Deutsches Institut für Bautechnik
DIBt

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Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

Designated according to Article 29 of Regulation (EU) No 305/2011 and member of EOTA (European Organisation for Technical Assessment)

European Technical Assessment — ETA-19/0501 of 30 October 2019

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	fischer Superbond dynamic
Product family to which the construction product belongs	Bonded anchor for use in concrete under fatigue cyclic loading
Manufacturer	fischerwerke GmbH & Co. KG Otto-Hahn-Straße 15 79211 Denzlingen DEUTSCHLAND
Manufacturing plant	fischerwerke
This European Technical Assessment contains	25 pages including 3 annexes which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	EAD 330250-00-0601

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Specific Part

1 Technical description of the product

The injection system fischer superbond dynamic is a bonded anchor consisting of a cartridge with injection mortar FIS SB or FIS SB High Speed or mortar capsule RSB, an anchor rod FIS A or RG M, a centering sleeve (only for through-setting installation), a conical washer with bore, a hexagon nut with spherical contact surface and a locknut. Alternatively the hexagon nut with spherical contact surface can be replaced by a spherical disc with hexagon nut.

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 resin capsule is placed into the hole and the steel element is driven by machine with simultaneous hammering and turning. The anchor rod is anchored via the bond between steel element, chemical 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 fatigue resistance under cyclic tension loading (Assessment method C)	
Characteristic steel fatigue resistance	See Annexes C1 and C3
Characteristic concrete cone and splitting fatigue resistance	
Characteristic combined pull- out /concrete cone fatigue resistance	
Characteristic fatigue resistance under cyclic shear loading (Assessment method C)	
Characteristic steel fatigue resistance	See Annexes C2 and C3
Characteristic concrete edge fatigue resistance	
Characteristic concrete pry out fatigue resistance	

Essential characteristic	Performance
Characteristic fatigue resistance under cyclic combined tension and shear loading (Assessment method C)	
Characteristic steel fatigue resistance	See Annexes C2 and C3
Load transfer factor for cyclic tension and shear loading	
Load transfer factor	See Annexes C2 and C3

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

In accordance with European Assessment Document No. 330250-00-0601, 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 with Deutsches Institut für Bautechnik.

Issued in Berlin on 30 October 2019 by Deutsches Institut für Bautechnik

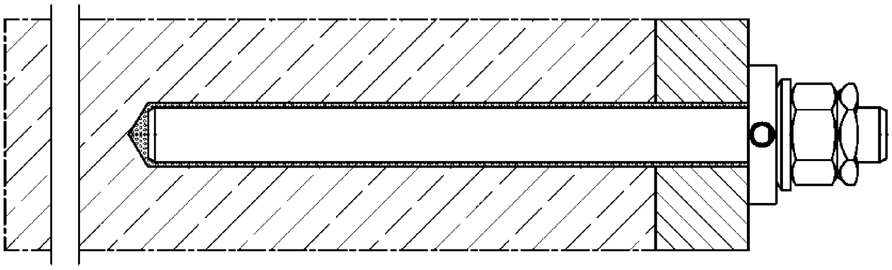
Dr.-Ing. Lars Eckfeldt
p. p. Head of Department

beglaubigt:
Stiller

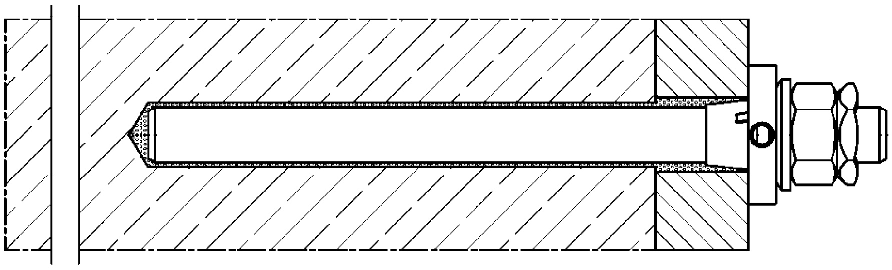
Installation conditions

fischer anchor rod FIS A or RG M with fischer injection system FIS SB

Pre positioned installation with the necessary components (annular gap filled with mortar)

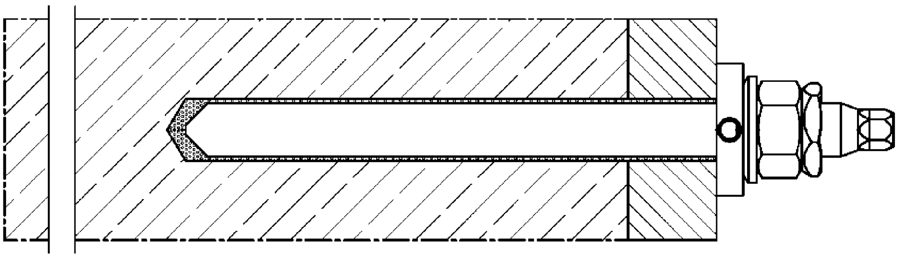


Push through installation with the necessary components (annular gap filled with mortar)



fischer anchor rod RG M with fischer mortar capsule system RSB

Pre-positioned installation with the necessary components (annular gap filled with mortar)



