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**European Technical Assessment Body** for construction products



## **European Technical Assessment**

## ETA-25/0482 of 8 August 2025

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

Injection system ULEP-585 for concrete

Bonded fastener and bonded expansion fastener for use in concrete

Youluo Precision Technology (Zhejiang) Co. 12# factory building, first floor

No. 19 Haiguan Avenue Xitangqiao Sub-district, Haiyan County

**VOLKSREPUBLIK CHINA** 

German factory

JIAXING CITY

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

EAD 330499-02-0601, Edition 12/2023

# **European Technical Assessment ETA-25/0482**

English translation prepared by DIBt



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#### **Specific Part**

#### 1 Technical description of the product

The "Injection system ULEP-585 for concrete" is a bonded anchor consisting of a cartridge with injection mortar Injection mortar ULEP-585 and a steel element according to Annex A 3 to Annex A 5.

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

The product description is given in Annex A.

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

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

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

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

#### 3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic resistance to tension load (static and quasi-static loading)	See Annex C 1 to C 6, C 8 to C 11, C 13 to C 16, B 3
Characteristic resistance to shear load (static and quasi-static loading)	See Annex C 1, C 7, C 12, C 17
Displacements under short-term and long-term loading	See Annex C 18 to C 20
Characteristic resistance and displacements for seismic performance categories C1 and C2	See Annex C 21 to C 28

#### 3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire	See Annex C 29 to C 31

#### 3.3 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 330499-02-0601 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.

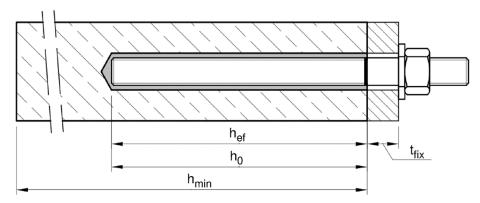
Issued in Berlin on 8 August 2025 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock Head of Section beglaubigt: Baderschneider

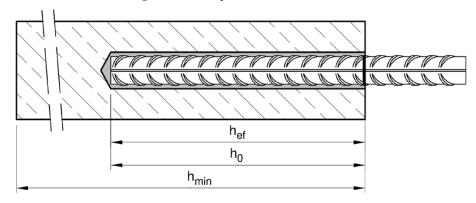


## Installation threaded rod M8 up to M30

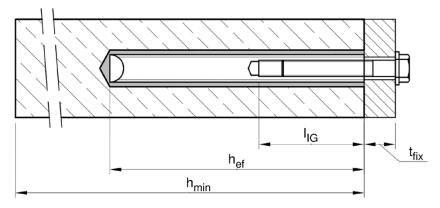
prepositioned installation or push through installation (annular gap filled with mortar)



### Installation reinforcing bar Ø8 up to Ø40



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



 $t_{fix}$  = thickness of fixture

 $h_0$  = drill hole depth

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

= thread engagement length

h<sub>min</sub> = minum thickness of member

## Injection system ULEP-585 for concrete

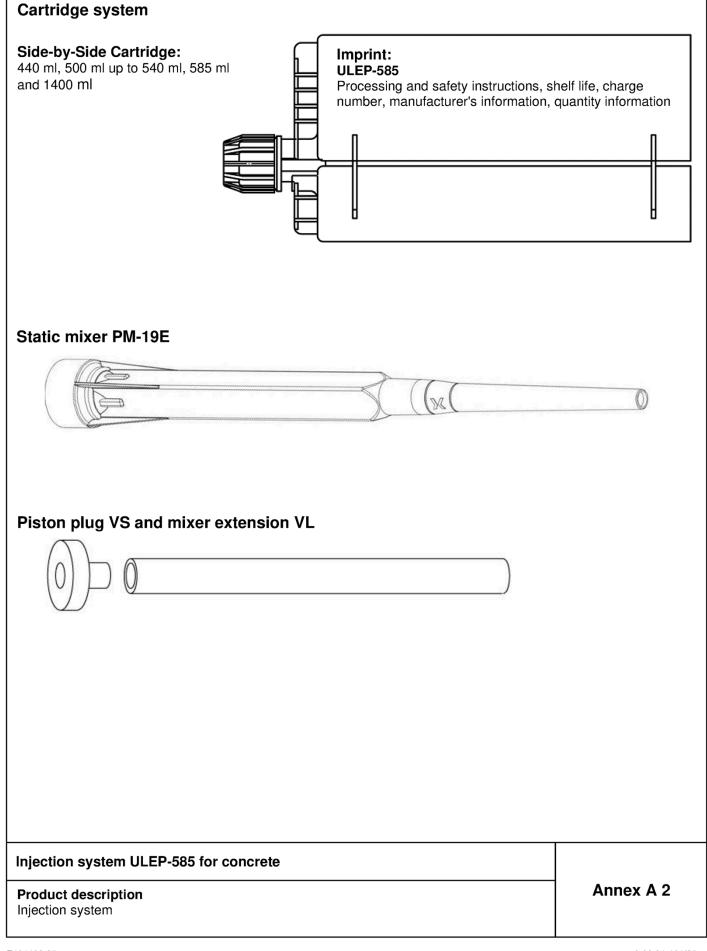
#### **Product description**

Installed condition

Annex A 1

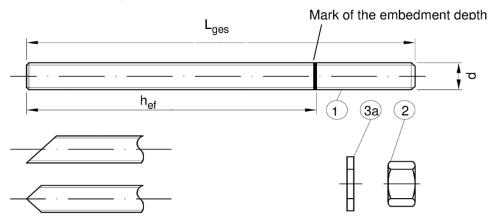
 $I_{IG}$ 







## Threaded rod M8 up to M30 with washer and hexagon nut

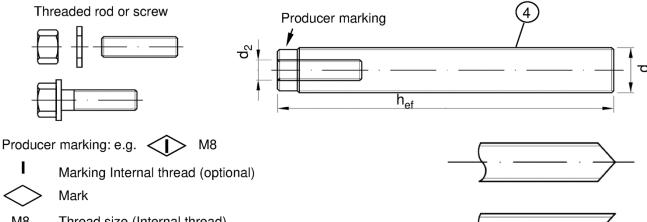


Commercial standard rod with:

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

For hot dip galvanized elements, the requirements with regards to the combination of nuts and rods according to EN ISO 10684:2004+AC:2009 Annex F shall be considered.

#### Internal threaded rod IG-M6 to IG-M20



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

HCR additional mark for high-corrosion resistance steel

-8 additional mark for property class 8.8



## Filling washer VFS

#### Mixer reduction nozzle MR





### Injection system ULEP-585 for concrete

#### **Product description**

Threaded rod; Internal threaded rod Filling washer; Mixer reduction nozzle

Annex A 3



_	ble A1: Mate	I				
	Designation	Material	2010	EN 10000 0017)		
		acc. to EN ISO 683-4:2				
Z h		pum acc. to EN ISO		2:2022 or 1:2022 and EN ISO 10684:	2004±4€:2009 or	
		5 µm acc. to EN ISO			2004+70.2009 01	
		T	.,,	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>vk</sub> = 240 N/mm <sup>2</sup>	A <sub>5</sub> > 8%
	Thus a dead we d			f <sub>uk</sub> = 400 N/mm <sup>2</sup>	f <sub>Vk</sub> = 320 N/mm <sup>2</sup>	A <sub>5</sub> > 8%
1	Threaded rod	acc. to		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 ISO 898-1:2013		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%
				f <sub>uk</sub> = 800 N/mm <sup>2</sup>	f <sub>VK</sub> = 640 N/mm <sup>2</sup>	$A_5 \ge 12\%^{3}$
			4	for anchor rod class 4.6 o	l <b>′</b>	1.3
2	Hexagon nut	acc. to		for anchor rod class 5.6 o		
		EN ISO 898-2:2022	<u>5</u>	for anchor rod class 8.8		
	Washer	Steel, zinc plated, ho	t-dip	galvanised or sherardized		
3a	Washer	(e.g.: EN ISO 887:20	06, E	N ISO 7089:2000, EN ISC	7093:2000 or EN ISO	7094:2000)
3b	Filling washer	Steel, zinc plated, ho	t-dip	galvanised or sherardized	_	
		Property class		Characteristic steel	Characteristic steel	Elongation at
	nternal threaded Property class		Lultinaata tanaila atranath	1: - 1 - 1 4 4 !-		
	Internal threaded			ultimate tensile strength	yield strength	fracture
1	Internal threaded anchor rod	acc. to		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%
4	1	acc. to EN ISO 898-1:2013		f <sub>uk</sub> = 500 N/mm <sup>2</sup>		_
	anchor rod	EN ISO 898-1:2013	8.8	f <sub>uk</sub> = 500 N/mm <sup>2</sup>	$f_{yk} = 400 \text{ N/mm}^2$ $f_{yk} = 640 \text{ N/mm}^2$	A <sub>5</sub> > 8%
Stai Stai	anchor rod  nless steel A2 (Mate nless steel A4 (Mate	EN ISO 898-1:2013 rial 1.4301 / 1.4307 / 1 rial 1.4401 / 1.4404 / 1	8.8 .431 .457	f <sub>uk</sub> = 500 N/mm <sup>2</sup> f <sub>uk</sub> = 800 N/mm <sup>2</sup> 1 / 1.4567 or 1.4541, acc. t 1 / 1.4362 or 1.4578, acc. t	f <sub>yk</sub> = 400 N/mm <sup>2</sup> f <sub>yk</sub> = 640 N/mm <sup>2</sup> o EN 10088-1:2023) o EN 10088-1:2023)	A <sub>5</sub> > 8%
Stai Stai	anchor rod  nless steel A2 (Mate nless steel A4 (Mate	EN ISO 898-1:2013 rial 1.4301 / 1.4307 / 1 rial 1.4401 / 1.4404 / 1	8.8 .431 .457	f <sub>uk</sub> = 500 N/mm <sup>2</sup> f <sub>uk</sub> = 800 N/mm <sup>2</sup> 1 / 1.4567 or 1.4541, acc. t 1 / 1.4362 or 1.4578, acc. t r 1.4565, acc. to EN 10088	f <sub>yk</sub> = 400 N/mm <sup>2</sup> f <sub>yk</sub> = 640 N/mm <sup>2</sup> o EN 10088-1:2023) o EN 10088-1:2023) -1:2023)	A <sub>5</sub> > 8% A <sub>5</sub> > 8%
Stai Stai	anchor rod  nless steel A2 (Mate nless steel A4 (Mate	EN ISO 898-1:2013 rial 1.4301 / 1.4307 / 1 rial 1.4401 / 1.4404 / 1 ce steel (Material 1.45	8.8 .431 .457	f <sub>uk</sub> = 500 N/mm <sup>2</sup> f <sub>uk</sub> = 800 N/mm <sup>2</sup> 1 / 1.4567 or 1.4541, acc. t 1 / 1.4362 or 1.4578, acc. t r 1.4565, acc. to EN 10088 Characteristic steel	f <sub>yk</sub> = 400 N/mm <sup>2</sup> f <sub>yk</sub> = 640 N/mm <sup>2</sup> o EN 10088-1:2023) o EN 10088-1:2023) -1:2023) Characteristic steel	$A_5 > 8\%$ $A_5 > 8\%$ Elongation at
Stai Stai	anchor rod  nless steel A2 (Mate nless steel A4 (Mate	EN ISO 898-1:2013 rial 1.4301 / 1.4307 / 1 rial 1.4401 / 1.4404 / 1	8.8 .431 .457 29 o	f <sub>uk</sub> = 500 N/mm <sup>2</sup> f <sub>uk</sub> = 800 N/mm <sup>2</sup> 1 / 1.4567 or 1.4541, acc. t 1 / 1.4362 or 1.4578, acc. t r 1.4565, acc. to EN 10088 Characteristic steel ultimate tensile strength	f <sub>yk</sub> = 400 N/mm <sup>2</sup> f <sub>yk</sub> = 640 N/mm <sup>2</sup> o EN 10088-1:2023) o EN 10088-1:2023) -1:2023) Characteristic steel yield strength	A <sub>5</sub> > 8% A <sub>5</sub> > 8%  Elongation at fracture
Stai Stai Hig	nless steel A2 (Mate nless steel A4 (Mate n corrosion resistand	EN ISO 898-1:2013 rial 1.4301 / 1.4307 / 1 rial 1.4401 / 1.4404 / 1 ce steel (Material 1.45  Property class	8.8 .431 .457	f <sub>uk</sub> = 500 N/mm <sup>2</sup> f <sub>uk</sub> = 800 N/mm <sup>2</sup> 1 / 1.4567 or 1.4541, acc. t 1 / 1.4362 or 1.4578, acc. t r 1.4565, acc. to EN 10088  Characteristic steel ultimate tensile strength  f <sub>uk</sub> = 500 N/mm <sup>2</sup>	f <sub>yk</sub> = 400 N/mm <sup>2</sup> f <sub>yk</sub> = 640 N/mm <sup>2</sup> o EN 10088-1:2023) o EN 10088-1:2023) -1:2023) Characteristic steel yield strength f <sub>yk</sub> = 210 N/mm <sup>2</sup>	$A_5 > 8\%$ $A_5 > 8\%$ Elongation at fracture $A_5 \ge 8\%$
Stai Stai Hig	anchor rod  nless steel A2 (Mate nless steel A4 (Mate	EN ISO 898-1:2013 rial 1.4301 / 1.4307 / 1 rial 1.4401 / 1.4404 / 1 ce steel (Material 1.45  Property class  acc. to	8.8 .431 .457 29 o	f <sub>uk</sub> = 500 N/mm <sup>2</sup> f <sub>uk</sub> = 800 N/mm <sup>2</sup> 1 / 1.4567 or 1.4541, acc. t 1 / 1.4362 or 1.4578, acc. t r 1.4565, acc. to EN 10088 Characteristic steel ultimate tensile strength	f <sub>yk</sub> = 400 N/mm <sup>2</sup> f <sub>yk</sub> = 640 N/mm <sup>2</sup> o EN 10088-1:2023) o EN 10088-1:2023) -1:2023) Characteristic steel yield strength	A <sub>5</sub> > 8% A <sub>5</sub> > 8%  Elongation at fracture
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Stai Stai Hig	nless steel A2 (Mate nless steel A4 (Mate n corrosion resistand	EN ISO 898-1:2013 rial 1.4301 / 1.4307 / 1 rial 1.4401 / 1.4404 / 1 ce steel (Material 1.45  Property class  acc. to  EN ISO 3506-1:2020	8.8 .431 .457 29 o	f <sub>uk</sub> = 500 N/mm <sup>2</sup> f <sub>uk</sub> = 800 N/mm <sup>2</sup> 1 / 1.4567 or 1.4541, acc. to 1.4565, acc. to EN 10088  Characteristic steel ultimate tensile strength  f <sub>uk</sub> = 500 N/mm <sup>2</sup> f <sub>uk</sub> = 700 N/mm <sup>2</sup>	fyk = 400 N/mm² fyk = 640 N/mm² o EN 10088-1:2023) o EN 10088-1:2023) -1:2023) Characteristic steel yield strength fyk = 210 N/mm² fyk = 450 N/mm²	$A_5 > 8\%$ $A_5 > 8\%$ Elongation at fracture $A_5 \ge 8\%$ $A_5 \ge 12\%^3$
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Stai Stai High	anchor rod  nless steel A2 (Mate nless steel A4 (Mate n corrosion resistant)  Threaded rod 1)4)  Hexagon nut 1)4)	EN ISO 898-1:2013 rial 1.4301 / 1.4307 / 1 rial 1.4401 / 1.4404 / 1 ce steel (Material 1.45  Property class  acc. to EN ISO 3506-1:2020  A2: Material 1.4301 / A4: Material 1.4401 /	8.8 .431 .457 29 o 50 70 80 50 70 80 1.43 1.44	f <sub>uk</sub> = 500 N/mm <sup>2</sup> f <sub>uk</sub> = 800 N/mm <sup>2</sup> 1 / 1.4567 or 1.4541, acc. t 1 / 1.4362 or 1.4578, acc. t 1 / 1.4565, acc. to EN 10088  Characteristic steel ultimate tensile strength  f <sub>uk</sub> = 500 N/mm <sup>2</sup> f <sub>uk</sub> = 700 N/mm <sup>2</sup> for anchor rod class 50  for anchor rod class 70  for anchor rod class 80  307 / 1.4311 / 1.4567 or 1.4  404 / 1.4571 / 1.4362 or 1.4	fyk = 400 N/mm² fyk = 640 N/mm² o EN 10088-1:2023) o EN 10088-1:2023) -1:2023) Characteristic steel yield strength fyk = 210 N/mm² fyk = 450 N/mm² fyk = 600 N/mm²	A <sub>5</sub> > 8% A <sub>5</sub> > 8%  Elongation at fracture A <sub>5</sub> $\geq$ 8%  A <sub>5</sub> $\geq$ 12% A <sub>5</sub> $\geq$ 12%  1:2023
Stai Stai Hig	nless steel A2 (Mate nless steel A4 (Mate n corrosion resistant	EN ISO 898-1:2013 rial 1.4301 / 1.4307 / 1 rial 1.4401 / 1.4404 / 1 ce steel (Material 1.45 Property class  acc. to EN ISO 3506-1:2020  A2: Material 1.4301 / A4: Material 1.4401 / HCR: Material 1.4529	8.8 .431 .457 29 or 50 70 80 50 70 80 1.43 1.44	f <sub>uk</sub> = 500 N/mm <sup>2</sup> f <sub>uk</sub> = 800 N/mm <sup>2</sup> 1 / 1.4567 or 1.4541, acc. t 1 / 1.4362 or 1.4578, acc. t r 1.4565, acc. to EN 10088  Characteristic steel ultimate tensile strength f <sub>uk</sub> = 500 N/mm <sup>2</sup> f <sub>uk</sub> = 700 N/mm <sup>2</sup> for anchor rod class 50 for anchor rod class 70 for anchor rod class 80  107 / 1.4311 / 1.4567 or 1.4 1.4565, acc. to EN 10088-1	fyk = 400 N/mm² fyk = 640 N/mm² o EN 10088-1:2023) o EN 10088-1:2023) -1:2023) Characteristic steel yield strength fyk = 210 N/mm² fyk = 450 N/mm² fyk = 600 N/mm²	A <sub>5</sub> > 8% A <sub>5</sub> > 8%  Elongation at fracture A <sub>5</sub> $\geq$ 8%  A <sub>5</sub> $\geq$ 12%  A <sub>5</sub> $\geq$ 12%  1:2023 1:2023
Stai Stai Hig 1	anchor rod  nless steel A2 (Mate nless steel A4 (Mate n corrosion resistant)  Threaded rod 1)4)  Hexagon nut 1)4)  Washer	EN ISO 898-1:2013 rial 1.4301 / 1.4307 / 1 rial 1.4401 / 1.4404 / 1 ce steel (Material 1.45  Property class  acc. to EN ISO 3506-1:2020  A2: Material 1.4301 / A4: Material 1.4401 / HCR: Material 1.452( e.g.: EN ISO 887:20	8.8 .431 .457 29 o 70 80 .50 .70 80 1.43 1.44 9 or 1	f <sub>uk</sub> = 500 N/mm <sup>2</sup> f <sub>uk</sub> = 800 N/mm <sup>2</sup> 1 / 1.4567 or 1.4541, acc. to 1 / 1.4362 or 1.4578, acc. to 1.4565, acc. to EN 10088  Characteristic steel ultimate tensile strength  f <sub>uk</sub> = 500 N/mm <sup>2</sup> f <sub>uk</sub> = 700 N/mm <sup>2</sup> f <sub>uk</sub> = 800 N/mm <sup>2</sup> for anchor rod class 50  for anchor rod class 70  for anchor rod class 80  107 / 1.4311 / 1.4567 or 1.4  1.4565, acc. to EN 10088-1  EN ISO 7089:2000, EN ISC	fyk = 400 N/mm² fyk = 640 N/mm² o EN 10088-1:2023) o EN 10088-1:2023) -1:2023) Characteristic steel yield strength fyk = 210 N/mm² fyk = 450 N/mm² fyk = 600 N/mm²	A <sub>5</sub> > 8% A <sub>5</sub> > 8%  Elongation at fracture A <sub>5</sub> $\geq$ 8%  A <sub>5</sub> $\geq$ 12%  A <sub>5</sub> $\geq$ 12%  1:2023 1:2023
Stai Stai Hig 1	anchor rod  nless steel A2 (Mate nless steel A4 (Mate n corrosion resistant)  Threaded rod 1)4)  Hexagon nut 1)4)	EN ISO 898-1:2013 rial 1.4301 / 1.4307 / 1 rial 1.4401 / 1.4404 / 1 ce steel (Material 1.45  Property class  acc. to EN ISO 3506-1:2020  A2: Material 1.4301 / A4: Material 1.4401 / HCR: Material 1.452( e.g.: EN ISO 887:20	8.8 .431 .457 29 o 70 80 .50 .70 80 1.43 1.44 9 or 1	f <sub>uk</sub> = 500 N/mm <sup>2</sup> f <sub>uk</sub> = 800 N/mm <sup>2</sup> 1 / 1.4567 or 1.4541, acc. to 1 / 1.4362 or 1.4578, acc. to 1.4565, acc. to EN 10088  Characteristic steel ultimate tensile strength  f <sub>uk</sub> = 500 N/mm <sup>2</sup> f <sub>uk</sub> = 700 N/mm <sup>2</sup> for anchor rod class 50  for anchor rod class 50  for anchor rod class 70  for anchor rod class 80  307 / 1.4311 / 1.4567 or 1.4  1.4565, acc. to EN 10088-1  EN ISO 7089:2000, EN ISC orrosion resistance steel	fyk = 400 N/mm² fyk = 640 N/mm² o EN 10088-1:2023) o EN 10088-1:2023) -1:2023) 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-:2023 0 7093:2000 or EN ISO	A <sub>5</sub> > 8%  A <sub>5</sub> > 8%  Elongation at fracture  A <sub>5</sub> $\geq$ 8%  A <sub>5</sub> $\geq$ 12%  A <sub>5</sub> $\geq$ 12%  1:2023  1:2023  7094:2000)
Stai Stai Hig 1	anchor rod  nless steel A2 (Mate nless steel A4 (Mate n corrosion resistant)  Threaded rod 1)4)  Hexagon nut 1)4)  Washer  Filling washer	EN ISO 898-1:2013 rial 1.4301 / 1.4307 / 1 rial 1.4401 / 1.4404 / 1 ce steel (Material 1.45  Property class  acc. to EN ISO 3506-1:2020  A2: Material 1.4301 / A4: Material 1.4401 / HCR: Material 1.452( e.g.: EN ISO 887:20	8.8 .431 .457 29 o 70 80 .50 .70 80 1.43 1.44 9 or 1	f <sub>uk</sub> = 500 N/mm <sup>2</sup> f <sub>uk</sub> = 800 N/mm <sup>2</sup> 1 / 1.4567 or 1.4541, acc. to 1 / 1.4362 or 1.4578, acc. to 1.4565, acc. to EN 10088  Characteristic steel ultimate tensile strength  f <sub>uk</sub> = 500 N/mm <sup>2</sup> f <sub>uk</sub> = 700 N/mm <sup>2</sup> f <sub>uk</sub> = 800 N/mm <sup>2</sup> for anchor rod class 50  for anchor rod class 70  for anchor rod class 80  307 / 1.4311 / 1.4567 or 1.4  4.4565, acc. to EN 10088-1  EN ISO 7089:2000, EN ISC orrosion resistance steel  Characteristic steel	fyk = 400 N/mm² fyk = 640 N/mm² o EN 10088-1:2023) o EN 10088-1:2023) -1:2023) 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- :2023 0 7093:2000 or EN ISO	A <sub>5</sub> > 8% A <sub>5</sub> > 8%  Elongation at fracture A <sub>5</sub> ≥ 8%  A <sub>5</sub> ≥ 12% <sup>3</sup> )  A <sub>5</sub> ≥ 12% <sup>3</sup> )  1:2023 1:2023 7094:2000)
Stai	anchor rod  nless steel A2 (Mate nless steel A4 (Mate corrosion resistant)  Threaded rod 1)4)  Hexagon nut 1)4)  Washer  Filling washer  Internal threaded	EN ISO 898-1:2013 rial 1.4301 / 1.4307 / 1 rial 1.4401 / 1.4404 / 1 ce steel (Material 1.45 Property class  acc. to EN ISO 3506-1:2020  A2: Material 1.4301 / A4: Material 1.4401 / HCR: Material 1.4529 (e.g.: EN ISO 887:20  Stainless steel A4, H Property class	8.8 .431 .457 29 or 50 70 80 50 70 80 1.43 1.44 9 or 1 06, E	f <sub>uk</sub> = 500 N/mm <sup>2</sup> f <sub>uk</sub> = 800 N/mm <sup>2</sup> 1 / 1.4567 or 1.4541, acc. to 1 / 1.4362 or 1.4578, acc. to 1.4565, acc. to EN 10088  Characteristic steel ultimate tensile strength  f <sub>uk</sub> = 500 N/mm <sup>2</sup> f <sub>uk</sub> = 700 N/mm <sup>2</sup> f <sub>uk</sub> = 800 N/mm <sup>2</sup> for anchor rod class 50  for anchor rod class 70  for anchor rod class 80  307 / 1.4311 / 1.4567 or 1.4  404 / 1.4571 / 1.4362 or 1.4  1.4565, acc. to EN 10088-1  EN ISO 7089:2000, EN ISO  orrosion resistance steel  Characteristic steel  ultimate tensile strength	fyk = 400 N/mm² fyk = 640 N/mm² o EN 10088-1:2023) o EN 10088-1:2023) -1:2023) 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- :2023 7093:2000 or EN ISO Characteristic steel yield strength	A <sub>5</sub> > 8%  A <sub>5</sub> > 8%  Elongation at fracture  A <sub>5</sub> ≥ 8%  A <sub>5</sub> ≥ 12% <sup>3</sup> )  A <sub>5</sub> ≥ 12% <sup>3</sup> )  1:2023 1:2023 7094:2000)  Elongation at fracture
Stai Stai High	anchor rod  nless steel A2 (Mate nless steel A4 (Mate n corrosion resistant)  Threaded rod 1)4)  Hexagon nut 1)4)  Washer  Filling washer	EN ISO 898-1:2013 rial 1.4301 / 1.4307 / 1 rial 1.4401 / 1.4404 / 1 ce steel (Material 1.45 Property class  acc. to EN ISO 3506-1:2020  A2: Material 1.4301 / A4: Material 1.4401 / HCR: Material 1.452! (e.g.: EN ISO 887:20  Stainless steel A4, H	8.8 .431.457 29 or 10 80 50 70 80 1.43 1.44 9 or 10 06, Eigh c	f <sub>uk</sub> = 500 N/mm <sup>2</sup> f <sub>uk</sub> = 800 N/mm <sup>2</sup> 1 / 1.4567 or 1.4541, acc. to 1 / 1.4362 or 1.4578, acc. to 1.4565, acc. to EN 10088  Characteristic steel ultimate tensile strength  f <sub>uk</sub> = 500 N/mm <sup>2</sup> f <sub>uk</sub> = 700 N/mm <sup>2</sup> f <sub>uk</sub> = 800 N/mm <sup>2</sup> for anchor rod class 50  for anchor rod class 70  for anchor rod class 80  307 / 1.4311 / 1.4567 or 1.4  4.4565, acc. to EN 10088-1  EN ISO 7089:2000, EN ISC orrosion resistance steel  Characteristic steel	fyk = 400 N/mm² fyk = 640 N/mm² o EN 10088-1:2023) o EN 10088-1:2023) -1:2023) 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- :2023 0 7093:2000 or EN ISO	A <sub>5</sub> > 8% A <sub>5</sub> > 8%  Elongation at fracture A <sub>5</sub> ≥ 8%  A <sub>5</sub> ≥ 12% <sup>3</sup> )  A <sub>5</sub> ≥ 12% <sup>3</sup> )  1:2023 1:2023 7094:2000)

