			6,0	6,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0
Reduction factor $\psi^0_{\ \ \ \ \ \ \ \ }$	hole in cracked and		d concrete (				·			,	ĺ		
Reduction factor ψ <sup>0</sup> sus holes (CD) and with h	hole in cracked and lollow drill bit (HE		d concrete (				·	holes	(HD),	,	ĺ		
Reduction factor ψ <sup>0</sup> sus holes (CD) and with h	hole in cracked and collow drill bit (HE Dry, wet concrete and		d concrete (				·	holes		,	ĺ		
Reduction factor $\psi^0_{sus}$ holes (CD) and with hopo	hole in cracked and nollow drill bit (HE	)B)					·	holes 0,	(HD),	,	ĺ		
Reduction factor ψ <sup>0</sup> sus holes (CD) and with h	hole in cracked and anollow drill bit (HE Dry, wet concrete and flooded bore	OB) Ψ <sup>0</sup> sus	[-] 5/30				·	0, 0,	(HD), 6 80 68	,	ĺ		
Reduction factor ψ <sup>0</sup> <sub>sus</sub> holes (CD) and with h	hole in cracked and lollow drill bit (HE Dry, wet concrete and flooded bore hole	OB) Ψ <sup>0</sup> sus ———————————————————————————————————	[-] 5/30 0/37				·	0, 0, 1,	80 68 02 04	,	ĺ		
Reduction factor $\psi^0_{\text{sus}}$ holes (CD) and with holes (CD) and	hole in cracked and lollow drill bit (HE Dry, wet concrete and flooded bore hole	OB) Ψ <sup>0</sup> sus C25 C30 C35	[-] 5/30 5/37 5/45				·	0, 0, 1, 1,	80 68 02 04 07	,	ĺ		
Reduction factor ψ <sup>0</sup> <sub>sus</sub> holes (CD) and with h	hole in cracked and lollow drill bit (HE Dry, wet concrete and flooded bore hole	OB)  Ψ <sup>0</sup> sus  C25  C30  C35  C40	[-] 5/30 0/37 5/45 0/50				·	0, 0, 1, 1, 1,	80 68 02 04 07	,	ĺ		
Reduction factor $\psi^0_{\text{sus}}$ holes (CD) and with holes (CD) and	hole in cracked and lollow drill bit (HE Dry, wet concrete and flooded bore hole	OB)  Ψ <sup>0</sup> sus  C25  C30  C40  C45	[-] 5/30 5/37 5/45				·	0, 0, 1, 1, 1, 1,	80 68 02 04 07	,	ĺ		
Reduction factor $\psi^0_{\text{sus}}$ holes (CD) and with holes (CD) and	hole in cracked and lollow drill bit (HE Dry, wet concrete and flooded bore hole concrete	OB)  Ψ <sup>0</sup> sus  C25  C30  C40  C45	[-] 5/30 0/37 5/45 0/50 5/55				·	0, 0, 1, 1, 1, 1,	80 68 02 04 07 08	,	ĺ		
Reduction factor ψ <sup>0</sup> <sub>sus</sub> holes (CD) and with holes (ED) and wit	hole in cracked and lollow drill bit (HE Dry, wet concrete and flooded bore hole concrete	OB)  Ψ <sup>0</sup> sus  C25  C30  C40  C45	[-] 5/30 0/37 5/45 0/50 5/55				drilled	0, 0, 1, 1, 1, 1,	80 68 02 04 07 08	compr	ĺ		
Reduction factor ψ <sup>0</sup> <sub>sus</sub> holes (CD) and with h  The standard of the sus part of the sus par	hole in cracked and lollow drill bit (HE Dry, wet concrete and flooded bore hole concrete	OB)  Ψ <sup>0</sup> sus  C25  C30  C40  C45	[-] 5/30 0/37 5/45 0/50 5/55				drilled	0, 0, 1, 1, 1, 1,	80 68 02 04 07 08 09	compr	ĺ		
Reduction factor $\psi^0_{\text{sus}}$ holes (CD) and with holes (CD) and with holes (ED) and with holes (CD) and hole	hole in cracked and lollow drill bit (HE Dry, wet concrete and flooded bore hole concrete	OB)  Ψ <sup>0</sup> sus  C25  C30  C40  C45	[-] 5/30 0/37 5/45 0/50 5/55				drilled	0, 0, 1, 1, 1, 1, see Ta	80 68 02 04 07 08 09	compr	ĺ		
Reduction factor $\psi^0_{\text{sus}}$ holes (CD) and with holes (CD) and	hole in cracked and anollow drill bit (HE Dry, wet concrete and flooded bore hole  concrete	OB)  Ψ <sup>0</sup> sus  C25  C30  C35  C40  C45	[-] 5/30 0/37 5/45 0/50 5/55				drilled	0, 0, 1, 1, 1, 1, see Ta	(HD), 6 68 02 04 07 08 09 10	compr	ĺ		
Reduction factor $\psi^0_{\text{sus}}$ holes (CD) and with holes (CD) and holes (CD	hole in cracked and anollow drill bit (HE Dry, wet concrete and flooded bore hole  concrete	OB)  Ψ <sup>0</sup> sus  C28  C30  C40  C49	[-] 5/30 5/37 5/45 5/50 5/55 5/60				drilled	0, 0, 1, 1, 1, 1, see Ta	(HD), 6 68 02 04 07 08 09 10 able C2	compr	ĺ		
Reduction factor $\psi^0_{\text{sut}}$ holes (CD) and with holes (CD) and we concrete cone failur Relevant parameter Splitting  Relevant parameter Installation factor for dry and wet concrete for flooded bore hole (CD) fulk shall be taken fro	hole in cracked and incollow drill bit (HE Dry, wet concrete and flooded bore hole  concrete  e e e e e e e e e e e e e e e e e	OB)  Ψ <sup>0</sup> sus  C25  C30  C40  C45  C50	[-] 5/30 5/37 5/45 5/55 5/55 0/60				drilled	0, 0, 1, 1, 1, 1, see Ta	(HD), 6 68 02 04 07 08 09 10	compr	ĺ		
Reduction factor $\psi^0_{\text{sus}}$ holes (CD) and with holes (CD) and wet concrete the form of the hole (CD) and wet concrete for flooded bore hole (CD) and with holes (CD) and wet concrete for flooded bore hole (CD) and with holes (CD) and holes (C	hole in cracked and inclow drill bit (HE Dry, wet concrete and flooded bore hole  concrete  ete (HD; HDB, CD) m the specification al regulation	OB)  Ψ <sup>0</sup> sus  C28  C30  C38  C40  C48  C50  γ <sub>inst</sub> ns of reinforce	[-] 5/30 5/37 5/45 5/55 5/55 5/60 [-]				drilled	0, 0, 1, 1, 1, 1, see Ta	(HD), 6 68 02 04 07 08 09 10 able C2	compr	ĺ		