Figures not to scale

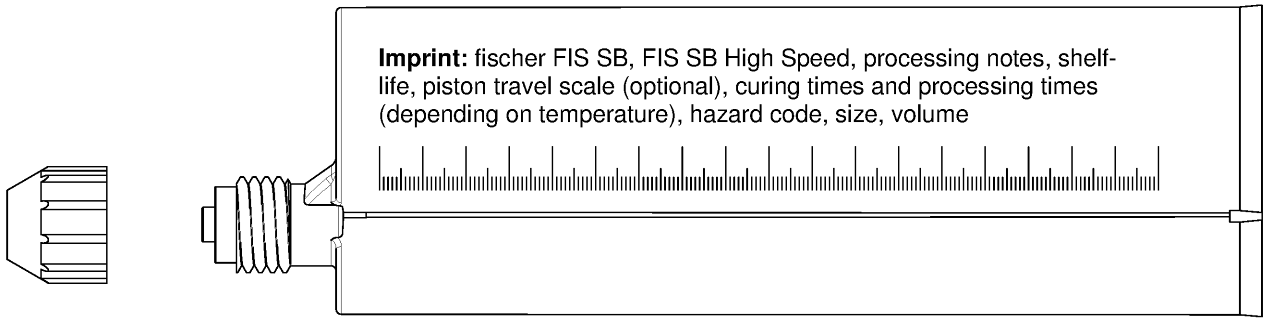
fischer Superbond dynamic

Product description
Installation conditions

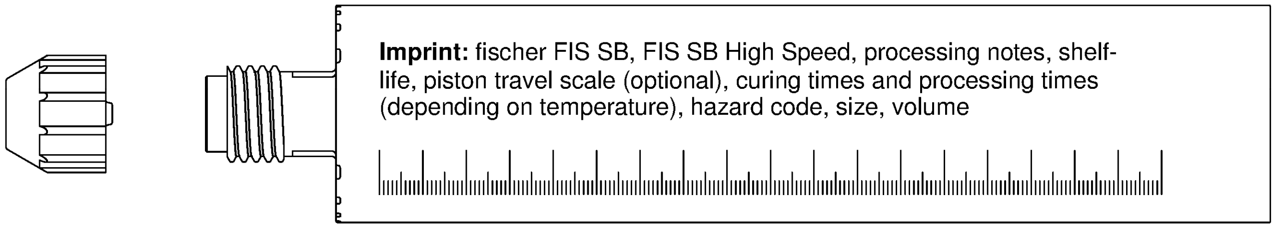
Annex A 1

Overview system components Part 1

Mortar cartridge (shuttle cartridge) with sealing cap; Size: 390 ml, 585 ml, 1100 ml, 1500 ml

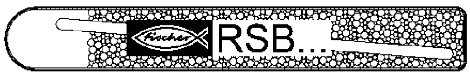


Mortar cartridge (coaxial cartridge) with sealing cap; Size: 150 ml, 300 ml ,380 ml, 410 ml

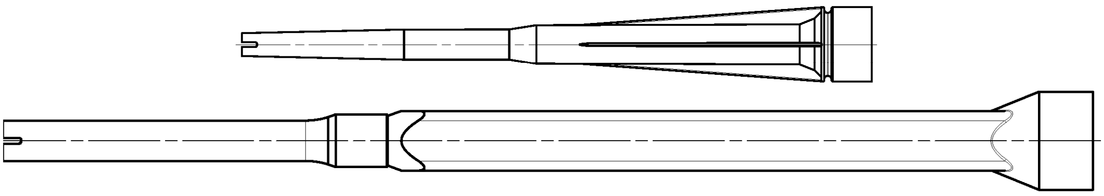


Mortar capsule

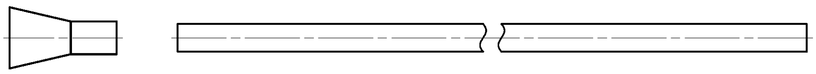
Size: 12 mini, 12, 16 mini, 16



Static mixer FIS MR Plus or UMR



Injection adapter / extension tube for static mixer



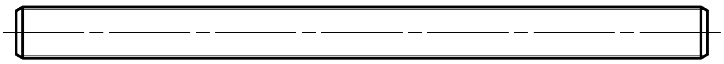
Figures not to scale

fischer Superbond dynamic	Annex A 2
System description Overview system components part 1; cartridges / capsule / static mixer / injection adapter	

Overview system components Part 2

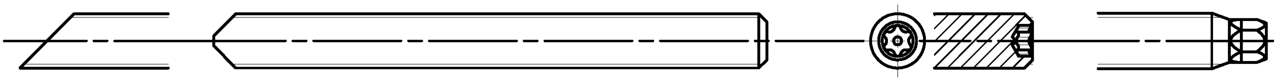
fischer anchor rod FIS A

Size: M12, M16

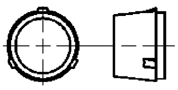


fischer anchor rod RG M

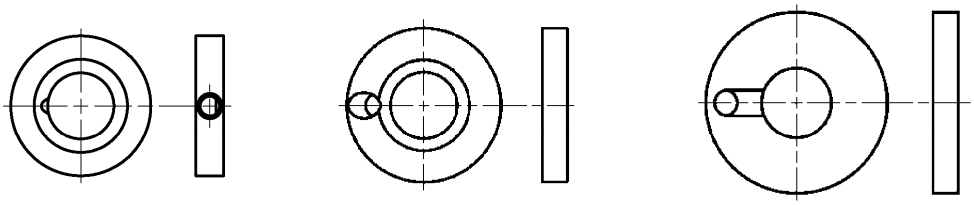
Size: M12, M16



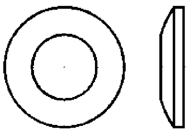
Centering sleeve



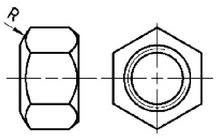
fillable conical washer (various versions)



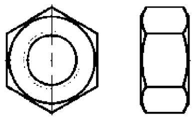
spherical washer



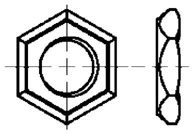
hexagonal nut with spherical contact surface



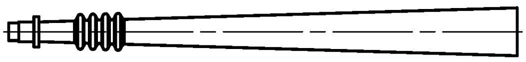
hexagon nut



lock nut

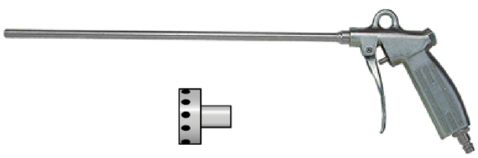


Filling adapter



Cleaning brush BS

Blow-out pump ABG or ABP with cleaning nozzle



Figures not to scale

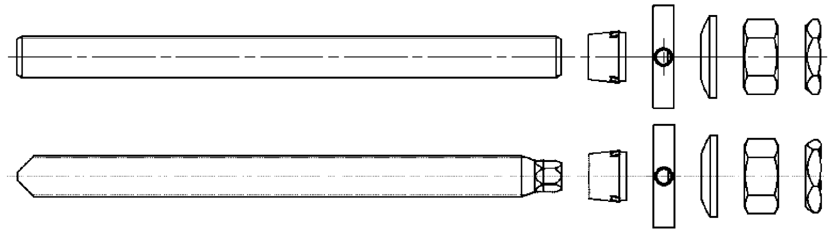
fischer Superbond dynamic	**Annex A 3**
System description Overview system components part 2; Steel components / filling adapter / cleaning brush / blow-out pump	

