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European Technical Assessment Body  
for construction products



# European Technical Assessment

# ETA-25/0993 of 4 May 2026

English translation prepared by DIBt - Original version in German language

## General Part

|                                                                                                                             |                                                                                                                                                                                                               |
|-----------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Technical Assessment Body issuing the European Technical Assessment:                                                        | Deutsches Institut für Bautechnik                                                                                                                                                                             |
| Trade name of the construction product                                                                                      | G&B Fissaggi Injection system Gebofix EPO PLUS RE for concrete                                                                                                                                                |
| Product family<br>to which the construction product belongs                                                                 | Bonded fasteners and bonded expansion fasteners for use in concrete<br>(Alternative drilling methods, seismic and fire in steel fibre reinforced concrete, variable working life, time-to-failure assessment) |
| Manufacturer                                                                                                                | G&B Fissaggi Srl<br>Corso Savona, 22<br>10029 VILLASTELLONE (TO)<br>ITALY                                                                                                                                     |
| Manufacturing plant                                                                                                         | G&B Fissaggi S.r.l., Plant 4                                                                                                                                                                                  |
| This European Technical Assessment contains                                                                                 | 49 pages including 3 annexes which form an integral part of this assessment                                                                                                                                   |
| This European Technical Assessment is issued in accordance with Article 95(4) of Regulation (EU) 2024/3110, on the basis of | EAD 330499-02-0601-v01                                                                                                                                                                                        |

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## Specific Part

### 1 Technical description of the product

The "G&B Fissaggi Injection system Gebofix EPO PLUS RE for concrete" is a bonded anchor consisting of a cartridge with injection mortar Gebofix EPO PLUS RE 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 according to Annex B2, use conditions. 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 |

**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-v01 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.

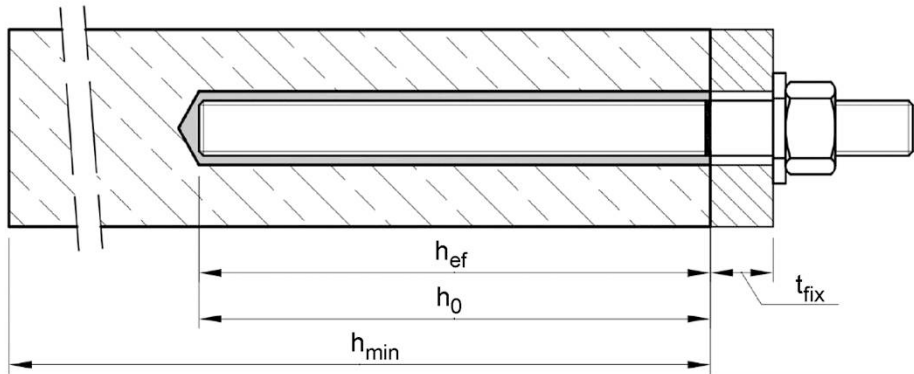
Issued in Berlin on 4 May 2026 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock  
Head of Section

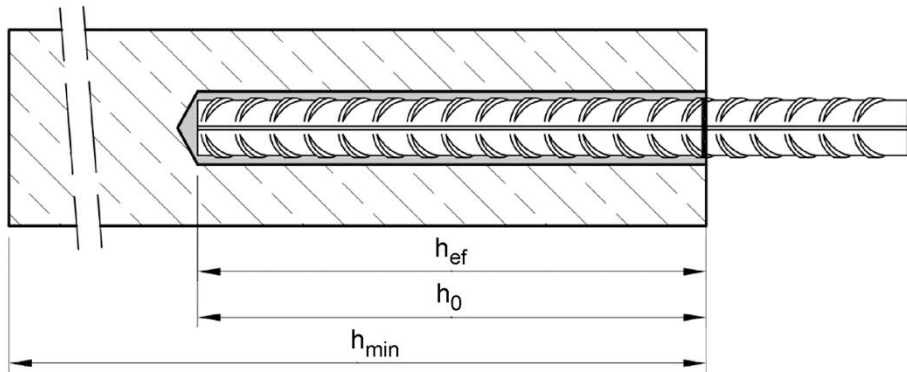
*beglaubigt:*  
Baderschneider

Installation threaded rod M8 up to M30

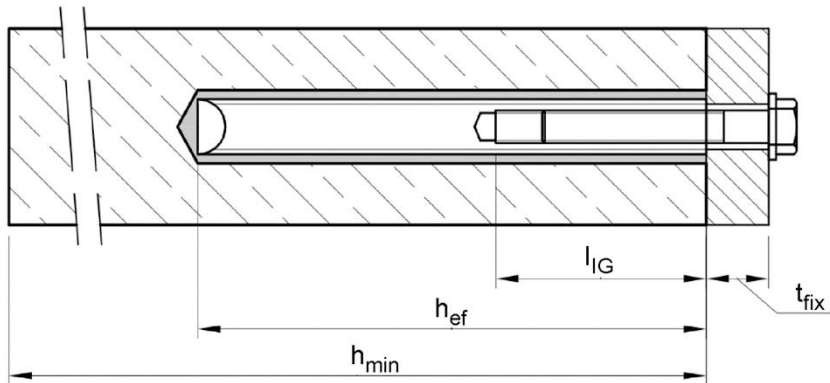
prepositioned installation or  
push through installation (annular gap filled with mortar)



Installation reinforcing bar Ø8 up to Ø40



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



$t_{fix}$  = thickness of fixture  
 $h_{ef}$  = effective embedment depth  
 $h_{min}$  = minum thickness of member

$h_0$  = drill hole depth  
 $l_{IG}$  = thread engagement length

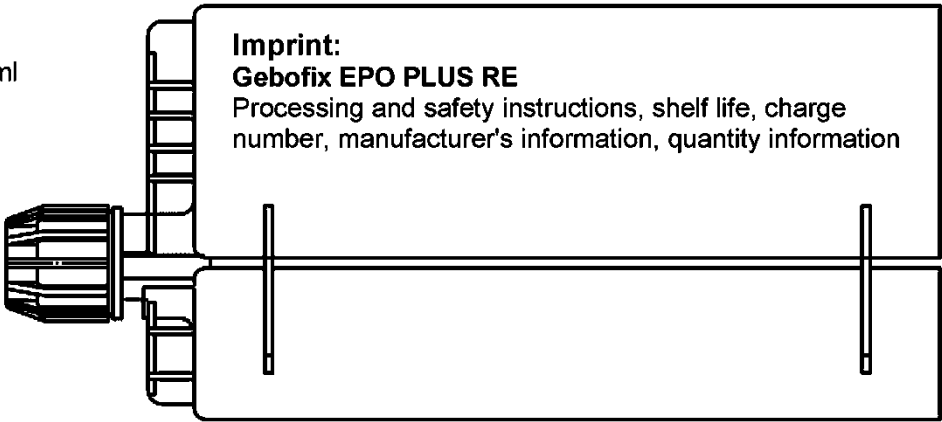
G&B Fissaggi Injection system Gebofix EPO PLUS RE for concrete

Product description  
Installed condition

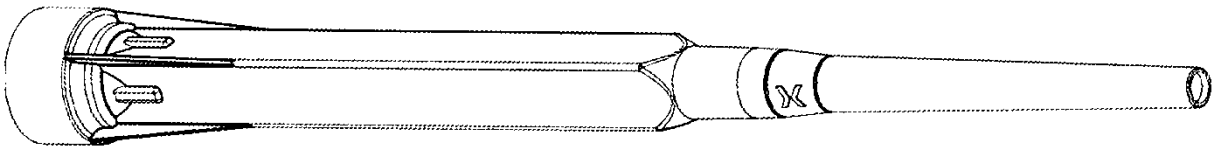
Annex A 1

**Cartridge system**

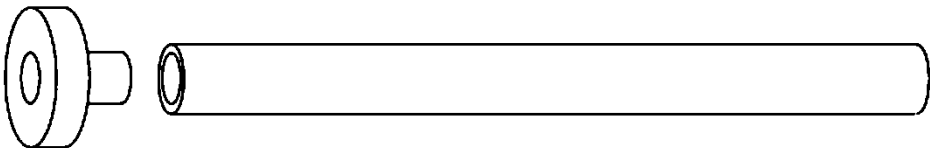
**Side-by-Side Cartridge:**  
440 ml, 500 ml up to 540 ml, 585 ml  
and 1400 ml



**Static mixer M25/S**



**Piston plug MP and mixer extension ML**

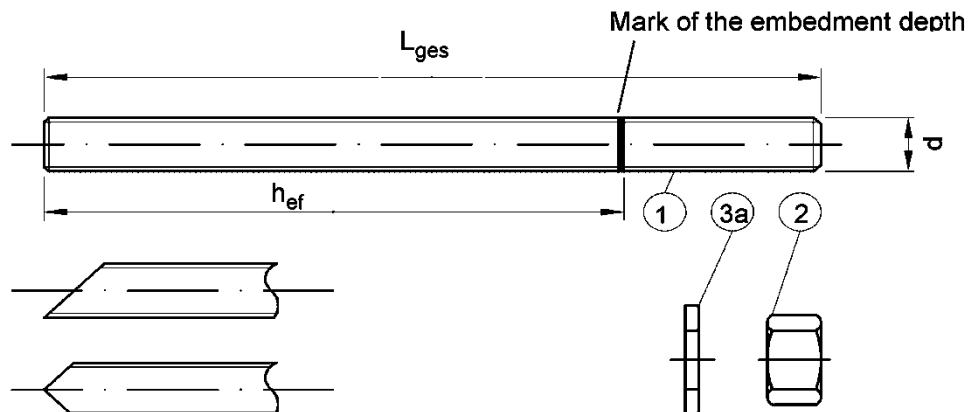


**G&B Fissaggi Injection system Gebofix EPO PLUS RE for concrete**

**Product description**  
Injection system

**Annex A 2**

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



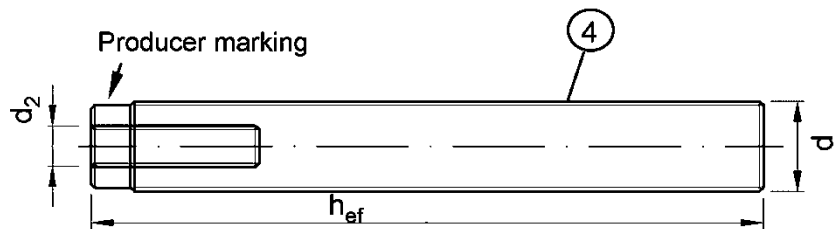
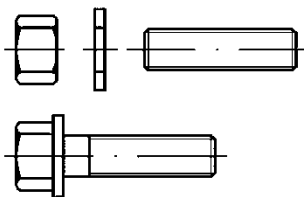
Commercial standard rod with:

- 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 BI-M6 to BI-M20

Threaded rod or screw



Producer marking: e.g.  M8

 Marking Internal thread (optional)

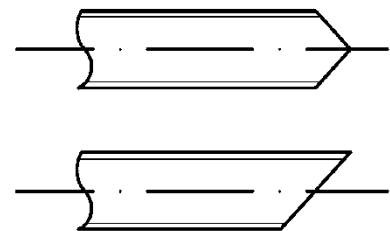
 Mark

M8 Thread size (Internal thread)

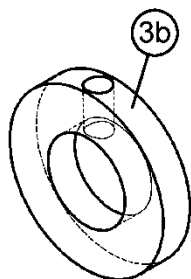
A4 additional mark for stainless steel

HCR additional mark for high-corrosion resistance steel

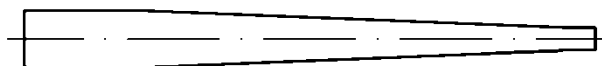
-8 additional mark for property class 8.8