	ing bar		ars	Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Steel failure													
Characteristic tension	resistance	N <sub>Rk,s</sub>	[kN]					A <sub>s</sub> ·	f <sub>uk</sub> 1)				
Cross section area		A <sub>s</sub>	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial factor		γMs,N	[-]					1,	<b>4</b> <sup>2)</sup>				
Combined pull-out ar	nd concrete fail												
Characteristic bond re	sistance in non-c	cracked cond	crete C20/2	:5 in h	ammer	drilled	d holes	(HD)	and co	ompre	ssed a	ir drille	ed
holes (CD)			<u> </u>						I	I		I	
Temperature range :I C.\O.\O.\O.\O.\O.\O.\O.\O.\O.\O.\O.\O.\O.	Dry, wet concrete and flooded bore hole	<sup>τ</sup> Rk,ucr	[N/mm²]	16	16	16	16	16	16	15	15	15	15
Characteristic bond re-	sistance in non-c	racked cond	crete C20/2	5 in h	ammei	drilled	holes	with	hollow	drill bi	t (HDE	3)	
I: 40°C/24°C	Dry, wet concrete	_	[N]/ma ma 21	14	14	13	13	13	13	13	13	13	13
д ш ш П: 40°С/24°С	flooded bore hole	<sup>τ</sup> Rk,ucr	[N/mm²]	13	13	13	13	13	13	13	13	13	13
Characteristic bond re-		ed concrete	C20/25 in	hamm	er drill	ed hol	es (HD	), con	npress	ed air	drilled	holes	(CD)
and with hollow drill bit	t (HDB)	Τ	<u> </u>						ı	I			
Temperature range :I 3.5/5/5.00	Dry, wet concrete and flooded bore hole	<sup>τ</sup> Rk,cr	[N/mm²]	6,5	6,5	7,5	7,5	7,5	7,5	7,5	7,5	7,5	7,5
Reduction factor $\psi^0_{sus}$ holes (CD) and with h	•		concrete (	C20/25	in hai	mmer	drilled	holes	(HD),	compr	essed	air dril	led
· /	Dry, wet	) 		0,80									
Temperature range :I O.057/ O.057/	concrete and flooded bore hole	$\Psi^0$ sus	[-]					0,	80				
Ted Early Division I: 40°C/24°C	flooded bore	Ψ <sup>0</sup> sus							80 02				
	flooded bore hole	C25	5/30					1, 1,	02 04				
Increasing factors for o	flooded bore hole	C25 C30	5/30 0/37 5/45					1, 1, 1,	02 04 07				
	flooded bore hole	C25 C30 C35	5/30 0/37 5/45 0/50					1, 1, 1,	02 04 07 08				
Increasing factors for o	flooded bore hole	C25 C30 C35 C40	5/30 0/37 5/45 0/50 5/55					1, 1, 1, 1,	02 04 07 08 09				
Increasing factors for o	flooded bore hole concrete	C25 C30 C35	5/30 0/37 5/45 0/50 5/55					1, 1, 1, 1,	02 04 07 08				
Increasing factors for $\phi$	flooded bore hole concrete	C25 C30 C35 C40	5/30 0/37 5/45 0/50 5/55					1, 1, 1, 1,	02 04 07 08 09	2			
Increasing factors for $\Psi_{c}$	flooded bore hole concrete	C25 C30 C35 C40	5/30 0/37 5/45 0/50 5/55					1, 1, 1, 1,	02 04 07 08 09	2			
Increasing factors for $\phi$ $\psi_c$ Concrete cone failure Relevant parameter	flooded bore hole concrete	C25 C30 C35 C40	5/30 0/37 5/45 0/50 5/55					1, 1, 1, 1, 1, 1, see Ta	02 04 07 08 09				
Increasing factors for one of the second sec	flooded bore hole concrete	C25 C30 C35 C40	5/30 0/37 5/45 0/50 5/55					1, 1, 1, 1, 1, 1, see Ta	02 04 07 08 09 10				
Increasing factors for out of the second factor of	flooded bore hole concrete	C25 C30 C35 C40 C45	5/30 0/37 5/45 0/50 5/55 0/60					1, 1, 1, 1, 1, see Ta	02 04 07 08 09 10 able C2 ,0				
Increasing factors for of the second factors for of the second failure. The second failure is a second failure in the second factor for dry and wet concretion flooded bore hole (	te (HD; HDB, CD	C25 C30 C35 C40 C45 C50	5/30 5/37 5/45 5/50 5/55 0/60					1, 1, 1, 1, 1, see Ta	02 04 07 08 09 10 able C2				
Increasing factors for out of the second factor of	te (HD; HDB, CD HD; HDB, CD) m the specification	C25 C30 C35 C40 C45 C50	5/30 5/37 5/45 5/50 5/55 0/60					1, 1, 1, 1, 1, see Ta	02 04 07 08 09 10 able C2 ,0				
Increasing factors for of the state of the s	te (HD; HDB, CD) HD; HDB, CD) m the specification al regulation	C25 C30 C35 C45 C45 C50   Yinst  ns of reinforce	5/30 0/37 5/45 0/50 5/55 0/60					1, 1, 1, 1, 1, see Ta	02 04 07 08 09 10 able C2 ,0				