Table A4.1: Materials

Part	Designation	Material
1	Injection cartridge	Mortar, hardener, filler
2	Resin capsule	Mortar, hardener, filler
3	fischer anchor rod FIS A or RG M	Property class 8.8; EN ISO 898-1:2013 zinc plated ≥ 5 µm EN ISO 4042:1999 A2K f_{uk} ≤ 1000 N/mm^2 A_5 > 12% fracture elongation
4	Centering sleeve	Plastic
5	Fillable conical washer similar to DIN 6319-G	zinc plated ≥ 5 µm, EN ISO 4042:1999 A2K
6	Spherical washer	zinc plated ≥ 5 µm, EN ISO 4042:1999 A2K
7	Hexagon nut	Property class 8; EN ISO 898-2:2012 zinc plated ≥ 5 µm, ISO 4042:1999 A2K
7a	hexagonal nut with spherical contact surface	
8	Lock nut	zinc plated ≥ 5 µm, EN ISO 4042:1999 A2K

Specifications of intended use (part 1)

Table B1.1: Overview use and performance categories injection motar system

Anchorages subject to			**FIS SB with**	
			fischer anchor rod FIS A or fischer anchor rod RG M 	
Hammer drilling with standard drill bit 			Nominal drill bit diameter (d_0) 14 mm and 18 mm	
Hammer drilling with hollow drill bit  (fischer “FHD”, Heller "Duster Expert"; Bosch “Speed Clean”; Hilti “TE-CD, TE-YD")				
Diamond drilling 			not permitted	
Fatigue load, in		uncracked concrete	M12 and M16	
		cracked concrete		
Design method I acc. to TR061			$n = 1$ to $n = \infty$	
Design method II acc. to TR061			$n = \infty$	
Use category	I1	dry or wet concrete	M12 and M16	
Installation direction			D3 Downwards, horizontal and upwards (overhead) installation	
Installation method			prepositioned or push through installation	
Installation temperature			FIS SB: $T_{i,min} = -15$ °C to $T_{i,max} = +40$ °C FIS SB High Speed: $T_{i,min} = -20$ °C to $T_{i,max} = +40$ °C	
In-service temperature	Temperature range I:		-40 °C to +40 °C	(max. short term temperature +40 °C; max. long term temperature +24 °C)
	Temperature range II:		-40 °C to +80 °C	(max. short term temperature +80 °C; max. long term temperature +50 °C)

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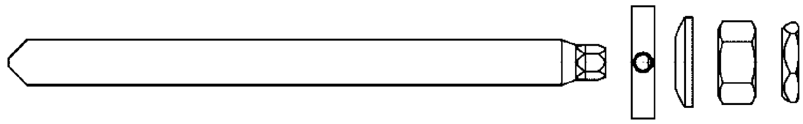
Specifications of intended use (part 2)

Table B2.1: Overview use and performance categories resin capsule system

Anchorages subject to		**RSB with**	
		fischer anchor rod RG M 	
Hammer drilling with standard drill bit 		Nominal drill bit diameter (d_0) 14 mm and 18 mm	
Hammer drilling with hollow drill bit  (fischer “FHD”, Heller "Duster Expert"; Bosch „Speed Clean“; Hilti "TE-CD, TE-YD")			
Diamond drilling 		Nominal drill bit diameter (d_0) 14 mm and 18 mm	
Fatigue load, in	uncracked concrete cracked concrete	M12 and M16	
Design method I acc. to TR061		n = 1 to n = ∞	
Design method II acc. to TR061		n = ∞	
Use category	I1 dry or wet concrete	M12 and M16	
Installation direction		D3 Downward, horizontal and upwards (overhead) installation	
Installation method		Only pre-positioned installation	
Installation temperature		RSB: $T_{i,min}$ = -30 °C to $T_{i,max}$ = +40 °C	
In-service temperature	Temperature range I:	-40 °C to +40 °C	(max. short term temperature +40 C; max. long term temperature +24 C)
	Temperature range II:	-40 °C to +80 °C	(max. short term temperature +80 C; max. long term temperature +50 C)

fischer Superbond dynamic	Annex B 2
Intended use Specifications resin capsule system RSB (part 2)	

Specifications of intended use (part 3)

Base materials:

- Compacted reinforced or unreinforced normal weight concrete without fibers of strength classes C20/25 to C50/60 according to EN 206:2013+A1:2016

Use conditions (Environmental conditions):

- Structures subject to dry internal conditions (zinc coated steel).

Design:

- Anchorages have to be designed by a responsible engineer with experience of concrete anchor design.
- Verifiable calculation notes and drawings are to be 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 have to be designed in accordance with:
  - EN 1992-4:2018 and
  - EOTA Technical Report TR 061 "Design method for fasteners in concrete under fatigue cyclic loading", Edition January 2013
- static and quasi static loading see ETA-12/0258
- Anchorages shall be positioned outside of critical regions (e.g. plastic hinges) of the concrete structure
- Fastenings in stand-off installation or with a grout layer are not covered by this European Technical Assessment (ETA)

Installation:

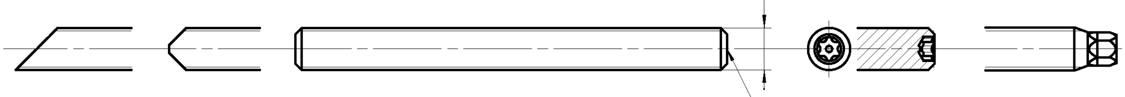
- Anchor installation is to be carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site
- In case of aborted hole: The hole shall be filled with mortar
- Anchorage depth should be marked and adhered to on installation
- If only tension loads are involved in the application, the annular gap does not need to be filled

fischer Superbond dynamic	**Annex B 3**
Intended use Specifications (part 3)	