## Filling washer KSW



## Mixer reduction nozzle KSM



G&B Fissaggi Injection system Gebofix EPO PLUS RE for concrete

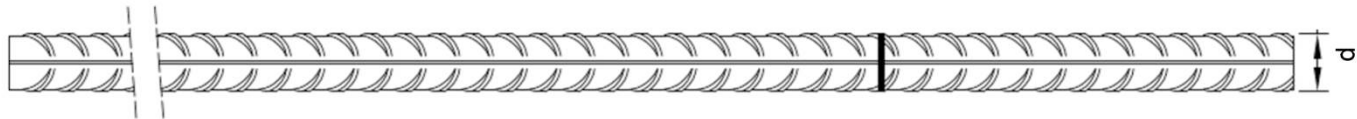
### Product description

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

Annex A 3

| Table A1: Materials                                                                                                  |                                              |                                                                                                                                                                                                                                                                                                                      |                                                |                                     |                               |                      |
|----------------------------------------------------------------------------------------------------------------------|----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|-------------------------------------|-------------------------------|----------------------|
| Part                                                                                                                 | Designation                                  | Material                                                                                                                                                                                                                                                                                                             |                                                |                                     |                               |                      |
| Steel, zinc plated (Steel acc. to EN ISO 683-4:2018 or EN 10263:2017)                                                |                                              |                                                                                                                                                                                                                                                                                                                      |                                                |                                     |                               |                      |
| - zinc plated ≥ 5 µm acc. to EN ISO 4042:2022 or                                                                     |                                              |                                                                                                                                                                                                                                                                                                                      |                                                |                                     |                               |                      |
| - hot-dip galvanised ≥ 40 µm acc. to EN ISO 1461:2022 and EN ISO 10684:2004 + AC:2009 or                             |                                              |                                                                                                                                                                                                                                                                                                                      |                                                |                                     |                               |                      |
| - sherardized ≥ 45 µm acc. to EN ISO 17668:2016                                                                      |                                              |                                                                                                                                                                                                                                                                                                                      |                                                |                                     |                               |                      |
| 1                                                                                                                    | Threaded rod                                 | Property class                                                                                                                                                                                                                                                                                                       | Characteristic steel ultimate tensile strength | Characteristic steel yield strength | Elongation at fracture        |                      |
|                                                                                                                      |                                              | acc. to EN ISO 898-1:2013                                                                                                                                                                                                                                                                                            | 4.6                                            | $f_{uk} = 400 \text{ N/mm}^2$       | $f_{yk} = 240 \text{ N/mm}^2$ | $A_5 > 8\%$          |
|                                                                                                                      |                                              |                                                                                                                                                                                                                                                                                                                      | 4.8                                            | $f_{uk} = 400 \text{ N/mm}^2$       | $f_{yk} = 320 \text{ N/mm}^2$ | $A_5 > 8\%$          |
|                                                                                                                      |                                              |                                                                                                                                                                                                                                                                                                                      | 5.6                                            | $f_{uk} = 500 \text{ N/mm}^2$       | $f_{yk} = 300 \text{ N/mm}^2$ | $A_5 > 8\%$          |
|                                                                                                                      |                                              |                                                                                                                                                                                                                                                                                                                      | 5.8                                            | $f_{uk} = 500 \text{ N/mm}^2$       | $f_{yk} = 400 \text{ N/mm}^2$ | $A_5 > 8\%$          |
|                                                                                                                      |                                              |                                                                                                                                                                                                                                                                                                                      | 8.8                                            | $f_{uk} = 800 \text{ N/mm}^2$       | $f_{yk} = 640 \text{ N/mm}^2$ | $A_5 \geq 12\%^{3)}$ |
| 2                                                                                                                    | Hexagon nut                                  | acc. to EN ISO 898-2:2022                                                                                                                                                                                                                                                                                            | 4                                              | for anchor rod class 4.6 or 4.8     |                               |                      |
|                                                                                                                      |                                              |                                                                                                                                                                                                                                                                                                                      | 5                                              | for anchor rod class 5.6 or 5.8     |                               |                      |
|                                                                                                                      |                                              |                                                                                                                                                                                                                                                                                                                      | 8                                              | for anchor rod class 8.8            |                               |                      |
| 3a                                                                                                                   | Washer                                       | Steel, zinc plated, hot-dip galvanised or sherardized (e.g.: EN ISO 887:2006, EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7094:2000)                                                                                                                                                                                |                                                |                                     |                               |                      |
| 3b                                                                                                                   | Filling washer                               | Steel, zinc plated, hot-dip galvanised or sherardized                                                                                                                                                                                                                                                                |                                                |                                     |                               |                      |
| 4                                                                                                                    | Internal threaded anchor rod                 | Property class                                                                                                                                                                                                                                                                                                       | Characteristic steel ultimate tensile strength | Characteristic steel yield strength | Elongation at fracture        |                      |
|                                                                                                                      |                                              | acc. to EN ISO 898-1:2013                                                                                                                                                                                                                                                                                            | 5.8                                            | $f_{uk} = 500 \text{ N/mm}^2$       | $f_{yk} = 400 \text{ N/mm}^2$ | $A_5 > 8\%$          |
|                                                                                                                      |                                              |                                                                                                                                                                                                                                                                                                                      | 8.8                                            | $f_{uk} = 800 \text{ N/mm}^2$       | $f_{yk} = 640 \text{ N/mm}^2$ | $A_5 > 8\%$          |
| Stainless steel A2 (Material 1.4301 / 1.4307 / 1.4311 / 1.4567 or 1.4541, acc. to EN 10088-1:2023)                   |                                              |                                                                                                                                                                                                                                                                                                                      |                                                |                                     |                               |                      |
| Stainless steel A4 (Material 1.4401 / 1.4404 / 1.4571 / 1.4362 or 1.4578, acc. to EN 10088-1:2023)                   |                                              |                                                                                                                                                                                                                                                                                                                      |                                                |                                     |                               |                      |
| High corrosion resistance steel (Material 1.4529 or 1.4565, acc. to EN 10088-1:2023)                                 |                                              |                                                                                                                                                                                                                                                                                                                      |                                                |                                     |                               |                      |
| 1                                                                                                                    | Threaded rod <sup>1)4)</sup>                 | Property class                                                                                                                                                                                                                                                                                                       | Characteristic steel ultimate tensile strength | Characteristic steel yield strength | Elongation at fracture        |                      |
|                                                                                                                      |                                              | acc. to EN ISO 3506-1:2020                                                                                                                                                                                                                                                                                           | 50                                             | $f_{uk} = 500 \text{ N/mm}^2$       | $f_{yk} = 210 \text{ N/mm}^2$ | $A_5 \geq 8\%$       |
|                                                                                                                      |                                              |                                                                                                                                                                                                                                                                                                                      | 70                                             | $f_{uk} = 700 \text{ N/mm}^2$       | $f_{yk} = 450 \text{ N/mm}^2$ | $A_5 \geq 12\%^{3)}$ |
|                                                                                                                      |                                              |                                                                                                                                                                                                                                                                                                                      | 80                                             | $f_{uk} = 800 \text{ N/mm}^2$       | $f_{yk} = 600 \text{ N/mm}^2$ | $A_5 \geq 12\%^{3)}$ |
| 2                                                                                                                    | Hexagon nut <sup>1)4)</sup>                  | acc. to EN ISO 3506-1:2020                                                                                                                                                                                                                                                                                           | 50                                             | for anchor rod class 50             |                               |                      |
|                                                                                                                      |                                              |                                                                                                                                                                                                                                                                                                                      | 70                                             | for anchor rod class 70             |                               |                      |
|                                                                                                                      |                                              |                                                                                                                                                                                                                                                                                                                      | 80                                             | for anchor rod class 80             |                               |                      |
| 3a                                                                                                                   | Washer                                       | A2: Material 1.4301 / 1.4307 / 1.4311 / 1.4567 or 1.4541, acc. to EN 10088-1:2023<br>A4: Material 1.4401 / 1.4404 / 1.4571 / 1.4362 or 1.4578, acc. to EN 10088-1:2023<br>HCR: Material 1.4529 or 1.4565, acc. to EN 10088-1:2023<br>(e.g.: EN ISO 887:2006, EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7094:2000) |                                                |                                     |                               |                      |
| 3b                                                                                                                   | Filling washer                               | Stainless steel A4, High corrosion resistance steel                                                                                                                                                                                                                                                                  |                                                |                                     |                               |                      |
| 4                                                                                                                    | Internal threaded anchor rod <sup>1)2)</sup> | Property class                                                                                                                                                                                                                                                                                                       | Characteristic steel ultimate tensile strength | Characteristic steel yield strength | Elongation at fracture        |                      |
|                                                                                                                      |                                              | acc. to EN ISO 3506-1:2020                                                                                                                                                                                                                                                                                           | 50                                             | $f_{uk} = 500 \text{ N/mm}^2$       | $f_{yk} = 210 \text{ N/mm}^2$ | $A_5 > 8\%$          |
|                                                                                                                      |                                              |                                                                                                                                                                                                                                                                                                                      | 70                                             | $f_{uk} = 700 \text{ N/mm}^2$       | $f_{yk} = 450 \text{ N/mm}^2$ | $A_5 > 8\%$          |
| 1) Property class 70 or 80 for anchor rods and hexagon nuts up to M24 and Internal threaded anchor rods up to BI-M16 |                                              |                                                                                                                                                                                                                                                                                                                      |                                                |                                     |                               |                      |
| 2) for BI-M20 only property class 50                                                                                 |                                              |                                                                                                                                                                                                                                                                                                                      |                                                |                                     |                               |                      |
| 3) $A_5 > 8\%$ fracture elongation if no use for seismic performance category C2                                     |                                              |                                                                                                                                                                                                                                                                                                                      |                                                |                                     |                               |                      |
| 4) Property class 80 only for stainless steel A4 and HCR                                                             |                                              |                                                                                                                                                                                                                                                                                                                      |                                                |                                     |                               |                      |
| G&B Fissaggi Injection system Gebofix EPO PLUS RE for concrete                                                       |                                              |                                                                                                                                                                                                                                                                                                                      |                                                |                                     | Annex A 4                     |                      |
| Product description<br>Materials threaded rod, Internal threaded anchor rod and filling washer                       |                                              |                                                                                                                                                                                                                                                                                                                      |                                                |                                     |                               |                      |

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  $0,05d \leq h_{rib} \leq 0,07d$   
(d: Nominal diameter of the bar;  $h_{rib}$ : Rib height of the bar)

Table A2: Materials Reinforcing bar

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

G&B Fissaggi Injection system Gebofix EPO PLUS RE for concrete

Product description  
Materials reinforcing bar

Annex A 5

| Specification of the intended use                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                     |                                                            |                                                                                                             |                            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|----------------------------|
| Fasteners subject to (Static and quasi-static loads):                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                     |                                                            |                                                                                                             |                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                          | Working life 50 years                                                                                                                               |                                                            | Working life 100 years                                                                                      |                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                          | in concrete C20/25 to C90/105 without fibers<br>and in concrete C20/25 to C50/60 with fibers <sup>5)</sup>                                          |                                                            |                                                                                                             |                            |
| Base material                                                                                                                                                                                                                                                                                                                                                                                                                            | uncracked<br>concrete                                                                                                                               | cracked<br>concrete                                        | uncracked<br>concrete                                                                                       | cracked<br>concrete        |
| HD: Hammer drilling<br>HDB: Hammer drilling with<br>hollow drill bit<br>CD: Compressed air drilling                                                                                                                                                                                                                                                                                                                                      | M8 to M30,<br>Ø8 to Ø32,<br>BI-M6 to BI-M20                                                                                                         |                                                            | M8 to M30,<br>Ø8 to Ø32,<br>BI-M6 to BI-M20                                                                 |                            |
| HD: Hammer drilling<br>CD: Compressed air drilling                                                                                                                                                                                                                                                                                                                                                                                       | Ø36 to Ø40                                                                                                                                          | No performance<br>assessed                                 | Ø36 to Ø40                                                                                                  | No performance<br>assessed |
| DD: Diamond drilling                                                                                                                                                                                                                                                                                                                                                                                                                     | M8 to M30,<br>Ø8 to Ø40,<br>BI-M6 to BI-M20                                                                                                         | M16 to M30 <sup>4)</sup><br>BI-M10 to BI-M20 <sup>4)</sup> | M8 to M30,<br>Ø8 to Ø40,<br>BI-M6 to BI-M20                                                                 | No performance<br>assessed |
| Temperature Range:                                                                                                                                                                                                                                                                                                                                                                                                                       | I: - 40°C to +40°C <sup>1)</sup><br>II: - 40°C to +72°C <sup>2)</sup><br>III: - 40°C to +80°C <sup>3)</sup>                                         |                                                            | I: - 40°C to +40°C <sup>1)</sup><br>II: - 40°C to +72°C <sup>2)</sup><br>III: - 40°C to +80°C <sup>3)</sup> |                            |
| Fasteners subject to (seismic action):                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                     |                                                            |                                                                                                             |                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                          | Performance Category C1                                                                                                                             |                                                            | Performance Category C2                                                                                     |                            |
| Base material                                                                                                                                                                                                                                                                                                                                                                                                                            | Cracked and uncracked concrete C20/25 to C50/60 with and without fibers <sup>5)</sup>                                                               |                                                            |                                                                                                             |                            |
| HD: Hammer drilling<br>HDB: Hammer drilling with<br>hollow drill bit<br>CD: Compressed air drilling                                                                                                                                                                                                                                                                                                                                      | M8 to M30,<br>Ø8 to Ø32                                                                                                                             |                                                            | M12 to M30                                                                                                  |                            |
| DD: Diamond drilling                                                                                                                                                                                                                                                                                                                                                                                                                     | No performance assessed                                                                                                                             |                                                            | No performance assessed                                                                                     |                            |
| Temperature Range:                                                                                                                                                                                                                                                                                                                                                                                                                       | I: - 40°C to +40°C <sup>1)</sup><br>II: - 40°C to +72°C <sup>2)</sup><br>III: - 40°C to +80°C <sup>3)</sup>                                         |                                                            | I: - 40°C to +40°C <sup>1)</sup><br>II: - 40°C to +72°C <sup>2)</sup><br>III: - 40°C to +80°C <sup>3)</sup> |                            |
| Fasteners subject to (fire exposure):                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                     |                                                            |                                                                                                             |                            |
| Base material                                                                                                                                                                                                                                                                                                                                                                                                                            | Cracked and uncracked concrete C20/25 to C90/105 without fibers<br>and in cracked and uncracked concrete C20/25 to C50/60 with fibers <sup>5)</sup> |                                                            |                                                                                                             |                            |
| HD: Hammer drilling<br>HDB: Hammer drilling with<br>hollow drill bit<br>CD: Compressed air drilling                                                                                                                                                                                                                                                                                                                                      | M8 to M30,<br>Ø8 to Ø32,<br>BI-M6 to BI-M20                                                                                                         |                                                            |                                                                                                             |                            |
| DD: Diamond drilling                                                                                                                                                                                                                                                                                                                                                                                                                     | No performance assessed                                                                                                                             |                                                            |                                                                                                             |                            |
| Temperature Range:                                                                                                                                                                                                                                                                                                                                                                                                                       | I: - 40°C to +40°C <sup>1)</sup><br>II: - 40°C to +72°C <sup>2)</sup><br>III: - 40°C to +80°C <sup>3)</sup>                                         |                                                            |                                                                                                             |                            |
| <sup>1)</sup> (max. long-term temperature +24°C and max. short-term temperature +40°C)<br><sup>2)</sup> (max. long-term temperature +50°C and max. short-term temperature +72°C)<br><sup>3)</sup> (max. long-term temperature +60°C and max. short-term temperature +80°C)<br><sup>4)</sup> only C20/25 to C50/60 and without fibers<br><sup>5)</sup> with fibers only by hammer (HD), hollow (HDB) or compressed air drilling mode (CD) |                                                                                                                                                     |                                                            |                                                                                                             |                            |
| G&B Fissaggi Injection system Gebofix EPO PLUS RE for concrete                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                     |                                                            |                                                                                                             | Annex B 1                  |
| Intended use<br>Specifications                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                     |                                                            |                                                                                                             |                            |

#### Base materials:

- Compacted, reinforced or unreinforced normal weight concrete with strength classes C20/25 to C90/105 according to EN 206:2013 + A2:2021.
- Steel fiber reinforced concrete according to EN 206:2013 + A2:2021 with steel fibers according to EN 14889-1:2006, section 5, group 1, with a maximum fiber content of 80kg/m<sup>3</sup>.

#### Use conditions (Environmental conditions):

##### For working life for at least 50 and / or 100 years

- 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 A2 according to Annex A 4, Table A1: CRC II
  - Stainless steel A4 according to Annex A 4, Table A1: CRC III
  - High corrosion resistance steel HCR according to Annex A 4, Table A1: CRC V

##### For variable working life

- Structures subject to internal and external conditions: Classification of atmospheric corrosivity, determination and estimation C1-CX according to EN ISO 9223:2012 Table C.1 for a variable working life according to Table B1.
  - Carbon steel, hot dip galvanized according to EN ISO 10684:2004 + AC:2009 with mean thickness  $\geq 50 \mu\text{m}$

**Table B1: Variable working life**

| Corrosivity category <sup>1)</sup> | Corrosivity | Working life (years) |
|------------------------------------|-------------|----------------------|
| C1                                 | Very low    | 50                   |
| C2                                 | Low         | 50                   |
| C3                                 | Medium      | 25                   |
| C4                                 | High        | 12,5                 |
| C5                                 | Very High   | 5                    |
| CX                                 | Extreme     | 2                    |

<sup>1)</sup> Corrosivity categories according to EN ISO 9223:2012, Table C.1

#### 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.
- Fasteners in steel fiber reinforced concrete may be designed in accordance with EN 1992-4:2018. All performance parameters are to be applied as for normal concrete of strength classes C20/25 to C50/60 without fibers.
- 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.

**G&B Fissaggi Injection system Gebofix EPO PLUS RE for concrete**

**Intended use**  
Specifications (Continued)

**Annex B 2**

**Table B2: Installation parameters for threaded rod**

| Threaded rod                              |                                       |      | M8                                                | M10 | M12              | M16             | M20 | M24 | M27 | M30 |
|-------------------------------------------|---------------------------------------|------|---------------------------------------------------|-----|------------------|-----------------|-----|-----|-----|-----|
| Diameter of element                       | $d = d_{nom}$                         | [mm] | 8                                                 | 10  | 12               | 16              | 20  | 24  | 27  | 30  |
| Nominal drill hole diameter               | $d_0$                                 | [mm] | 10                                                | 12  | 14               | 18              | 22  | 28  | 30  | 35  |
| Effective embedment depth                 | $h_{ef,min}$                          | [mm] | 60                                                | 60  | 70               | 80              | 90  | 96  | 108 | 120 |
|                                           | $h_{ef,max}$                          | [mm] | 160                                               | 200 | 240              | 320             | 400 | 480 | 540 | 600 |
| Diameter of clearance hole in the fixture | Prepositioned installation $d_f \leq$ | [mm] | 9                                                 | 12  | 14               | 18              | 22  | 26  | 30  | 33  |
|                                           | Push through installation $d_f$       | [mm] | 12                                                | 14  | 16               | 20              | 24  | 30  | 33  | 40  |
| Maximum installation torque               | $\max T_{inst}$                       | [Nm] | 10                                                | 20  | 40 <sup>1)</sup> | 60              | 100 | 170 | 250 | 300 |
| Minimum thickness of member               | $h_{min}$                             | [mm] | $h_{ef} + 30 \text{ mm}$<br>$\geq 100 \text{ mm}$ |     |                  | $h_{ef} + 2d_0$ |     |     |     |     |
| Minimum spacing                           | $s_{min}$                             | [mm] | 40                                                | 50  | 60               | 75              | 95  | 115 | 125 | 140 |
| Minimum edge distance                     | $c_{min}$                             | [mm] | 35                                                | 40  | 45               | 50              | 60  | 65  | 75  | 80  |