Table C13: Char for a	acteristic va service life			oads	und	er sta	atic a	nd q	<sub>l</sub> uasi	-stati	ic act	tion	
Anchor size reinforci				Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Steel failure			_		•	•						'	
Characteristic tension	resistance	N <sub>Rk,s</sub>	[kN]					$A_s$ •	f <sub>uk</sub> 1)				
Cross section area		A <sub>s</sub>	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial factor		γMs,N	[-]	1,42)									
Combined pull-out ar	nd concrete fail	ure	•										
Characteristic bond re	sistance in non-c	racked conc	rete C20/2	25 in d	amon	d drille	d hole	s (DD)					
II: 40°C/20°C	Dry, wet concrete and flooded bore	TD	[N/mm <sup>2</sup> ]	14	13	13	13	12	12	11	11	11	11
ਰੁੱਲ   ਰੂ   ਸ਼ੁਰੂ   ਸ਼ੁਰੂ	flooded bore hole	<sup>τ</sup> Rk,ucr	[[14/111111-]	11	11	10	10	10	9,5	9,5	9,5	9,0	9,0
Reduction factor $\psi^0_{sus}$	in non-cracked	concrete C2	0/25 in dia	mond	drilled	holes	(DD)						
II: 72°C/50°C	Dry, wet concrete and	Ψ <sup>0</sup> sus	[-]	0,77									
II: 72°C/50°C	flooded bore hole	₩ sus	11	0,72									
	•	C25	/30	1,04									
		C30	/37	1,08									
Increasing factors for o	concrete	C35		1,12									
$\Psi_{C}$		C40							15				
		C45							17				
Opposets some failum		C50	/60					1,	19				
Concrete cone failure	•							000 T	able C2	<u> </u>			
Relevant parameter  Splitting								see 18	able Ca				
Relevant parameter								SAA Ta	able C2				
Installation factor								355 16	1016 UZ	_			
for dry and wet concre	te (DD)							1	,0				
for flooded bore hole (		γ <sub>inst</sub>	[-]		1	,2		<u> </u>	,,,	1	,4		
1) 6 1 111 1 1 6				•				•					

 $<sup>^{\</sup>rm 1)}$   $f_{uk}$  shall be taken from the specifications of reinforcing bars  $^{\rm 2)}$  in absence of national regulation

B+BTec Injection System BIS-PE GEN3 for concrete	
Performances Characteristic values of tension loads under static and quasi-static action	Annex C 13



Table C14: Characteristic	values of	shear	load	s un	der s	tatio	and	d qua	si-sta	atic ac	tion	
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 <sup>0</sup> Rk,s	[kN]					0,5	· A <sub>s</sub>	· f <sub>uk</sub> 1)			
Cross section area	A <sub>s</sub>	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial factor	γ <sub>Ms,V</sub>	[-]	1,52)									
Ductility factor	k <sub>7</sub>	[-]						1,0				
Steel failure with lever arm	•	•	•									
Characteristic bending moment	M <sup>0</sup> Rk,s	[Nm]					1.2	• W <sub>el</sub>	• f <sub>uk</sub> 1)			
Elastic section modulus	W <sub>el</sub>	[mm³]	50	98	170	269	402	785	1357	1534	2155	3217
Partial factor	γ <sub>Ms,V</sub>	[-]		•	•		•	1,52	)			•
Concrete pry-out failure	•	•										
Factor	k <sub>8</sub>	[-]						2,0				
Installation factor	γinst	[-]						1,0				
Concrete edge failure	'	•	•									
Effective length of fastener	If	[mm]	min(h <sub>ef</sub> ; 12 • d <sub>nom</sub> ) min(h <sub>ef</sub> ; 300mm				mm)					
Outside diameter of fastener	d <sub>nom</sub>	[mm]	8	10	12	14	16	20	24	25	28	32
Installation factor	γinst	[-]		•	•			1,0				