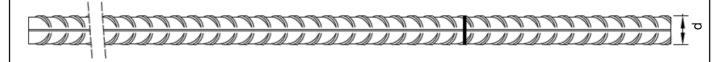
<sup>4)</sup> Property class 80 only for stainless steel A4 and HCR

Injection system ULEP-585 for concrete	
Product description  Materials threaded rod, Internal threaded anchor rod and filling washer	Annex A 4

 <sup>2)</sup> for IG-M20 only property class 50
 3) A<sub>5</sub> > 8% fracture elongation if no use for seismic performance category C2



Reinforcing bar: ø8 up to ø40



Minimum value of related rip area  $f_{R,min}$  according to EN 1992-1-1:2004+AC:2010 Rib height of the bar shall be in the range  $0.05d \le h_{rib} \le 0.07d$  (d: Nominal diameter of the bar;  $h_{rib}$ : Rib height of the bar)

Table A2: Materials Reinforcing bar

Part	Designation	Material
Reba	ar	
	Reinforcing steel according to EN 1992-1-1:2004+AC:2010, Annex C	Bars and rebars from ring class B or C $f_{yk}$ and k according to NDP or NCI according to EN 1992-1-1/NA $f_{uk} = f_{tk} = k \cdot f_{yk}$

Injection system ULEP-585 for concrete

Product description
Materials reinforcing bar

Annex A 5



Specification of the inter	ded use			
Fasteners subject to (Station	<u> </u>			
		fe 50 years 0/25 to C90/105		ng life 100 years e C20/25 to C90/105
Base materi	uncracked concrete	cracked concrete	uncracked concrete	
HD: Hammer drilling HDB: Hammer drilling with hollow drill bit CD: Compressed air drilling	Ø8 to	0 M30, 0 Ø32, 0 IG-M20		M8 to M30, Ø8 to Ø32, M6 to IG-M20
HD: Hammer drilling CD: Compressed air drilling	Ø36 to Ø40	No performance assessed	Ø36 to Ø40	No performance assessed
DD: Diamond drilling	M8 to M30, Ø8 to Ø40, IG-M6 to IG-M20	M16 to M30 <sup>4)</sup> IG-M10 to IG-M20 <sup>4)</sup>	M8 to M30, Ø8 to Ø40, IG-M6 to IG-N	, accessed
Temperature Range:	I: - 40°C II: - 40°C III: - 40°C	to $+40^{\circ}C^{1)}$ to $+72^{\circ}C^{2)}$ to $+80^{\circ}C^{3)}$	l: - 40 ll: - 40 lll: - 40	0°C to +72°C <sup>2)</sup>
Fasteners subject to (seisn	nic action):			
	Performance	Category C1	Performa	ance Category C2
Base materia	l Crac	ked and uncracked c	oncrete C20/25 t	to C50/60
HD: Hammer drilling HDB: Hammer drilling with hollow drill bit CD: Compressed air drilling	1	M30, o ⊘32	M	112 to M24
DD: Diamond drilling	No performa	nce assessed	No perfo	rmance assessed
Temperature Range:	l: - 40°C ll: - 40°C lll: - 40°C	to +40°C¹) to +72°C²) to +80°C³)	II: - 40	0°C to +40°C¹) 0°C to +72°C²) 0°C to +80°C³)
Fasteners subject to (fire e	kposure):			
Base materia	l Crac	ked and uncracked co	oncrete C20/25 t	to C50/60
HD: Hammer drilling HDB: Hammer drilling with hollow drill bit CD: Compressed air drilling		M8 to ⊘8 to IG-M6 to	Ø32,	
DD: Diamond drilling		No performar	ice assessed	
Temperature Range:		I: - 40°C : II: - 40°C : III: - 40°C :	to +72°C <sup>2)</sup>	
1) (max. long-term temperature +242) (max. long-term temperature +503) (max. long-term temperature +604) C20/25 to C50/60 only	°C and max. short-term	temperature +72°C)		
Injection system ULEP-585 f	or concrete			
Intended use Specifications				Annex B 1



#### **Base materials:**

- Compacted, reinforced or unreinforced normal weight concrete without fibres according to EN 206:2013 + A2:2021.
- Strength classes C20/25 to C90/105 according to EN 206:2013 + A2:2021.

## 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 fastener is indicated on the design drawings (e. g. position of the fastener relative to reinforcement or to supports, etc.).
- Fasteners are designed under the responsibility of an engineer experienced in fasteners and concrete work.
- The fasteners are designed in accordance to EN 1992-4:2018 and Technical Report TR 055, Edition February 2018:
- The fasteners under fire exposure are designed in accordance to Technical Report TR 082, Edition June 2023.

#### 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.
- Fastener installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.

Injection system ULEP-585 for concrete	
Intended use Specifications (Continued)	Annex B 2



Table B1:	Installation pa	arameters	for thre	eaded	rod						
Threaded rod				M8	M10	M12	M16	M20	M24	M27	M30
Diameter of elemen	t	$d = d_{nom}$	[mm]	8	10	12	16	20	24	27	30
Nominal drill hole di	ameter	d <sub>0</sub>	[mm]	10	12	14	18	22	28	30	35
Effective embedme	at donth	h <sub>ef,min</sub>	[mm]	60	60	70	80	90	96	108	120
Effective embedmer	п аерт	h <sub>ef,max</sub>	[mm]	160	200	240	320	400	480	540	600
Diameter of	Prepositioned ins	stallation d <sub>f</sub> ≤	[mm]	9	12	14	18	22	26	30	33
clearance hole in the fixture	Push through i	' '	[mm]	12	14	16	20	24	30	33	40
Maximum installatio	n torque	max T <sub>inst</sub>	[Nm]	10	20	40 <sup>1)</sup>	60	100	170	250	300
Minimum thickness	of member	h <sub>min</sub>	[mm]	١ ~	<sub>f</sub> + 30 m : 100 mr			ŀ	n <sub>ef</sub> + 2do	)	
Minimum spacing		s <sub>min</sub>	[mm]	40	50	60	75	95	115	125	140
Minimum edge dista	ınce	c <sub>min</sub>	[mm]	35	40	45	50	60	65	75	80

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

## Table B2: Installation parameters for reinforcing bar

<del></del>			T	- 4\		4\	T	4)					4\	T	4\				
Reinforcing bar			Ø	8 <sup>1)</sup>	Ø 1	10¹)	Ø:	12 <sup>1)</sup>	Ø 14	Ø 16	Ø 20	Ø2	241)	Ø	25 <sup>1)</sup>	Ø 28	Ø 32	Ø 36	Ø 40
Diameter of element	d = d <sub>nom</sub>	[mm]		8	1	0	1	2	14	16	20	2	4	2	25	28	32	36	40
Nominal drill hole diameter	d <sub>0</sub>	[mm]	10	12	12	14	14	16	18	20	25	30	32	30	32	35	40	45	52/55
Effective embedment	h <sub>ef,min</sub>	[mm]	6	0	6	0	7	0	75	80	90	9	6	1	00	112	128	144	160
depth	h <sub>ef,max</sub>	[mm]		60		00	_	40	280	320	400	48	30	5	00	560	640	720	800
Minimum thickness of member	h <sub>min</sub>	[mm]	h	ef <sup>+</sup> 10	30 ı 00 m		2					h	n <sub>ef</sub> +	- 2d	0				
Minimum spacing	s <sub>min</sub>	[mm]	4	10	5	0	6	0	70	75	95	12	20	1:	20	130	150	180	200
Minimum edge distance	c <sub>min</sub>	[mm]	3	35	4	0	4	5	50	50	60	7	0	7	'0	75	85	180	200