1) Maximum installation torque for M12 with steel Grade 4.6 is 35 Nm

**Table B3: Installation parameters for reinforcing bar**

| Reinforcing bar             |               |      | $\varnothing 8^1)$                           | $\varnothing 10^1)$ | $\varnothing 12^1)$ | $\varnothing 14$ | $\varnothing 16$ | $\varnothing 20$ | $\varnothing 24^1)$ | $\varnothing 25^1)$ | $\varnothing 28$ | $\varnothing 32$ | $\varnothing 36$ | $\varnothing 40$ |
|-----------------------------|---------------|------|----------------------------------------------|---------------------|---------------------|------------------|------------------|------------------|---------------------|---------------------|------------------|------------------|------------------|------------------|
| Diameter of element         | $d = d_{nom}$ | [mm] | 8                                            | 10                  | 12                  | 14               | 16               | 20               | 24                  | 25                  | 28               | 32               | 36               | 40               |
| Nominal drill hole diameter | $d_0$         | [mm] | 10   12                                      | 12   14             | 14   16             | 18               | 20               | 25               | 30   32             | 30   32             | 35               | 40               | 45               | 52/55            |
| Effective embedment depth   | $h_{ef,min}$  | [mm] | 60                                           | 60                  | 70                  | 75               | 80               | 90               | 96                  | 100                 | 112              | 128              | 144              | 160              |
|                             | $h_{ef,max}$  | [mm] | 160                                          | 200                 | 240                 | 280              | 320              | 400              | 480                 | 500                 | 560              | 640              | 720              | 800              |
| Minimum thickness of member | $h_{min}$     | [mm] | $h_{ef} + 30 \text{ mm} \geq 100 \text{ mm}$ |                     |                     | $h_{ef} + 2d_0$  |                  |                  |                     |                     |                  |                  |                  |                  |
| Minimum spacing             | $s_{min}$     | [mm] | 40                                           | 50                  | 60                  | 70               | 75               | 95               | 120                 | 120                 | 130              | 150              | 180              | 200              |
| Minimum edge distance       | $c_{min}$     | [mm] | 35                                           | 40                  | 45                  | 50               | 50               | 60               | 70                  | 70                  | 75               | 85               | 180              | 200              |

1) both nominal drill hole diameter can be used

**Table B4: Installation parameters for Internal threaded anchor rod**

| Internal threaded anchor rod               |                 |      | BI-M6                                             | BI-M8 | BI-M10 | BI-M12          | BI-M16 | BI-M20 |
|--------------------------------------------|-----------------|------|---------------------------------------------------|-------|--------|-----------------|--------|--------|
| Internal diameter of anchor rod            | $d_2$           | [mm] | 6                                                 | 8     | 10     | 12              | 16     | 20     |
| Outer diameter of anchor rod <sup>1)</sup> | $d = d_{nom}$   | [mm] | 10                                                | 12    | 16     | 20              | 24     | 30     |
| Nominal drill hole diameter                | $d_0$           | [mm] | 12                                                | 14    | 18     | 22              | 28     | 35     |
| Effective embedment depth                  | $h_{ef,min}$    | [mm] | 60                                                | 70    | 80     | 90              | 96     | 120    |
|                                            | $h_{ef,max}$    | [mm] | 200                                               | 240   | 320    | 400             | 480    | 600    |
| Diameter of clearance hole in the fixture  | $d_f \leq$      | [mm] | 7                                                 | 9     | 12     | 14              | 18     | 22     |
| Maximum installation torque                | $\max T_{inst}$ | [Nm] | 10                                                | 10    | 20     | 40              | 60     | 100    |
| Thread engagement length min/max           | $l_{IG}$        | [mm] | 8/20                                              | 8/20  | 10/25  | 12/30           | 16/32  | 20/40  |
| Minimum thickness of member                | $h_{min}$       | [mm] | $h_{ef} + 30 \text{ mm}$<br>$\geq 100 \text{ mm}$ |       |        | $h_{ef} + 2d_0$ |        |        |
| Minimum spacing                            | $s_{min}$       | [mm] | 50                                                | 60    | 75     | 95              | 115    | 140    |
| Minimum edge distance                      | $c_{min}$       | [mm] | 40                                                | 45    | 50     | 60              | 65     | 80     |

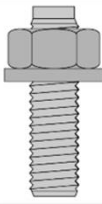
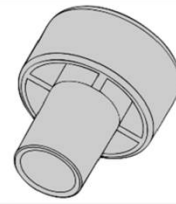
1) With metric threads

**G&B Fissaggi Injection system Gebofix EPO PLUS RE for concrete**

**Intended use**  
Installation parameters

**Annex B 3**

**Table B5: Parameter cleaning and installation tools**

|  |  |  |  |  |                             |  |                                      |                                                                                            |             |                                                                                     |                                                                                     |  |      |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------|-------------------------------------------------------------------------------------|--------------------------------------|--------------------------------------------------------------------------------------------|-------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--|------|
| Threaded Rod                                                                      | Re-inforcing bar                                                                  | Internal threaded anchor rod                                                      | d <sub>0</sub><br>Drill bit - Ø                                                   |                                                                                   | d <sub>b</sub><br>Brush - Ø |                                                                                     | d <sub>b,min</sub><br>min. Brush - Ø |                                                                                            | Piston plug | Installation direction and use of piston plug                                       |                                                                                     |  |      |
|                                                                                   |                                                                                   |                                                                                   | DD                                                                                | HD, HDB, CD                                                                       |                             |                                                                                     |                                      |         |             |  |  |  |      |
| [mm]                                                                              | [mm]                                                                              | [mm]                                                                              | [mm]                                                                              |                                                                                   |                             | [mm]                                                                                | [mm]                                 | No plug required                                                                           |             |                                                                                     |                                                                                     |  |      |
| M8                                                                                | 8                                                                                 |                                                                                   | 10                                                                                |                                                                                   | SC10                        | 11,5                                                                                | 10,5                                 |                                                                                            |             |                                                                                     |                                                                                     |  |      |
| M10                                                                               | 8 / 10                                                                            | BI-M6                                                                             | 12                                                                                |                                                                                   | SC12                        | 13,5                                                                                | 12,5                                 |                                                                                            |             |                                                                                     |                                                                                     |  |      |
| M12                                                                               | 10 / 12                                                                           | BI-M8                                                                             | 14                                                                                |                                                                                   | SC14                        | 15,5                                                                                | 14,5                                 |                                                                                            |             |                                                                                     |                                                                                     |  |      |
| -                                                                                 | 12                                                                                | -                                                                                 | 16                                                                                |                                                                                   | SC16                        | 17,5                                                                                | 16,5                                 | <div>h<sub>ef</sub> &gt; 250 mm</div> <div>h<sub>ef</sub> &gt; 250 mm</div> <div>all</div> |             |                                                                                     |                                                                                     |  |      |
| M16                                                                               | 14                                                                                | BI-M10                                                                            | 18                                                                                |                                                                                   | SC18                        | 20,0                                                                                | 18,5                                 |                                                                                            |             |                                                                                     |                                                                                     |  | MP18 |
| -                                                                                 | 16                                                                                | -                                                                                 | 20                                                                                |                                                                                   | SC20                        | 22,0                                                                                | 20,5                                 |                                                                                            |             |                                                                                     |                                                                                     |  | MP20 |
| M20                                                                               | -                                                                                 | BI-M12                                                                            | 22                                                                                |                                                                                   | SC22                        | 24,0                                                                                | 22,5                                 |                                                                                            |             |                                                                                     |                                                                                     |  | MP22 |
| -                                                                                 | 20                                                                                | -                                                                                 | 25                                                                                |                                                                                   | SC25                        | 27,0                                                                                | 25,5                                 |                                                                                            |             |                                                                                     |                                                                                     |  | MP25 |
| M24                                                                               | -                                                                                 | BI-M16                                                                            | 28                                                                                |                                                                                   | SC28                        | 30,0                                                                                | 28,5                                 |                                                                                            |             |                                                                                     |                                                                                     |  | MP28 |
| M27                                                                               | 24 / 25                                                                           | -                                                                                 | 30                                                                                |                                                                                   | SC30                        | 31,8                                                                                | 30,5                                 |                                                                                            |             |                                                                                     |                                                                                     |  | MP30 |
| -                                                                                 | 24 / 25                                                                           | -                                                                                 | 32                                                                                |                                                                                   | SC32                        | 34,0                                                                                | 32,5                                 |                                                                                            |             |                                                                                     |                                                                                     |  | MP32 |
| M30                                                                               | 28                                                                                | BI-M20                                                                            | 35                                                                                |                                                                                   | SC35                        | 37,0                                                                                | 35,5                                 |                                                                                            |             |                                                                                     |                                                                                     |  | MP35 |
| -                                                                                 | 32                                                                                | -                                                                                 | 40                                                                                |                                                                                   | SC40                        | 43,5                                                                                | 40,5                                 |                                                                                            |             |                                                                                     |                                                                                     |  | MP40 |
| -                                                                                 | 36                                                                                | -                                                                                 | 45                                                                                |                                                                                   | SC45                        | 47,0                                                                                | 45,5                                 |                                                                                            |             |                                                                                     |                                                                                     |  | MP45 |
| -                                                                                 | 40                                                                                | -                                                                                 | 52                                                                                | -                                                                                 | SC52                        | 54,0                                                                                | 52,5                                 | MP52                                                                                       | all         | all                                                                                 | all                                                                                 |  |      |
| -                                                                                 |                                                                                   | -                                                                                 | -                                                                                 | 55                                                                                | SC55                        | 58,5                                                                                | 55,5                                 | MP55                                                                                       |             |                                                                                     |                                                                                     |  |      |

## Cleaning and installation tools

### HDB – Hollow drill bit system



The hollow drill system consists of Heller Duster Expert hollow drill bit or a hollow drill bit with equivalent performance and a class M Hoover with a minimum negative pressure of 253 hPa and a flow rate of minimum 150 m³/h (42 l/s).

### Compressed air tool

(min 6 bar)



### Centring aid

CA-Cap



CA-Ring



### Brush SC



### Piston Plug MP



### Brush extension SL



G&B Fissaggi Injection system Gebofix EPO PLUS RE for concrete

### Intended use

Cleaning and installation tools

**Annex B 4**

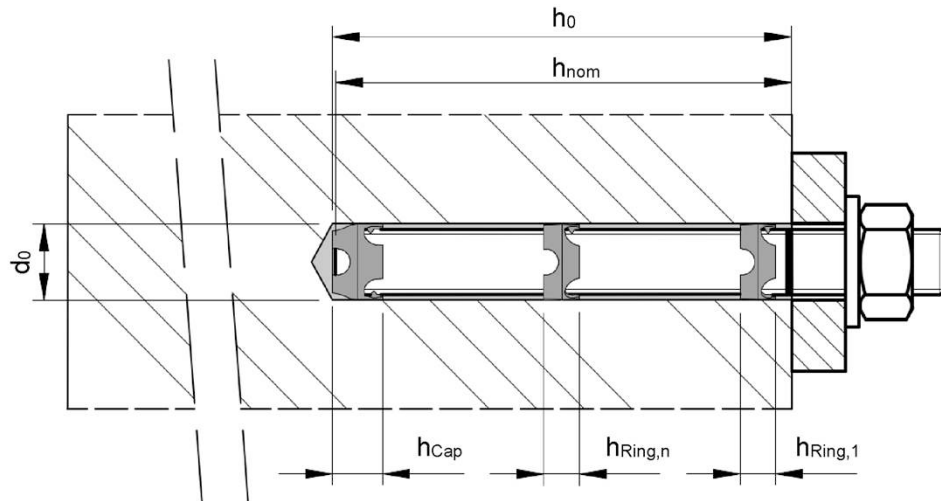
**Table B6: Installation parameters Centring aid**

|                               |                        |                                                      |        |                         |        |        |
|-------------------------------|------------------------|------------------------------------------------------|--------|-------------------------|--------|--------|
| Threaded rod                  |                        | M10                                                  | M12    | M16                     | M20    | M24    |
| Internal threaded anchor rod  |                        | BI-M6                                                | BI-M8  | BI-M10                  | BI-M12 | BI-M16 |
| Centring aid CA-Ring / CA-Cap |                        | CA-M10                                               | CA-M12 | CA-M16                  | CA-M20 | CA-M24 |
| Centring aid CA-Ring          | $h_{\text{Ring}}$ [mm] | 6,5                                                  | 8,0    | 9,0                     | 9,0    | 12,0   |
| Centring aid CA-Cap           | $h_{\text{Cap}}$ [mm]  | 8,0                                                  | 10,0   | 12,0                    | 14,0   | 16,0   |
| Drill hole depth              | $h_0$ [mm]             | $h_0 \geq h_{\text{nom}} + 3 \text{ mm}$             |        |                         |        |        |
| Minimum thickness of member   | $h_{\text{min}}$ [mm]  | $h_{\text{nom}} + 30 \text{ mm} \geq 100 \text{ mm}$ |        | $h_{\text{nom}} + 2d_0$ |        |        |

The effective embedment depth  $h_{\text{ef}}$  is reduced by the height all centering ring used.

$$h_{\text{ef}} = h_{\text{nom}} - h_{\text{Cap}} - n \cdot h_{\text{Ring}} \geq h_{\text{ef,min}}$$

$n$  = number of used centering rings



**Table B7: Working and curing time**

| Temperature in base material |    |         | Maximum working time | Minimum curing time <sup>1)</sup> |
|------------------------------|----|---------|----------------------|-----------------------------------|
| T                            |    |         | $t_{\text{work}}$    | $t_{\text{cure}}$                 |
| + 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                      | 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                               |
| Cartridge temperature        |    |         | +5 °C to +40 °C      |                                   |

<sup>1)</sup> The minimum curing time is only valid for dry base material.  
In wet base material the curing time must be doubled.

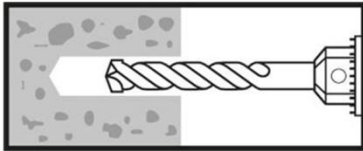
**G&B Fissaggi Injection system Gebofix EPO PLUS RE for concrete**

**Intended use**  
Parameter Centring aid  
Working time and curing time

**Annex B 5**

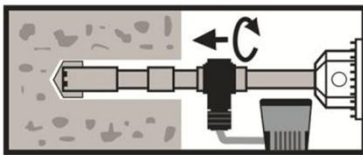
## Installation instructions

### 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 B2, B3 or B4.  
Aborted drill holes shall be filled with mortar.  
Proceed with Step 2.



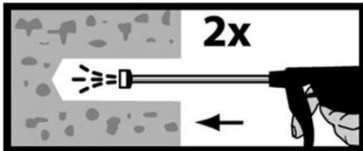
#### 1b. Hollow drill bit system (HDB) (see Annex B 4)

Drill a hole to the required embedment depth.  
Drill bit diameter according to Table B2, B3 or B4.  
The hollow drilling system removes the dust and cleans the bore hole.  
Proceed with Step 3.

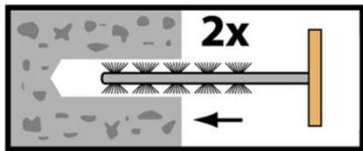
**Attention! Standing water in the bore hole must be removed before cleaning.**

### Compressed Air Cleaning (CAC):

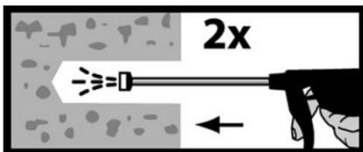
All diameter in cracked and uncracked concrete



2a. 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.)



2b. Brush the bore hole minimum 2x with brush SC according to Table B5 over the entire embedment depth in a twisting motion. (If necessary, a brush extension SL shall be used.)



2c. 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.

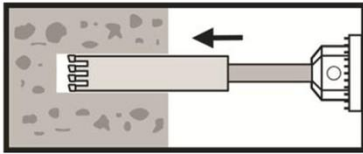
G&B Fissaggi Injection system Gebofix EPO PLUS RE for concrete

Intended use  
Installation instructions

Annex B 6

## Installation instructions (continuation)

### Drilling of the bore hole (DD)

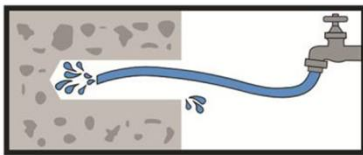


- 1a. Diamond drilling (DD)  
Drill a hole to the required embedment depth required  
Drill bit diameter according to Table B2, B3 or B4.  
Aborted drill holes shall be filled with mortar.  
Proceed with Step 2.