 $<sup>^{\</sup>rm 1)}$   $f_{\rm uk}$  shall be taken from the specifications of reinforcing bars  $^{\rm 2)}$  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 <sup>1)</sup> 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	
Non-cracked concrete C20/25 under static and quasi-static action for a service life of 50 years											
Temperature range I:	$\delta_{N0}$ -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/mm <sup>2</sup> )]	0,028	0,029	0,030	0,033	0,035	0,038	0,039	0,041	
Temperature range II:	δ <sub>N0</sub> -factor	[mm/(N/mm <sup>2</sup> )]	0,038	0,039	0,040	0,044	0,047	0,051	0,052	0,055	
72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,047	0,049	0,051	0,055	0,059	0,064	0,067	0,070	
Cracked concrete C20/2	Cracked concrete C20/25 under static and quasi-static action for a service life of 50 years										
Temperature range I:	$\delta_{N0}$ -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/mm <sup>2</sup> )]	0,193	0,115	0,122	0,128	0,135	0,142	0,155	0,171	
Temperature range II:	$\delta_{N0}$ -factor	[mm/(N/mm <sup>2</sup> )]	0,092	0,095	0,096	0,099	0,102	0,106	0,109	0,110	
72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/mm <sup>2</sup> )]	0,259	0,154	0,163	0,172	0,181	0,189	0,207	0,229	
Non-cracked concrete (	C20/25 unde	static and quasi	-static a	ction for	a servi	ce life of	f 100 yea	ars			
Temperature range I:	δ <sub>N0</sub> -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	0,030	0,031	0,033	0,036	0,038	0,040	0,042	
Cracked concrete C20/2	25 under stat	ic and quasi-stat	ic action	for a se	ervice lif	e of 100	years				
Temperature range I:	$\delta_{N0}$ -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)]	0,193	0,115	0,122	0,128	0,135	0,142	0,155	0,171	

<sup>1)</sup> Calculation of the displacement

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

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

# Table C16: Displacements under tension load<sup>1)</sup> in diamond drilled holes (DD)

Anchor size threaded ro	M8	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										
Temperature range I:	δ <sub>N0</sub> -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)]	0,018	0,019	0,019	0,020	0,022	0,023	0,024	0,025
Temperature range II:	δ <sub>N0</sub> -factor	[mm/(N/mm²)]	0,013	0,014	0,014	0,015	0,016	0,016	0,018	0,018
72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,052	0,053	0,055	0,058	0,062	0,065	0,068	0,070

<sup>1)</sup> Calculation of the displacement

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

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

# Table C17: Displacements under shear load<sup>2)</sup> for all drilling methods

Anchor size threa	M8	M10	M12	M16	M20	M24	M27	M30		
Non-cracked and cracked concrete C20/25 under static and quasi-static action										
All temperature	$\delta_{V0}$ -factor	[mm/kN]	0,06	0,06	0,05	0,04	0,04	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

<sup>2)</sup> Calculation of the displacement

 $\delta_{V0} = \delta_{V0}$ -factor  $\cdot$  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 (threaded rods)

Annex C 15



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

Anchor size Internal thre	eaded anchor	rod	IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20		
Non-cracked concrete C			tatic actio	n for a ser	vice life of	50 years				
Temperature range I:	δ <sub>N0</sub> -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	0,041		
Temperature range II:	δ <sub>N0</sub> -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 C20/2	Cracked concrete C20/25 under static and quasi-static action for a service life of 50 years									
Temperature range I: 40°C/24°C	δ <sub>N0</sub> -factor	[mm/(N/mm²)]	0,071	0,072	0,074	0,076	0,079	0,082		
	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,115	0,122	0,128	0,135	0,142	0,171		
Temperature range II:	δ <sub>N0</sub> -factor	[mm/(N/mm²)]	0,095	0,096	0,099	0,102	0,106	0,110		
72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,154	0,163	0,172	0,181	0,189	0,229		
Non-cracked concrete C	20/25 under s	tatic and quasi-s	tatic actio	n for a ser	vice life of	100 years				
Temperature range I:	δ <sub>N0</sub> -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)]	0,030	0,031	0,033	0,036	0,038	0,042		
Cracked concrete C20/2	5 under static	and quasi-static	action for	a service	life of 100	years				
Temperature range I:	δ <sub>N0</sub> -factor	[mm/(N/mm²)]	0,071	0,072	0,074	0,076	0,079	0,082		
40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,115	0,122	0,128	0,135	0,142	0,171		

<sup>1)</sup> Calculation of the displacement

 $\delta_{\text{N0}} = \delta_{\text{N0}}\text{-factor} \cdot \tau;$ 

τ: action bond stress for tension

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

# Table C19: Displacements under tension load<sup>1)</sup> in diamond drilled holes (DD)

Anchor size Internal three	IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20				
Non-cracked concrete C20/25 under static and quasi-static action for a service life of 50 years										
Temperature range I:	$\delta_{N0}$ -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	0,023	0,025		
Temperature range II:	$\delta_{N0}$ -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		