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

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

Internal threaded anchor rod			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>	[mm]	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 installation torque	max 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]	١ .	30 mm 0 mm		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
1) 14 (1)	•				•			•

<sup>1)</sup> With metric threads

### Injection system ULEP-585 for concrete

#### Intended use

Installation parameters

Annex B 3



				mound	Markey Mark				
hreaded Rod	Re- inforcing	Internal threaded	d <sub>0</sub> Drill bit - Ø HD,	d <sub>b</sub> Brush - Ø	d <sub>b,min</sub> min.	Piston plug	1	n directior piston plu	
	bar	anchor rod	DD HDB,		Brush - Ø	piug	1	<b></b>	1
[mm]	[mm]	[mm]	[mm]	[mm					
M8	8		10	RB10 11,5	<del></del>	-			
M10	8 / 10	IG-M6	12	RB12 13,5		4	No plua	required	
M12	10 / 12	IG-M8	14	RB14 15,5		1	p.ag	,	
-	12	-	16	RB16 17,5				,	
M16	14	IG-M10	18	RB18 20,0		VS18	_		
-	16	-	20	RB20 22,0		VS20			
M20	-	IG-M12	22	RB22 24,0		VS22			
-	20	-	25	RB25 27,0	25,5	VS25	h	h	
M24	-	IG-M16	28	RB28 30,0	28,5	VS28	h <sub>ef</sub> >	h <sub>ef</sub> > 250 mm	all
M27	24 / 25	-	30	RB30 31,8		VS30	250 mm		
-	24 / 25	-	32	RB32 34,0		VS32	1		
M30	28	IG-M20	35	RB35 37,0		VS35	1		
	32	-	40	RB40 43,5		VS40	1		
-	J 32						_		
-		_	45	RB45   47 0	45.5	VS45			
-	36	-	45 52 -	RB45 47,0		VS45 VS52	   all	<sub>all</sub>	all
- - Cleanin	36 40 g and inst	allation to	52 - - 55	RB45 47,0 RB52 54,0 RB55 58,5	52,5	VS45 VS52 VS55	all	all	all
Cleaning HDB – Ho Compress (min 6 bar)	36 40 g and installow drill bit sed air tool	allation to	52 - - 55	RB52 54,0	52,5 55,5 The hollow drill hollow drill bit inegative press 150 m³/h (42 l/	VS52 VS55 Il system c and a clas sure of 253 (s).	onsists of He	eller Duster E	ım
Compress (min 6 bar)	g and installow drill bit	allation to	52 - - 55	RB52 54,0	52,5 55,5 The hollow drill hollow drill bit negative press	VS52 VS55 Il system c and a clas sure of 253 (s).	onsists of He	eller Duster E	Expert im
Compress (min 6 bar)  Brush RB	g and installow drill bit sed air tool	allation to	52 - - 55 ols	RB52 54,0 RB55 58,5	52,5 55,5 The hollow drill hollow drill bit inegative press 150 m³/h (42 l/	VS52 VS55	onsists of Hes M hoover with the hood and a f	eller Duster E	Expert im



Table B5:	Worki	ng and curing	ı time	
Temperature in base material			Maximum working time	Minimum curing time <sup>1)</sup>
	Т		t <sub>work</sub>	t <sub>cure</sub>
+ 0 °C	to	+ 4°C	80 min	144 h
+ 5°C	to	+ 9°C	80 min	48 h
+ 10°C	to + 14 °C		60 min	28 h
+ 15°C	15°C to + 19°C		40 min	18 h
+ 20 °C	to	+ 24 °C	30 min	12 h
+ 25 °C	to	+ 34 °C	12 min	9 h
+ 35 °C	to	+ 39 °C	8 min	6 h
	+ 40 °C		8 min	4 h
Cartr	idge tempe	erature	+5°C to	+40°C

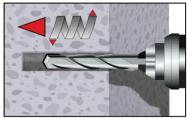
The minimum curing time is only valid for dry base material. In wet base material the curing time must be doubled.

Injection system ULEP-585 for concrete	
Intended use Working time and curing time	Annex B 5

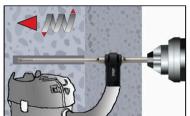


#### Installation instructions

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



1a. Hammer drilling (HD) / Compressed air drilling (CD) Drill a hole to the required embedment depth. Drill bit diameter according to Table B1, B2 or B3. Aborted drill holes shall be filled with mortar. Proceed with Step 2.

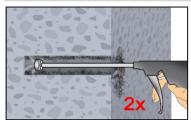


Hollow drill bit system (HDB) (see Annex B 4)
Drill a hole to the required embedment depth.
Drill bit diameter according to Table B1, B2 or B3.
The hollow drilling system removes the dust and cleans the bore hole.
Proceed with Step 3.

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

#### Compressed Air Cleaning (CAC):

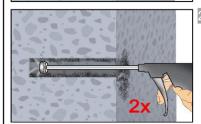
All diameter in cracked and uncracked concrete



Blow the bore hole clean minimum 2x with compressed air (min. 6 bar, oil-free) (Annex B 4) over the entire embedment depth until return air stream is free of noticeable dust. (If necessary, an extension shall be used.)



Brush the bore hole minimum 2x with brush RB according to Table B4 over the entire embedment depth in a twisting motion. (If necessary, a brush extension RBL shall be used.)



Finally blow the bore hole clean minimum 2x with compressed air (min. 6 bar, oil-free) (Annex B 4) over the entire embedment depth until return air stream is free of noticeable dust. (If necessary, an extension shall be used.)

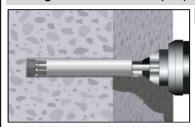
Cleaned bore hole has to be protected against re-contamination in an appropriate way, If necessary, repeat cleaning process directly before dispensing the mortar. In-flowing water must not contaminate the bore hole again.

Injection system ULEP-585 for concrete	
Intended use Installation instructions	Annex B 6



#### Installation instructions (continuation)

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



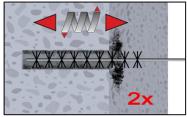
Diamond drilling (DD)
Drill a hole to the required embedment depth required
Drill bit diameter according to Table B1, B2 or B3.
Aborted drill holes shall be filled with mortar.
Proceed with Step 2.

#### Flush & Compressed Air Cleaning (SPCAC):

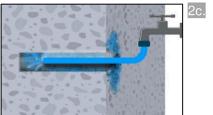
All diameter in uncracked concrete



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

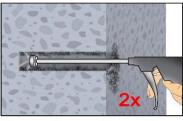


Brush the bore hole minimum 2x with brush RB according to Table B4 over the entire embedment depth in a twisting motion. (If necessary, a brush extension RBL shall be used.)

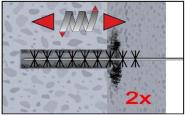


Flushing again with water until clear water comes out.

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



Blow the bore hole clean minimum 2x with compressed air (min. 6 bar, oil-free) (Annex B 4) over the entire embedment depth until return air stream is free of noticeable dust. (If necessary, an extension shall be used.)



Brush the bore hole minimum 2x with brush RB according to Table B4 over the entire embedment depth in a twisting motion. (If necessary, a brush extension RBL shall be used.)

#### Injection system ULEP-585 for concrete

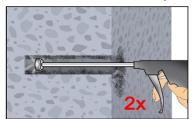
#### Intended use

Installation instructions (continuation)

Annex B 7

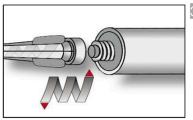


#### Installation instructions (continuation)



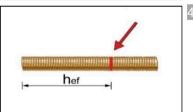
Finally blow the bore hole clean minimum 2x with compressed air (min. 6 bar, oil-free) (Annex B 4) over the entire embedment depth until return air stream is free of noticeable dust. (If necessary, an extension shall be used.)

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



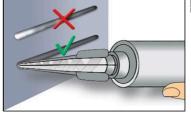
Screw on static-mixing nozzle PM-19E and load the cartridge into an appropriate dispensing tool.

For every working interruption longer than the maximum working time  $t_{work}$  (Annex B 5) as well as for new cartridges, a new static-mixer shall be used.



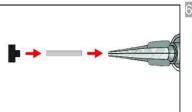
Mark embedment depth on the anchor rod.

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



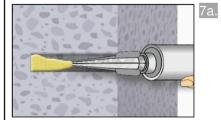
Not proper mixed mortar is not sufficient for fastening.

Dispense and discard mortar until an uniform grey or red colour is shown (at least 3 full strokes).



Piston plugs VS and mixer nozzle extensions VL shall be used according to Table B4 for the following applications:

- Horizontal and vertical downwards direction: Drill bit-Ø  $d_0 \ge 18$  mm and embedment depth  $h_{ef} > 250$ mm
- Vertical upwards direction: Drill bit- $\emptyset$  d<sub>0</sub>  $\ge$  18 mm Assemble mixing nozzle, mixer extension and piston plug before injecting mortar.



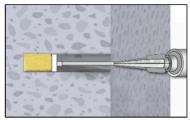
#### Injecting mortar without piston plug VS:

Starting at bottom of the hole and fill the hole up to approximately two-thirds with adhesive. (If necessary, a mixer nozzle extension shall be used.) Slowly withdraw of the static mixing nozzle avoid creating air pockets Observe the temperature related working time  $t_{work}$  (Annex B 5).

Injection system ULEP-585 for concrete	
Intended use Installation instructions (continuation)	Annex B 8



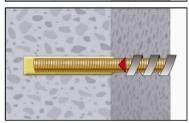
#### Installation instructions (continuation)



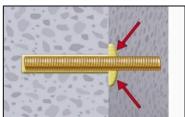
## 7b. Injecting mortar with piston plug VS:

Starting at bottom of the hole and fill the hole up to approximately two-thirds with adhesive. (If necessary, a mixer nozzle extension shall be used.) During injection the piston plug is pushed out of the bore hole by the back pressure of the mortar.

Observe the temperature related working time t<sub>work</sub> (Annex B 5).

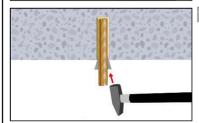


Insert the anchor rod while turning slightly up to the embedment mark.

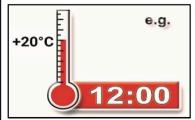


Annular gap between anchor rod and base material must be completely filled with mortar. In case of push through installation the annular gap in the fixture must be filled with mortar also.

Otherwise, the installation must be repeated starting from step 7 before the maximum working time  $t_{\rm work}$  has expired.



For application in vertical upwards direction the anchor rod shall be fixed (e.g. wedges).



11. Temperature related curing time t<sub>cure</sub> (Annex B 5) must be observed. Do not move or load the fastener during curing time.



Install the fixture by using a calibrated torque wrench. Observe maximum installation torque (Table B1 or B3).

In case of static requirements (e.g. seismic), fill the annular gab in the fixture with mortar (Annex A 2). Therefore replace the washer by the filling washer VFS and use the mixer reduction nozzle MR.

Injection system ULEP-585 for concrete	
Intended use Installation instructions (continuation)	Annex B 9



T	Table C1: Characteristic values for steel tension resistance and steel shear resistance of threaded rods											
Tł	readed rod		M8	M10	M12	M16	M20	M24	M27	M30		
Cr	oss section area	A <sub>s</sub>	[mm²]	36,6	58	84,3	157	245	353	459	561	
CI	naracteristic tension resistance, Steel failu	re <sup>1)</sup>										
St	eel, Property class 4.6 and 4.8	N <sub>Rk,s</sub>	[kN]	15 (13)	23 (21)	34	63	98	141	184	224	
St	eel, Property class 5.6 and 5.8	N <sub>Rk,s</sub>	[kN]	18 (17)	29 (27)	42	78	122	176	230	280	
St	eel, Property class 8.8	N <sub>Rk,s</sub>	[kN]	29 (27)	46 (43)	67	125	196	282	368	449	
St	ainless steel A2, A4 and HCR, class 50	N <sub>Rk,s</sub>	[kN]	18	29	42	79	123	177	230	281	
St	ainless steel A2, A4 and HCR, class 70	N <sub>Rk,s</sub>	[kN]	26	41	59	110	171	247	_3)	_3)	
	ainless steel A4 and HCR, class 80	N <sub>Rk,s</sub>	[kN]	29	46	67	126	196	282	_3)	_3)	
	naracteristic tension resistance, Partial fac	tor <sup>2)</sup>										
	eel, Property class 4.6 and 5.6	γ <sub>Ms,N</sub>	[-]				2,0					
├─	eel, Property class 4.8, 5.8 and 8.8	γ <sub>Ms,N</sub>	[-]				1,5					
	ainless steel A2, A4 and HCR, class 50	γ <sub>Ms,N</sub>	[-]				2,8					
	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								
CI	naracteristic shear resistance, Steel failure	1)										
arm	Steel, Property class 4.6 and 4.8	V <sup>0</sup> Rk,s	[kN]	9 (8)	14 (13)	20	38	59	85	110	135	
	Steel, Property class 5.6 and 5.8	V <sup>0</sup> <sub>Rk,s</sub>	[kN]	11 (10)	· , ,	25	47	74	106	138	168	
leve	Steel, Property class 8.8	V <sup>0</sup> <sub>Rk,s</sub>	[kN]	15 (13)	23 (21)	34	63	98	141	184	224	
ont	Stainless steel A2, A4 and HCR, class 50	V <sup>0</sup> Rk,s	[kN]	9	15	21	39	61	88	115	140	
Without lever	Stainless steel A2, A4 and HCR, class 70	V <sup>0</sup> Rk.s	[kN]	13	20	30	55	86	124	_3)	_3)	
>	Stainless steel A4 and HCR, class 80	V <sup>0</sup> Rk,s	[kN]	15	23	34	63	98	141	_3)	_3)	
	Steel, Property class 4.6 and 4.8	M <sup>0</sup> <sub>Rk,s</sub>	[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	
		M <sup>0</sup> Rk,s	[Nm]	30 (26)	60 (53)	105	266	519	896	1333	1797	
th lever	Stainless steel A2, A4 and HCR, class 50	M <sup>0</sup> Rk,s	[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	_3)	_3)	
	Stainless steel A4 and HCR, class 80	M <sup>0</sup> Rk,s	[Nm]	30	59	105	266	519	896	_3)	_3)	
CI	naracteristic shear resistance, Partial facto											
St	eel, Property class 4.6 and 5.6	γ <sub>Ms,V</sub>	[-]	1,67								
St	eel, Property class 4.8, 5.8 and 8.8	γ <sub>Ms,V</sub>	[-]				1,2	5				
St	ainless steel A2, A4 and HCR, class 50	γ <sub>Ms,V</sub>	[-]	2,38								
St	ainless steel A2, A4 and HCR, class 70	γ <sub>Ms,V</sub>	[-]	1,56								
St	ainless steel A4 and HCR, class 80	γ <sub>Ms,V</sub>	[-]				1,3	3				

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

<sup>3)</sup> Fastener type not part of the ETA

naracteristic values for steel tension resistance and steel shear resistance of threaded	
Performances Characteristic values for steel tension resistance and steel shear resistance of threaded rods	Annex C 1

<sup>2)</sup> in absence of national regulation

Axial distance



2 c<sub>cr,sp</sub>

Table C2: Characteristic values of tension loads under static and quasi-static action for a working life of 50 and 100 years										
Fastener				All Fastener type and sizes						
Concrete cone fa	ailure									
Uncracked concrete		k <sub>ucr,N</sub>	[-]	11,0						
Cracked concrete		k <sub>cr,N</sub>	[-]	7,7						
Edge distance		c <sub>cr,N</sub>	[mm]	1,5 h <sub>ef</sub>						
Axial distance		s <sub>cr,N</sub>	[mm]	2 c <sub>cr,N</sub>						
Splitting										
	h/h <sub>ef</sub> ≥ 2,0			1,0 h <sub>ef</sub>						
Edge distance	$2.0 > h/h_{ef} > 1.3$	2,0 > h/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>						