Table B4.1: Installation parameters for fischer anchor rods in combination with injection mortar system FIS SB

fischer anchor rods			**Thread**	**M12**	**M16**
Width across flats		SW	[mm]	19	24
Nominal drill hole diameter		d_0	[mm]	14	18
Drill hole depth		h_0	[mm]	$h_0 = h_{ef}$	
Effective embedment depth		$h_{ef,\ min}$	[mm]	70	80
		$h_{ef,\ max}$	[mm]	240	320
Minimum spacing and minimum edge distance		$s_{min} = c_{min}$	[mm]	55	65
Diameter of the clearance hole of the fixture	prepositioned installation	d_f	[mm]	14-16	18-20
	push through installation	d_f	[mm]	15-16	19-20
Fixture thickness		$t_{fix,min}$	[mm]	12	16
		$t_{fix,max}$	[mm]	200	
Minimum thickness of concrete member		h_{min}	[mm]	$h_{ef} + 30$ (≥ 100)	$h_{ef} + 2d_0$ (≥ 116)
Protrusion anchor rod FIS A		$h_{p,min}$	[mm]	$25 + t_{fix}$	$30 + t_{fix}$
Protrusion anchor rod RG M		$h_{p,min}$	[mm]	$32 + t_{fix}$	$38 + t_{fix}$
Installation torque		T_{inst}	[Nm]	40	60

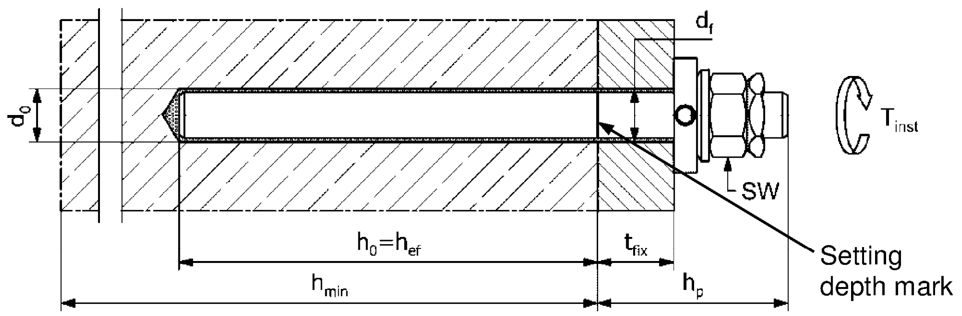
fischer anchor rod FIS A or RG M



Marking (on random place) fischer anchor rod:

Property class 8.8: • or colour coding

Installation conditions:



Installation conditions for RG M see Annex B 5

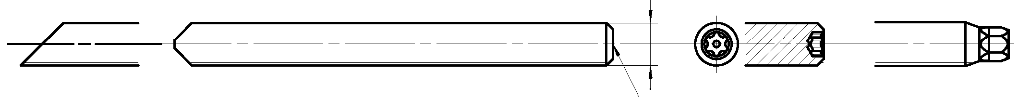
Figures not to scale

fischer Superbond dynamic	**Annex B 4**
Intended use Installation parameters fischer anchor rods FIS A and RG M in combination with injection mortar system FIS SB	

Table B5.1: Installation parameters for fischer anchor rods RG M in combination with resin capsule system RSB

fischer anchor rod RG M		**Thread**	**M12**	**M16**
Width across flats	SW	mm]	19	24
Nominal drill hole diameter	d_0		14	18
Drill hole depth	h_0		$h_0 = h_{ef}$	
Effective embedment depth	$h_{ef,1}$		75	95
	$h_{ef,2}$		110	125
	$h_{ef,3}$		150	190
Minimum spacing and minimum edge distance	$s_{min} = c_{min}$		55	65
Diameter of the clearance hole of the fixture — prepositioned installation	d_f		14-16	18-20
Fixture thickness	$t_{fix,min}$		12	16
	$t_{fix,max}$		200	
Minimum thickness of concrete member	h_{min}		$h_{ef} + 30$ (≥ 100)	$h_{ef} + 2d_0$ (≥ 116)
Protrusion anchor rod RG M	$h_{p,min}$		$32 + t_{fix}$	$38 + t_{fix}$
Installation torque	T_{inst}	[Nm]	40	60

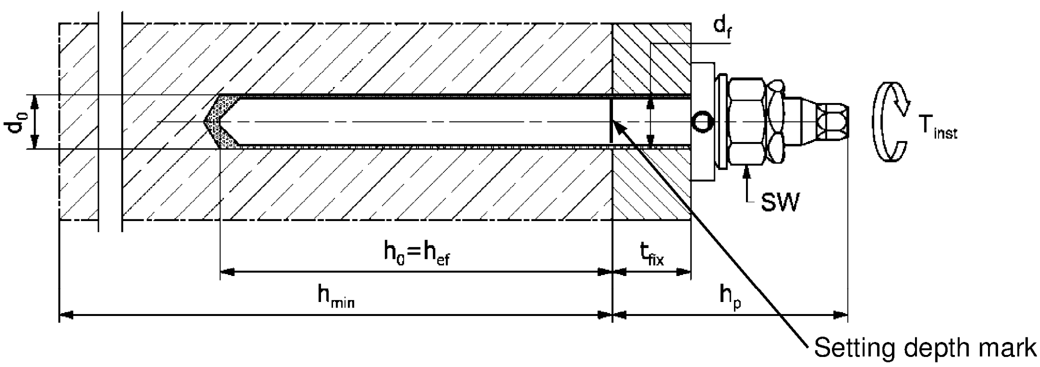
fischer Anchor rod RG M



Marking (on random place) fischer anchor rod RG M:

Property class 8.8: • or colour coding

Installation conditions:



Figures not to scale

fischer Superbond dynamic	**Annex B 5**
Intended use Installation parameters fischer anchor rod RG M in combination with resin capsule system RSB	

Table B6.1: Dimension of resin capsule RSB

Resin Capsule RSB			12 mini	12	16 mini	16
Capsule diameter	d_P	[mm]	12,5		16,5	
Capsule length	L_P	[mm]	72	97	72	95

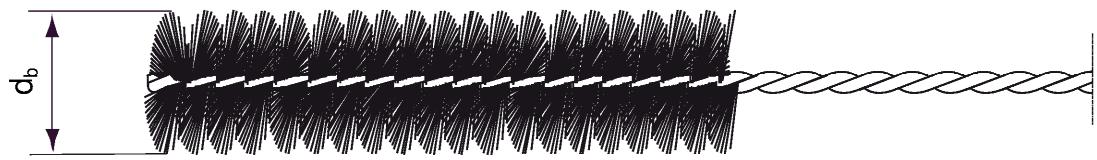
Table B6.2: Assignment of resin capsule RSB to fischer anchor rod RG M