<sup>1)</sup> Calculation of the displacement

$$\begin{split} \delta_{\text{N0}} &= \delta_{\text{N0}}\text{-factor} \cdot \tau; \\ \delta_{\text{N}\infty} &= \delta_{\text{N}\infty}\text{-factor} \cdot \tau; \end{split}$$

 $\tau\text{:}$  action bond stress for tension

# Table C20: Displacements under shear load<sup>2)</sup> for all drilling methods

Anchor size Inter	IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20				
Non-cracked and cracked concrete C20/25 under static and quasi-static action										
All temperature	$\delta_{V0}$ -factor	[mm/kN]	0,07	0,06	0,06	0,05	0,04	0,04		
ranges	$\delta_{V\infty}$ -factor	[mm/kN]	0,10	0,09	0,08	0,08	0,06	0,06		

<sup>&</sup>lt;sup>2)</sup> Calculation of the displacement

 $\delta v_0 = \delta v_0$ -factor  $\cdot V$ ;

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 (Internal threaded anchor rod)

Annex C 16



Table C21:	Displacements under	er tension load	<sup>l)</sup> in hammer drill	ed holes (HD),
compressed	d air drilled holes (CI	) and with holl	ow 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	crete C20/25	under static an	d quasi	-static	action	for a se	rvice li	fe of 50	years			
Temp range I:	$\delta_{N0}$ -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	$\delta_{N\infty}$ -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:	$\delta_{N0}$ -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 C20/25 under static and quasi-static action for a service life of 50 years												
Temp range I:	$\delta_{N0}$ -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	$\delta_{N\infty}$ -factor	[mm/(N/mm <sup>2</sup> )]	0,115	0,122	0,128	0,135	0,142	0,155	0,171	0,171	0,181	0,194
Temp range II:	$\delta_{N0}$ -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 <sup>2</sup> )]	0,154	0,163	0,172	0,181	0,189	0,207	0,229	0,229	0,242	0,260
Non-cracked cond	crete C20/25	under static an	d quasi	-static	action	for a se	rvice li	fe of 10	0 years	3		
Temp range I:	$\delta_{N0}$ -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	$\delta_{N\infty}$ -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 ye	ars			
Temp range I:	$\delta_{N0}$ -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	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,115	0,122	0,128	0,135	0,142	0,155	0,171	0,171	0,181	0,194

<sup>1)</sup> Calculation of the displacement

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

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

# Table C22: Displacements under tension load<sup>1)</sup> in diamond drilled holes (DD)

Anchor size reinforcing bar				Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Non-cracked concrete C20/25 under static and quasi-static action for a service life of 50 years												
Temp range I: 40°C/24°C	$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,008	0,009	0,009	0,01	0,011	0,012	0,013	0,013	0,014	0,015
	$\delta_{N\infty}$ -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:	$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,009	0,011	0,011	0,012	0,013	0,014	0,015	0,015	0,016	0,018
I '. ". F	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,048	0,051	0,054	0,058	0,061	0,068	0,076	0,076	0,081	0,088

<sup>1)</sup> Calculation of the displacement

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

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

# Table C23: Displacements under shear load<sup>2)</sup> for all drilling methods

Anchor size reinforcing bar			Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
For concrete C2	0/25 under st	-static	action									
All temperature	$\delta_{V0}$ -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

<sup>&</sup>lt;sup>2)</sup> Calculation of the displacement

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

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

# B+BTec Injection System BIS-PE GEN3 for concrete

#### **Performances**

Displacements under static and quasi-static action (rebar)

Annex C 17



Tabl	e C24: Characto (perform	eristic value											
Ancho	r size threaded rod				M8	M10	M12	M16	M20	M24	M27	M30	
Steel f	ailure												
(Seism			N <sub>Rk,s,eq,C1</sub>	[kN]				1,0 •	N <sub>Rk,s</sub>				
Characteristic tension resistance, (Seismic C2) Steel, strength class 8.8 Stainless Steel A4 and HCR, Strength class ≥70		N <sub>Rk,s,eq,C2</sub>	[kN]	NPA			1,0 • N <sub>Rk,s</sub>				PA		
Partial	factor		γ <sub>Ms,N</sub>	/Ms,N [-] see Table C1									
Combi	ned pull-out and co	ncrete failure											
	teristic bond resistar holes (CD) and with			d concrete (	C20/25	in han	nmer dı	rilled ho	oles (Hi	D), com	presse	ed air	
ē	L: 40°C/24°C  I: 72°C/50°C		τ <sub>Rk,eq,C1</sub>	[N/mm <sup>2</sup> ]	7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5	
eratu ige		Dry, wet concrete and	<sup>τ</sup> Rk,eq,C2	[N/mm <sup>2</sup> ]	NPA		5,8	4,8	5,0	5,1	NI	PA	
mpe		flooded bore hole	<sup>τ</sup> Rk,eq,C1	[N/mm²]	6,0	6,0	7,0	7,0	7,0	7,0	7,0	7,0	
_ Ψ	I: 72°C/50°C	TIOIC	<sup>τ</sup> Rk,eq,C2	[N/mm²]	NPA		5,0	4,1	4,3	4,4	NI	PA	
	tion factor ψ <sup>0</sup> sus in c CD) and with hollow		-cracked conci	ete C20/25	in har	mmer d	drilled h	noles (H	HD), co	mpres	sed air	drilled	
Temperature range	I: 40°C/24°C	Dry, wet concrete and	J.,,0	r 1				0,	80				
Tempe	II: 72°C/50°C	flooded bore hole	Ψ <sup>0</sup> sus	[-]				0,	68				
Increas	sing factors for concr	ete $\psi_{C}$	C25/30 to	C50/60				1	,0				
Concre	ete cone failure												
Relevant parameter								see Ta	able C2				
Splitting													
	Relevant parameter						see Table C2						
	ation factor			I									
	for dry and wet concrete (HD; HDB, CD) for flooded bore hole (HD; HDB, CD)		$\gamma_{inst}$	[-]					,0				
for floo	aea bore noie (HD; F	111				1	,2						