[mm]

s<sub>cr,sp</sub>

Injection system ULEP-585 for concrete	
Performances Characteristic values of tension loads under static and quasi-static action	Annex C 2
for a working life of 50 and 100 years	



	racteristic va a working life			ls und	der st	atic a	nd q	uasi-	static	actio	on
Threaded rod				M8	M10	M12	M16	M20	M24	M27	M30
Steel failure	niatanas	N <sub>-</sub> .	FI-NIT			Δ - f	. /or o	oo Tah	la (°1)		
Characteristic tension res	sistance	N <sub>Rk,s</sub>	[kN]			A <sub>S</sub> · I		ee Tab	ie CT)		
Partial factor  Combined pull-out and	concrete failure	γ <sub>Ms,N</sub>	[-]				see 18	able C1			
Characteristic bond resis		d concrete C20	)/25 in hamr	ner dril	led (HD	) and	compre	essed a	ir drille	d holes	(CD)
	Dry, wet concrete or flooded bore			20	20	19	19	18	17	16	16
Cemperature		<sup>τ</sup> Rk,ucr	[N/mm²]	15	15	15	14	13	13	12	12
년 III:60°C/80°C	hole			6,5	6,5	6,5	6,0	6,0	5,5	5,5	5,5
Characteristic bond resis	tance in uncracke	d concrete C20	)/25 in hamr	mer dril	led hol	es with	hollow	drill bi	t (HDB)	)	
ტ I: 24°C/40°C				17	16	16	16	15	14	14	13
1: 24°C/40°C	Dry or wet concrete			14	14	14	13	13	12	12	11
일 III:60°C/80°C		_	[N]/mamm2]	6,5	6,5	6,5	6,0	6,0	5,5	5,5	5,5
I: 24°C/40°C		<sup>τ</sup> Rk,ucr	[N/mm <sup>2</sup> ]	16	16	16	15	15	14	14	13
<u>।।: 50°C/72°C</u>	flooded bore hole			14	14	14	13	13	12	12	11
<sup>Φ</sup> III:60°C/80°C	Tiole			6,5	6,5	6,5	6,0	6,0	5,5	5,5	5,5
Characteristic bond resis and in hammer drilled ho			5 in hamme	r drilled	holes	(HD) ,	compre	essed a	air drille	d hole:	s (CD)
일 I: 24°C/40°C	Dry, wet		[N/mm²]	7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5
Cemperature	concrete or flooded bore	<sup>τ</sup> Rk,cr		6,0	6,0	7,0	7,0	7,0	7,0	7,0	7,0
旧:60°C/80°C	hole			5,0	5,0	5,0	4,5	4,5	4,5	4,5	4,5
Reduction factor $\psi^0_{sus}$ in holes (CD) and in hamme				hamme	er drille	d holes	(HD),	compre	essed a	air drille	ed
	Dry, wet						0.	80			
II: 20°C/72°C	concrete or	$\psi^0$ sus	[-]	0,68							
世 日 記 III:60°C/80°C	flooded bore hole	Ψ <sup>*</sup> sus		0,70							
Increasing factors for	≤ C50/60			(f <sub>ck</sub> / 20) <sup>0,1</sup>							
concrete	> C50/60	$\Psi_{c}$	[-]	1,1							
Characteristic bond resis		τ <sub>Rk,ucr</sub> =		Ψc • τRk,ucr,(C20/25)							
on the concrete strength		τ <sub>Rk,cr</sub> =				Ψ	c <sup>• τ</sup> Rk,	cr,(C20/2	25)		
Concrete cone failure o Relevant parameter	or Splitting						200 T	able C2			
Installation factor				<u> </u>			300 T	101 <del>0</del> 02			
for dry and wet concrete	(HD; HDB, CD)	ν	r 1	1,0 1,2							
for flooded bore hole (HD	; HDB, CD)	γinst	[-]								
Performances Characteristic values of	of tension loads u	nder static and	d quasi-stat	tic actio	on			_	Anne	х С 3	3
for a working life of 50	years (threaded	rod)									



Table		racteristic va working life			ls und	der st	atic a	and q	uasi-	static	actic	n
Threade					M8	M10	M12	M16	M20	M24	M27	M30
Steel fai		intanac	N <sub>-</sub> .	FL-N 17			٧٠.	1000	00 Tab	lo C1)		
	eristic tension res	sistance	N <sub>Rk,s</sub>	[kN]			A <sub>S</sub> • I <sub>l</sub>		ee Tab	U ( )		
Partial fa		concrete failure	γ <sub>Ms,N</sub>	[-]				see Ta	ible C1			
	•	tance in uncracke	d concrete C20	)/25 in hamr	ner dril	led (HD			ssed a	ir drilled	 d holes	(CD
	I: 24°C/40°C	Dry, wet			20	20	19	19	18	17	16	16
Temperature range	II: 50°C/72°C	concrete or flooded bore	τ <sub>Rk,ucr,100</sub>	[N/mm <sup>2</sup> ]	15	15	15	14	13	13	12	12
Ten	III:60°C/80°C	hole			6,5	6,5	6,5	6,0	6,0	5,5	5,5	5,5
Characte	eristic bond resist	tance in uncracke	d concrete C20	)/25 in hamr	ner dril	led hole	es with	hollow	drill bit	t (HDB)		
<u>e</u>	I: 24°C/40°C				17	16	16	16	15	14	14	13
ang	II: 50°C/72°C	Dry or wet concrete			14	14	14	13	13	12	12	11
urer	III:60°C/80°C	CONTOLOGIC		INI/ CT	6,5	6,5	6,5	6,0	6,0	5,5	5,5	5,5
Temperaturerange	I: 24°C/40°C	<sup>τ</sup> Rk,ucr,100	[N/mm <sup>2</sup> ]	16	16	16	15	15	14	14	13	
mp.	II: 50°C/72°C	flooded bore			14	14	14	13	13	12	12	11
Te -	III:60°C/80°C	hole			6,5	6,5	6,5	6,0	6,0	5,5	5,5	5,5
		tance in cracked c les with hollow dri		5 in hamme				compre	essed a			
	I: 24°C/40°C	Dry, wet	<sup>τ</sup> Rk,cr,100		6,5	6,5	7,5	7,5	7,5	7,5	7,5	7,5
Temperature range	II: 50°C/72°C	concrete or flooded bore		[N/mm²]	5,5	5,5	6,5	6,5	6,5	6,5	6,5	6,5
Ten	III:60°C/80°C	hole			5,0	5,0	5,0	4,5	4,5	4,5	4,5	4,5
holes (C		in cracked and ι er drilled holes wit			ō in har	mmer d	rilled h	oles (H	D), cor	npresse	ed air c	Irilled
	I: 24°C/40°C	Dry, wet						0,	80			
perat ange	II: 50°C/72°C	concrete or flooded bore	Ψ <sup>0</sup> sus,100	[-]		0,68						
<u> </u>	III:60°C/80°C	hole			0,70							
Increasir	ng factors for	≤ C50/60	716	r_1	(f <sub>ck</sub> / 20) <sup>0,1</sup>							
concrete	•	> C50/60	Ψc	[-]	1,1							
	eristic bond resist		τ <sub>Rk,ucr,100</sub> =						k,ucr,100,(C20/25)			
	oncrete strength		τ <sub>Rk,cr,100</sub> =				Ψ <sub>C</sub> •	<sup>τ</sup> Rk,cr,	100,(C2	0/25)		
	e cone failure o	r Splitting							ıbla Oo			
	t parameter ion factor				L			see 18	able C2			
	nd wet concrete (	(HD; HDB, CD)	74.	r.1	1,0							
for flooded bore hole (HD;		,	γinst	[-]	1,2							
Injection	on system ULE	EP-585 for cond	crete						]			
Charac		f tension loads u		d quasi-stat	ic actio	on				Anne	x C 4	
701 a W	5.1.11g 1110 01 100	, Jan tineaded										



		a working life	01 00 yea									
Thread					M8	M10	M12	M16	M20	M24	M27	M30
Steel fa		.1.4	N	FL-N IZ			Λ . f	(or s	oo Tob	lo C1)		
	teristic tension res	sistance	N <sub>Rk,s</sub>	[kN]				<sub>ık</sub> (or so				
Partial			γ <sub>Ms,N</sub>	[-]				see Ta	ible C1			
	ned pull-out and		d aanarata Ci	20/25 in diam		اامط امما	00 (DD	١				
		tance in uncracke		20/25 in diam								
ature e	I: 24°C/40°C	Dry, wet			15	14	14	13	12	12	11	11
Temperature range	II: 50°C/72°C	concrete or flooded bore	<sup>τ</sup> Rk,ucr	[N/mm²]	12	12	11	10	9,5	9,5	9,0	9,0
Ten	III:60°C/80°C	hole			5,5	5,5	5,0	4,5	4,5	4,5	4,0	4,0
Charac	teristic bond resis	tance in cracked o	oncrete C20/	/25 in diamon	d drille	d holes	(DD)					
ture	I: 24°C/40°C	Dry, wet						5,5	5,5	5,5	5,5	5,4
Femperature range	II: 50°C/72°C	concrete or flooded bore	τ <sub>Rk,cr</sub> [N/mm	[N/mm²]	1)			4,6	4,6	4,6	4,6	4,5
Tem	III:60°C/80°C	hole						2,4	2,3	2,4	2,4	2,3
Reduct	ion factor ψ <sup>0</sup> sus in	uncracked concre	ete C20/25 in	diamond drill	ed hole	es (DD)						
iure	I: 24°C/40°C	Dry, wet			0,77							
Temperature range	II: 50°C/72°C	concrete or flooded bore	$\Psi^0_{sus}$	[-]	0,72							
Tem	III:60°C/80°C	hole			0,72							
		≤ C50/60			(f <sub>ck</sub> / 20) <sup>0,2</sup>							
Increas	ing factors for	> C50/60	Ψc,ucr	[-]	1,2							
	-	≤ C50/60	Ψ <sub>c,cr</sub>	[-]				(f <sub>ck</sub> / 2	20) 0,4			
Charac	teristic bond resis	tance depending	τ <sub>Rk,ucr</sub> =	<b>I</b>			Ψ <sub>c,u</sub>	cr • τ <sub>Rk</sub>	ucr,(C2	20/25)		
on the	concrete strength	class	τ <sub>Rk,cr</sub> =				Ψ <b>c</b> ,	cr • <sup>τ</sup> Rk	,cr,(C20	/25)		
Concre	te cone failure o	r Splitting										
	nt parameter							see Ta	ble C2			
	tion factor											
	and wet concrete	· ·	γ <sub>inst</sub>	[-]				1	,0			
	ded bore hole (DD erformance assess	<u>′</u>	- 11131			1,2				1,4		

Injection system ULEP-585 for concrete	
Performances Characteristic values of tension loads under static and quasi-static action for a working life of 50 years (threaded rod)	Annex C 5



Tabl		racteristic va a working life			s und	der st	tatic a	and q	uasi-	static	actio	n n
Threac	led rod				M8	M10	M12	M16	M20	M24	M27	M30
Steel f	ailure						•					
Charac	teristic tension res	sistance	N <sub>Rk,s</sub>	[kN]			$A_s \cdot f$	<sub>uk</sub> (or s	ee Tab	le C1)		
Partial	Partial factor			[-]				see Ta	ıble C1			
Combi	ned pull-out and	concrete failure		•								
Charac	teristic bond resis	tance in uncracke	d concrete C20	/25 in diam	ond dri	lled ho	les (DD	))				
ture	I: 24°C/40°C	Dry, wet			15	14	14	13	12	12	11	11
nperat range	II: 50°C/72°C   III: 60°C/80°C   III:	concrete or flooded bore	<sup>τ</sup> Rk,ucr,100	[N/mm <sup>2</sup> ]	11	11	10	10	9,5	9,0	8,5	8,5
Terr	III:60°C/80°C	hole			5,5	5,5	5,0	4,5	4,5	4,5	4,0	4,0
Reduct	tion factor ψ <sup>0</sup> sus,10	o in uncracked co	ncrete C20/25	in diamond	drilled	holes (	DD)					
ture	I: 24°C/40°C	Dry, wet			0,73							
Temperature range	II: 50°C/72°C	concrete or flooded bore	Ψ <sup>0</sup> sus,100	[-]	0,70							
Terr	III:60°C/80°C	hole			0,72							
Increas	sing factors for	≤ C50/60		r1	(f <sub>ck</sub> / 20) <sup>0,2</sup>							
concre	_	> C50/60	$\Psi_{c}$	[-]	1,2							
	teristic bond resist		τ <sub>Rk,ucr,100</sub> =		Ψc * <sup>τ</sup> Rk,ucr,100,(C20/25)							
Concre	ete cone failure o	r Splitting										
	nt parameter							see Ta	ble C2			
	ation factor											
	and wet concrete	· · ·	γ <sub>inst</sub>	[-]				1	,0			
for floo	ded bore hole (DD	)	.11121	[,		1,2				1,4		

Injection system ULEP-585 for concrete	
Performances Characteristic values of tension loads under static and quasi-static action for a working life of 100 years (threaded rod)	Annex C 6



Table C7: Characteristic for a working I					nder s	tatic a	ınd qu	asi-sta	atic acti	on
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> Rk,s	[kN]			0,6 •	A <sub>s</sub> ·f <sub>uk</sub>	(or see	Table C	1)	
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 C1)							
Partial factor	γ <sub>Ms,V</sub>	[-]	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 • \	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	γ <sub>inst</sub>	[-]					1,0			
Concrete edge failure		'								
Effective length of fastener	I <sub>f</sub>	[mm]		m	nin(h <sub>ef</sub> ; 1	2 · d <sub>nor</sub>	m)		min(h <sub>ef</sub> ;	300mm)
Outside diameter of fastener	d <sub>nom</sub>	[mm]	8 10 12 16 20 24 27					30		
Installation factor	γinst	[-]					1,0			

Injection system ULEP-585 for concrete	
Performances Characteristic values of shear loads under static and quasi-static action for a working life of 50 and 100 years (threaded rod)	Annex C 7

**Performances** 



Internal threa	ded anchor rods	S			IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20	
Steel failure1)	1						•				
Characteristic	tension resistanc	e, 5.8	$N_{Rk,s}$	[kN]	10	17	29	42	76	123	
Steel, strength	n 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	γMs,N	[-]			1	,5			
Characteristic tension resistance, Stainless Steel A4 and HCR, Strength class 70 <sup>2)</sup>			N <sub>Rk,s</sub>	[kN]	14	26	41	59	110	124	
Partial factor	Tori, orlangin ac	200 7 0	γMs,N	[-]		l	1,87			2,86	
	ıll-out and concr	ete cone failui					,				
	bond resistance			20/25 in h	ammer dr	illed (HD)	and comp	ressed air	r drilled ho	les (CD)	
	I: 24°C/40°C	Dry, wet			20	19	19	18	17	16	
Temperature	II: 50°C/72°C	concrete or	τ <sub>Rk,ucr</sub>	[N/mm²]	15	15	14	13	13	12	
range	III:60°C/80°C	flooded bore hole	T IK, UCI	[[]	6,5	6,5	6,0	6,0	5,5	5,5	
Characteristic	bond resistance		ncrete C	⊥ 20/25 in h	-		<u> </u>			0,0	
Characteristic	I: 24°C/40°C				16	16	16	15	14	13	
	II: 50°C/72°C	Dry or wet			14	14	13			11	
Temperature	III:60°C/80°C	concrete		[ FA.1 / GT	6,5	6,5	6,0	6,0		5,5	
range	I: 24°C/40°C		<sup>τ</sup> Rk,ucr	[N/mm²]	16	16	15	15	14	13	
	II: 50°C/72°C	flooded bore hole			14	14	13	13	12	11	
	III:60°C/80°C				6,5	6,5	6,0	6,0	5,5	5,5	
	bond resistance er drilled holes wit			/25 in ham	mer drille	ed holes (F	HD), comp	ressed air	drilled ho	les (CD)	
Tomporeture =	I: 24°C/40°C	Dry, wet			7,0	8,5	8,5	8,5	8,5	8,5	
Temperature	II: 50°C/72°C	concrete or flooded bore	<sup>τ</sup> Rk,cr	[N/mm <sup>2</sup> ]	6,0	7,0	7,0	7,0	7,0	7,0	
range	III:60°C/80°C	hole			5,0	5,0	4,5	4,5	4,5	4,5	
Reduction fac	tor w <sup>0</sup> aug in crack	ked and uncrac	ked conci	rete C20/2	5 in hamı	mer drilled	holes (H[	D), compre	essed air o	drilled	
	d in hammer drille						(	,,			
(=, =, =, =, =, =, =, =, =, =, =, =, =, =	I: 24°C/40°C	Dry, wet			0,80						
Temperature	II: 50°C/72°C	concrete or	$\Psi^0_{sus}$	[-]				68			
range	III:60°C/80°C	flooded bore	y sus	',			-	70			
	111.00 0/00 0	hole							6,0 5,5 5,15 14 13 13 12 13 6,0 5,5 5,5 5,5 5,5 5,5 5,6 6 air drilled holes (C 8,5 8,5 8,5 8,5 7,0 7,0 7,0 4,5 4,5 4,5 4,5 5,5 6 compressed air drilled c 6,11 c 6,		
Increasing fac	tors for concrete	≤ C50/60	Ψς	[-]				20) <sup>0,1</sup>			
		> C50/60	_				1	,1			
	bond resistance	depending on		τ <sub>Rk,ucr</sub> =			Ψc • τ <sub>Rk,ι</sub>	ucr,(C20/25)			
the concrete s	trength class			τ <sub>Rk,cr</sub> =			Ψc • τ <sub>Rk,</sub>	cr,(C20/25)			
Concrete cor	ne failure or Split	tting									
Relevant para							see Ta	able C2			
Installation fa											
<u> </u>	et concrete (HD; F		γ <sub>inst</sub>	[-]				,0			
	re hole (HD; HDB	<del>, ,</del>						,2		ala.al	
The charac	(incl. nut and was steristic tension res	istance for steel								ea roa.	
-) For IG-M20	strength class 50	is valid									

Characteristic values of tension loads under static and quasi-static action for a working life of 50 years (Internal threaded anchor rod)