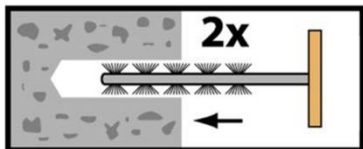
### Flush & Compressed Air Cleaning (SPCAC):

All diameter in uncracked concrete

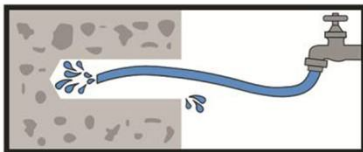
- 2a. Flushing with water until clear water comes out.



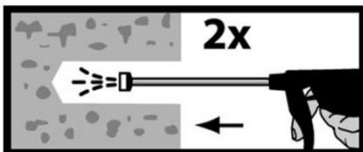
- 2b. Brush the bore hole minimum 2x with brush SC according to Table B5 over the entire embedment depth in a twisting motion. (If necessary, a brush extension SL shall be used.)



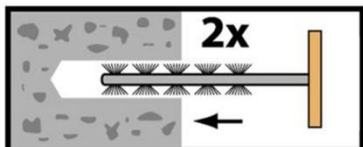
- 2c. Flushing again with water until clear water comes out.



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



- 2d. 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.)



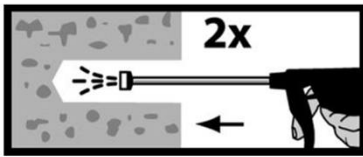
- 2e. Brush the bore hole minimum 2x with brush SC according to Table B5 over the entire embedment depth in a twisting motion. (If necessary, a brush extension SL shall be used.)

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Intended use  
Installation instructions (continuation)

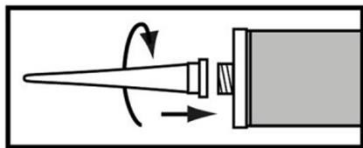
Annex B 7

## Installation instructions (continuation)

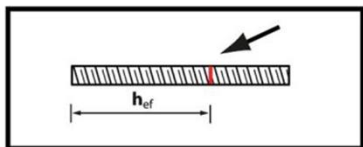


- 2f. Finally blow the bore hole clean minimum 2x with compressed air (min. 6 bar, oil-free) (Annex B 4) over the entire embedment depth until return air stream is free of noticeable dust. (If necessary, an extension shall be used.)

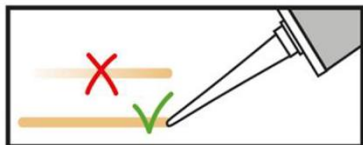
**Cleaned bore hole has to be protected against re-contamination in an appropriate way, If necessary, repeat cleaning process directly before dispensing the mortar. In-flowing water must not contaminate the bore hole again.**



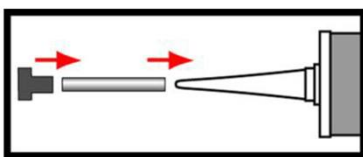
3. Screw on static-mixing nozzle M25/S and load the cartridge into an appropriate dispensing tool.  
For every working interruption longer than the maximum working time  $t_{work}$  (Annex B 5) as well as for new cartridges, a new static-mixer shall be used.



4. Mark embedment depth on the anchor rod.  
The anchor rod shall be free of dirt, grease, oil or other foreign material.



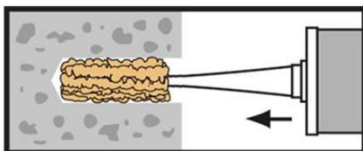
5. Not proper mixed mortar is not sufficient for fastening.  
Dispense and discard mortar until an uniform grey or red colour is shown (at least 3 full strokes).



6. Piston plugs MP and mixer nozzle extensions ML shall be used according to Table B5 for the following applications:

- Horizontal and vertical downwards direction: Drill bit- $\varnothing d_0 \geq 18$  mm and embedment depth  $h_{ef} > 250$ mm
- Vertical upwards direction: Drill bit- $\varnothing d_0 \geq 18$  mm

Assemble mixing nozzle, mixer extension and piston plug before injecting mortar.



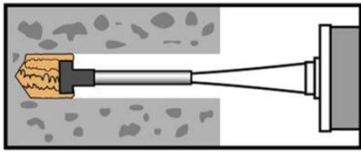
- 7a. **Injecting mortar without piston plug MP:**  
Starting at bottom of the hole and fill the hole up to approximately two-thirds with adhesive. (If necessary, a mixer nozzle extension shall be used.)  
Slowly withdraw of the static mixing nozzle avoid creating air pockets  
Observe the temperature related working time  $t_{work}$  (Annex B 5).

G&B Fissaggi Injection system Gebofix EPO PLUS RE for concrete

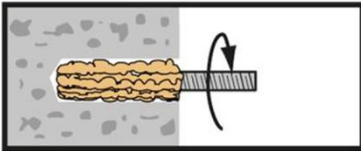
**Intended use**  
Installation instructions (continuation)

**Annex B 8**

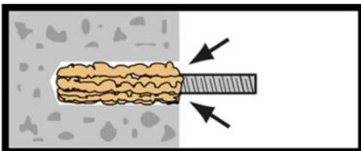
## Installation instructions (continuation)



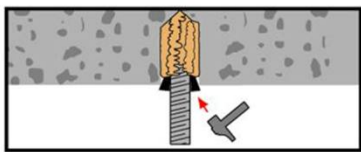
- 7b. Injecting mortar with piston plug MP:**  
Starting at bottom of the hole and fill the hole up to approximately two-thirds with adhesive. (If necessary, a mixer nozzle extension shall be used.) During injection the piston plug is pushed out of the bore hole by the back pressure of the mortar.  
Observe the temperature related working time  $t_{\text{work}}$  (Annex B 5).



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



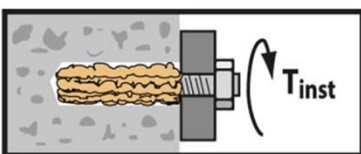
- 9.** Annular gap between anchor rod and base material must be completely filled with mortar. In case of push through installation the annular gap in the fixture must be filled with mortar also.  
Otherwise, the installation must be repeated starting from step 7 before the maximum working time  $t_{\text{work}}$  has expired.



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



- 11.** Temperature related curing time  $t_{\text{cure}}$  (Annex B 5) must be observed.  
Do not move or load the fastener during curing time.



- 12.** Install the fixture by using a calibrated torque wrench. Observe maximum installation torque (Table B2 or B4).  
In case of static requirements (e.g. seismic), fill the annular gap in the fixture with mortar (Annex A 2). Therefore replace the washer by the filling washer KSW and use the mixer reduction nozzle KSM.

G&B Fissaggi Injection system Gebofix EPO PLUS RE for concrete

Intended use  
Installation instructions (continuation)

Annex B 9

**Table C1: Characteristic values for steel tension resistance and steel shear resistance of threaded rods**

| Threaded rod                                                                                                                                                                                                                                         |                                          |                                | M8      | M10     | M12     | M16 | M20       | M24 | M27 | M30  |      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|--------------------------------|---------|---------|---------|-----|-----------|-----|-----|------|------|
| Cross section area                                                                                                                                                                                                                                   | A <sub>s</sub>                           | [mm²]                          | 36,6    | 58      | 84,3    | 157 | 245       | 353 | 459 | 561  |      |
| Characteristic tension resistance, Steel failure 1)                                                                                                                                                                                                  |                                          |                                |         |         |         |     |           |     |     |      |      |
| Steel, Property class 4.6 and 4.8                                                                                                                                                                                                                    | N <sub>Rk,s</sub>                        | [kN]                           | 15 (13) | 23 (21) | 34      | 63  | 98        | 141 | 184 | 224  |      |
| Steel, Property class 5.6 and 5.8                                                                                                                                                                                                                    | N <sub>Rk,s</sub>                        | [kN]                           | 18 (17) | 29 (27) | 42      | 78  | 122       | 176 | 230 | 280  |      |
| Steel, Property class 8.8                                                                                                                                                                                                                            | N <sub>Rk,s</sub>                        | [kN]                           | 29 (27) | 46 (43) | 67      | 125 | 196       | 282 | 368 | 449  |      |
| Stainless steel A2, A4 and HCR, class 50                                                                                                                                                                                                             | N <sub>Rk,s</sub>                        | [kN]                           | 18      | 29      | 42      | 79  | 123       | 177 | 230 | 281  |      |
| Stainless steel A2, A4 and HCR, class 70                                                                                                                                                                                                             | N <sub>Rk,s</sub>                        | [kN]                           | 26      | 41      | 59      | 110 | 171       | 247 | ₃)  | ₃)   |      |
| Stainless steel A4 and HCR, class 80                                                                                                                                                                                                                 | N <sub>Rk,s</sub>                        | [kN]                           | 29      | 46      | 67      | 126 | 196       | 282 | ₃)  | ₃)   |      |
| Characteristic tension resistance, Partial factor 2)                                                                                                                                                                                                 |                                          |                                |         |         |         |     |           |     |     |      |      |
| Steel, Property class 4.6 and 5.6                                                                                                                                                                                                                    | γ <sub>Ms,N</sub>                        | [-]                            | 2,0     |         |         |     |           |     |     |      |      |
| Steel, Property class 4.8, 5.8 and 8.8                                                                                                                                                                                                               | γ <sub>Ms,N</sub>                        | [-]                            | 1,5     |         |         |     |           |     |     |      |      |
| Stainless steel A2, A4 and HCR, class 50                                                                                                                                                                                                             | γ <sub>Ms,N</sub>                        | [-]                            | 2,86    |         |         |     |           |     |     |      |      |
| Stainless steel A2, A4 and HCR, class 70                                                                                                                                                                                                             | γ <sub>Ms,N</sub>                        | [-]                            | 1,87    |         |         |     |           |     |     |      |      |
| Stainless steel A4 and HCR, class 80                                                                                                                                                                                                                 | γ <sub>Ms,N</sub>                        | [-]                            | 1,6     |         |         |     |           |     |     |      |      |
| Characteristic shear resistance, Steel failure 1)                                                                                                                                                                                                    |                                          |                                |         |         |         |     |           |     |     |      |      |
| Without lever arm                                                                                                                                                                                                                                    | Steel, Property class 4.6 and 4.8        | V <sup>0</sup> <sub>Rk,s</sub> | [kN]    | 9 (8)   | 14 (13) | 20  | 38        | 59  | 85  | 110  | 135  |
|                                                                                                                                                                                                                                                      | Steel, Property class 5.6 and 5.8        | V <sup>0</sup> <sub>Rk,s</sub> | [kN]    | 11 (10) | 17 (16) | 25  | 47        | 74  | 106 | 138  | 168  |
|                                                                                                                                                                                                                                                      | Steel, Property class 8.8                | V <sup>0</sup> <sub>Rk,s</sub> | [kN]    | 15 (13) | 23 (21) | 34  | 63        | 98  | 141 | 184  | 224  |
|                                                                                                                                                                                                                                                      | Stainless steel A2, A4 and HCR, class 50 | V <sup>0</sup> <sub>Rk,s</sub> | [kN]    | 9       | 15      | 21  | 39        | 61  | 88  | 115  | 140  |
|                                                                                                                                                                                                                                                      | Stainless steel A2, A4 and HCR, class 70 | V <sup>0</sup> <sub>Rk,s</sub> | [kN]    | 13      | 20      | 30  | 55        | 86  | 124 | ₃)   | ₃)   |
|                                                                                                                                                                                                                                                      | Stainless steel A4 and HCR, class 80     | V <sup>0</sup> <sub>Rk,s</sub> | [kN]    | 15      | 23      | 34  | 63        | 98  | 141 | ₃)   | ₃)   |
| With lever arm                                                                                                                                                                                                                                       | 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  |
|                                                                                                                                                                                                                                                      | Steel, Property class 5.6 and 5.8        | M <sup>0</sup> <sub>Rk,s</sub> | [Nm]    | 19 (16) | 37 (33) | 65  | 166       | 324 | 560 | 833  | 1123 |
|                                                                                                                                                                                                                                                      | Steel, Property class 8.8                | M <sup>0</sup> <sub>Rk,s</sub> | [Nm]    | 30 (26) | 60 (53) | 105 | 266       | 519 | 896 | 1333 | 1797 |
|                                                                                                                                                                                                                                                      | Stainless steel A2, A4 and HCR, class 50 | M <sup>0</sup> <sub>Rk,s</sub> | [Nm]    | 19      | 37      | 66  | 167       | 325 | 561 | 832  | 1125 |
|                                                                                                                                                                                                                                                      | Stainless steel A2, A4 and HCR, class 70 | M <sup>0</sup> <sub>Rk,s</sub> | [Nm]    | 26      | 52      | 92  | 232       | 454 | 784 | ₃)   | ₃)   |
|                                                                                                                                                                                                                                                      | Stainless steel A4 and HCR, class 80     | M <sup>0</sup> <sub>Rk,s</sub> | [Nm]    | 30      | 59      | 105 | 266       | 519 | 896 | ₃)   | ₃)   |
| Characteristic shear resistance, Partial factor 2)                                                                                                                                                                                                   |                                          |                                |         |         |         |     |           |     |     |      |      |
| Steel, Property class 4.6 and 5.6                                                                                                                                                                                                                    | γ <sub>Ms,V</sub>                        | [-]                            | 1,67    |         |         |     |           |     |     |      |      |
| Steel, Property class 4.8, 5.8 and 8.8                                                                                                                                                                                                               | γ <sub>Ms,V</sub>                        | [-]                            | 1,25    |         |         |     |           |     |     |      |      |
| Stainless steel A2, A4 and HCR, class 50                                                                                                                                                                                                             | γ <sub>Ms,V</sub>                        | [-]                            | 2,38    |         |         |     |           |     |     |      |      |
| Stainless steel A2, A4 and HCR, class 70                                                                                                                                                                                                             | γ <sub>Ms,V</sub>                        | [-]                            | 1,56    |         |         |     |           |     |     |      |      |
| Stainless steel A4 and HCR, class 80                                                                                                                                                                                                                 | γ <sub>Ms,V</sub>                        | [-]                            | 1,33    |         |         |     |           |     |     |      |      |
| 1) 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. |                                          |                                |         |         |         |     |           |     |     |      |      |
| 2) in absence of national regulation                                                                                                                                                                                                                 |                                          |                                |         |         |         |     |           |     |     |      |      |
| 3) Fastener type not part of the ETA                                                                                                                                                                                                                 |                                          |                                |         |         |         |     |           |     |     |      |      |
| G&B Fissaggi Injection system Gebofix EPO PLUS RE for concrete                                                                                                                                                                                       |                                          |                                |         |         |         |     | Annex C 1 |     |     |      |      |
| Performances<br>Characteristic values for steel tension resistance and steel shear resistance of threaded rods                                                                                                                                       |                                          |                                |         |         |         |     |           |     |     |      |      |

**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 failure |                        |             |                             |                                                        |
| Uncracked concrete    | $k_{ucr,N}$            | [-]         | 11,0                        |                                                        |
| Cracked concrete      | $k_{cr,N}$             | [-]         | 7,7                         |                                                        |
| Edge distance         | $c_{cr,N}$             | [mm]        | 1,5 $h_{ef}$                |                                                        |
| Axial distance        | $s_{cr,N}$             | [mm]        | 2 $c_{cr,N}$                |                                                        |
| Splitting             |                        |             |                             |                                                        |
| Edge distance         | $h/h_{ef} \geq 2,0$    | $c_{cr,sp}$ | [mm]                        | 1,0 $h_{ef}$                                           |
|                       | $2,0 > h/h_{ef} > 1,3$ |             |                             | $2 \cdot h_{ef} \left( 2,5 - \frac{h}{h_{ef}} \right)$ |
|                       | $h/h_{ef} \leq 1,3$    |             |                             | 2,4 $h_{ef}$                                           |
| Axial distance        | $s_{cr,sp}$            | [mm]        | 2 $c_{cr,sp}$               |                                                        |

**G&B Fissaggi Injection system Gebofix EPO PLUS RE for concrete**

**Performances**

Characteristic values of tension loads under static and quasi-static action for a working life of 50 and 100 years