Anchor rod RG M			M12	M16
Effective anchorage depth	$h_{ef,1}$	[mm]	75	95
Related capsule RSB		[-]	12 mini	16 mini
Effective anchorage depth	$h_{ef,2}$	[mm]	110	125
Related capsule RSB		[-]	12	16
Effective anchorage depth	$h_{ef,3}$	[mm]	150	190
Related capsule RSB		[-]	2x 12 mini	2x 16 mini

Table B6.3: Parameters of the cleaning brush BS (steel brush with steel bristles)

The size of the cleaning brush refers to the drill hole diameter

Nominal drill hole diameter	d_0	[mm]	14	18
Steel brush diameter	d_b	[mm]	16	20



fischer Superbond dynamic

Intended use
Dimensions of the capsules; Assignment of the capsule to the anchor rod RG M;
Cleaning brush (steel brush)

Annex B 6

Maximum processing time of the mortar and minimum curing time

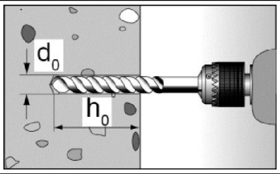
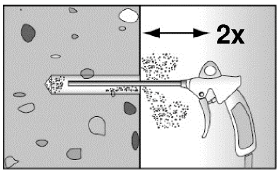
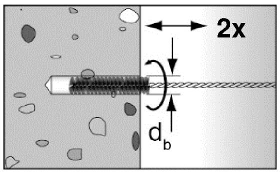
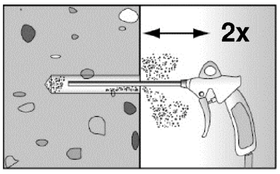
During the curing time of the mortar the concrete temperature may not fall below the listed minimum temperature. Minimal cartridge temperature +5 °C; minimal resin capsule temperature -15 °C

Table B7.1: FIS SB, RSB

Temperature at anchoring base [°C]	Maximum processing time t_{work}		Minimum curing time t_{cure}		
	FIS SB	FIS SB High Speed	FIS SB	FIS SB High Speed	RSB
-30 to -20	---	---	---	---	120 h
> -20 to -15	---	60 min	---	24 h	48 h
> -15 to -10	60 min	30 min	36 h	8 h	30 h
> -10 to -5	30 min	15 min	24 h	3 h	16 h
> -5 to ±0	20 min	10 min	8 h	2 h	10 h
> ±0 to +5	13 min	5 min	4 h	1 h	45 min
> +5 to +10	9 min	3 min	2 h	45 min	30 min
> +10 to +20	5 min	2 min	1 h	30 min	20 min
> +20 to +30	4 min	1 min	45 min	15 min	5 min
> +30 to +40	2 min	---	30 min	---	3 min

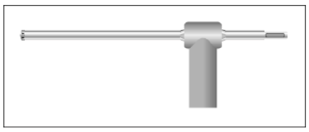
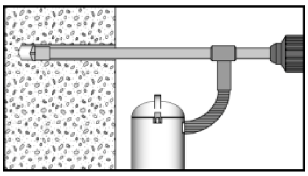
Installation instructions part 1; injection mortar system FIS SB

Drilling and cleaning the hole (hammer drilling with standard drill bit)

1		Drill the hole. Nominal drill hole diameter $\mathbf{d_0}$ and drill hole depth $\mathbf{h_0}$ see **table B4.1**
2		Clean the drill hole: Blow out the drill hole twice, with oil free compressed air (p ≥ 6 bar) In uncracked concrete the use of the manual blow-out pump ABG is possible (Installation parameters: d_0 < 18 mm and h_{ef} < 10d) 
3		Brush the drill hole twice. For deep holes use an extension. Corresponding brushes see **table B6.3**
4		Clean the drill hole: Blow out the drill hole twice, with oil free compressed air (p ≥ 6 bar) In uncracked concrete the use of the manual blow-out pump ABG is possible (Installation parameters: d_0 < 18 mm and h_{ef} < 10d) 

Go to step 6 (Annex B 9)

Drilling and cleaning the hole (hammer drilling with hollow drill bit)

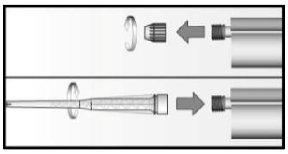
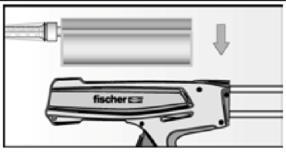
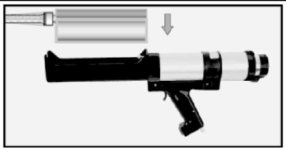
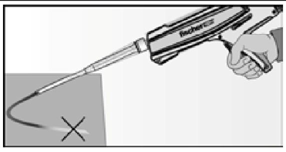
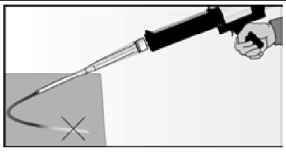
1		Check a suitable hollow drill (see **table B1.1**) for correct operation of the dust extraction
2		Use a suitable dust extraction system, e. g. Bosch GAS 35 M AFC or a comparable dust extraction system with equivalent performance data. Drill the hole with hollow drill bit. The dust extraction system has to extract the drill dust nonstop during the drilling process and must be adjusted to maximum power. Nominal drill hole diameter $\mathbf{d_0}$ and drill hole depth $\mathbf{h_0}$ see **table B4.1**

Go to step 6 (Annex B 9)

fischer Superbond dynamic	**Annex B 8**
Intended use Installation instructions part 1; injection motar system FIS SB	

Installation instructions part 2; injection mortar system FIS SB

Preparing the cartridge

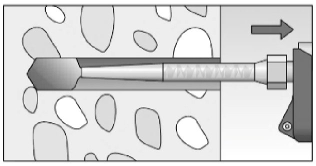
6			Remove the sealing cap Screw on the static mixer (the spiral in the static mixer must be clearly visible)
7			Place the cartridge into the dispenser
8			Extrude approximately 10 cm of material out until the resin is evenly grey in colour. Do not use mortar that is not uniformly grey

Go to step 9 (prepositioned installation Annex B 10 or push through installation Annex B11)

Installation instructions part 3, injection mortar system FIS SB

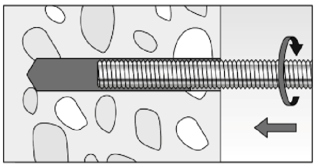
Prepositioned installation

9

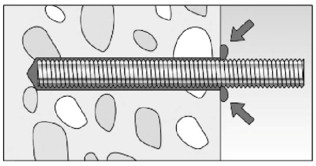


Fill approximately 2/3 of the drill hole with mortar. Always begin from the bottom of the hole and avoid bubbles.
For drill hole depth ≥ 150 mm use an extension tube. For overhead installation, deep holes h_0 > 250 mm use an injection-adapter.