Annex C 8



Characteristic tension resistance,   5.8   N <sub>Rk,s</sub>   [kN]   10   17   29   42   76   123   196		eristic value rking life of						,		
Characteristic tension resistance,   5.8   N <sub>Rk,s</sub>   [kN]   10   17   29   42   76   123		S			IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20
Steel, strength class   8.8   N <sub>RIk,S</sub>   [kN]   16   27   46   67   121   196	Steel failure <sup>1)</sup>									
Partial factor, strength class 5.8 and 8.8   YMS, N   [-]   1,5   1,5   1,0   1,2   1,2   1,2   1,5   1,5   1,6	Characteristic tension resistand	ce, <u>5.8</u>	N <sub>Rk,s</sub>	[kN]	10	17	29	42	76	123
Characteristic tension resistance, Stainless   Steel A4 and HCR, Strength class 70²   NRk,s   [kN]   14   26   41   59   110   124   27   2,86   2,	Steel, strength class	8.8	N <sub>Rk,s</sub>	[kN]	16	27	46	67	121	196
Steel A4 and HCR, Strength class 70 <sup>2</sup>   NRk,   IRN   14   26   41   59   110   124	Partial factor, strength class 5.8		[-]			1	,5			
Characteristic bond resistance in uncracked concrete C20/25 in hammer drilled (HD) and compressed air drilled holes (CI remperature finds)   18   24°C/40°C   Concrete or flooded bore hole   Tak,ucr,100   Tak,uc		N <sub>Rk,s</sub>	[kN]	14	26	41	59	110	124	
Characteristic bond resistance in uncracked concrete C20/25 in hammer drilled (HD) and compressed air drilled holes (CI arrange)	Partial factor		γMs,N	[-]			1,87			2,86
Temperature range	Combined pull-out and conc	rete cone failu	re							
Temperature range	Characteristic bond resistance	in uncracked c	oncrete C20	)/25 in ha	mmer dril	led (HD) a	and comp	ressed air	drilled ho	les (CD)
Figure   1.5		1 .			20	19	19	18	17	16
III:60°C/80°C   hole			τ <sub>Bk ucr 100</sub>	[N/mm²]	15	15	14	13	13	12
Characteristic bond resistance in uncracked concrete C20/25 in hammer drilled holes with hollow drill bit (HDB)    1. 24°C/40°C   II: 50°C/72°C   III: 50°C/72°			1111,001,100		6.5	6.5	6.0	6.0	5.5	5.5
Temperature range   Temp			oncrete C20	)/25 in ha						
Temperature range    II: 50°C/72°C   Hi: 60°C/80°C   E24°C/40°C   Hi: 50°C/72°C   Hi: 50°C/72									ì í	13
Temperature range   His 60°C/80°C   Hoole   Hool	-	1 *							12	
Concrete concrete Strength Class   Concrete Co	Temperature III:60°C/80°C	concrete		[N 1 /v== 27]	6,5	6,5	6,0	6,0	5,5	5,5
15.0°C/72°C   Nole   14	range I: 24°C/40°C	flandad bass	Rk,ucr,100	[IN/MM²] 	16	16	15	15	14	13
Ill: $60^{\circ}C/80^{\circ}C$   6,5   6,5   6,0   6,0   5,5   5,5   5,5   Characteristic bond resistance in cracked concrete C20/25 in hammer drilled holes (HD), compressed air drilled holes (CE and in hammer drilled holes with hollow drill bit (HDB)  Temperature range   I: $24^{\circ}C/40^{\circ}C$   Dry, wet concrete or flooded bore hole   $\tau_{Rk,cr,100}$   $\tau_{Rk,cr,100,(C20/25)}$   $\tau_{Rk,cr,100,(C20/25)}$   $\tau_{Rk,cr,100}$   $\tau_{Rk,cr,100}$   $\tau_{Rk,cr,100}$   $\tau_{Rk,cr,100,(C20/25)}$   $\tau_{Rk,cr,100,(C20/25)}$   $\tau_{Rk,cr,100}$   $\tau_{Rk,cr,100}$   $\tau_{Rk,cr,100,(C20/25)}$   $\tau_{Rk,cr,100,($	II: 50°C/72°C				14	14	13	13	12	11
Temperature range   1: 24°C/40°C     Dry, wet concrete or flooded bore hole   Tak,cr,100   Tak							<u> </u>			
Temperature range $ \frac{ I : 50^{\circ}\text{C}/72^{\circ}\text{C}}{ II : 60^{\circ}\text{C}/80^{\circ}\text{C}} \frac{ I : 50^{\circ}\text{C}/72^{\circ}\text{C}}{ II : 60^{\circ}\text{C}/80^{\circ}\text{C}} \frac{ I : 50^{\circ}\text{C}/72^{\circ}\text{C}}{ II : 60^{\circ}\text{C}/80^{\circ}\text{C}} \frac{ I : 50^{\circ}\text{C}/80^{\circ}\text{C}}{ II : 60^{\circ}\text{C}/80^{\circ}\text{C}} \frac{ I : 50^{\circ}\text{C}/72^{\circ}\text{C}}{ II : 60^{\circ}\text{C}/80^{\circ}\text{C}} \frac{ I : 50^{\circ}\text{C}/7$				5 in hamr	ner drilled	l holes (H	D), compr	essed air	drilled ho	les (CD)
range    II: 50°C/72°C   flooded bore hole   flooded bore flooded bore hole   flooded			<sup>τ</sup> Rk,cr,100		6,5	7,5	7,5	7,5	7,5	7,5
Reduction factor $\psi^0_{SuS,100}$ in cracked and uncracked concrete C20/25 in hammer drilled holes (HD), compressed air drilled holes (CD) and in hammer drilled holes with hollow drill bit (HDB)  Temperature range    I: 24°C/40°C   Dry, wet concrete or flooded bore hole   $\psi^0_{SuS,100}$   [-]   0,80   0,80   0,70   0,70   0,68   0,70	11 50 (7/2)			[N/mm <sup>2</sup> ]	5,5	6,5	6,5	6,5	6,5	6,5
$ \frac{\text{drilled holes (CD) and in hammer drilled holes with hollow drill bit (HDB)}}{\text{II: } 24^{\circ}\text{C}/40^{\circ}\text{C}} \frac{\text{II: } 50^{\circ}\text{C}/72^{\circ}\text{C}}{\text{III: } 50^{\circ}\text{C}/72^{\circ}\text{C}} \frac{\text{III: } 50^{\circ}\text{C}/72^{\circ}\text{C}}{\text{III: } 60^{\circ}\text{C}/80^{\circ}\text{C}} \frac{\text{III: } 50^{\circ}\text{C}/80^{\circ}\text{C}}{\text{III: } 60^{\circ}\text{C}/80^{\circ}\text{C}} \frac{\text{III: } 60^{\circ}\text{C}/80^{\circ}\text{C}}{\text{III: } 60^{\circ}\text{C}/80^{\circ}\text{C}} \frac{\text{III: } 60^{\circ}\text$	III:60°C/80°C				5,0	5,0	4,5	4,5	4,5	4,5
Temperature range $\begin{tabular}{ l l l l l l l l l l l l l l l l l l l$						ammer dr	illed holes	(HD), co	mpressed	air
Temperature range $\begin{tabular}{ l l l l l l l l l l l l l l l l l l l$	, ,	1	With Hollow		(סטו			00		
range $\frac{\text{II: 50°C/72°C}}{\text{III: 60°C/80°C}}$ flooded bore hole $\frac{\text{Flooded bore}}{\text{hole}}$ flooded bore hole $\frac{\text{Flooded bore}}{\text{Flooded bore}}$ flooded bore hole (HD; HDB, CD) $\frac{\text{Flooded bore}}{\text{Flooded bore}}$ flooded bore hole (HD; HDB, CD) $\frac{\text{Flooded bore}}{\text{Flooded bore}}$ flooded bore hole (HD; HDB, CD) $\frac{\text{Flooded bore}}{\text{Flooded bore}}$ for steel failure is valid for the internal threaded rod. The characteristic tension resistance for steel failure is valid for the internal threaded rod and the fastening element.	Tomporature -			.,						
Increasing factors for concrete $\frac{\leq C50/60}{> C50/60}$ $\forall_C$ $\psi_C$ $\psi_$	range III. 50°C/72°C		Ψ <sup>0</sup> sus,100	[-]						
Characteristic bond resistance depending on the concrete strength class  Concrete cone failure or Splitting  Relevant parameter  For dry and wet concrete (HD; HDB, CD) for flooded bore hole (HD; HDB, CD)  Takk, cr, 100 = Takk, ur, 100, (C20/25)  Takk, ur, 100 = Takk, ur, 100, ur	III:60°C/80°C	hole								
Characteristic bond resistance depending on the concrete strength class   τ <sub>Rk,cr,100</sub> =   Ψ <sub>c</sub> • τ <sub>Rk,cr,100,(C20/25)</sub>     Concrete cone failure or Splitting	Increasing factors for concrete	≤ C50/60	111				(f <sub>ck</sub> / :	20) <sup>0,1</sup>		
the concrete strength class $\tau_{Rk,cr,100} = \frac{\psi_c \cdot \tau_{Rk,cr,100,(C20/25)}}{\psi_c \cdot \tau_{Rk,cr,100,(C20/25)}}$ Concrete cone failure or Splitting  Relevant parameter  see Table C2  Installation factor  for dry and wet concrete (HD; HDB, CD)  for flooded bore hole (HD; HDB, CD)  1,0  1,2  1) Fastenings (incl. nut and washer) must comply with the appropriate material and property class of the internal threaded rod. The characteristic tension resistance for steel failure is valid for the internal threaded rod and the fastening element.	increasing factors for concrete	> C50/60	$\int_{0}^{1} \Psi_{c}$	[-]			1	,1		
Concrete cone failure or Splitting  Relevant parameter see Table C2  Installation factor  for dry and wet concrete (HD; HDB, CD) for flooded bore hole (HD; HDB, CD)  1) Fastenings (incl. nut and washer) must comply with the appropriate material and property class of the internal threaded rod. The characteristic tension resistance for steel failure is valid for the internal threaded rod and the fastening element.		depending on	τ <sub>Rk,</sub>	ucr,100 =		Ψ	<sup>/</sup> c <sup>• τ</sup> Rk,ucr	,100,(C20/2	25)	
Relevant parameter  Installation factor  for dry and wet concrete (HD; HDB, CD) for flooded bore hole (HD; HDB, CD)  1) Fastenings (incl. nut and washer) must comply with the appropriate material and property class of the internal threaded rod. The characteristic tension resistance for steel failure is valid for the internal threaded rod and the fastening element.	the concrete strength class		τ <sub>Rl</sub>	k,cr,100 =		1	Ψc • τ <sub>Rk,cr,</sub>	,100,(C20/2	(5)	
Installation factor for dry and wet concrete (HD; HDB, CD) for flooded bore hole (HD; HDB, CD)  1,2  1) Fastenings (incl. nut and washer) must comply with the appropriate material and property class of the internal threaded rod. The characteristic tension resistance for steel failure is valid for the internal threaded rod and the fastening element.	Concrete cone failure or Spli	tting								
for dry and wet concrete (HD; HDB, CD) for flooded bore hole (HD; HDB, CD)  1,0  1,2  1) Fastenings (incl. nut and washer) must comply with the appropriate material and property class of the internal threaded rod. The characteristic tension resistance for steel failure is valid for the internal threaded rod and the fastening element.							see Ta	able C2		
for flooded bore hole (HD; HDB, CD)  Yinst  1,2  1) Fastenings (incl. nut and washer) must comply with the appropriate material and property class of the internal threaded rod. The characteristic tension resistance for steel failure is valid for the internal threaded rod and the fastening element.										
1) Fastenings (incl. nut and washer) must comply with the appropriate material and property class of the internal threaded rod.  The characteristic tension resistance for steel failure is valid for the internal threaded rod and the fastening element.	•		γ <sub>inst</sub>	[-]						
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	The characteristic tension res	sistance for stee	ly with the a I failure is va	ppropriate alid for the	material a internal th	and prope readed ro	rty class of od and the	f the intern fastening	al threade element.	ed rod.

Injection system ULEP-585 for concrete	
Performances	Annex C 9
Characteristic values of tension loads under static and quasi-static action	
for a working life of 100 years (Internal threaded anchor rod)	



1,0

1,4

Table C10		eristic value rking life of			nds und	ler stat	ic and o	quasi-s	tatic ac	tion
Internal threa	ded anchor rod	 S			IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20
Steel failure1)										
Characteristic	tension resistanc	e, <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 5.8	3 and 8.8	$\gamma_{Ms,N}$	[-]			1	,5		
Characteristic tension resistance, Stainless Steel A4 and HCR, Strength class 70 <sup>2)</sup>			N <sub>Rk,s</sub>	[kN]	14	26	41	59	110	124
Partial factor			γ <sub>Ms,N</sub>	[-]			1,87			2,86
Combined pu	Il-out and concr	ete cone failu	re							
Characteristic	bond resistance	in uncracked co	oncrete C20	0/25 in dia	mond dril	led holes	(DD)			
	I: 24°C/40°C	I HOOGEG DOIC	<sup>τ</sup> Rk,ucr		14	14	13	12	12	11
Temperature range	II: 50°C/72°C			[N/mm²]	12	11	10	9,5	9,5	9,0
	III:60°C/80°C	hole			5,5	5,0	4,5	4,5	4,5	4,0
Characteristic I	bond resistance i	n cracked cond	rete C20/2	5 in diamo	nd drilled	l holes (D	D)			
	I: 24°C/40°C	Dry, wet concrete or flooded bore hole			3)		5,5	5,5	5,5	5,4
Temperature range	II: 50°C/72°C		<sup>τ</sup> Rk,cr	[N/mm²]			4,6	4,6	4,6	4,5
	III:60°C/80°C						2,4	2,3	2,4	2,3
Reduction fact	or ${\psi^0}_{ t sus}$ in uncra	acked concrete	C20/25 in 6	diamond d	rilled hole	es (DD)				
	I: 24°C/40°C	Dry, wet			0,77					
Temperature range	II: 50°C/72°C	concrete or flooded bore	$\Psi^0_{sus}$	[-]			0,	72		
	III:60°C/80°C	hole			0,72					
		≤ C50/60	Ψ <sub>c,ucr</sub>	[-]			(f <sub>ck</sub> / 2	20) 0,2		
Increasing fact	ors for concrete	> C50/60	₹C,ucr	1.1				,2		
		≤ C50/60	Ψ <sub>c,cr</sub>	[-]			(f <sub>ck</sub> / 2	20) 0,4		
	bond resistance	depending on		τ <sub>Rk,ucr</sub> =	Ψc,ucr * <sup>τ</sup> Rk,ucr,(C20/25)					
the concrete st				τ <sub>Rk,cr</sub> =	Ψ <b>c</b> ,cr • <sup>τ</sup> Rk,cr,(C20/25)					
Relevant para	<b>e failure or Spli</b> t meter	tting					see Ta	able C2		
Installation fa										

<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.

 $\gamma_{\text{inst}}$ 

[-]

1,2

for dry and wet concrete (DD)

for flooded bore hole (DD)

Injection system ULEP-585 for concrete	
Performances	Annex C 10
Characteristic values of tension loads under static and quasi-static action for a working life of 50 years (Internal threaded anchor rod)	

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

<sup>3)</sup> no performance assessed



Table C11:	Characteristic values of tension loa for a working life of 100 years	ads und	der stat	ic and o	quasi-s	tatic ac	tion
Internal threaded	i anchor rods	IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M

Internal threa	ded anchor rods	S			IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20	
Steel failure1)											
Characteristic	tension resistanc	e, 5.8	N <sub>Rk,s</sub>	[kN]	10	17	29	42	76	123	
Steel, strength	Steel, strength class 8.8		N <sub>Rk,s</sub>	[kN]	16	27	46	67	121	196	
Partial factor, s	strength class 5.8	3 and 8.8	γ <sub>Ms,N</sub>	[-]			1	,5			
	tension resistand ICR, Strength cla	,	N <sub>Rk,s</sub>	[kN]	14	26	41	59	110	124	
Partial factor			γ <sub>Ms,N</sub>	[-]			1,87			2,86	
Combined pu	II-out and concr	ete cone failu	re								
Characteristic	bond resistance	in uncracked co	oncrete C20	)/25 in dia	mond dril	led holes	(DD)				
Temperature range _	I: 24°C/40°C	Dry, wet concrete or flooded bore	<sup>τ</sup> Rk,ucr,100	[N/mm²]	14	14	13	12	12	11	
	II: 50°C/72°C				11	10	10	9,5	9,0	8,5	
	III:60°C/80°C	hole			5,5	5,0	4,5	4,5	4,5	4,0	
Reduction factor	or ${\psi^0}_{ extsf{sus},100}$ in $\iota$	ıncracked cond	rete C20/25	in diamo	nd drilled	holes (D	D)				
	I: 24°C/40°C	Dry, wet		[-]	0,73						
Temperature range	II: 50°C/72°C	concrete or flooded bore	Ψ <sup>0</sup> sus,100		0,70						
	III:60°C/80°C	hole			0,72						
		≤ C50/60					(f <sub>ck</sub> / :	20) <sup>0,2</sup>			
ncreasing factors for concrete > C50/60		> C50/60	Ψc	[-]	1,2						
Characteristic l he concrete st	oond resistance o	depending on	<sup>τ</sup> Rk,	ucr,100 =	Ψ <b>c</b> * <sup>τ</sup> Rk,ucr,100,(C20/25)						
	e failure or Split	tting	•	'							
Relevant parar	meter				see Table C2						

for dry and wet concrete (DD)	γ	,	1,0					
for flooded bore hole (DD)	7 inst	[-]	1.2	1.4				

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

Installation factor

Injection system ULEP-585 for concrete	
Performances	Annex C 11
Characteristic values of tension loads under static and quasi-static action for a working life of 100 years (Internal threaded anchor rod)	

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



teel failure without lever arm characteristic shear resistance, teel, strength class	1)		Internal threaded anchor rods IG-M6   IG-M8   IG-M10   IG-M12   IG-M16										
,													
teel, strength class	5.8	V <sup>0</sup> Rk,s	[kN]	5	9	15	21	38	61				
	8.8	V <sup>0</sup> <sub>Rk,s</sub>	[kN]	8	14	23	34	60	98				
artial factor, strength class 5.8	and 8.8	γ <sub>Ms,V</sub>	[-]	1,25									
haracteristic shear resistance, tainless Steel A4 and HCR, trength class 70 <sup>2)</sup>		V <sup>0</sup> Rk,s	[kN]	7	7 13 20 30 55								
artial factor		$\gamma_{Ms,V}$	[-]	[-] 1,56 2,0									
uctility factor		k <sub>7</sub>	[-]	[-] 1,0									
teel failure with lever arm1)		•											
haracteristic bending moment,	5.8	M <sup>0</sup> Rk,s	[Nm]	8	19	37	66	167	325				
teel, strength class	8.8	M <sup>0</sup> Rk,s	[Nm]	12	30	60	105	267	519				
artial factor, strength class 5.8	and 8.8	γ <sub>Ms,V</sub>	[-]	1,25									
characteristic bending moment, tainless Steel A4 and HCR, trength class 70 <sup>2)</sup>		M <sup>0</sup> <sub>Rk,s</sub>	[Nm]	11	26	52	92	233	456				
artial factor		γ <sub>Ms,V</sub>	[-]	[-] 1,56 2,38									
oncrete pry-out failure													
actor		k <sub>8</sub>	[-]	[-] 2,0									
nstallation factor		γ <sub>inst</sub>	[-]	[-] 1,0									