B+BTec Injection System BIS-PE GEN3 for concrete	
Performances Characteristic values of tension loads under seismic action (performance category C1+C2)	Annex C 18



Table C25: Charac (perfor	teristic value mance categ															
Anchor size threaded ro	d			M8	M10	M12	M16	M20	M24	M27	M30					
Steel failure																
Characteristic tension resi (Seismic C1)	istance	N <sub>Rk,s,eq,C1</sub>	[kN]				1,0 •	N <sub>Rk,s</sub>								
Characteristic tension resi (Seismic C2) Steel, strength class 8.8 Stainless Steel A4 and H0 Strength class ≥70	·	N <sub>Rk,s,eq,C2</sub>	[kN]	N	NPA 1,0 • N <sub>Rk,s</sub>					NPA						
Partial factor		γ <sub>Ms,N</sub>	[-]				see Ta	d holes (HD), compressed air								
Combined pull-out and	concrete failure		•	•												
Characteristic bond resistantial drilled holes (CD) and with			d concrete (	C20/25	in han	nmer di	illed ho	oles (HI	D), com	npresse	d air					
Temperature range II - 1 Co. 57 Co. 50 Co. 5	Dry, wet concrete and	<sup>τ</sup> Rk,eq,C1	[N/mm²]	6,5	6,5	7,5	7,5	7,5	7,5	7,5	7,5					
Temperar	flooded bore hole	<sup>τ</sup> Rk,eq,C2	[N/mm <sup>2</sup> ]	NPA		5,8 4,8 5,0 5,1			NPA							
Reduction factor $\psi^0_{sus}$ in holes (CD) and with hollo		-cracked conc	rete C20/25	in hai	mmer c	drilled h	noles (F	HD), co	mpres	sed air	drilled					
Temperature range range C/57% C C C C C C C C C C C C C C C C C C C	Dry, wet concrete and flooded bore hole	$\Psi^0$ sus	[-]				0,	80								
Increasing factors for cond	crete ψ <sub>C</sub>	C25/30 to	C50/60				1	,0								
Concrete cone failure		•		I												
Relevant parameter							see Ta	ble C2	1							
Splitting																
Relevant parameter							see Ta	ble C2	1							
Installation factor																
for dry and wet concrete (		$\gamma_{inst}$	[-]					,0								
r flooded bore hole (HD; HDB, CD)		rinst	.,				1	,2								

B+BTec Injection System BIS-PE GEN3 for concrete	
Performances Characteristic values of tension loads under seismic action (performance category C1+C2)	Annex C 19



Table C26: Characteristic (performance			oads	undei	r seisı	mic ac	tion			
Anchor size threaded rod			М8	M10	M12	M16	M20	M24	M27	M30
Steel failure without lever arm				•			•	•		
Characteristic shear resistance (Seismic C1)	V <sub>Rk,s,eq,C1</sub>	[kN]				0,70	o∙v <sup>0</sup> <sub>Rk</sub>	.,s		
Characteristic shear resistance (Seismic C2), Steel, strength class 8.8 Stainless Steel A4 and HCR, Strength class ≥70	V <sub>Rk,s,eq,C2</sub>	[kN]	N	PA		0,70 •	V <sup>0</sup> Rk,s		NI	PA
Partial factor	γ <sub>Ms,V</sub> [-] see Table C1									
Ductility factor	k <sub>7</sub>	[-]					1,0			
Steel failure with lever arm	<u>'</u>									
	M <sup>0</sup> Rk,s,eq,C1	[Nm]			No Pe	rforman	ce Asse	essed (N	IPA)	
Characteristic bending moment	M <sup>0</sup> <sub>Rk,s,eq,C2</sub>	[Nm]			No Pe	rforman	ce Asse	essed (N	IPA)	
Concrete pry-out failure										
Factor	k <sub>8</sub>	[-]					2,0			
Installation factor	γinst	[-]					1,0			
Concrete edge failure	·									
Effective length of fastener	If	[mm]	$\min(h_{ef}; 12 \cdot d_{nom}) \qquad \min(h_{ef}; 300mn)$							300mm)
Outside diameter of fastener	d <sub>nom</sub>	[mm]	nm] 8 10 12 16 20 24 27						30	
Installation factor	γinst	[-]	1,0							
Factor for annular gap	$\alpha_{\sf gap}$	[-]	[-] 0,5 (1,0) <sup>1)</sup>							