**Annex C 2**

| Table C3: Characteristic values of tension loads under static and quasi-static action for a working life of 50 years                                                               |                |                                        |                   |                                      |                                       |     |     |     |     |           |     |     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------------------------------------|-------------------|--------------------------------------|---------------------------------------|-----|-----|-----|-----|-----------|-----|-----|
| Threaded rod                                                                                                                                                                       |                |                                        |                   | M8                                   | M10                                   | M12 | M16 | M20 | M24 | M27       | M30 |     |
| Steel failure                                                                                                                                                                      |                |                                        |                   |                                      |                                       |     |     |     |     |           |     |     |
| Characteristic tension resistance                                                                                                                                                  |                | $N_{Rk,s}$                             | [kN]              | $A_s \cdot f_{uk}$ (or see Table C1) |                                       |     |     |     |     |           |     |     |
| Partial factor                                                                                                                                                                     |                | $\gamma_{Ms,N}$                        | [-]               | see Table C1                         |                                       |     |     |     |     |           |     |     |
| Combined pull-out and concrete failure                                                                                                                                             |                |                                        |                   |                                      |                                       |     |     |     |     |           |     |     |
| Characteristic bond resistance in uncracked concrete C20/25 in hammer drilled (HD) and compressed air drilled holes (CD)                                                           |                |                                        |                   |                                      |                                       |     |     |     |     |           |     |     |
| Temperature range                                                                                                                                                                  | I: 24°C/40°C   | Dry, wet concrete or flooded bore hole | $\tau_{Rk,ucr}$   | [N/mm²]                              | 20                                    | 20  | 19  | 19  | 18  | 17        | 16  | 16  |
|                                                                                                                                                                                    | II: 50°C/72°C  |                                        |                   |                                      | 15                                    | 15  | 15  | 14  | 13  | 13        | 12  | 12  |
|                                                                                                                                                                                    | III: 60°C/80°C |                                        |                   |                                      | 6,5                                   | 6,5 | 6,5 | 6,0 | 6,0 | 5,5       | 5,5 | 5,5 |
| Characteristic bond resistance in uncracked concrete C20/25 in hammer drilled holes with hollow drill bit (HDB)                                                                    |                |                                        |                   |                                      |                                       |     |     |     |     |           |     |     |
| Temperature range                                                                                                                                                                  | I: 24°C/40°C   | Dry or wet concrete                    | $\tau_{Rk,ucr}$   | [N/mm²]                              | 17                                    | 16  | 16  | 16  | 15  | 14        | 14  | 13  |
|                                                                                                                                                                                    | II: 50°C/72°C  |                                        |                   |                                      | 14                                    | 14  | 14  | 13  | 13  | 12        | 12  | 11  |
|                                                                                                                                                                                    | III: 60°C/80°C |                                        |                   |                                      | 6,5                                   | 6,5 | 6,5 | 6,0 | 6,0 | 5,5       | 5,5 | 5,5 |
|                                                                                                                                                                                    | I: 24°C/40°C   | flooded bore hole                      |                   |                                      | 16                                    | 16  | 16  | 15  | 15  | 14        | 14  | 13  |
|                                                                                                                                                                                    | II: 50°C/72°C  |                                        |                   |                                      | 14                                    | 14  | 14  | 13  | 13  | 12        | 12  | 11  |
|                                                                                                                                                                                    | III: 60°C/80°C |                                        |                   |                                      | 6,5                                   | 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 (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 | $\tau_{Rk,cr}$    | [N/mm²]                              | 7,0                                   | 7,0 | 8,5 | 8,5 | 8,5 | 8,5       | 8,5 | 8,5 |
|                                                                                                                                                                                    | II: 50°C/72°C  |                                        |                   |                                      | 6,0                                   | 6,0 | 7,0 | 7,0 | 7,0 | 7,0       | 7,0 | 7,0 |
|                                                                                                                                                                                    | III: 60°C/80°C |                                        |                   |                                      | 5,0                                   | 5,0 | 5,0 | 4,5 | 4,5 | 4,5       | 4,5 | 4,5 |
| Reduction factor 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 | $\psi_{sus}^0$    | [-]                                  | 0,99                                  |     |     |     |     |           |     |     |
|                                                                                                                                                                                    | II: 50°C/72°C  |                                        |                   |                                      | 0,68                                  |     |     |     |     |           |     |     |
|                                                                                                                                                                                    | III: 60°C/80°C |                                        |                   |                                      | 0,70                                  |     |     |     |     |           |     |     |
| Increasing factors for concrete                                                                                                                                                    |                | ≤ C50/60                               | $\psi_c$          | [-]                                  | $(f_{ck} / 20)^{0,1}$                 |     |     |     |     |           |     |     |
|                                                                                                                                                                                    |                | > C50/60                               |                   |                                      | 1,1                                   |     |     |     |     |           |     |     |
| Characteristic bond resistance depending on the concrete strength class                                                                                                            |                |                                        | $\tau_{Rk,ucr} =$ |                                      | $\psi_c \cdot \tau_{Rk,ucr,(C20/25)}$ |     |     |     |     |           |     |     |
|                                                                                                                                                                                    |                |                                        | $\tau_{Rk,cr} =$  |                                      | $\psi_c \cdot \tau_{Rk,cr,(C20/25)}$  |     |     |     |     |           |     |     |
| Concrete cone failure or Splitting                                                                                                                                                 |                |                                        |                   |                                      |                                       |     |     |     |     |           |     |     |
| Relevant parameter                                                                                                                                                                 |                |                                        |                   | see Table C2                         |                                       |     |     |     |     |           |     |     |
| Installation factor                                                                                                                                                                |                |                                        |                   |                                      |                                       |     |     |     |     |           |     |     |
| for dry and wet concrete (HD; HDB, CD)                                                                                                                                             |                | $\gamma_{inst}$                        | [-]               | 1,0                                  |                                       |     |     |     |     |           |     |     |
| for flooded bore hole (HD; HDB, CD)                                                                                                                                                |                |                                        |                   | 1,2                                  |                                       |     |     |     |     |           |     |     |
| G&B Fissaggi Injection system Gebofix EPO PLUS RE for concrete                                                                                                                     |                |                                        |                   |                                      |                                       |     |     |     |     | Annex C 3 |     |     |
| Performances<br>Characteristic values of tension loads under static and quasi-static action for a working life of 50 years (threaded rod)                                          |                |                                        |                   |                                      |                                       |     |     |     |     |           |     |     |

| Table C4: Characteristic values of tension loads under static and quasi-static action for a working life of 100 years                                                              |                |                                        |                       |         |                                           |     |     |     |           |     |     |     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------------------------------------|-----------------------|---------|-------------------------------------------|-----|-----|-----|-----------|-----|-----|-----|
| Threaded rod                                                                                                                                                                       |                |                                        |                       |         | M8                                        | M10 | M12 | M16 | M20       | M24 | M27 | M30 |
| Steel failure                                                                                                                                                                      |                |                                        |                       |         |                                           |     |     |     |           |     |     |     |
| Characteristic tension resistance                                                                                                                                                  |                |                                        | $N_{Rk,s}$            | [kN]    | $A_s \cdot f_{uk}$ (or see Table C1)      |     |     |     |           |     |     |     |
| Partial factor                                                                                                                                                                     |                |                                        | $\gamma_{Ms,N}$       | [-]     | see Table C1                              |     |     |     |           |     |     |     |
| Combined pull-out and concrete failure                                                                                                                                             |                |                                        |                       |         |                                           |     |     |     |           |     |     |     |
| Characteristic bond resistance in uncracked concrete C20/25 in hammer drilled (HD) and compressed air drilled holes (CD)                                                           |                |                                        |                       |         |                                           |     |     |     |           |     |     |     |
| Temperature range                                                                                                                                                                  | I: 24°C/40°C   | Dry, wet concrete or flooded bore hole | $\tau_{Rk,ucr,100}$   | [N/mm²] | 20                                        | 20  | 19  | 19  | 18        | 17  | 16  | 16  |
|                                                                                                                                                                                    | II: 50°C/72°C  |                                        |                       |         | 15                                        | 15  | 15  | 14  | 13        | 13  | 12  | 12  |
|                                                                                                                                                                                    | III: 60°C/80°C |                                        |                       |         | 6,5                                       | 6,5 | 6,5 | 6,0 | 6,0       | 5,5 | 5,5 | 5,5 |
| Characteristic bond resistance in uncracked concrete C20/25 in hammer drilled holes with hollow drill bit (HDB)                                                                    |                |                                        |                       |         |                                           |     |     |     |           |     |     |     |
| Temperature range                                                                                                                                                                  | I: 24°C/40°C   | Dry or wet concrete                    | $\tau_{Rk,ucr,100}$   | [N/mm²] | 17                                        | 16  | 16  | 16  | 15        | 14  | 14  | 13  |
|                                                                                                                                                                                    | II: 50°C/72°C  |                                        |                       |         | 14                                        | 14  | 14  | 13  | 13        | 12  | 12  | 11  |
|                                                                                                                                                                                    | III: 60°C/80°C |                                        |                       |         | 6,5                                       | 6,5 | 6,5 | 6,0 | 6,0       | 5,5 | 5,5 | 5,5 |
|                                                                                                                                                                                    | I: 24°C/40°C   | flooded bore hole                      |                       |         | 16                                        | 16  | 16  | 15  | 15        | 14  | 14  | 13  |
|                                                                                                                                                                                    | II: 50°C/72°C  |                                        |                       |         | 14                                        | 14  | 14  | 13  | 13        | 12  | 12  | 11  |
|                                                                                                                                                                                    | III: 60°C/80°C |                                        |                       |         | 6,5                                       | 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 (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 | $\tau_{Rk,cr,100}$    | [N/mm²] | 6,5                                       | 6,5 | 7,5 | 7,5 | 7,5       | 7,5 | 7,5 | 7,5 |
|                                                                                                                                                                                    | II: 50°C/72°C  |                                        |                       |         | 5,5                                       | 5,5 | 6,5 | 6,5 | 6,5       | 6,5 | 6,5 | 6,5 |
|                                                                                                                                                                                    | III: 60°C/80°C |                                        |                       |         | 5,0                                       | 5,0 | 5,0 | 4,5 | 4,5       | 4,5 | 4,5 | 4,5 |
| Reduction factor 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 | $\psi_{sus,100}^0$    | [-]     | 0,97                                      |     |     |     |           |     |     |     |
|                                                                                                                                                                                    | II: 50°C/72°C  |                                        |                       |         | 0,68                                      |     |     |     |           |     |     |     |
|                                                                                                                                                                                    | III: 60°C/80°C |                                        |                       |         | 0,70                                      |     |     |     |           |     |     |     |
| Increasing factors for concrete                                                                                                                                                    |                | ≤ C50/60                               | $\psi_c$              | [-]     | $(f_{ck} / 20)^{0,1}$                     |     |     |     |           |     |     |     |
|                                                                                                                                                                                    |                | > C50/60                               |                       |         | 1,1                                       |     |     |     |           |     |     |     |
| Characteristic bond resistance depending on the concrete strength class                                                                                                            |                |                                        | $\tau_{Rk,ucr,100} =$ |         | $\psi_c \cdot \tau_{Rk,ucr,100,(C20/25)}$ |     |     |     |           |     |     |     |
|                                                                                                                                                                                    |                |                                        | $\tau_{Rk,cr,100} =$  |         | $\psi_c \cdot \tau_{Rk,cr,100,(C20/25)}$  |     |     |     |           |     |     |     |
| Concrete cone failure or Splitting                                                                                                                                                 |                |                                        |                       |         |                                           |     |     |     |           |     |     |     |
| Relevant parameter                                                                                                                                                                 |                |                                        |                       |         | see Table C2                              |     |     |     |           |     |     |     |
| Installation factor                                                                                                                                                                |                |                                        |                       |         |                                           |     |     |     |           |     |     |     |
| for dry and wet concrete (HD; HDB, CD)                                                                                                                                             |                |                                        | $\gamma_{inst}$       | [-]     | 1,0                                       |     |     |     |           |     |     |     |
| for flooded bore hole (HD; HDB, CD)                                                                                                                                                |                |                                        |                       |         | 1,2                                       |     |     |     |           |     |     |     |
|                                                                                                                                                                                    |                |                                        |                       |         |                                           |     |     |     |           |     |     |     |
| G&B Fissaggi Injection system Gebofix EPO PLUS RE for concrete                                                                                                                     |                |                                        |                       |         |                                           |     |     |     | Annex C 4 |     |     |     |
| Performances<br>Characteristic values of tension loads under static and quasi-static action for a working life of 100 years (threaded rod)                                         |                |                                        |                       |         |                                           |     |     |     |           |     |     |     |

| Table C5: Characteristic values of tension loads under static and quasi-static action for a working life of 50 years                      |                |                                        |                               |                                                    |                                                   |     |     |     |           |     |     |     |
|-------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------------------------------------|-------------------------------|----------------------------------------------------|---------------------------------------------------|-----|-----|-----|-----------|-----|-----|-----|
| Threaded rod                                                                                                                              |                |                                        |                               |                                                    | M8                                                | M10 | M12 | M16 | M20       | M24 | M27 | M30 |
| Steel failure                                                                                                                             |                |                                        |                               |                                                    |                                                   |     |     |     |           |     |     |     |
| Characteristic tension resistance                                                                                                         |                | N <sub>Rk,s</sub>                      | [kN]                          | A <sub>s</sub> · f <sub>uk</sub> (or see Table C1) |                                                   |     |     |     |           |     |     |     |
| Partial factor                                                                                                                            |                | γ <sub>Ms,N</sub>                      | [-]                           | see Table C1                                       |                                                   |     |     |     |           |     |     |     |
| Combined pull-out and concrete failure                                                                                                    |                |                                        |                               |                                                    |                                                   |     |     |     |           |     |     |     |
| Characteristic bond resistance in uncracked concrete C20/25 in diamond drilled holes (DD)                                                 |                |                                        |                               |                                                    |                                                   |     |     |     |           |     |     |     |
| Temperature range                                                                                                                         | I: 24°C/40°C   | Dry, wet concrete or flooded bore hole | τ <sub>Rk,ucr</sub>           | [N/mm²]                                            | 15                                                | 14  | 14  | 13  | 12        | 12  | 11  | 11  |
|                                                                                                                                           | II: 50°C/72°C  |                                        |                               |                                                    | 12                                                | 12  | 11  | 10  | 9,5       | 9,5 | 9,0 | 9,0 |
|                                                                                                                                           | III: 60°C/80°C |                                        |                               |                                                    | 5,5                                               | 5,5 | 5,0 | 4,5 | 4,5       | 4,5 | 4,0 | 4,0 |
| Characteristic bond resistance in cracked concrete C20/25 in diamond drilled holes (DD)                                                   |                |                                        |                               |                                                    |                                                   |     |     |     |           |     |     |     |
| Temperature range                                                                                                                         | I: 24°C/40°C   | Dry, wet concrete or flooded bore hole | τ <sub>Rk,cr</sub>            | [N/mm²]                                            | 1)                                                |     |     | 5,5 | 5,5       | 5,5 | 5,5 | 5,4 |
|                                                                                                                                           | II: 50°C/72°C  |                                        |                               |                                                    |                                                   |     |     | 4,6 | 4,6       | 4,6 | 4,6 | 4,5 |
|                                                                                                                                           | III: 60°C/80°C |                                        |                               |                                                    |                                                   |     |     | 2,4 | 2,3       | 2,4 | 2,4 | 2,3 |
| Reduction factor in uncracked concrete C20/25 in diamond drilled holes (DD)                                                               |                |                                        |                               |                                                    |                                                   |     |     |     |           |     |     |     |
| Temperature range                                                                                                                         | I: 24°C/40°C   | Dry, wet concrete or flooded bore hole | ψ <sup>0</sup> <sub>sus</sub> | [-]                                                | 0,77                                              |     |     |     |           |     |     |     |
|                                                                                                                                           | II: 50°C/72°C  |                                        |                               |                                                    | 0,72                                              |     |     |     |           |     |     |     |
|                                                                                                                                           | III: 60°C/80°C |                                        |                               |                                                    | 0,72                                              |     |     |     |           |     |     |     |
| Increasing factors for concrete                                                                                                           | ≤ C50/60       | ψ <sub>c,ucr</sub>                     | [-]                           | (f <sub>ck</sub> / 20) <sup>0,2</sup>              |                                                   |     |     |     |           |     |     |     |
|                                                                                                                                           | > C50/60       |                                        |                               | 1,2                                                |                                                   |     |     |     |           |     |     |     |
|                                                                                                                                           |                | ≤ C50/60                               | ψ <sub>c,cr</sub>             | [-]                                                | (f <sub>ck</sub> / 20) <sup>0,4</sup>             |     |     |     |           |     |     |     |
| Characteristic bond resistance depending on the concrete strength class                                                                   |                | τ <sub>Rk,ucr</sub> =                  |                               |                                                    | ψ <sub>c,ucr</sub> · τ <sub>Rk,ucr,(C20/25)</sub> |     |     |     |           |     |     |     |
|                                                                                                                                           |                | τ <sub>Rk,cr</sub> =                   |                               |                                                    | ψ <sub>c,cr</sub> · τ <sub>Rk,cr,(C20/25)</sub>   |     |     |     |           |     |     |     |
| Concrete cone failure or Splitting                                                                                                        |                |                                        |                               |                                                    |                                                   |     |     |     |           |     |     |     |
| Relevant parameter                                                                                                                        |                |                                        |                               |                                                    | see Table C2                                      |     |     |     |           |     |     |     |
| Installation factor                                                                                                                       |                |                                        |                               |                                                    |                                                   |     |     |     |           |     |     |     |
| for dry and wet concrete (DD)                                                                                                             |                | γ <sub>inst</sub>                      | [-]                           | 1,0                                                |                                                   |     |     |     |           |     |     |     |
| for flooded bore hole (DD)                                                                                                                |                |                                        |                               | 1,2                                                |                                                   |     | 1,4 |     |           |     |     |     |
| 1) no performance assessed                                                                                                                |                |                                        |                               |                                                    |                                                   |     |     |     |           |     |     |     |
| G&B Fissaggi Injection system Gebofix EPO PLUS RE for concrete                                                                            |                |                                        |                               |                                                    |                                                   |     |     |     | Annex C 5 |     |     |     |
| Performances<br>Characteristic values of tension loads under static and quasi-static action for a working life of 50 years (threaded rod) |                |                                        |                               |                                                    |                                                   |     |     |     |           |     |     |     |