10

12

[mm]

[mm]

[-]

 $d_{nom}$ 

 $\gamma_{\mathsf{inst}}$ 

 $min(h_{ef}; 12 \cdot d_{nom})$ 

16

20

1,0

24

min(h<sub>ef</sub>; 300mm)

30

Effective length of fastener

Outside diameter of fastener

Installation factor

Injection system ULEP-585 for concrete	
Performances Characteristic values of shear loads under static and quasi-static action for a working life of 50 and 100 years (Internal threaded anchor rod)	Annex C 12

<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



Table C13:	Characte for a wor					load	s un	der s	statio	and	qua	si-st	atic	actio	n
Reinforcing bar				Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32	Ø 36	Ø 40
Steel failure															
Characteristic tensi resistance	on	N <sub>Rk,s</sub>	[kN]							f <sub>uk</sub> 1)					
Cross section area		A <sub>s</sub>	[mm <sup>2</sup> ]	50	79	113	154	201	314		491	616	804	1018	1256
Partial factor		γ <sub>Ms,N</sub>	[-]						1,	4 <sup>2)</sup>					
Combined pull-ou															
Characteristic bond	resistance i	n uncracked	concret	e C20	)/25 in	hamn	er (H	D) and	comp	resse	d air d	Irilled I	noles (	(CD)	
I: 24°C/40°C II: 50°C/72°C	Dry, wet concrete or	7.01	[N/mm <sup>2</sup> ]	16 12	16	16 12	16 12	16 12	16 12	15 12	15 12	15 11	15 11	15 11	15 11
E E III: 80°C\80°C	flooded bore hole	<sup>τ</sup> Rk,ucr	[[14/11111-]	5,5	5,5	5,5	5,5	5,5	5,5	5,0	5,0	5,0	5,0	4,5	4,5
Characteristic bond	resistance i	n uncracked	d concret	e C20	)/25 in	hamm	er dri	lled ho	les wi	th holl	ow dri	ll bit (F	HDB)		
I: 24°C/40°C	D			14	14	13	13	13	13	13	13	13	13		
II: 50°C/72°C	Dry, wet concrete			12	12	12	11	11	11	11	11	11	11		
Ti: 50°C/72°C    Ii: 50°C/72°C    Ii: 50°C/72°C    Ii: 50°C/72°C	Concrete	TDI	  [N/mm²]	5,5	5,5	5,5	5,5	5,5	5,5	5,0	5,0	5,0	5,0		3)
ਵੇਂ ਫ਼ੁ <u>I: 24°C/40°C</u>	flooded	<sup>τ</sup> Rk,ucr	[14/11111]	13	13	13	13	13	13	13	13	13	13		,
II: 50°C/72°C	bore hole			11	11	11	11	11	11	11	11	11	11	-	
III: 60°C/80°C	60°C/80°C   5,5   5,5   5,5   5,5   5,5   5,5   5,0   5,0   5,5   5,5   5,5   5,5   5,0										5,0	5,0	5,0	<u> </u>	(OD)
and in hammer drill					5 in na	ımmer	arilled	a noies	· HD)	, com	resse	a air c	irillea i	noies	(CD)
i: 24°C/40°C	Dry, wet			7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5	8,5	8,5		
E 24°C/40°C   II: 50°C/72°C   II: 60°C/80°C	concrete or flooded	τ <sub>Rk,cr</sub>	[N/mm <sup>2</sup> ]	6,0	6,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0	3)	
<sup>™</sup> <sup>™</sup> III:60°C/80°C	hore hole	,		4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	1	
holes (CD) and in h	Ψ <sup>0</sup> sus	nollow	0,80												
III: 60°C/80°C	flooded bore hole	Ψ sus	[7]	0,70											
									(f <sub>ck</sub> / 2						
Increasing factors for concrete	> C50/60	Ψс	[-]							,1					
Characteristic bond	l resistance	τ	Rk,ucr =					Wa	• TDk	or (CO)	)/OE)				
depending on the c	oncrete		-						• τ <sub>Rk,u</sub>						
strength class			<sup>τ</sup> Rk,cr =					Ψс	• τ <sub>Rk,</sub>	cr,(C20	/25)				
Concrete cone fai		ung							200 T	bla O	2				
Relevant paramete Installation factor		יחי							see Ta	ible C					
for dry and wet con	-	ر <i>و</i> ر						1	,0					1	,2
for flooded bore ho		γinst	[-]						<u>,0</u> ,2						<u>,∠</u> 3)
1) f <sub>uk</sub> shall be take		ecifications of	of reinforc	ina ba	ars			'	, <b>_</b>					`	- /
2) in absence of na 3) no performance	itional regulat		51 TOILIIOT	onig Sc											
Injection syster	m ULEP-58	5 for cond	crete												
Performances Characteristic va for a working life				tic an	d quas	si-stat	ic acti	on				Ar	nnex	C 13	3



Table C14:	Characte for a wor					load	s un	der s	tatic	and	qua	si-st	atic a	actio	n		
Reinforcing bar				Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32	Ø 36	Ø 40		
Steel failure																	
Characteristic tensi resistance	on	N <sub>Rk,s</sub>	[kN]						A <sub>s</sub> ·	f <sub>uk</sub> 1)							
Cross section area		A <sub>s</sub>	[mm <sup>2</sup> ]	50	79	113	154	201	314	452	491	616	804	1018	1256		
Partial factor		γ <sub>Ms,N</sub>	[-]						1,4	<b>4</b> <sup>2</sup> )							
Combined pull-ou	t and concre																
Characteristic bond	resistance i	n uncracked	d concret	e C20	/25 in	hamm	ner (HI	D) and	comp	resse	d air d	rilled ł	noles (	CD)			
1: 24°C/40°C	Dry, wet			16	16	16	16	16	16	15	15	15	15	15	15		
I: 50°C/72°C	concrete or	τ <sub>Rk,ucr,100</sub>	[N/mm²]	12	12	12	12	12	12	12	12	11	11	11	11		
☐ ☐ ☐ III:60°C\80°C	flooded	TRK,UCI, 100	[, ]	5,5	5,5	5,5	5,5	5,5	5,5	5,0	5,0	5,0	5,0	4,5	4,5		
			1											4,5	4,5		
Characteristic bond I: 24°C/40°C	resistance ii	n uncracked		e 020	14	13	13	13	13	13	13	13	13				
1: 50°C/72°C	Dry or wet			12	12	12	11	11	11	11	11	11	11				
a III. 60°C/80°C	concrete			5.5	5,5	5,5	5,5	5,5	5,5	5,0	5,0	5,0	5,0				
emperature   II: 50°C/72°C   I		<sup>τ</sup> Rk,ucr,100	[N/mm <sup>2</sup> ]	13	13	13	13	13	13	13	13	13	13	3	3)		
	nooaea			11	11	11	11	11	11	11	11	11	11				
III: 60°C/80°C	bore hole			5,5	5,5	5,5	5,5	5,5	5,5	5,0	5,0	5,0	5,0				
Characteristic bond resistance in cracked concrete C20/25 in hammer drilled holes (HD), compressed air drilled holes (CD) and in hammer drilled holes with hollow drill bit (HDB)																	
1. 0400/4000	Dry wet	THORIOW GITT		6,5	6,5	7,5	7,5	7,5	7,5	7,5	7,5	7,5	7,5				
I: 50°C/72°C	concrete or	_	[N]/mama21	<u> </u>										,	<b>)</b> \		
E E	flooded	<sup>τ</sup> Rk,cr,100	[N/mm <sup>2</sup> ]	⊢ ´	5,5	6,5	6,5	6,5	6,5	6,5	6,5	6,5	6,5	$\dashv$			
⊢ _ III:60°C/80°C	bore hole			4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5				
Reduction factor ψ <sup>0</sup> <sub>sus,100</sub> in cracked and uncracked concrete C20/25 in ham drilled holes (CD) and in hammer drilled holes with hollow drill bit (HDB)    So C/72°C   Dry, wet concrete or flooded   ψ <sup>0</sup> <sub>sus,100</sub>   [-]					amme	0,	80 68	S (ND)	), COIII	presse	eu air						
<u> III:60°C\80°C</u>	flooded bore hole	303,100							0,	70							
Increasing factors	≤ C50/60		ļ ,,						(f <sub>ck</sub> / 2	20) <sup>0,1</sup>							
for concrete	> C50/60	Ψc	[-]							,1							
Characteristic bond		7.51						317 • 3			00 (0.5)						
depending on the c			cr,100 =							,100,(C							
strength class			cr,100 =					Ψ <sub>c</sub> •	<sup>τ</sup> Rk,cr,	100,(C2	20/25)						
Concrete cone fail		ting															
Relevant paramete									see Ta	ıble C2	2						
Installation factor		;D) ⊤	1	1													
for dry and wet con		γ <sub>inst</sub>	[-]						,0						,2		
for flooded bore ho				ina ha				1	,2						3)		
1) f <sub>uk</sub> shall be take	•		n reilliof(	ang ba	115												
2) in absence of national regulation 3) no performance assessed																	
Injection system	m ULEP-58	5 for cond	rete														
Performances Characteristic va for a working life				tic and	d quas	si-stat	ic acti	on				Ar	nex	C 14	ļ.		



Table C15:	Characte for a wor					load	s un	der s	tatic	and	qua	si-st	atic a	actio	n
Reinforcing bar				Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32	Ø 36	Ø 40
Steel failure															
Characteristic tens resistance	ion	N <sub>Rk,s</sub>	[kN]						A <sub>s</sub> ·	f <sub>uk</sub> 1)					
Cross section area		A <sub>s</sub>	[mm <sup>2</sup> ]	50	79	113	154	201	314	452	491	616	804	1018	1256
Partial factor		γ <sub>Ms,N</sub>	[-]	1,42)											
Combined pull-ou	t and concre	ete failure													
Characteristic bond	d resistance i	n uncracked	concret	e C20	/25 in	diamo	nd dri	lled ho	oles (C	D)					
일 I: 24°C/40°C	Dry, wet			14	13	13	13	12	12	11	11	11	11	11	10
III: 60°C/80°C	concrete or flooded	<sup>τ</sup> Rk,ucr	[N/mm²]	11	11	10	10	10	9,5	9,5	9,5	9,0	9,0	8,5	8,5
년 III:60°C/80°C				5,0	5,0	5,0	4,5	4,5	4,5	4,0	4,0	4,0	4,0	4,0	4,0
Reduction factor $\psi$	o <sub>sus</sub> in uncra	cked concr	ete C20/2	25 in c	diamor	nd drill	ed hol	es (D[	D)						
<u>9</u> I: 24°C/40°C				0,77											
III: 50°C/72°C	concrete or flooded	$\Psi^0$ sus	[-]	0,72											
트 III:60°C/80°C	bore hole								0,	72					
Increasing factors	≤ C50/60								(f <sub>ck</sub> / 2	20) <sup>0,2</sup>	2				
for concrete	> C50/60	Ψc,ucr	[-]						1	,2					
Characteristic bond depending on the d strength class		τ	Rk,ucr =	$\Psi_{c,ucr} \cdot \tau_{Rk,ucr,(C20/25)}$											
Concrete cone fai	lure or Split	ting													
Relevant paramete	Relevant parameter							5	see Ta	ıble C	2				
Installation factor	(DD)														
	for dry and wet concrete		[_1	1,0 1,2											
for flooded bore hole $\gamma_{\text{inst}}$			[-]		1	,2				1	,4			3	3)

 $<sup>^{1)}\,</sup>f_{uk}$  shall be taken from the specifications of reinforcing bars

Injection system ULEP-585 for concrete	
Performances	Annex C 15
Characteristic values of tension loads under static and quasi-static action	
for a working life of 50 years (reinforcing bar)	

<sup>2)</sup> in absence of national regulation

<sup>3)</sup> no performance assessed



Table C16:	Characte for a wor					load	s un	der s	tatic	and	qua	si-st	atic a	actio	n
Reinforcing bar				Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32	Ø 36	Ø 40
Steel failure															
Characteristic tensi resistance	ion	N <sub>Rk,s</sub>	[kN]						A <sub>s</sub> ·	f <sub>uk</sub> 1)				_	
Cross section area		$A_s$	[mm <sup>2</sup> ]	50	79	113	154	201	314	452	491	616	804	1018	1256
Partial factor		γ <sub>Ms,N</sub>	[-]	1,4 <sup>2</sup> )											
Combined pull-ou	it and concre	ete failure													
Characteristic bond	d resistance i	n uncracked	concret	e C20	/25 in	diamo	nd dri	lled ho	oles (C	D)					
일 I: 24°C/40°C				14	13	13	13	12	12	11	11	11	11	11	10
II: 50°C/72°C	concrete or flooded	τRk,ucr,100	[N/mm²]	11	10	10	10	9,5	9,0	9,0	9,0	8,5	8,5	8,0	8,0
हिं III:60°C/80°C	0°C/80°C bore hole			5,0	5,0	5,0	4,5	4,5	4,5	4,0	4,0	4,0	4,0	4,0	4,0
Reduction factor $\psi'$	<sup>0</sup> sus,100 in ս	ncracked c	oncrete (	220/25	5 in dia	amond	drille	d holes	s (DD)						
일 I: 24°C/40°C			[-]	0,73											
III: 50°C/72°C	concrete or flooded	Ψ <sup>0</sup> sus,100		0,70											
티:60°C/80°C									0,	72					
Increasing factors	≤ C50/60								(f <sub>ck</sub> / 2	20) <sup>0,2</sup>	2				
for concrete	> C50/60	Ψc,ucr	[-]						1	,2					
Characteristic bond depending on the c strength class		<sup>τ</sup> Rk,u	cr,100 =	$\Psi_{c,ucr} \cdot \tau_{Rk,ucr,100,(C20/25)}$											
Concrete cone fai	<b>.</b>	ting													
	Relevant parameter							5	see Ta	ble C	2				
Installation factor	<u> </u>														
	r dry and wet concrete		[-]	1,0 1,2											
for flooded bore hole		11101	.,		1	,2				1	,4				3)

 $<sup>^{1)}\,</sup>f_{uk}$  shall be taken from the specifications of reinforcing bars

Injection system ULEP-585 for concrete	
Performances	Annex C 16
Characteristic values of tension loads under static and quasi-static action	
for a working life of 100 years (reinforcing bar)	

<sup>2)</sup> in absence of national regulation

<sup>3)</sup> no performance assessed



Table C17: Character a working						uno	der s	tatio	and	quas	si-sta	tic a	ction	for
Reinforcing bar			Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32	Ø 36	Ø 40
Steel failure without lever arm							•	•						
Characteristic shear resistance	V <sup>0</sup> <sub>Rk,s</sub>	[kN]						0,5	· A <sub>s</sub> · f	uk <sup>1)</sup>				
Cross section area	A <sub>s</sub>	[mm²]	2] 50 79 113 154 201 314 452 491 616 804							1018	1256			
Partial factor	γ <sub>Ms,V</sub>	[-]							1,5 <sup>2)</sup>					
Ductility factor	k <sub>7</sub>	[-]	1,0											
Steel failure with lever arm														
Characteristic bending moment	M <sup>0</sup> <sub>Rk,s</sub>	[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	4580	6283
Partial factor	γ <sub>Ms,V</sub>	[-]							1,5 <sup>2)</sup>					
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]	$\min(h_{ef}; 12 \cdot d_{nom}) \qquad \min(h_{ef}; 300mm)$											
Outside diameter of fastener	d <sub>nom</sub>	[mm]	1] 8 10 12 14 16 20 24 25 28 32 36					36	40					
Installation factor	γ <sub>inst</sub>	[-]	1,0											

 $<sup>^{1)}</sup>$   $f_{uk}$  shall be taken from the specifications of reinforcing bars

Injection system ULEP-585 for concrete	
Performances	Annex C 17
Characteristic values of shear loads under static and quasi-static action	
for a working life of 50 and 100 years (reinforcing bar)	

<sup>2)</sup> in absence of national regulation



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

Threaded rod				M10	M12	M16	M20	M24	M27	M30
Uncracked concrete under static and quasi-static action for a working life of 50 and 100 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
24°C/40°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,028	0,029	0,030	0,033	0,035	0,038	0,039	0,041
Temperature range II: 50°C/72°C	$\delta_{\text{N0}}$ -factor	[mm/(N/mm²)]	0,038	0,039	0,040	0,044	0,047	0,051	0,052	0,055
	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,047	0,049	0,051	0,055	0,059	0,064	0,067	0,070
Temperature range III:	$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,038	0,039	0,040	0,044	0,047	0,051	0,052	0,055
60°C/80°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 unde	Cracked concrete under static and quasi-static action for a working life of 50 and 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
24°C/40°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,100	0,115	0,122	0,128	0,135	0,142	0,155	0,171
Temperature range II:	$\delta_{\text{N0}}$ -factor	[mm/(N/mm²)]	0,092	0,095	0,096	0,099	0,102	0,106	0,109	0,110
50°C/72°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,134	0,154	0,163	0,172	0,181	0,189	0,207	0,229
Temperature range III: 60°C/80°C	$\delta_{\text{N0}}$ -factor	[mm/(N/mm²)]	0,092	0,095	0,096	0,099	0,102	0,106	0,109	0,110
	$\delta_{N\infty}$ -factor	[mm/(N/mm <sup>2</sup> )]	0,134	0,154	0,163	0,172	0,181	0,189	0,207	0,229