<sup>&</sup>lt;sup>1)</sup> 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+C2)	Annex C 20



Table C27: Charac	cteristic va								ion				
Anchor size reinforcing			-						Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Steel failure							•			•			
Characteristic tension res	sistance	N <sub>Rk,s,eq</sub>	[kN]		1,4 <sup>2)</sup> crete C20/25 in hammer drilled holes (HD), compressed air  7,0 7,0 8,5 8,5 8,5 8,5 8,5 8,5 8,5 8,5 8,5								
Cross section area		As	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial factor		γ <sub>Ms,N</sub>	[-]					1,	<b>4</b> <sup>2)</sup>				
Combined pull-out and	concrete failu	ire	•										
Characteristic bond resis drilled holes (CD) and w			cracked co	ncrete	C20/2	25 in h	amme	r drille	d hole	s (HD)	), comp	oresse	d air
II: 72°C/50°C	Dry, wet concrete and	<sup>τ</sup> Rk,eq	[N/mm²]	7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5	8,5	8,5
등 II: 72°C/50°C	flooded bore hole	<sup>τ</sup> 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 $\psi^0_{sus}$ in holes (CD) and with holls			concrete (	C20/25	in ha	mmer	drilled	holes	(HD),	compr	essed	air dril	led
I: 40°C/24°C  Tange  II: 72°C/50°C	Dry, wet concrete	J.,,0	r.1					0,	80				
0	and flooded bore hole	Ψ <sup>0</sup> sus	[-]					0,	68				
Increasing factors for cor	icrete ψ <sub>C</sub>	C25/30 to	C50/60					1	,0				
Concrete cone failure													
Relevant parameter							;	see Ta	able C	2			
Splitting													
Relevant parameter						see Ta	able C	2					
Installation factor													
-	or dry and wet concrete (HD; HDB, CD)								,0				
for flooded bore hole (HD	[ []					1	,2						

 $<sup>^{\</sup>rm 1)}$   $f_{uk}$  shall be taken from the specifications of reinforcing bars  $^{\rm 2)}$  in absence of national regulation

B+BTec Injection System BIS-PE GEN3 for concrete	
Performances Characteristic values of tension loads under seismic action (performance category C1)	Annex C 21



	Table C28: Characteristic values of tension loads under seismic action (performance category C1) for a service life of 100 years												
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 tension res	sistance	N <sub>Rk,s,eq</sub>	[kN]		1,4 <sup>2)</sup> ete C20/25 in hammer drilled holes (HD), compressed air								
Cross section area		A <sub>s</sub>	[mm²]	50	79	113	154	201	314	452	491	616	804
Partial factor		γ <sub>Ms,N</sub>	[-]	1,4 <sup>2)</sup>									
Combined pull-out and	concrete failu	ıre	•										
drilled holes (CD) and w			cracked co	ncrete	C20/2	25 in h	amme	r drille	d hole	s (HD)	, comp	oresse	d air
Temperature range :I O.057/0.00	[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 <sup>0</sup> <sub>sus</sub> in	cracked and r	on-cracked	concrete (	C20/25	in ha	mmer	drilled	holes	(HD),	compr	essed	air dril	led
holes (CD) and with holl		B)											
Temperature range I: 40°C/57*C C	Dry, wet concrete and flooded bore hole	Ψ <sup>0</sup> sus	[-]					0,	80				
Increasing factors for cor	icrete $\psi_{C}$	C25/30 to	C50/60					1	,0				
Concrete cone failure		•											
Relevant parameter							;	see Ta	able C	2			
Splitting													
Relevant parameter					;	see Ta	able C	2					
Installation factor													
for dry and wet concrete for flooded bore hole (HD	[-]	1,0 1,2											

 $<sup>^{1)}</sup>$   $f_{uk}$  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 tension loads under seismic action (performance category C1)	Annex C 22



	Table C29: 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 without lever arm			•										
Characteristic shear resistance	V <sub>Rk,s,eq</sub>	[kN]	0,35 • A <sub>s</sub> • f <sub>uk</sub> <sup>1)</sup>										
Cross section area	A <sub>s</sub>	[mm²]	50 79 113 154 201 314 452 491 616					616	804				
Partial factor	γ <sub>Ms,V</sub>	[-]	1,52)										
Ductility factor	k <sub>7</sub>	[-]	1,0										
Steel failure with lever arm													
Characteristic bending moment	M <sup>0</sup> <sub>Rk,s,eq</sub>	[Nm]	No Performance Assessed (NPA)										
Concrete pry-out failure			•										
Factor	k <sub>8</sub>	[-]						2,0					
Installation factor	γ <sub>inst</sub>	[-]						1,0					
Concrete edge failure													
Effective length of fastener	l <sub>f</sub>	[mm]		ı	min(h <sub>e</sub>	<sub>ef</sub> ; 12 ·	· d <sub>nom</sub>	)		min(	h <sub>ef</sub> ; 300	mm)	
Outside diameter of fastener	d <sub>nom</sub>	[mm]	8	10	12	14	16	20	24	25	28	32	
Installation factor	γ <sub>inst</sub>	[-]						1,0					
Factor for annular gap	$\alpha_{\sf gap}$	[-]					0,	5 (1,0	)3)				