| Table C6: Characteristic values of tension loads under static and quasi-static action for a working life of 100 years |                |                                        |                       |                                      |                                           |     |     |     |     |     |     |     |
|-----------------------------------------------------------------------------------------------------------------------|----------------|----------------------------------------|-----------------------|--------------------------------------|-------------------------------------------|-----|-----|-----|-----|-----|-----|-----|
| Threaded rod                                                                                                          |                |                                        |                       |                                      | M8                                        | M10 | M12 | M16 | M20 | M24 | M27 | M30 |
| Steel failure                                                                                                         |                |                                        |                       |                                      |                                           |     |     |     |     |     |     |     |
| Characteristic tension resistance                                                                                     |                | $N_{Rk,s}$                             | [kN]                  | $A_s \cdot f_{uk}$ (or see Table C1) |                                           |     |     |     |     |     |     |     |
| Partial factor                                                                                                        |                | $\gamma_{Ms,N}$                        | [-]                   | see Table C1                         |                                           |     |     |     |     |     |     |     |
| Combined pull-out and concrete failure                                                                                |                |                                        |                       |                                      |                                           |     |     |     |     |     |     |     |
| Characteristic bond resistance in uncracked concrete C20/25 in diamond drilled holes (DD)                             |                |                                        |                       |                                      |                                           |     |     |     |     |     |     |     |
| Temperature range                                                                                                     | I: 24°C/40°C   | Dry, wet concrete or flooded bore hole | $\tau_{Rk,ucr,100}$   | [N/mm²]                              | 15                                        | 14  | 14  | 13  | 12  | 12  | 11  | 11  |
|                                                                                                                       | II: 50°C/72°C  |                                        |                       |                                      | 11                                        | 11  | 10  | 10  | 9,5 | 9,0 | 8,5 | 8,5 |
|                                                                                                                       | III: 60°C/80°C |                                        |                       |                                      | 5,5                                       | 5,5 | 5,0 | 4,5 | 4,5 | 4,5 | 4,0 | 4,0 |
| Reduction factor in uncracked concrete C20/25 in diamond drilled holes (DD)                                           |                |                                        |                       |                                      |                                           |     |     |     |     |     |     |     |
| Temperature range                                                                                                     | I: 24°C/40°C   | Dry, wet concrete or flooded bore hole | $\psi^0_{sus,100}$    | [-]                                  | 0,73                                      |     |     |     |     |     |     |     |
|                                                                                                                       | II: 50°C/72°C  |                                        |                       |                                      | 0,70                                      |     |     |     |     |     |     |     |
|                                                                                                                       | III: 60°C/80°C |                                        |                       |                                      | 0,72                                      |     |     |     |     |     |     |     |
| Increasing factors for concrete                                                                                       |                | ≤ C50/60                               | $\psi_c$              | [-]                                  | $(f_{ck} / 20)^{0,2}$                     |     |     |     |     |     |     |     |
|                                                                                                                       |                | > C50/60                               |                       |                                      | 1,2                                       |     |     |     |     |     |     |     |
| Characteristic bond resistance depending on the concrete strength class                                               |                |                                        | $\tau_{Rk,ucr,100} =$ |                                      | $\psi_c \cdot \tau_{Rk,ucr,100,(C20/25)}$ |     |     |     |     |     |     |     |
| Concrete cone failure or Splitting                                                                                    |                |                                        |                       |                                      |                                           |     |     |     |     |     |     |     |
| Relevant parameter                                                                                                    |                |                                        |                       |                                      | see Table C2                              |     |     |     |     |     |     |     |
| Installation factor                                                                                                   |                |                                        |                       |                                      |                                           |     |     |     |     |     |     |     |
| for dry and wet concrete (DD)                                                                                         |                | $\gamma_{inst}$                        | [-]                   | 1,0                                  |                                           |     |     |     |     |     |     |     |
| for flooded bore hole (DD)                                                                                            |                |                                        |                       | 1,2                                  |                                           |     | 1,4 |     |     |     |     |     |
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| Table C7: Characteristic values of shear loads under static and quasi-static action for a working life of 50 and 100 years |                 |       |                                                   |     |     |     |     |     |                              |      |
|----------------------------------------------------------------------------------------------------------------------------|-----------------|-------|---------------------------------------------------|-----|-----|-----|-----|-----|------------------------------|------|
| Threaded rod                                                                                                               |                 |       | M8                                                | M10 | M12 | M16 | M20 | M24 | M27                          | M30  |
| Steel failure without lever arm                                                                                            |                 |       |                                                   |     |     |     |     |     |                              |      |
| Characteristic shear resistance<br>Steel, strength class 4.6, 4.8 and 5.6, 5.8                                             | $V_{Rk,s}^0$    | [kN]  | $0,6 \cdot A_s \cdot f_{uk}$ (or see Table C1)    |     |     |     |     |     |                              |      |
| Characteristic shear resistance<br>Steel, strength class 8.8<br>Stainless Steel A2, A4 and HCR, all strength classes       | $V_{Rk,s}^0$    | [kN]  | $0,5 \cdot A_s \cdot f_{uk}$ (or see Table C1)    |     |     |     |     |     |                              |      |
| Partial factor                                                                                                             | $\gamma_{Ms,V}$ | [-]   | see Table C1                                      |     |     |     |     |     |                              |      |
| Ductility factor                                                                                                           | $k_7$           | [-]   | 1,0                                               |     |     |     |     |     |                              |      |
| Steel failure with lever arm                                                                                               |                 |       |                                                   |     |     |     |     |     |                              |      |
| Characteristic bending moment                                                                                              | $M_{Rk,s}^0$    | [Nm]  | $1,2 \cdot W_{el} \cdot f_{uk}$ (or see Table C1) |     |     |     |     |     |                              |      |
| Elastic section modulus                                                                                                    | $W_{el}$        | [mm³] | 31                                                | 62  | 109 | 277 | 541 | 935 | 1387                         | 1874 |
| Partial factor                                                                                                             | $\gamma_{Ms,V}$ | [-]   | see Table C1                                      |     |     |     |     |     |                              |      |
| Concrete pry-out failure                                                                                                   |                 |       |                                                   |     |     |     |     |     |                              |      |
| Factor                                                                                                                     | $k_8$           | [-]   | 2,0                                               |     |     |     |     |     |                              |      |
| Installation factor                                                                                                        | $\gamma_{inst}$ | [-]   | 1,0                                               |     |     |     |     |     |                              |      |
| Concrete edge failure                                                                                                      |                 |       |                                                   |     |     |     |     |     |                              |      |
| Effective length of fastener                                                                                               | $l_f$           | [mm]  | $\min(h_{ef}; 12 \cdot d_{nom})$                  |     |     |     |     |     | $\min(h_{ef}; 300\text{mm})$ |      |
| Outside diameter of fastener                                                                                               | $d_{nom}$       | [mm]  | 8                                                 | 10  | 12  | 16  | 20  | 24  | 27                           | 30   |
| Installation factor                                                                                                        | $\gamma_{inst}$ | [-]   | 1,0                                               |     |     |     |     |     |                              |      |
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| Table C8: Characteristic values of tension loads under static and quasi-static action for a working life of 50 years                                                                                                                                      |                |                                        |                   |                      |                                       |        |        |           |        |     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------------------------------------|-------------------|----------------------|---------------------------------------|--------|--------|-----------|--------|-----|
| Internal threaded anchor rods                                                                                                                                                                                                                             |                |                                        |                   | BI-M6                | BI-M8                                 | BI-M10 | BI-M12 | BI-M16    | BI-M20 |     |
| Steel failure <sup>1)</sup>                                                                                                                                                                                                                               |                |                                        |                   |                      |                                       |        |        |           |        |     |
| Characteristic tension resistance, Steel, strength class                                                                                                                                                                                                  | 5.8<br>8.8     | $N_{Rk,s}$                             | [kN]              | 10                   | 17                                    | 29     | 42     | 76        | 123    |     |
| Partial factor, strength class 5.8 and 8.8                                                                                                                                                                                                                |                | $\gamma_{Ms,N}$                        | [-]               | 1,5                  |                                       |        |        |           |        |     |
| Characteristic tension resistance, Stainless Steel A4 and HCR, Strength class 70 <sup>2)</sup>                                                                                                                                                            |                | $N_{Rk,s}$                             | [kN]              | 14                   | 26                                    | 41     | 59     | 110       | 124    |     |
| Partial factor                                                                                                                                                                                                                                            |                | $\gamma_{Ms,N}$                        | [-]               | 1,87                 |                                       |        |        |           |        |     |
| Combined pull-out and concrete cone failure                                                                                                                                                                                                               |                |                                        |                   |                      |                                       |        |        |           |        |     |
| Characteristic bond resistance in uncracked concrete C20/25 in hammer drilled (HD) and compressed air drilled holes (CD)                                                                                                                                  |                |                                        |                   |                      |                                       |        |        |           |        |     |
| Temperature range                                                                                                                                                                                                                                         | I: 24°C/40°C   | Dry, wet concrete or flooded bore hole | $\tau_{Rk,ucr}$   | [N/mm <sup>2</sup> ] | 20                                    | 19     | 19     | 18        | 17     | 16  |
|                                                                                                                                                                                                                                                           | II: 50°C/72°C  |                                        |                   |                      | 15                                    | 15     | 14     | 13        | 13     | 12  |
|                                                                                                                                                                                                                                                           | III: 60°C/80°C |                                        |                   |                      | 6,5                                   | 6,5    | 6,0    | 6,0       | 5,5    | 5,5 |
| Characteristic bond resistance in uncracked concrete C20/25 in hammer drilled holes with hollow drill bit (HDB)                                                                                                                                           |                |                                        |                   |                      |                                       |        |        |           |        |     |
| Temperature range                                                                                                                                                                                                                                         | I: 24°C/40°C   | Dry or wet concrete                    | $\tau_{Rk,ucr}$   | [N/mm <sup>2</sup> ] | 16                                    | 16     | 16     | 15        | 14     | 13  |
|                                                                                                                                                                                                                                                           | II: 50°C/72°C  |                                        |                   |                      | 14                                    | 14     | 13     | 13        | 12     | 11  |
|                                                                                                                                                                                                                                                           | III: 60°C/80°C |                                        |                   |                      | 6,5                                   | 6,5    | 6,0    | 6,0       | 5,5    | 5,5 |
|                                                                                                                                                                                                                                                           | I: 24°C/40°C   | flooded bore hole                      |                   |                      | 16                                    | 16     | 15     | 15        | 14     | 13  |
|                                                                                                                                                                                                                                                           | II: 50°C/72°C  |                                        |                   |                      | 14                                    | 14     | 13     | 13        | 12     | 11  |
|                                                                                                                                                                                                                                                           | III: 60°C/80°C |                                        |                   |                      | 6,5                                   | 6,5    | 6,0    | 6,0       | 5,5    | 5,5 |
| 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)                                                                         |                |                                        |                   |                      |                                       |        |        |           |        |     |
| Temperature range                                                                                                                                                                                                                                         | I: 24°C/40°C   | Dry, wet concrete or flooded bore hole | $\tau_{Rk,cr}$    | [N/mm <sup>2</sup> ] | 7,0                                   | 8,5    | 8,5    | 8,5       | 8,5    | 8,5 |
|                                                                                                                                                                                                                                                           | II: 50°C/72°C  |                                        |                   |                      | 6,0                                   | 7,0    | 7,0    | 7,0       | 7,0    | 7,0 |
|                                                                                                                                                                                                                                                           | III: 60°C/80°C |                                        |                   |                      | 5,0                                   | 5,0    | 4,5    | 4,5       | 4,5    | 4,5 |
| Reduction factor 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 | $\psi_{sus}^0$    | [-]                  | 0,99                                  |        |        |           |        |     |
|                                                                                                                                                                                                                                                           | II: 50°C/72°C  |                                        |                   |                      | 0,68                                  |        |        |           |        |     |
|                                                                                                                                                                                                                                                           | III: 60°C/80°C |                                        |                   |                      | 0,70                                  |        |        |           |        |     |
| Increasing factors for concrete                                                                                                                                                                                                                           |                | ≤ C50/60                               | $\psi_c$          | [-]                  | $(f_{ck} / 20)^{0,1}$                 |        |        |           |        |     |
|                                                                                                                                                                                                                                                           |                | > C50/60                               |                   |                      | 1,1                                   |        |        |           |        |     |
| Characteristic bond resistance depending on the concrete strength class                                                                                                                                                                                   |                |                                        | $\tau_{Rk,ucr} =$ |                      | $\psi_c \cdot \tau_{Rk,ucr,(C20/25)}$ |        |        |           |        |     |
|                                                                                                                                                                                                                                                           |                |                                        | $\tau_{Rk,cr} =$  |                      | $\psi_c \cdot \tau_{Rk,cr,(C20/25)}$  |        |        |           |        |     |
| Concrete cone failure or Splitting                                                                                                                                                                                                                        |                |                                        |                   |                      |                                       |        |        |           |        |     |
| Relevant parameter                                                                                                                                                                                                                                        |                |                                        |                   | see Table C2         |                                       |        |        |           |        |     |
| Installation factor                                                                                                                                                                                                                                       |                |                                        |                   |                      |                                       |        |        |           |        |     |
| for dry and wet concrete (HD; HDB, CD)                                                                                                                                                                                                                    |                |                                        | $\gamma_{inst}$   | [-]                  | 1,0                                   |        |        |           |        |     |
| 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. |                |                                        |                   |                      |                                       |        |        |           |        |     |
| 2) For BI-M20 strength class 50 is valid                                                                                                                                                                                                                  |                |                                        |                   |                      |                                       |        |        |           |        |     |
| G&B Fissaggi Injection system Gebofix EPO PLUS RE for concrete                                                                                                                                                                                            |                |                                        |                   |                      |                                       |        |        | Annex C 8 |        |     |
| Performances<br>Characteristic values of tension loads under static and quasi-static action for a working life of 50 years (Internal threaded anchor rod)                                                                                                 |                |                                        |                   |                      |                                       |        |        |           |        |     |