<sup>1)</sup> Calculation of the displacement:  $\delta_{N0} = \delta_{N0}$ -factor  $\tau$ ;  $\delta_{N\infty} = \delta_{N\infty}$ -factor  $\tau$ ;  $\tau$ : action bond stress for tension

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

Threaded rod				M10	M12	M16	M20	M24	M27	M30
Cracked and uncracked concrete under static and quasi-static action for a working life of 50 years										
Temperature range I: 24°C/40°C	$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,011	0,012	0,012	0,013	0,014	0,014	0,015	0,015
	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,018	0,019	0,019	0,020	0,022	0,023	0,024	0,025
Temperature range II: 50°C/72°C	$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,013	0,014	0,014	0,015	0,016	0,016	0,018	0,018
	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,052	0,053	0,055	0,058	0,062	0,065	0,068	0,070
Temperature range III: 60°C/80°C	$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,013	0,014	0,014	0,015	0,016	0,016	0,018	0,018
	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,052	0,053	0,055	0,058	0,062	0,065	0,068	0,070
Uncracked concrete un	der static and	d quasi-static act	ion for a	a workin	g life of	100 yea	rs			
Temperature range I: 24°C/40°C	$\delta_{\text{N0}}$ -factor	[mm/(N/mm²)]	0,011	0,012	0,012	0,013	0,014	0,014	0,015	0,015
	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,020	0,021	0,021	0,023	0,024	0,025	0,026	0,027
Temperature range II: 50°C/72°C	$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,013	0,014	0,014	0,015	0,016	0,016	0,018	0,018
	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,038	0,039	0,040	0,043	0,045	0,047	0,049	0,051
Temperature range III: 60°C/80°C	$\delta_{\rm N0}$ -factor	[mm/(N/mm²)]	0,013	0,014	0,014	0,015	0,016	0,016	0,018	0,018
	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,038	0,039	0,040	0,043	0,045	0,047	0,049	0,051
A										

<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 C20: Displacements under shear load<sup>1)</sup> for all drilling methods

Threaded rod			M8	M10	M12	M16	M20	M24	M27	M30
Uncracked and cracked concrete under static and quasi-static action for a working life of 50 and 100 years										
All temperature	δ <sub>V0</sub> -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
43										

<sup>1)</sup> Calculation of the displacement  $\delta v_0 = \delta v_0$ -factor  $\cdot V$ ;  $\delta v_\infty = \delta v_\infty$ -factor  $\cdot V$ ; V: action shear load

### Injection system ULEP-585 for concrete

#### **Performances**

Displacements under static and quasi-static action for a working life of 50 and 100 years (threaded rod)

Annex C 18



Table C21:	Displacements under tension load <sup>1)</sup> in hammer drilled holes (HD), comp. air
	drilled holes (CD) and in hammer drilled holes with hollow drill bit (HDB)

armod fields (65) and in figurinos armod fields with fields with bit (1155)											
Internal threaded ancho	r rods		IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20			
Uncracked concrete und	Uncracked concrete under static and quasi-static action for a working life of 50 and 100 years										
Temperature range I:	$\delta_{N0}$ -factor	[mm/(N/mm <sup>2</sup> )]	0,029	0,030	0,033	0,035	0,038	0,041			
24°C/40°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,029	0,030	0,033	0,035	0,038	0,041			
Temperature range II:	[mm/(N/mm <sup>2</sup> )]	0,039	0,040	0,044	0,047	0,051	0,055				
50°C/72°C	[mm/(N/mm <sup>2</sup> )]	0,049	0,051	0,055	0,059	0,064	0,070				
Temperature range III:	$\delta_{N0}$ -factor	[mm/(N/mm <sup>2</sup> )]	0,039	0,040	0,044	0,047	0,051	0,055			
60°C/80°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,049	0,051	0,055	0,059	0,064	0,070			
Cracked concrete under	static and qua	si-static action	for a work	ing life of 8	50 and 100	years					
Temperature range I:	$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,071	0,072	0,074	0,076	0,079	0,082			
24°C/40°C	$\delta_{N\infty}$ -factor	[mm/(N/mm <sup>2</sup> )]	0,115	0,122	0,128	0,135	0,142	0,171			
Temperature range II:	$\delta_{N0}$ -factor	[mm/(N/mm <sup>2</sup> )]	0,095	0,096	0,099	0,102	0,106	0,110			
50°C/72°C $\delta_{N\infty}$ -factor		[mm/(N/mm <sup>2</sup> )]	0,154	0,163	0,172	0,181	0,189	0,229			
Temperature range III:	$\delta_{N0}$ -factor	[mm/(N/mm <sup>2</sup> )]	0,095	0,096	0,099	0,102	0,106	0,110			
60°C/80°C	$\delta_{N\infty}$ -factor	[mm/(N/mm <sup>2</sup> )]	0,154	0,163	0,172	0,181	0,189	0,229			

<sup>1)</sup> Calculation of the displacement:  $\delta_{N0} = \delta_{N0}$ -factor  $\tau$ ;  $\delta_{N\infty} = \delta_{N\infty}$ -factor  $\tau$ ;  $\tau$ : action bond stress for tension

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

Internal threaded ancho	ternal threaded anchor rods				IG-M10	IG-M12	IG-M16	IG-M20
Cracked and uncracked	concrete unde	r static and qua	si-static ad	ction for a	working li	ie of 50 ye	ars	
Temperature range I:	$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,012	0,012	0,013	0,014	0,014	0,015
24°C/40°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
		[mm/(N/mm²)]	0,053	0,055	0,058	0,062	0,065	0,070
Temperature range III:	0,014	0,014	0,015	0,016	0,016	0,018		
60°C/80°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,053	0,055	0,058	0,062	0,065	0,070
Uncracked concrete und	der static and q	uasi-static actio	n for a wo	rking life o	of 100 year	s		
Temperature range I:	$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,012	0,012	0,013	0,014	0,014	0,015
24°C/40°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,021	0,021	0,023	0,024	0,025	0,027
Temperature range II:	$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,014	0,014	0,015	0,016	0,016	0,018
50°C/72°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,039	0,040	0,043	0,045	0,047	0,051
Temperature range III:	$\delta_{\rm N0}$ -factor	[mm/(N/mm²)]	0,014	0,014	0,015	0,016	0,016	0,018
60°C/80°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,039	0,040	0,043	0,045	0,047	0,051

<sup>1)</sup> Calculation of the displacement:  $\delta_{N0} = \delta_{N0}$ -factor  $\tau$ ;  $\delta_{N\infty} = \delta_{N\infty}$ -factor  $\tau$ ;  $\tau$ : action bond stress for tension

# Table C23: Displacements under shear load<sup>1)</sup> for all drilling methods

Internal threaded	anchor rods		IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20			
Uncracked and cracked concrete under static and quasi-static action for a working life of 50 and 100 years											
All temperature	δ <sub>V0</sub> -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			
43		•									

<sup>1)</sup> Calculation of the displacement  $\delta_{V0} = \delta_{V0}$ -factor  $\cdot$  V;  $\delta_{V\infty} = \delta_{V\infty}$ -factor  $\cdot$  V; V: action shear load

### Injection system ULEP-585 for concrete

#### **Performances**

Displacements under static and quasi-static action for a working life of 50 and 100 years (Internal threaded anchor rod)

Annex C 19



Table C24:	•	cements ur holes (CD)									•			
Reinforcing bar	r		Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32	Ø 36	Ø 40
Uncracked con	crete under	static and qua	asi-sta	tic acti	ion for	a wor	king li	fe of 5	0 and	100 ye	ears			
Temp range	$\delta_{N0}$ -factor	[mm/(N/mm²)]						_						
I: 24°C/40°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]						_	_	_	_	_	_	_
Temp range	$\delta_{N0}$ -factor	[mm/(N/mm <sup>2</sup> )]	<del>' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' </del>	<del>'</del>	<u> </u>	<u> </u>	<del>'</del>	<u> </u>	<u> </u>	<del>_</del>	<del>_</del>	<del>_</del>	<u> </u>	<u> </u>
II: 50°C/72°C	$\delta_{N\infty}$ -factor	[mm/(N/mm <sup>2</sup> )]	<u>'</u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>		<u> </u>	<u> </u>	<u> </u>		<u> </u>
Temp range	$\delta_{N0}$ -factor	[mm/(N/mm <sup>2</sup> )]	<del>'                                    </del>	<del>-                                    </del>	<del>- '</del>	<del></del>	<del></del>	<del>_</del>	+ -	<del>- '</del>	+ -	<del>-                                    </del>	<u> </u>	<u> </u>
III: 60°C/80°C	$\delta_{N\infty}$ -factor	[mm/(N/mm <sup>2</sup> )]	' '									8 0,072	0,074	0,079
Cracked concre	1	<del> </del>	_				_			<del></del> -				
Temp range	$\delta_{N0}$ -factor	[mm/(N/mm²)]		_	_	_		_	_	_	_	_	-	
I: 24°C/40°C	$\delta_{N\infty}$ -factor	[mm/(N/mm <sup>2</sup> )]											-	
Temp range	$\delta_{N0}$ -factor	[mm/(N/mm²)]	<del>'                                    </del>	<u> </u>		<del></del>	<del></del>	_	<del>-</del>	+ -	+ -	_	4 2	2)
II: 50°C/72°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]						_	_	_	_	_		,
Temp range III: 60°C/80°C	$\delta_{N0}$ -factor	[mm/(N/mm²)]		_		_		_	_	_	_	_	-	
	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	<u> </u>	1 -			<u> </u>							
1) Calculation of 2) No performan Table C25:	ice assessed	ment: δNO = δN					tor · τ; n diar					tension  DD)		
Reinforcing ba	r		Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32	Ø 36	Ø 40
Uncracked con	crete under	static and qua	asi-sta	tic acti	on for	a wor	king li	fe of 5	0 year	s	'			
Temp range	$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,008	0,009	0,009	0,01	0,011	0,012	0,013	0,013	0,014	0,015	0,016	0,017
I: 24°C/40°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,018	0,018	0,019	0,020	0,021	0,024	0,027	0,027	0,028	0,031	0,032	0,034
Temp range	$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,009	0,011	0,011	0,012	0,013	0,014	0,015	0,015	0,016	0,018	0,019	0,020
II: 50°C/72°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,048	0,051	0,054	0,058	0,061	0,068	0,076	0,076	0,081	0,088	0,090	0,097
Temp range	$\delta_{N0}$ -factor	[mm/(N/mm²)]	0,009	0,011	0,011	0,012	0,013	0,014	0,015	0,015	0,016	0,018	0,019	0,020
III: 60°C/80°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,048	0,051	0,054	0,058	0,061	0,068	0,076	0,076	0,081	0,088	0,090	0,097
Uncracked con														
Temp range	$\delta_{\rm N0}$ -factor	[mm/(N/mm <sup>2</sup> )]	0,008	0,009	0,009	0,010	0,011	0,012	0,013	0,013	0,014	0,015	0,016	0,017
I: 24°C/40°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,018	0,020	0,021	0,022	0,024	0,026	0,029	0,029	0,031	0,034	0,035	0,037
Temp range	$\delta_{\rm N0}$ -factor	[mm/(N/mm²)]	0,009	0,011	0,011	0,012	0,013	0,014	0,015	0,015	0,016	0,018	0,019	0,020
II: 50°C/72°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,035	0,037	0,040	0,042	0,045	0,049	0,055	0,055	0,059	0,064	0,066	0,070
Temp range	$\delta_{N0}$ -factor	[mm/(N/mm²)]		_			_							_
III: 60°C/80°C	$\delta_{N\infty}$ -factor	[mm/(N/mm²)]	0,035	0,037			<u> </u>	1 '	0,055	0,055	0,059	0,064	0,090	0,097
1) Calculation of <b>Table C26:</b>	•	ment: $\delta_{N0} = \delta_{N}$					tor · τ; all dı					tension		
Reinforcing bar												Ø 32	Ø 36	Ø 40
Uncracked and														
All temperature	$\delta_{V0}$ -factor			<del></del>						0,03	0,03	0,03	0,03	0,03
ranges	$\delta_{V_{\infty}}$ -factor	<del></del>					<del></del>	<del></del>		0,05	0,04	0,04	0,04	0,04
1) Calculation of	the displace	ment $\delta v_0 = \delta v$	o-factor	· V;	δ <sub>V∞</sub> = 8	 δ <sub>∨∞</sub> -fac	tor · V;	; V: a	action s	hear lo	ad			
Injection sys	tem ULEP-	585 for conc	rete											
Performances Displacements for a working life	s under stati										,	Anne	x C 2	0



Tabl	Table C27: Characteristic values of tension loads under seismic action (performance category C1) for a working life of 50 years												
Thread	ded rod				M8	M10	M12	M16	M20	M24	M27	M30	
Steel fa	ailure												
Charac	teristic tension resis	tance	N <sub>Rk,s,eq,C1</sub>	[kN]				1,0 •	$N_{Rk,s}$				
Partial	factor		γ <sub>Ms,N</sub>	[-]				see Ta	able C1				
Combined pull-out and concrete failure													
	Characteristic bond resistance in cracked and uncracked concrete C20/25 in hammer drilled holes (HD), compressed air drilled holes (CD) and in hammer drilled holes with hollow drill bit (HDB)												
ture	I: 24°C/40°C	Dry, wet	<sup>τ</sup> Rk,eq,C1	[N/mm <sup>2</sup> ]	7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5	
Temperature range	II: 50°C/72°C	concrete and flooded bore	<sup>τ</sup> Rk,eq,C1	[N/mm²]	6,0	6,0	7,0	7,0	7,0	7,0	7,0	7,0	
Tem	III:60°C/80°C	hole	<sup>τ</sup> Rk,eq,C1	[N/mm²]	5,0	5,0	5,0	4,5	4,5	4,5	4,5	4,5	
Increas	sing factors for conci	ete	Ψc	[-]				1	,0				
	cteristic bond resista concrete strength cla	, ,	τ	Rk,eq,C1 =			Ψс	¹ <sup>τ</sup> Rk,eq	ı,C1,(C2	0/25)			
Installa	ation factor												
for dry	and wet concrete (H	D; HDB, CD)	2/4	F 1				1	,0				
for floo	ded bore hole (HD; I	HDB, CD)	γinst	[-]				1	,2				

Injection system ULEP-585 for concrete	
Performances Characteristic values of tension loads under seismic action (performance category C1) for a working life of 50 years (threaded rod)	Annex C 21



Tabl	Table C28: Characteristic values of tension loads under seismic action (performance category C1) for a working life of 100 years												
Thread	led rod				M8	M10	M12	M16	M20	M24	M27	M30	
Steel fa	ailure												
Charac	teristic tension r	esistance	N <sub>Rk,s,eq,C1</sub>	[kN]				1,0 •	$N_{Rk,s}$				
Partial	factor		$\gamma_{Ms,N}$	[-]				see Ta	able C1				
Combi	ned pull-out an	d concrete failure											
1	Characteristic bond resistance in cracked and uncracked concrete C20/25 in hammer drilled holes (HD), compressed air drilled holes (CD) and in hammer drilled holes with hollow drill bit (HDB)												
ture	I: 24°C/40°C	Dry, wet	<sup>τ</sup> Rk,eq,C1	[N/mm <sup>2</sup> ]	6,5	6,5	7,5	7,5	7,5	7,5	7,5	7,5	
Temperature range	II: 50°C/72°C	concrete and flooded bore	<sup>τ</sup> Rk,eq,C1	[N/mm²]	5,5	5,5	6,5	6,5	6,5	6,5	6,5	6,5	
Tem	III:60°C/80°C	hole	<sup>τ</sup> Rk,eq,C1	[N/mm²]	5,0	5,0	5,0	4,5	4,5	4,5	4,5	4,5	
Increas	sing factors for c	oncrete	Ψς	[-]				1	,0				
	teristic bond res concrete strengt	istance depending h class	τ	Rk,eq,C1 =			Ψс	<sup>τ</sup> Rk,eq	,C1,(C2	0/25)			
Installa	ation factor												
for dry	and wet concret	e (HD; HDB, CD)	γ:	[-]					,0				
for floo	ded bore hole (H	HD; HDB, CD)	<sup>γ</sup> inst	[-]	1,2								

Injection system ULEP-585 for concrete	
Performances Characteristic values of tension loads under seismic action (performance category C1) for a working life of 100 years (threaded rod)	Annex C 22



	characteristic performance								-	'S			
Threaded rod				M8	M10	M12	M16	M20	M24	M27	M30		
Steel failure													
Characteristic shear (Seismic C1)	Characteristic shear resistance VDL and KNI 0.70 · VOD.												
Partial factor		γ <sub>Ms,V</sub>	[-]				see	Table C	21				
Factor for annular g	ар	$\alpha_{\sf gap}$	[-]				0,	5 (1,0) <sup>1)</sup>					

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

Injection system ULEP-585 for concrete	
Performances Characteristic values of shear loads under seismic action (performance category C1) for a working life of 50 and 100 years (threaded rod)	Annex C 23