<sup>1)</sup> fuk shall be taken from the specifications of reinforcing bars

B+BTec Injection System BIS-PE GEN3 for concrete	
Performances Characteristic values of shear loads under seismic action (performance category C1)	Annex C 23

<sup>2)</sup> 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



Table C30: Displa	Table C30: Displacements under tension load <sup>1)</sup> (threaded rod)													
Anchor size threaded ro	od		M8	M10	M12	M16	M20	M24	M27	M30				
Non-cracked and cracked	ed concrete (	C20/25 under seis	smic C1	action f	or a ser	vice life	of 50 ye	ars						
Temperature range I: 40°C/24°C	$\delta_{\text{N0}}$ -factor	[mm/(N/mm²)]	0,069	0,071	0,072	0,074	0,076	0,079	0,081	0,082				
	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,193	0,115	0,122	0,128	0,135	0,142	0,155	0,171				
Temperature range II:	$\delta_{\text{N0}}$ -factor	[mm/(N/mm²)]	0,092	0,095	0,096	0,099	0,102	0,106	0,109	0,110				
72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,259	0,154	0,163	0,172	0,181	0,189	0,207	0,229				
Non-cracked and crack	ed concrete (	C20/25 under seis	smic C1	action f	or a ser	vice life	of 100 y	ears						
Temperature range I: 40°C/24°C	$\delta_{\text{N0}}$ -factor	[mm/(N/mm²)]	0,069	0,071	0,072	0,074	0,076	0,079	0,081	0,082				
	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,193	0,115	0,122	0,128	0,135	0,142	0,155	0,171				

# Table C31: Displacements under tension load<sup>1)</sup> (rebar)

Anchor size reinfo	rcing bar		Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32		
Non-cracked and	Non-cracked and cracked concrete C20/25 under seismic C1 action for a service life of 50 years													
Temperature	$\delta_{\text{N0}}$ -factor	[mm/(N/mm²)]	0,069	0,071	0,072	0,073	0,074	0,076	0,079	0,079	0,081	0,084		
range I: 40°C/24°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,115	0,122	0,128	0,135	0,142	0,155	0,171	0,171	0,181	0,194		
Temperature	$\delta_{\text{N0}}$ -factor	[mm/(N/mm²)]	0,092	0,095	0,096	0,098	0,099	0,102	0,106	0,106	0,109	0,113		
range II: 72°C/50°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,154	0,163	0,172	0,181	0,189	0,207	0,229	0,229	0,242	0,260		
Non-cracked and	cracked con	crete C20/25 un	der sei	smic C	1 action	າ for a s	service	life of	100 yea	rs				
l range l·	$\delta_{\text{N0}}$ -factor	[mm/(N/mm²)]	0,069	0,071	0,072	0,073	0,074	0,076	0,079	0,079	0,081	0,084		
	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,115	0,122	0,128	0,135	0,142	0,155	0,171	0,171	0,181	0,194		

<sup>1)</sup> Calculation of the displacement

 $\delta_{N0} = \delta_{N0}$ -factor  $\cdot \tau$ ;

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

# Table C32: Displacements under shear load<sup>2)</sup> (threaded rod)

Anchor size threaded rod				M10	M12	M16	M20	M24	M27	M30		
Non-cracked and cracked concrete C20/25 under seismic C1 action												
All temperature ranges	$\delta_{V0}$ -factor	[mm/kN]	0,06	0,06	0,05	0,04	0,04	0,03	0,03	0,03		
	$\delta_{V\infty}$ -factor	[mm/kN]	0,09	0,08	0,08	0,06	0,06	0,05	0,05	0,05		

# Table C33: Displacement under shear load<sup>1)</sup> (rebar)

Anchor size reinforcing bar				Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
For concrete C20/25 under seismic C1 action												
All temperature	$\delta_{V0}$ -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

<sup>&</sup>lt;sup>2)</sup> Calculation of the displacement

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

 $\delta_{V\infty} = \delta_{V\infty}$ -factor  $\cdot$  V; (V: action shear load)

B+BTec Injection System BIS-PE GEN3 for concrete	
Performances Displacements under seismic C1 action (threaded rods and rebar)	Annex C 24



Table C34: D	Table C34: Displacements under tension load <sup>1)</sup> (threaded rod)												
Anchor size threaded rod M8 M10 M12 M16 M20										M30			
Non-cracked and cracked concrete C20/25 under seismic C2 action													
All temperature	δ <sub>N,eq(DLS)</sub>	[mm]	N	DΛ	0,21	0,24	0,27	0,36	NPA				
ranges	$\delta_{N,eq(ULS)}$	[mm]	NPA -		0,54	0,51	0,54	0,63	INF	-A			

## Table C35: Displacements under shear load (threaded rod)

Anchor size threaded rod			M8	M10	M12	M16	M20	M24	M27	M30		
Non-cracked and cracked concrete C20/25 under seismic C2 action												
All temperature ranges	$\delta_{V,eq(DLS)}$	[mm]	NII	ID A	3,1	3,4	3,5	4,2	NF	ο Λ		
	$\delta_{V,ep(ULS)}$	[mm]	NPA	6,0	7,6	7,3	10,9	INI	-A			

B+BTec Injection System BIS-PE GEN3 for concrete

Performances
Displacements under seismic C2 action (threaded rods)

Annex C 25