**Table C9: Characteristic values of tension loads under static and quasi-static action for a working life of 100 years**

| Internal threaded anchor rods                                                                                                                                                                                                                             |               |                                        |                                   | BI-M6        | BI-M8                                             | BI-M10 | BI-M12 | BI-M16 | BI-M20 |     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|----------------------------------------|-----------------------------------|--------------|---------------------------------------------------|--------|--------|--------|--------|-----|
| Steel failure <sup>1)</sup>                                                                                                                                                                                                                               |               |                                        |                                   |              |                                                   |        |        |        |        |     |
| Characteristic tension resistance,                                                                                                                                                                                                                        | 5.8           | N <sub>Rk,s</sub>                      | [kN]                              | 10           | 17                                                | 29     | 42     | 76     | 123    |     |
| Steel, strength class                                                                                                                                                                                                                                     | 8.8           | N <sub>Rk,s</sub>                      | [kN]                              | 16           | 27                                                | 46     | 67     | 121    | 196    |     |
| Partial factor, strength class 5.8 and 8.8                                                                                                                                                                                                                |               | γ <sub>Ms,N</sub>                      | [-]                               | 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         |                                                   |        |        |        |        |     |
| Combined pull-out and concrete cone failure                                                                                                                                                                                                               |               |                                        |                                   |              |                                                   |        |        |        |        |     |
| Characteristic bond resistance in uncracked concrete C20/25 in hammer drilled (HD) and compressed air drilled holes (CD)                                                                                                                                  |               |                                        |                                   |              |                                                   |        |        |        |        |     |
| Temperature range                                                                                                                                                                                                                                         | I: 24°C/40°C  | Dry, wet concrete or flooded bore hole | τ <sub>Rk,ucr,100</sub>           | [N/mm²]      | 20                                                | 19     | 19     | 18     | 17     | 16  |
|                                                                                                                                                                                                                                                           | II: 50°C/72°C |                                        |                                   |              | 15                                                | 15     | 14     | 13     | 13     | 12  |
|                                                                                                                                                                                                                                                           | III:60°C/80°C |                                        |                                   |              | 6,5                                               | 6,5    | 6,0    | 6,0    | 5,5    | 5,5 |
| Characteristic bond resistance in uncracked concrete C20/25 in hammer drilled holes with hollow drill bit (HDB)                                                                                                                                           |               |                                        |                                   |              |                                                   |        |        |        |        |     |
| Temperature range                                                                                                                                                                                                                                         | I: 24°C/40°C  | Dry or wet concrete                    | τ <sub>Rk,ucr,100</sub>           | [N/mm²]      | 16                                                | 16     | 16     | 15     | 14     | 13  |
|                                                                                                                                                                                                                                                           | II: 50°C/72°C |                                        |                                   |              | 14                                                | 14     | 13     | 13     | 12     | 11  |
|                                                                                                                                                                                                                                                           | III:60°C/80°C |                                        |                                   |              | 6,5                                               | 6,5    | 6,0    | 6,0    | 5,5    | 5,5 |
|                                                                                                                                                                                                                                                           | I: 24°C/40°C  | flooded bore hole                      |                                   |              | 16                                                | 16     | 15     | 15     | 14     | 13  |
|                                                                                                                                                                                                                                                           | II: 50°C/72°C |                                        |                                   |              | 14                                                | 14     | 13     | 13     | 12     | 11  |
|                                                                                                                                                                                                                                                           | III:60°C/80°C |                                        |                                   |              | 6,5                                               | 6,5    | 6,0    | 6,0    | 5,5    | 5,5 |
| 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)                                                                         |               |                                        |                                   |              |                                                   |        |        |        |        |     |
| Temperature range                                                                                                                                                                                                                                         | I: 24°C/40°C  | Dry, wet concrete or flooded bore hole | τ <sub>Rk,cr,100</sub>            | [N/mm²]      | 6,5                                               | 7,5    | 7,5    | 7,5    | 7,5    | 7,5 |
|                                                                                                                                                                                                                                                           | II: 50°C/72°C |                                        |                                   |              | 5,5                                               | 6,5    | 6,5    | 6,5    | 6,5    | 6,5 |
|                                                                                                                                                                                                                                                           | III:60°C/80°C |                                        |                                   |              | 5,0                                               | 5,0    | 4,5    | 4,5    | 4,5    | 4,5 |
| Reduction factor 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 | ψ <sup>0</sup> <sub>sus,100</sub> | [-]          | 0,97                                              |        |        |        |        |     |
|                                                                                                                                                                                                                                                           | II: 50°C/72°C |                                        |                                   |              | 0,68                                              |        |        |        |        |     |
|                                                                                                                                                                                                                                                           | III:60°C/80°C |                                        |                                   |              | 0,70                                              |        |        |        |        |     |
| Increasing factors for concrete                                                                                                                                                                                                                           |               | ≤ C50/60                               | ψ <sub>c</sub>                    | [-]          | (f <sub>ck</sub> / 20) <sup>0,1</sup>             |        |        |        |        |     |
|                                                                                                                                                                                                                                                           |               | > C50/60                               |                                   |              | 1,1                                               |        |        |        |        |     |
| Characteristic bond resistance depending on the concrete strength class                                                                                                                                                                                   |               |                                        | τ <sub>Rk,ucr,100</sub> =         |              | ψ <sub>c</sub> • τ <sub>Rk,ucr,100,(C20/25)</sub> |        |        |        |        |     |
|                                                                                                                                                                                                                                                           |               |                                        | τ <sub>Rk,cr,100</sub> =          |              | ψ <sub>c</sub> • τ <sub>Rk,cr,100,(C20/25)</sub>  |        |        |        |        |     |
| Concrete cone failure or Splitting                                                                                                                                                                                                                        |               |                                        |                                   |              |                                                   |        |        |        |        |     |
| Relevant parameter                                                                                                                                                                                                                                        |               |                                        |                                   | see Table C2 |                                                   |        |        |        |        |     |
| Installation factor                                                                                                                                                                                                                                       |               |                                        |                                   |              |                                                   |        |        |        |        |     |
| for dry and wet concrete (HD; HDB, CD)                                                                                                                                                                                                                    |               | γ <sub>inst</sub>                      | [-]                               | 1,0          |                                                   |        |        |        |        |     |
| 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. |               |                                        |                                   |              |                                                   |        |        |        |        |     |
| 2) For BI-M20 strength class 50 is valid                                                                                                                                                                                                                  |               |                                        |                                   |              |                                                   |        |        |        |        |     |

**G&B Fissaggi Injection system Gebofix EPO PLUS RE for concrete**

**Performances**

Characteristic values of tension loads under static and quasi-static action for a working life of 100 years (Internal threaded anchor rod)

**Annex C 9**

**Table C10: Characteristic values of tension loads under static and quasi-static action for a working life of 50 years**

| Internal threaded anchor rods                                                                                                                                                                                                                                                                                                                                  |                |                                        |                                        | BI-M6        | BI-M8                                             | BI-M10   | BI-M12   | BI-M16     | BI-M20    |            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------------------------------------|----------------------------------------|--------------|---------------------------------------------------|----------|----------|------------|-----------|------------|
| Steel failure <sup>1)</sup>                                                                                                                                                                                                                                                                                                                                    |                |                                        |                                        |              |                                                   |          |          |            |           |            |
| Characteristic tension resistance, Steel, strength class                                                                                                                                                                                                                                                                                                       |                | 5.8<br>8.8                             | N <sub>Rk,s</sub><br>N <sub>Rk,s</sub> | [kN]<br>[kN] | 10<br>16                                          | 17<br>27 | 29<br>46 | 42<br>67   | 76<br>121 | 123<br>196 |
| Partial factor, strength class 5.8 and 8.8                                                                                                                                                                                                                                                                                                                     |                |                                        | γ <sub>Ms,N</sub>                      | [-]          | 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 pull-out and concrete cone failure                                                                                                                                                                                                                                                                                                                    |                |                                        |                                        |              |                                                   |          |          |            |           |            |
| Characteristic bond resistance in uncracked concrete C20/25 in diamond drilled holes (DD)                                                                                                                                                                                                                                                                      |                |                                        |                                        |              |                                                   |          |          |            |           |            |
| Temperature range                                                                                                                                                                                                                                                                                                                                              | I: 24°C/40°C   | Dry, wet concrete or flooded bore hole | τ <sub>Rk,ucr</sub>                    | [N/mm²]      | 14                                                | 14       | 13       | 12         | 12        | 11         |
|                                                                                                                                                                                                                                                                                                                                                                | II: 50°C/72°C  |                                        |                                        |              | 12                                                | 11       | 10       | 9,5        | 9,5       | 9,0        |
|                                                                                                                                                                                                                                                                                                                                                                | III: 60°C/80°C |                                        |                                        |              | 5,5                                               | 5,0      | 4,5      | 4,5        | 4,5       | 4,0        |
| Characteristic bond resistance in cracked concrete C20/25 in diamond drilled holes (DD)                                                                                                                                                                                                                                                                        |                |                                        |                                        |              |                                                   |          |          |            |           |            |
| Temperature range                                                                                                                                                                                                                                                                                                                                              | I: 24°C/40°C   | Dry, wet concrete or flooded bore hole | τ <sub>Rk,cr</sub>                     | [N/mm²]      | 3)                                                | 5,5      | 5,5      | 5,5        | 5,4       |            |
|                                                                                                                                                                                                                                                                                                                                                                | II: 50°C/72°C  |                                        |                                        |              |                                                   | 4,6      | 4,6      | 4,6        | 4,5       |            |
|                                                                                                                                                                                                                                                                                                                                                                | III: 60°C/80°C |                                        |                                        |              |                                                   | 2,4      | 2,3      | 2,4        | 2,3       |            |
| Reduction factor in uncracked concrete C20/25 in diamond drilled holes (DD)                                                                                                                                                                                                                                                                                    |                |                                        |                                        |              |                                                   |          |          |            |           |            |
| Temperature range                                                                                                                                                                                                                                                                                                                                              | I: 24°C/40°C   | Dry, wet concrete or flooded bore hole | ψ <sup>0</sup> <sub>sus</sub>          | [-]          | 0,77                                              |          |          |            |           |            |
|                                                                                                                                                                                                                                                                                                                                                                | II: 50°C/72°C  |                                        |                                        |              | 0,72                                              |          |          |            |           |            |
|                                                                                                                                                                                                                                                                                                                                                                | III: 60°C/80°C |                                        |                                        |              | 0,72                                              |          |          |            |           |            |
| Increasing factors for concrete                                                                                                                                                                                                                                                                                                                                |                | ≤ C50/60                               | ψ <sub>c,ucr</sub>                     | [-]          | (f <sub>ck</sub> / 20) <sup>0,2</sup>             |          |          |            |           |            |
|                                                                                                                                                                                                                                                                                                                                                                |                | > C50/60                               |                                        |              | 1,2                                               |          |          |            |           |            |
|                                                                                                                                                                                                                                                                                                                                                                |                | ≤ C50/60                               | ψ <sub>c,cr</sub>                      | [-]          | (f <sub>ck</sub> / 20) <sup>0,4</sup>             |          |          |            |           |            |
| Characteristic bond resistance depending on the concrete strength class                                                                                                                                                                                                                                                                                        |                |                                        | τ <sub>Rk,ucr</sub> =                  |              | ψ <sub>c,ucr</sub> · τ <sub>Rk,ucr</sub> (C20/25) |          |          |            |           |            |
|                                                                                                                                                                                                                                                                                                                                                                |                |                                        | τ <sub>Rk,cr</sub> =                   |              | ψ <sub>c,cr</sub> · τ <sub>Rk,cr</sub> (C20/25)   |          |          |            |           |            |
| Concrete cone failure or Splitting                                                                                                                                                                                                                                                                                                                             |                |                                        |                                        |              |                                                   |          |          |            |           |            |
| Relevant parameter                                                                                                                                                                                                                                                                                                                                             |                |                                        |                                        | see Table C2 |                                                   |          |          |            |           |            |
| Installation factor                                                                                                                                                                                                                                                                                                                                            |                |                                        |                                        |              |                                                   |          |          |            |           |            |
| for dry and wet concrete (DD)                                                                                                                                                                                                                                                                                                                                  |                |                                        | γ <sub>inst</sub>                      | [-]          | 1,0                                               |          |          |            |           |            |
| for flooded bore hole (DD)                                                                                                                                                                                                                                                                                                                                     |                |                                        |                                        |              | 1,2                                               | 1,4      |          |            |           |            |
| <div>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.</div> <div>2) For BI-M20 strength class 50 is valid</div> <div>3) no performance assessed</div> |                |                                        |                                        |              |                                                   |          |          |            |           |            |
| G&B Fissaggi Injection system Gebofix EPO PLUS RE for concrete                                                                                                                                                                                                                                                                                                 |                |                                        |                                        |              |                                                   |          |          | Annex C 10 |           |            |
| Performances<br>Characteristic values of tension loads under static and quasi-static action for a working life of 50 years (Internal threaded anchor rod)                                                                                                                                                                                                      |                |                                        |                                        |              |                                                   |          |          |            |           |            |

**Table C11: Characteristic values of tension loads under static and quasi-static action for a working life of 100 years**

| Internal threaded anchor rods                                                                                                                                                                                                                                                                                            |                |                                        |                                   | BI-M6        | BI-M8                                             | BI-M10 | BI-M12 | BI-M16     | BI-M20 |      |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------------------------------------|-----------------------------------|--------------|---------------------------------------------------|--------|--------|------------|--------|------|
| Steel failure <sup>1)</sup>                                                                                                                                                                                                                                                                                              |                |                                        |                                   |              |                                                   |        |        |            |        |      |
| Characteristic tension resistance,                                                                                                                                                                                                                                                                                       | 5.8            | N <sub>Rk,s</sub>                      | [kN]                              | 10           | 17                                                | 29     | 42     | 76         | 123    |      |
| Steel, strength class                                                                                                                                                                                                                                                                                                    | 8.8            | N <sub>Rk,s</sub>                      | [kN]                              | 16           | 27                                                | 46     | 67     | 121        | 196    |      |
| Partial factor, strength class 5.8 and 8.8                                                                                                                                                                                                                                                                               |                | γ <sub>Ms,N</sub>                      | [-]                               | 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 pull-out and concrete cone failure                                                                                                                                                                                                                                                                              |                |                                        |                                   |              |                                                   |        |        |            |        |      |
| Characteristic bond resistance in uncracked concrete C20/25 in diamond drilled holes (DD)                                                                                                                                                                                                                                |                |                                        |                                   |              |                                                   |        |        |            |        |      |
| Temperature range                                                                                                                                                                                                                                                                                                        | I: 24°C/40°C   | Dry, wet concrete or flooded bore hole | τ <sub>Rk,ucr,100</sub>           | [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 |                                        |                                   |              | 5,5                                               | 5,0    | 4,5    | 4,5        | 4,5    | 4,0  |
| Reduction factor in uncracked concrete C20/25 in diamond drilled holes (DD)                                                                                                                                                                                                                                              |                |                                        |                                   |              |                                                   |        |        |            |        |      |
| Temperature range                                                                                                                                                                                                                                                                                                        | I: 24°C/40°C   | Dry, wet concrete or flooded bore hole | ψ <sup>0</sup> <sub>sus,100</sub> | [-]          | 0,73                                              |        |        |            |        |      |
|                                                                                                                                                                                                                                                                                                                          | II: 50°C/72°C  |                                        |                                   |              | 0,70                                              |        |        |            |        |      |
|                                                                                                                                                                                                                                                                                                                          | III: 60°C/80°C |                                        |                                   |              | 0,72                                              |        |        |            |        |      |
| Increasing factors for concrete                                                                                                                                                                                                                                                                                          |                | ≤ C50/60                               | ψ <sub>c</sub>                    | [-]          | (f <sub>ck</sub> / 20) <sup>0,2</sup>             |        |        |            |        |      |
|                                                                                                                                                                                                                                                                                                                          |                | > C50/60                               |                                   |              | 1,2                                               |        |        |            |        |      |
| Characteristic bond resistance depending on the concrete strength class                                                                                                                                                                                                                                                  |                |                                        | τ <sub>Rk,ucr,100</sub> =         |              | ψ <sub>c</sub> * τ <sub>Rk,ucr,100,(C20/25)</sub> |        |        |            |        |      |
| Concrete cone failure or Splitting                                                                                                                                                                                                                                                                                       |                |                                        |                                   |              |                                                   |        |        |            |        |      |
| Relevant parameter                                                                                                                                                                                                                                                                                                       |                |                                        |                                   | see Table C2 |                                                   |        |        |            |        |      |
| Installation factor                                                                                                                                                                                                                                                                                                      |                |                                        |                                   |              |                                                   |        |        |            |        |      |
| for dry and wet concrete (DD)                                                                                                                                                                                                                                                                                            |                | γ <sub>inst</sub>                      | [-]                               | 1,0          |                                                   |        |        |            |        |      |
| for flooded bore hole (DD)                                                                                                                                                                                                                                                                                               |                |                                        |                                   | 1,2          | 1,4                                               |        |        |            |        |      |
| <div>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.</div> <div>2) For BI-M20 strength class 50 is valid</div> |                |                                        |                                   |              |                                                   |        |        |            |        |      |
| G&B Fissaggi Injection system Gebofix EPO PLUS RE for concrete                                                                                                                                                                                                                                                           |                |                                        |                                   |              |                                                   |        |        | Annex C 11 |        |      |
| <div>Performances</div> <div>Characteristic values of tension loads under static and quasi-static action for a working life of 100 years (Internal threaded anchor rod)</div>                                                                                                                                            |                |                                        |                                   |              |                                                   |        |        |            |        |      |