1,2

	(performance category C1) for a working life of 50 years												
Reinforcing bar				Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Steel failure													
Characteristic tension	resistance	N <sub>Rk,s,eq,C1</sub>	[kN]					1,0 • 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		γ <sub>Ms,N</sub>	[-]					1,	<b>4</b> <sup>2)</sup>				
Combined pull-out a	nd concrete failu	ire											
	Characteristic bond resistance in cracked and uncracked concrete C20/25 in hammer drilled holes (HD), compressed air drilled holes (CD) and in hammer drilled holes with hollow drill bit (HDB)												
<u>e</u> I: 24°C/40°C	Dry, wet	<sup>τ</sup> Rk,eq,C1	[N/mm <sup>2</sup> ]	7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5	8,5	8,5
III: 60°C/80°C	concrete and flooded bore	<sup>τ</sup> Rk,eq,C1	[N/mm²]	6,0	6,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0
ы III:60°С/80°С	hole	<sup>τ</sup> Rk,eq,C1	[N/mm²]	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5
Increasing factors for	concrete	Ψс	[-]					1	,0				
Characteristic bond red depending on the con class	τ <sub>F</sub>	kk,eq,C1 =				ψ <sub>c</sub> •	<sup>τ</sup> Rk,ec	j,C1,(C2	20/25)				
Installation factor													
for dry and wet concre	γ <sub>inst</sub>	[-]						,0					

 $<sup>^{1)}</sup>$   $f_{uk}$  shall be taken from the specifications of reinforcing bars

for flooded bore hole (HD; HDB, CD)

Injection system ULEP-585 for concrete	
Performances Characteristic values of tension loads under seismic action (performance category C1) for a working life of 50 years (reinforcing bar)	Annex C 24

<sup>2)</sup> in absence of national regulation



Table C31:	Characteristic values of tension loads under seismic action
	(performance category C1) for a working life of 100 years

									-					
Reinforcing bar					Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Steel f	ailure													
Charac	cteristic tension re	sistance	N <sub>Rk,s,eq,C1</sub>	[kN]				•	1,0 • A	s • f <sub>uk</sub>	1)			
Cross	section area		$A_s$	[mm <sup>2</sup> ]	50	79	113	154	201	314	452	491	616	804
Partial	factor		γ <sub>Ms,N</sub>	[-]					1,	42)				
Combi	ined pull-out and	l concrete failu	ire											
	cteristic bond resis holes (CD) and in						in har	nmer d	drilled	holes (	(HD), d	compre	essed	air
ture	I: 24°C/40°C	Dry, wet	<sup>τ</sup> Rk,eq,C1	[N/mm²]	6,5	6,5	7,5	7,5	7,5	7,5	7,5	7,5	7,5	7,5
Temperature range	II: 50°C/72°C	concrete and flooded bore	<sup>τ</sup> Rk,eq,C1	[N/mm²]	5,5	5,5	6,5	6,5	6,5	6,5	6,5	6,5	6,5	6,5
Теп	III:60°C/80°C	hole	<sup>τ</sup> Rk,eq,C1	[N/mm²]	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5
Increas	sing factors for co	ncrete	Ψc	[-]	1,0									
Characteristic bond resistance depending on the concrete strength class		<sup>τ</sup> R	k,eq,C1 =	Ψc • <sup>τ</sup> Rk,eq,C1,(C20/25)										
Install	ation factor													
for dry and wet concrete (HD; HDB, CD)		$\gamma_{inst}$	[-]	[-]										
for floo	ded bore hole (HI	D; HDB, CD)			1,2									

 $<sup>^{1)}</sup>$   $f_{uk}$  shall be taken from the specifications of reinforcing bars

Injection system ULEP-585 for concrete	
Performances Characteristic values of tension loads under seismic action (performance category C1) for a working life of 100 years (reinforcing bar)	Annex C 25

<sup>2)</sup> in absence of national regulation



Table C32: Characteristic values of shear loads under seismic action (performance category C1) for a working life of 50 and 100 years													
Reinforcing bar				Ø8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Steel failure													
Characteristic shear res	istance	V <sub>Rk,s,eq,C1</sub>	[kN]					0,35	·As·	$f_{uk}^{-1}$			
Cross section area		A <sub>s</sub>	[mm²]	50 79 113 154 201 314 452 491 616 804					804				
Partial factor		γ <sub>Ms,V</sub>	[-]	1,5 <sup>2)</sup>									
Factor for annular gap	)	$\alpha_{\sf gap}$	[-]	0,5 (1,0) <sup>3)</sup>									

 $<sup>^{1)}</sup>$   $f_{uk}$  shall be taken from the specifications of reinforcing bars

Injection system ULEP-585 for concrete	
Performances (1)	Annex C 26
Characteristic values of shear loads under seismic action (performance category C1) for a working life of 50 and 100 years (reinforcing bar)	

<sup>2)</sup> in absence of national regulation

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

for flooded bore hole (HD; HDB, CD)



1,2

Tabl		racteristic va formance ca								
Thread	ded rod				M12	M16	M20	M24		
Steel f	ailure									
Characteristic tension resistance, Steel, strength class 8.8 Stainless Steel A4 and HCR, Strength class ≥70		N <sub>Rk,s,eq,C2</sub>	[kN]	1,0 • N <sub>Rk,s</sub>						
Partial	factor		γ <sub>Ms,N</sub>	[-]		see Ta	able C1			
Combi	ined pull-out and	concrete failure	•							
	cteristic bond resist holes (CD) and in I					nmer drilled hol	es (HD), comp	ressed ai		
ture	I: 24°C/40°C	Dry, wet	<sup>τ</sup> Rk,eq,C2	[N/mm²]	5,8	4,8	5,0	5,1		
Temperature range	II: 50°C/72°C	concrete and flooded bore	<sup>τ</sup> Rk,eq,C2	[N/mm²]	5,0	4,1	4,3	4,4		
Теп	III:60°C/80°C	hole	<sup>τ</sup> Rk,eq,C2	[N/mm²]	1,9	1,6	1,6	1,7		
Increas	sing factors for con	crete	Ψc	[-]		1	,0			
	cteristic bond resist		τ	Rk,eq,C2 =		Ψc • <sup>τ</sup> Rk,eq	,C2,(C20/25)			
Install	ation factor									
	and wet concrete	, , ,	γ <sub>inst</sub>	[-]	1,0					
for floo	or flooded bore hole (HD: HDB, CD)		111151	1,	1.2					

#### Table C34: Characteristic values of shear loads under seismic action (performance category C2) for a working life of 50 and 100 years

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

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

Injection system ULEP-585 for concrete	
Performances	Annex C 27
Characteristic values of tension and shear loads under seismic action (performance category C2) for a working life of 50 and 100 years (threaded rod)	



Table C35: Displacements under tension load (threaded rod)										
Threaded rod			M12	M16	M20	M24				
Uncracked and cracked concrete under seismic action (performance category C2) for a working life of 50 and 100 years										
All temperature ranges	$\delta_{N,eq,C2(50\%)} = \delta_{N,eq,C2(DLS)}$	[mm]	0,21	0,24	0,27	0,36				
All temperature ranges	$\delta_{N,eq,C2(100\%)} = \delta_{N,eq,C2(ULS)}$	[mm]	0,54	0,51	0,54	0,63				

# Table C36: Displacements under shear load (threaded rod)

Threaded rod			M12	M16	M20	M24	
Uncracked and cracked concrete under seismic action (performance category C2) for a working life of 50 and 100 years							
All temperature ranges	$\delta_{V,eq,C2(50\%)} = \delta_{V,eq,C2(DLS)}$	[mm]	3,1	3,4	3,5	4,2	
All temperature ranges	$\delta_{V,eq,C2(100\%)} = \delta_{V,eq,C2(ULS)}$	[mm]	6,0	7,6	7,3	10,9	

Injection system ULEP-585 for concrete	
Performances Displacements under seismic action (performance category C2) for a working life of 50 and 100 years (threaded rod)	Annex C 28

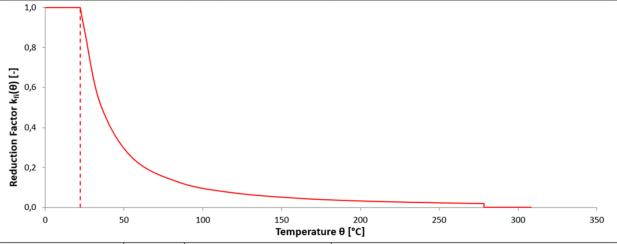


Table C37:	Characteristic values of tension and shear loads under fire exposure in
	hammer drilled holes (HD), compressed air drilled holes (CD) and in hammer
	drilled holes with hollow drill bit (HDB)

Threaded rod					М8	M10	M12	M16	M20	M24	M27	M30
Steel failure												
Characteristic tension resistance; Steel, Stainless Steel A2, A4 and HCR, strength class 5.8 resp. 50 and higher			Fire	30	1,1	1,7	3,0	5,7	8,8	12,7	16,5	20,2
	N <sub>Rk,s,fi</sub>	[kN]	exposure time [min]	60	0,9	1,4	2,3	4,2	6,6	9,5	12,4	15,1
				90	0,7	1,0	1,6	3,0	4,7	6,7	8,7	10,7
				120	0,5	0,8	1,2	2,2	3,4	4,9	6,4	7,9

Characteristic bond resistance in cracked and uncracked concrete C20/25 up to C50/60 under fire conditions for a given temperature  $\theta$ 

			θ < 23°C	1,0
Temperature reduction factor	$k_{fi,p}(\theta)$	[-]	23°C ≤ θ ≤ 278°C	150,28 • $\theta$ <sup>-1,598</sup> ≤ 1,0
			θ > 278°C	0,0



				Temperatur	e θ [°C]							
Characteristic bond resistance for a given temperature $(\theta)$	$\tau_{Rk,fi}(\theta)$	[N/mm²]			$k_{fi,p}(\theta) \cdot \tau_{Rk,cr,(C20/25)}^{1}$							
Steel failure without lever a	ırm											
Characteristic shear			Fire	30	1,1	1,7	3,0	5,7	8,8	12,7	16,5	20,2
resistance; Steel, Stainless Steel A2, A4 and HCR, strength class 5.8 resp. 50	V <sub>Rk,s,fi</sub>	[kN]	exposure time [min]	60	0,9	1,4	2,3	4,2	6,6	9,5	12,4	15,1
				90	0,7	1,0	1,6	3,0	4,7	6,7	8,7	10,7
and higher				120	0,5	0,8	1,2	2,2	3,4	4,9	6,4	7,9
Steel failure with lever arm												
Characteristic bending			Fire	30	1,1	2,2	4,7	12,0	23,4	40,4	59,9	81,0
moment; Steel, Stainless	N40	[MIM]	ovnocuro	60	0,9	1,8	3,5	9,0	17,5	30,3	44,9	60,7
Steel A2, A4 and HCR, strength class 5.8 resp. 50	M <sup>0</sup> <sub>Rk,s,fi</sub>	[Nm]	time	90	0,7	1,3	2,5	6,3	12,3	21,3	31,6	42,7
and higher			[min]	120	0,5	1,0	1,8	4,7	9,1	15,7	23,3	31,5

<sup>1)</sup>  $au_{Rk,cr,(C20/25)}$  characteristic bond resistance for cracked concrete for concrete strength class C20/25 for the relevant temperature range

Injection system ULEP-585 for concrete	
Performances Characteristic values of tension and shear loads under fire exposure (threaded rod)	Annex C 29

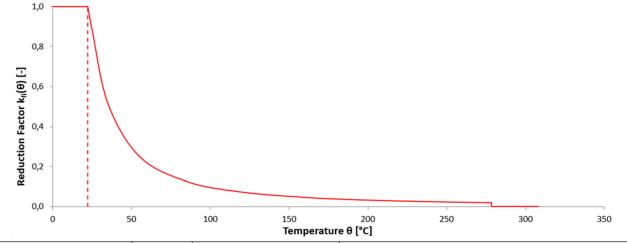


Table C38: Characteristic values of tension and shear loads under fire exposure in hammer drilled holes (HD), compressed air drilled holes (CD) and in hammer drilled holes with hollow drill bit (HDB)

Internal threaded anchor rods					IG-M6	IG-M8	IG-M10	IG-M12	IG-M16	IG-M20
Steel failure										
Characteristic tension resistance; Steel, Stainless Steel A4 and HCR, strength class 5.8 and 8.8 resp. 70			Fire	30	0,3	1,1	1,7	3,0	5,7	8,8
	N <sub>Rk,s,fi</sub>	[LAND	exposure time [min]	60	0,2	0,9	1,4	2,3	4,2	6,6
		[kN]		90	0,2	0,7	1,0	1,6	3,0	4,7
				120	0,1	0,5	0,8	1,2	2,2	3,4

Characteristic bond resistance in cracked and uncracked concrete C20/25 up to C50/60 under fire conditions for a given temperature  $\theta$ 

<u> </u>			θ < 23°C	1,0
Temperature reduction factor	$k_{fi,p}(\theta)$	[-]	23°C ≤ θ ≤ 278°C	150,28 • $\theta$ <sup>-1,598</sup> ≤ 1,0
lastor			θ > 278°C	0,0



				Temperatur	e θ [°C]							
Characteristic bond resistance for a given temperature (θ)	$\tau_{Rk,fi}(\theta)$	[N/mm²]			$k_{fi,p}(\theta) \cdot \tau_{Rk,cr,(C20/25)}^{1)}$							
Steel failure without lever arm												
Characteristic shear resistance; Steel, Stainless Steel A4 and HCR, strength			Fire	30	0,3	1,1	1,7	3,0	5,7	8,8		
	V <sub>Rk,s,fi</sub>	[kN]	ovposuro	60	0,2	0,9	1,4	2,3	4,2	6,6		
				90	0,2	0,7	1,0	1,6	3,0	4,7		
class 5.8 and 8.8 resp. 70				120	0,1	0,5	0,8	1,2	2,2	3,4		
Steel failure with lever arm												
Characteristic handing		[Nm]	Fire	30	0,2	1,1	2,2	4,7	12,0	23,4		
Characteristic bending moment; Steel, Stainless Steel A4 and HCR, strength class 5.8 and 8.8 resp. 70	NAO		ovpoduro	60	0,2	0,9	1,8	3,5	9,0	17,5		
	M <sup>0</sup> <sub>Rk,s,fi</sub>			90	0,1	0,7	1,3	2,5	6,3	12,3		
				120	0.1	0.5	1.0	1.8	47	9.1		

<sup>&</sup>lt;sup>1)</sup>  $\tau_{Rk,cr,(C20/25)}$  characteristic bond resistance for cracked concrete for concrete strength class C20/25 for the relevant temperature range

Injection system ULEP-585 for concrete	
Performances Characteristic values of tension and shear loads under fire exposure (internal threaded anchor rod )	Annex C 30



	acteristic ner drille d holes v	d ho	les (HD)	, comp	ress	ed a					•			mer
Reinforcing bar					Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 24	Ø 25	Ø 28	Ø 32
Steel failure						l					l			
				30	0,5	1,2	2,3	3,1	4,0	6,3	9,0	9,8	12,3	16,1
Characteristic tension	N <sub>Rk,s,fi</sub>	   [kN]	Fire exposure	60	0,5	1,0	1,7	2,3	3,0	4,7	6,8	7,4	9,2	12,1
resistance; BSt 500	HK,S,II	[[[,	time [min]	90	0,4	0,8	1,5	2,0	2,6	4,1	5,9	6,4	8,0	10,5
		<u> </u>		120	0,3	0,6	1,1	1,5	2,0	3,1	4,5	4,9	6,2	8,0
Characteristic bond resigned temperature θ	istance in o	cracke	ed and unc	racked o	oncre	ete C2	0/25 u	p to C	C50/60	unde	r fire	condi	tions 1	for a
			θ < 2	5°C					1	,0				
Temperature reduction factor	$k_{fi,p}(\theta)$	[-]	25°C ≤ θ	≤ 278°C				176,	<b>37</b> • θ	-1,598	≤ 1,0			
lactor			θ > 27	′8°C					0	,0				
Reduction Factor k <sub>ii</sub> (θ) [-]	50	10	000	150		200		250		<u>1</u>	00		350	
Characteristic bond	T			Tempera	ature θ									
resistance for a given temperature $(\theta)$	$\tau_{Rk,fi}(\theta)$		[N/mm²]		$k_{fi,p}(\theta) \cdot \tau_{Rk,cr,}$						(C20/25) <sup>1)</sup>			
Steel failure without leve	er arm			00	0.5	10	0.0	0.4	4.0	0.0	0.0	0.0	100	101
			Fire	30 60	0,5	1,2	2,3	3,1	3,0	6,3	9,0	9,8	12,3	16,1
Characteristic shear resistance; BSt 500	$V_{Rk,s,fi}$	[kN]	exposure	90	0,5	1,0 0,8	1,7 1,5	2,3	2,6	4,7 4,1	6,8 5,9	7,4 6,4	9,2	12,1 10,5
			time [min]	120	0,4	0,6	1,1	1,5	2,0	3,1	4,5	4,9	6,2	8,0
Steel failure with lever a	ırm			120	0,0	0,0	.,.	1,0	2,0	0,1	1,0	1,0	0,2	0,0
				30	0,6	1,8	4,1	6,5	9,7	18,8	32,6	36,8	51,7	77,2
Characteristic bending	N40	[MIM]	Fire	60	0,5	1,5	3,1	4,8	7,2	14,1	24,4	27,6	38,8	57,9
moment; BSt 500	M <sup>0</sup> Rk,s,fi	ן נואוון 	exposure time [min]	90	0,4	1,2	2,6	4,2	6,3	12,3	21,2	23,9	33,6	50,2
				120	0,3	0,9	2,0	3,2	4,8	9,4	16,3	18,4	25,9	38,6
1) τ <sub>Rk,cr,(C20/25)</sub> characte temperature range	ristic bond r	esistan	ce for crack	ed concre	ete for	concre	ete stre	ength o	lass C	20/25	for the	releva	ınt	
Injection system ULE Performances Characteristic values of				nder fire	expos	sure (ı	einfor	cing b	oar)		A	nnex	C 31	Í