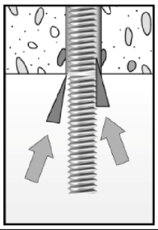
10



Only use clean and oil-free anchor elements.
Mark the setting depth of the anchor. Push the fischer anchor rod down to the bottom of the hole, turning it slightly while doing so.



After inserting the anchor element, excess mortar must be emerged around the anchor element. If not, pull out the anchor element immediately and reinject mortar.

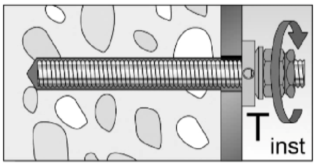


For overhead installations support the anchor rod with wedges.
(e. g. fischer centering wedges)

11

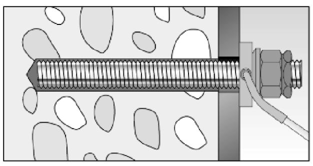
Wait for the specified curing time t_{cure}
see **table B7.1**

12



Attach the component and install the washer and nuts - without centering sleeve. Tighten the hexagon nut with installation torque T_{inst} (see **table B4.1**)
Tighten lock nut manually, then use wrench to give another quarter or half turn.

13



After the minimum curing time is reached, the gap between anchor and fixture (annular clearance) has to be filled with mortar (FIS SB or FIS SB High Speed) via the fillable conical washer.
If only tension loads are involved in the application, the annular gap does not necessarily have to be filled.

fischer Superbond dynamic

Intended use
Installation instructions part 3; prepositioned installation; injection mortar system FIS SB

Annex B 10

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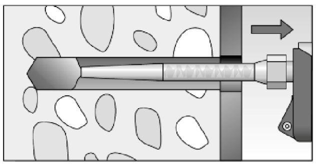
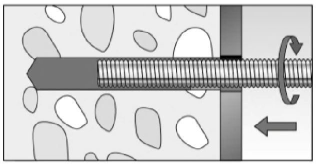
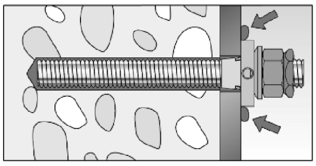
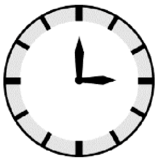
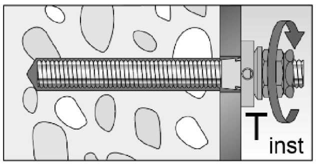
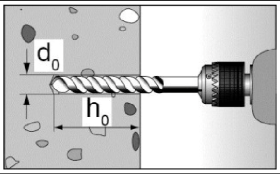
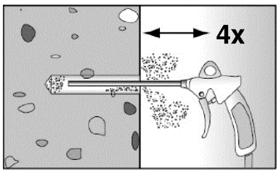
Installation instructions part 4, injection mortar system FIS SB

Push through installation

9		Fill approximately 2/3 of the drill hole incl. fixture with mortar. Always begin from the bottom of the hole and avoid bubbles. For drill hole depth ≥ 150 mm use an extension tube. For overhead installation, deep holes h_0 > 250 mm use an injection-adapter.
10		Only use clean and oil-free anchor elements. Mark the setting depth of the anchor. Push the fischer anchor rod down to the bottom of the hole, turning it slightly while doing so.
		After inserting the anchor element with pre-assembled components, excess mortar must be emerged around the anchor element (minimum on one point of the fillable conical washer). If not, pull out the anchor element immediately and reinject mortar.
11		Wait for the specified curing time t_{cure} see **table B7.1**
12		Tighten the hexagon nut with installation torque T_{inst} see **table B4.1.** Tighten lock nut manually, then use wrench to give another quarter or half turn.

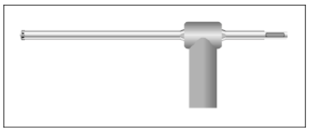
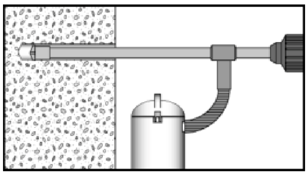
Installation instructions part 5; resin capsule RSB

Drilling and cleaning the hole (hammer drilling with standard drill bit)

1		Drill the hole. Nominal drill hole diameter $\mathbf{d_0}$ and drill hole depth $\mathbf{h_0}$ see **table B5.1**
2		Clean the drill hole: Blow out the drill hole four times, with oil free compressed air ($p \geq 6$ bar) In uncracked concrete the use of the manual blow-out pump ABG is possible (Installation parameters: $d_0 < 18$ mm and $h_{ef} < 10d$) 

Go to step 6 (Annex B 14)

Drilling and cleaning the hole (hammer drilling with hollow drill bit)

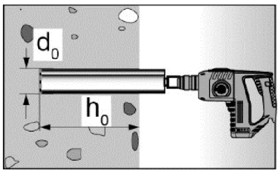
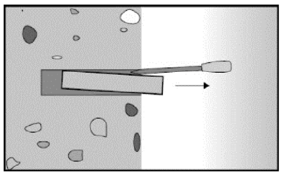
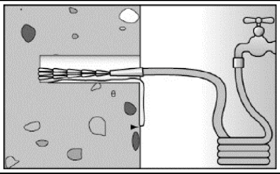
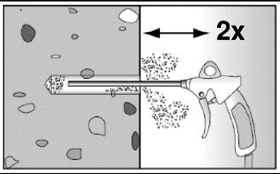
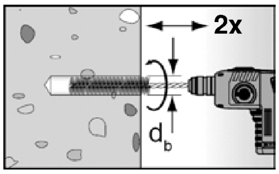
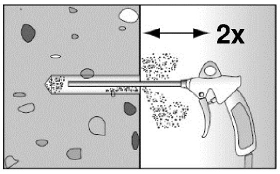
1		Check a suitable hollow drill (see **table B2.1**) for correct operation of the dust extraction
2		Use a suitable dust extraction system, e. g. Bosch GAS 35 M AFC or a comparable dust extraction system with equivalent performance data. Drill the hole with hollow drill bit. The dust extraction system has to extract the drill dust nonstop during the drilling process and must be adjusted to maximum power. Nominal drill hole diameter $\mathbf{d_0}$ and drill hole depth $\mathbf{h_0}$ see **table B5.1**

Go to step 6 (Annex B 14)

fischer Superbond dynamic	**Annex B 12**
Intended use Installation instructions part 5; resin capsule RSB	

Installation instructions part 6; resin capsule RSB

Drilling and cleaning the hole (wet drilling with diamond drill bit)

1		Drill the hole. Drill hole diameter $\mathbf{d_0}$ and nominal drill hole depth $\mathbf{h_0}$ see **table B5.1**		Break the drill core and remove it
2		Flush the drill hole, until clear water emerges from the drill hole		
3		Blow out the drill hole twice, using oil-free compressed air (p > 6 bar)		
4		Brush the drill hole twice using a power drill. Corresponding brushes see **table B6.3**		
5		Blow out the drill hole twice, using oil-free compressed air (p > 6 bar)		

Go to step 6 (Annex B 14)

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Installation instructions part 7; resin capsule RSB

Installation fischer anchor rod RG M

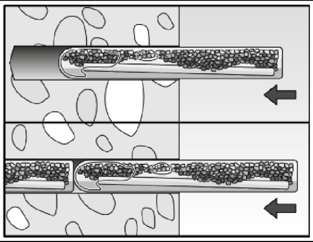
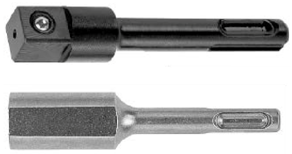
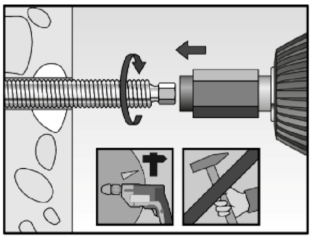
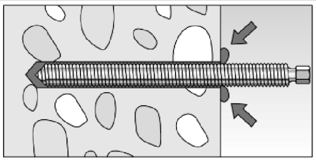
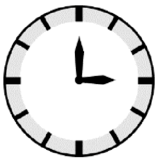
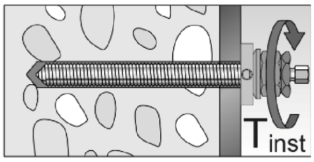
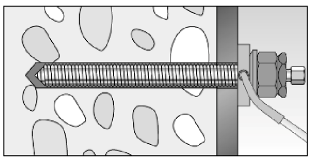
6		Resin capsule RSB or two RSB mini, must be pushed into the drill hole by hand  Depending on the anchor being installed, use a suitable setting tool
7		Only use clean and grease-free anchors. Using a suitable adapter, drive the fischer anchor rod RG M into the capsule using a hammer drill set on rotary hammer action. Stop when the anchor reaches the bottom of the hole and is set to the correct embedment depth
8		When reaching the correct embedment depth, excess mortar must emerge from the mouth of the drill hole. If not, the anchor must be pulled out directly and another resin capsule must be pushed into the drill hole. Setting process must be repeated (Step 7)
9		Wait for the specified curing time t_{cure} see **table B7.1**
10		Attach the component and install the washer and nuts - without centering sleeve. Tighten the hexagon nut with installation torque T_{inst} (see **table B5.1**). Tighten lock nut manually, then use wrench to give another quarter or half turn.
11		Fill the gap between anchor and fixture (annular clearance) with mortar (FIS SB or FIS SB High Speed) via fillable conical washer. If only tension loads are involved in the application, the annular gap does not necessarily have to be filled.

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Table C1.1: Essential characteristics under tension fatigue load for FIS SB / RSB; **Design method I** according to **TR 061**

Required evidence					
		Number of load cycles (n)			
		$n \leq 10^4$	$10^4 < n \leq 5 \cdot 10^6$	$5 \cdot 10^6 < n \leq 10^8$	$n > 10^8$
Tension load capacity					
Characteristic steel fatigue resistance					
$\Delta N_{Rk,s,0,n}$	[kN]	$0{,}75 \cdot N_{Rk,s,(8.8)} \cdot 0{,}33$	$0{,}75 \cdot N_{Rk,s,(8.8)} \cdot 10^{(-0{,}12 \cdot \log(n))}$	$0{,}75 \cdot N_{Rk,s,(8.8)} \cdot 10^{(-0{,}438-0{,}057 \cdot \log(n))}$	$0{,}75 \cdot N_{Rk,s,(8.8)} \cdot 0{,}12$
Characteristic combined pull- out /concrete cone fatigue resistance in uncracked and cracked concrete					
Characteristic bond strength in uncracked concrete					
$\Delta \tau_{Rk,p,ucr,0,n}$	[N/mm²]	$\tau_{Rk,ucr} \cdot 0{,}575$	$\tau_{Rk,ucr} \cdot 10^{(-0{,}06 \cdot \log(n))}$	$\tau_{Rk,ucr} \cdot 10^{(-0{,}207-0{,}029 \cdot \log(n))}$	$\tau_{Rk,ucr} \cdot 0{,}35$
Characteristic bond strength in cracked concrete					
$\Delta \tau_{Rk,p,cr,0,n}$	[N/mm²]	$\tau_{Rk,cr} \cdot 0{,}575$	$\tau_{Rk,cr} \cdot 10^{(-0{,}06 \cdot \log(n))}$	$\tau_{Rk,cr} \cdot 10^{(-0{,}207-0{,}029 \cdot \log(n))}$	$\tau_{Rk,cr} \cdot 0{,}35$
Characteristic fatigue resistance for concrete cone and concrete splitting					
Characteristic concrete fatigue resistance in uncracked concrete					
$\Delta N_{Rk,c/sp,ucr,0,n}$	[kN]	$N_{Rk,c/sp,ucr} \cdot 0{,}66$	$N_{Rk,c/sp,ucr} \cdot 1{,}1 \cdot n^{-0{,}055} \geq 0{,}5$		$N_{Rk,c/sp,ucr} \cdot 0{,}50$
Characteristic concrete fatigue resistance in cracked concrete					
$\Delta N_{Rk,c/sp,cr,0,n}$	[kN]	$N_{Rk,c/sp,cr} \cdot 0{,}66$	$N_{Rk,c/sp,cr} \cdot 1{,}1 \cdot n^{-0{,}055} \geq 0{,}5$		$N_{Rk,c/sp,cr} \cdot 0{,}50$
Exponents and load-transfer factor					
Exponent for combined load					
$\alpha_s = \alpha_{sn}$	[–]	0,5			
Load-transfer under					
ψ_{FN}	[–]	0,5			

$N_{Rk,s,(8.8)}$, $\tau_{Rk,ucr}$, $\tau_{Rk,cr}$ see ETA-12/0258

$N_{Rk,c/sp,ucr}$, $N_{Rk,c/sp,cr}$ see ETA-12/0258 and EN 1992-4:2018

fischer Superbond dynamic	**Annex C 1**
Performance Essential characteristic under tension fatigue load; Design method I according to TR 061	

Table C2.1: Essential characteristic under shear fatigue load for FIS SB / RSB; **Design method I** according to **TR 061**

Required evidence					
		Number of load cycles (n)			
		$n \leq 10^4$	$10^4 < n \leq 5 \cdot 10^6$	$5 \cdot 10^6 < n \leq 10^8$	$n > 10^8$
Shear load capacity					
Characteristic steel fatigue resistance					
$\Delta V_{Rk,s,0,n}$	[kN]	$V_{Rk,s,(8.8)} \cdot 0{,}23$	$V_{Rk,s,(8.8)} \cdot 10^{(-0{,}197 \cdot \log(n))}$	$V_{Rk,s,(8.8)} \cdot 10^{(-0{,}575-0{,}068 \cdot \log(n))}$	$V_{Rk,s,(8.8)} \cdot 0{,}08$
Characteristic concrete pry out fatigue resistance in cracked and uncracked concrete					
$\Delta V_{Rk,cp,0,n}$	[kN]	$V_{Rk,cp} \cdot 0{,}574$	$V_{Rk,cp} \cdot 1{,}2 \cdot n^{-0{,}08} \geq 0{,}5$		$V_{Rk,cp} \cdot 0{,}5$
Characteristic concrete edge fatigue resistance in cracked and uncracked concrete					
$\Delta V_{Rk,c,0,n}$	[kN]	$V_{Rk,c} \cdot 0{,}574$	$V_{Rk,c} \cdot 1{,}2 \cdot n^{-0{,}08} \geq 0{,}5$		$V_{Rk,c} \cdot 0{,}5$
Exponents, load-transfer factor					
Exponent for combined tension and shear loading, steel failure					
$\alpha_s = \alpha_{sn}$	[-]	0,5			
Exponent for combined tension and shear verification regarding failure modes other than steel failure					
α_c	[-]	1,5			
Load-transfer factor					
ψ_{FV}	[-]	0,5			

$V_{Rk,s,(8.8)}$ see ETA-12/0258

$V_{Rk,c}$, $V_{Rk,cp}$ see ETA-12/0258 and EN 1992-4:2018

fischer Superbond dynamic

Performance
Essential characteristic under shear fatigue load;
Design method I according to TR 061

Annex C 2

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Table C3.1: Essential characteristics under tension and shear fatigue load; **Design method II** according to **TR061**

Size			**M 12**	**M 16**
Tension load				
Effective embedment depth	$h_{ef,min}$	[mm]	95	125
Steel failure				
Characteristic steel fatigue resistance	$\Delta N_{Rk,s,0,\infty}$	[kN]	6,1	11,3
Exponent for combined tension and shear loading	$\alpha_s = \alpha_{sn}$	[-]	0,5	
Characteristic combined pull- out /concrete cone fatigue resistance in uncracked and cracked concrete				
Characteristic bond resistance	$\Delta\tau_{Rk,p,ucr,0\infty}$	[N/mm²]	$\tau_{Rk,ucr} \cdot 0{,}35$	
	$\Delta\tau_{Rk,p,cr,0,\infty}$	[N/mm²]	$\tau_{Rk,cr} \cdot 0{,}35$	
Concrete failure				
Characteristic concrete fatigue resistance	$\Delta N_{Rk,c,0,\infty}$	[-]	$0{,}5 \cdot N_{Rk,c}$ 1)	
	$\Delta N_{Rk,sp,0,\infty}$	[-]	$0{,}5 \cdot N_{Rk,sp}$ 1)	
Exponent for combined tension and shear verification	α_c	[-]	1,5	
Load-transfer factor	ψ_{FN}	[-]	0,5	
Shear load				
Steel failure				
Characteristic steel fatigue resistance	$\Delta V_{Rk,s,0,\infty}$	[kN]	2,7	5,0
Exponent for combined tension and shear loading	$\alpha_s = \alpha_{sn}$		0,5	
Concrete pryout failure				
Characteristic concrete fatigue resistance	$\Delta V_{Rk,cp,0,\infty}$	[kN]	$0{,}5 \cdot V_{Rk,cp}$ 1)	
Concrete edge failure				
Characteristic concrete fatigue resistance	$\Delta V_{Rk,c,0,\infty}$	[kN]	$0{,}5 \cdot V_{Rk,c}$ 1)	
The value of h_{ef} (=l_f) under shear load	l_f	[mm]	≥ 95	≥ 125
Effective outside diameter of the anchor	d_{nom}	[mm]	12	16
Exponent for combined tension and shear verification	α_c		1,5	
Load-transfer factor	ψ_{FV}	[-]	0,5	

1) $N_{Rk,c}$, $N_{Rk,sp}$, $V_{Rk,c}$ and $V_{Rk,cp}$ – Essential characteristics for concrete failure under static and quasi static load according to ETA-12/0258 and EN 1992-4:2018.

fischer Superbond dynamic	**Annex C 3**
Performance Essential characteristics under tension / shear fatigue load; Design method II according to TR 061	