| Table C12: Characteristic values of shear loads under static and quasi-static action for a working life of 50 and 100 years                                                                                                                                                                                              |                 |              |      |                                  |       |        |        |            |                              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|--------------|------|----------------------------------|-------|--------|--------|------------|------------------------------|
| Internal threaded anchor rods                                                                                                                                                                                                                                                                                            |                 |              |      | BI-M6                            | BI-M8 | BI-M10 | BI-M12 | BI-M16     | BI-M20                       |
| Steel failure without lever arm <sup>1)</sup>                                                                                                                                                                                                                                                                            |                 |              |      |                                  |       |        |        |            |                              |
| Characteristic shear resistance, Steel, strength class                                                                                                                                                                                                                                                                   | 5.8             | $V_{Rk,s}^0$ | [kN] | 5                                | 9     | 15     | 21     | 38         | 61                           |
|                                                                                                                                                                                                                                                                                                                          | 8.8             | $V_{Rk,s}^0$ | [kN] | 8                                | 14    | 23     | 34     | 60         | 98                           |
| Partial factor, strength class 5.8 and 8.8                                                                                                                                                                                                                                                                               | $\gamma_{Ms,V}$ |              | [-]  | 1,25                             |       |        |        |            |                              |
| Characteristic shear resistance, Stainless Steel A4 and HCR, Strength class 70 <sup>2)</sup>                                                                                                                                                                                                                             |                 | $V_{Rk,s}^0$ | [kN] | 7                                | 13    | 20     | 30     | 55         | 40                           |
| Partial factor                                                                                                                                                                                                                                                                                                           | $\gamma_{Ms,V}$ |              | [-]  | 1,56                             |       |        |        |            | 2,38                         |
| Ductility factor                                                                                                                                                                                                                                                                                                         | $k_7$           |              | [-]  | 1,0                              |       |        |        |            |                              |
| Steel failure with lever arm <sup>1)</sup>                                                                                                                                                                                                                                                                               |                 |              |      |                                  |       |        |        |            |                              |
| Characteristic bending moment, Steel, strength class                                                                                                                                                                                                                                                                     | 5.8             | $M_{Rk,s}^0$ | [Nm] | 8                                | 19    | 37     | 66     | 167        | 325                          |
|                                                                                                                                                                                                                                                                                                                          | 8.8             | $M_{Rk,s}^0$ | [Nm] | 12                               | 30    | 60     | 105    | 267        | 519                          |
| Partial factor, strength class 5.8 and 8.8                                                                                                                                                                                                                                                                               | $\gamma_{Ms,V}$ |              | [-]  | 1,25                             |       |        |        |            |                              |
| Characteristic bending moment, Stainless Steel A4 and HCR, Strength class 70 <sup>2)</sup>                                                                                                                                                                                                                               |                 | $M_{Rk,s}^0$ | [Nm] | 11                               | 26    | 52     | 92     | 233        | 456                          |
| Partial factor                                                                                                                                                                                                                                                                                                           | $\gamma_{Ms,V}$ |              | [-]  | 1,56                             |       |        |        |            | 2,38                         |
| Concrete pry-out failure                                                                                                                                                                                                                                                                                                 |                 |              |      |                                  |       |        |        |            |                              |
| Factor                                                                                                                                                                                                                                                                                                                   | $k_8$           |              | [-]  | 2,0                              |       |        |        |            |                              |
| Installation factor                                                                                                                                                                                                                                                                                                      | $\gamma_{inst}$ |              | [-]  | 1,0                              |       |        |        |            |                              |
| Concrete edge failure                                                                                                                                                                                                                                                                                                    |                 |              |      |                                  |       |        |        |            |                              |
| Effective length of fastener                                                                                                                                                                                                                                                                                             | $l_f$           |              | [mm] | $\min(h_{ef}; 12 \cdot d_{nom})$ |       |        |        |            | $\min(h_{ef}; 300\text{mm})$ |
| Outside diameter of fastener                                                                                                                                                                                                                                                                                             | $d_{nom}$       |              | [mm] | 10                               | 12    | 16     | 20     | 24         | 30                           |
| Installation factor                                                                                                                                                                                                                                                                                                      | $\gamma_{inst}$ |              | [-]  | 1,0                              |       |        |        |            |                              |
| <div>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.</div> <div>2) For BI-M20 strength class 50 is valid</div> |                 |              |      |                                  |       |        |        |            |                              |
| G&B Fissaggi Injection system Gebofix EPO PLUS RE for concrete                                                                                                                                                                                                                                                           |                 |              |      |                                  |       |        |        | Annex C 12 |                              |
| <div>Performances</div> <div>Characteristic values of shear loads under static and quasi-static action for a working life of 50 and 100 years (Internal threaded anchor rod)</div>                                                                                                                                       |                 |              |      |                                  |       |        |        |            |                              |

| Table C13: Characteristic values of tension loads under static and quasi-static action for a working life of 50 years                                                             |                |                                        |                 |                                       |      |      |      |      |      |      |      |      |            |      |      |     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------------------------------------|-----------------|---------------------------------------|------|------|------|------|------|------|------|------|------------|------|------|-----|
| Reinforcing bar                                                                                                                                                                   |                |                                        | Ø 8             | 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 tension resistance                                                                                                                                                 |                | $N_{Rk,s}$                             | [kN]            | $A_s \cdot f_{uk}^{1)}$               |      |      |      |      |      |      |      |      |            |      |      |     |
| Cross section area                                                                                                                                                                |                | $A_s$                                  | [mm²]           | 50                                    | 79   | 113  | 154  | 201  | 314  | 452  | 491  | 616  | 804        | 1018 | 1256 |     |
| Partial factor                                                                                                                                                                    |                | $\gamma_{Ms,N}$                        | [-]             | 1,4 <sup>2)</sup>                     |      |      |      |      |      |      |      |      |            |      |      |     |
| Combined pull-out and concrete failure                                                                                                                                            |                |                                        |                 |                                       |      |      |      |      |      |      |      |      |            |      |      |     |
| Characteristic bond resistance in uncracked concrete C20/25 in hammer (HD) and compressed air drilled holes (CD)                                                                  |                |                                        |                 |                                       |      |      |      |      |      |      |      |      |            |      |      |     |
| Temp.-range                                                                                                                                                                       | I: 24°C/40°C   | Dry, wet concrete or flooded bore hole | $\tau_{Rk,ucr}$ | [N/mm²]                               | 16   | 16   | 16   | 16   | 16   | 16   | 15   | 15   | 15         | 15   | 15   |     |
|                                                                                                                                                                                   | II: 50°C/72°C  |                                        |                 |                                       | 12   | 12   | 12   | 12   | 12   | 12   | 12   | 12   | 11         | 11   | 11   | 11  |
|                                                                                                                                                                                   | III: 60°C/80°C |                                        |                 |                                       | 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 in uncracked concrete C20/25 in hammer drilled holes with hollow drill bit (HDB)                                                                   |                |                                        |                 |                                       |      |      |      |      |      |      |      |      |            |      |      |     |
| Temperature range                                                                                                                                                                 | I: 24°C/40°C   | Dry, wet concrete                      | $\tau_{Rk,ucr}$ | [N/mm²]                               | 14   | 14   | 13   | 13   | 13   | 13   | 13   | 13   | 13         | 13   | 3)   |     |
|                                                                                                                                                                                   | II: 50°C/72°C  |                                        |                 |                                       | 12   | 12   | 12   | 11   | 11   | 11   | 11   | 11   | 11         | 11   |      |     |
|                                                                                                                                                                                   | III: 60°C/80°C |                                        |                 |                                       | 5,5  | 5,5  | 5,5  | 5,5  | 5,5  | 5,5  | 5,0  | 5,0  | 5,0        | 5,0  |      |     |
|                                                                                                                                                                                   | I: 24°C/40°C   | flooded bore hole                      |                 |                                       | 13   | 13   | 13   | 13   | 13   | 13   | 13   | 13   | 13         | 13   |      |     |
|                                                                                                                                                                                   | II: 50°C/72°C  |                                        |                 |                                       | 11   | 11   | 11   | 11   | 11   | 11   | 11   | 11   | 11         | 11   |      |     |
|                                                                                                                                                                                   | III: 60°C/80°C |                                        |                 |                                       | 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) |                |                                        |                 |                                       |      |      |      |      |      |      |      |      |            |      |      |     |
| Temp.-range                                                                                                                                                                       | I: 24°C/40°C   | Dry, wet concrete or flooded bore hole | $\tau_{Rk,cr}$  | [N/mm²]                               | 7,0  | 7,0  | 8,5  | 8,5  | 8,5  | 8,5  | 8,5  | 8,5  | 8,5        | 8,5  | 3)   |     |
|                                                                                                                                                                                   | II: 50°C/72°C  |                                        |                 |                                       | 6,0  | 6,0  | 7,0  | 7,0  | 7,0  | 7,0  | 7,0  | 7,0  | 7,0        | 7,0  |      |     |
|                                                                                                                                                                                   | III: 60°C/80°C |                                        |                 |                                       | 4,5  | 4,5  | 4,5  | 4,5  | 4,5  | 4,5  | 4,5  | 4,5  | 4,5        | 4,5  |      |     |
| Reduction factor 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) |                |                                        |                 |                                       |      |      |      |      |      |      |      |      |            |      |      |     |
| Temp.-range                                                                                                                                                                       | I: 24°C/40°C   | Dry, wet and flooded bore hole         | $\psi_{sus}^0$  | [-]                                   | 0,99 |      |      |      |      |      |      |      |            |      |      |     |
|                                                                                                                                                                                   | II: 50°C/72°C  |                                        |                 |                                       | 0,68 |      |      |      |      |      |      |      |            |      |      |     |
|                                                                                                                                                                                   | III: 60°C/80°C |                                        |                 |                                       | 0,70 |      |      |      |      |      |      |      |            |      |      |     |
| Increasing factors for concrete                                                                                                                                                   | ≤ C50/60       | $\psi_c$                               | [-]             | $(f_{ck} / 20)^{0,1}$                 |      |      |      |      |      |      |      |      |            |      |      |     |
|                                                                                                                                                                                   | > C50/60       |                                        |                 | 1,1                                   |      |      |      |      |      |      |      |      |            |      |      |     |
| Characteristic bond resistance depending on the concrete strength class                                                                                                           |                | $\tau_{Rk,ucr} =$                      |                 | $\psi_c \cdot \tau_{Rk,ucr,(C20/25)}$ |      |      |      |      |      |      |      |      |            |      |      |     |
|                                                                                                                                                                                   |                | $\tau_{Rk,cr} =$                       |                 | $\psi_c \cdot \tau_{Rk,cr,(C20/25)}$  |      |      |      |      |      |      |      |      |            |      |      |     |
| Concrete cone failure or Splitting                                                                                                                                                |                |                                        |                 |                                       |      |      |      |      |      |      |      |      |            |      |      |     |
| Relevant parameter                                                                                                                                                                |                |                                        | see Table C2    |                                       |      |      |      |      |      |      |      |      |            |      |      |     |
| Installation factor (HD; HDB, CD)                                                                                                                                                 |                |                                        |                 |                                       |      |      |      |      |      |      |      |      |            |      |      |     |
| for dry and wet concrete                                                                                                                                                          |                | $\gamma_{inst}$                        | [-]             | 1,0                                   |      |      |      |      |      |      |      |      |            | 1,2  |      |     |
| for flooded bore hole                                                                                                                                                             |                |                                        |                 | 1,2                                   |      |      |      |      |      |      |      |      |            | 3)   |      |     |
| 1) $f_{uk}$ shall be taken from the specifications of reinforcing bars<br>2) in absence of national regulation<br>3) no performance assessed                                      |                |                                        |                 |                                       |      |      |      |      |      |      |      |      |            |      |      |     |
| G&B Fissaggi Injection system Gebofix EPO PLUS RE for concrete                                                                                                                    |                |                                        |                 |                                       |      |      |      |      |      |      |      |      | Annex C 13 |      |      |     |
| Performances<br>Characteristic values of tension loads under static and quasi-static action for a working life of 50 years (reinforcing bar)                                      |                |                                        |                 |                                       |      |      |      |      |      |      |      |      |            |      |      |     |

| Table C14: Characteristic values of tension loads under static and quasi-static action for a working life of 100 years                                                            |                                        |                                   |                                                |                                                   |      |      |      |      |      |      |      |      |            |      |     |     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|-----------------------------------|------------------------------------------------|---------------------------------------------------|------|------|------|------|------|------|------|------|------------|------|-----|-----|
| Reinforcing bar                                                                                                                                                                   |                                        |                                   | Ø 8                                            | 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 tension resistance                                                                                                                                                 | N <sub>Rk,s</sub>                      | [kN]                              | A <sub>s</sub> · f <sub>uk</sub> <sup>1)</sup> |                                                   |      |      |      |      |      |      |      |      |            |      |     |     |
| Cross section area                                                                                                                                                                | A <sub>s</sub>                         | [mm²]                             | 50                                             | 79                                                | 113  | 154  | 201  | 314  | 452  | 491  | 616  | 804  | 1018       | 1256 |     |     |
| Partial factor                                                                                                                                                                    | γ <sub>Ms,N</sub>                      | [-]                               | 1,4 <sup>2)</sup>                              |                                                   |      |      |      |      |      |      |      |      |            |      |     |     |
| Combined pull-out and concrete failure                                                                                                                                            |                                        |                                   |                                                |                                                   |      |      |      |      |      |      |      |      |            |      |     |     |
| Characteristic bond resistance in uncracked concrete C20/25 in hammer (HD) and compressed air drilled holes (CD)                                                                  |                                        |                                   |                                                |                                                   |      |      |      |      |      |      |      |      |            |      |     |     |
| Temp.-range<br>I: 24°C/40°C<br>II: 50°C/72°C<br>III: 60°C/80°C                                                                                                                    | Dry, wet concrete or flooded bore hole | τ <sub>Rk,ucr,100</sub>           | [N/mm²]                                        | 16                                                | 16   | 16   | 16   | 16   | 16   | 15   | 15   | 15   | 15         | 15   | 15  |     |
|                                                                                                                                                                                   |                                        |                                   |                                                | 12                                                | 12   | 12   | 12   | 12   | 12   | 12   | 12   | 11   | 11         | 11   | 11  |     |
|                                                                                                                                                                                   |                                        |                                   |                                                | 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 in uncracked concrete C20/25 in hammer drilled holes with hollow drill bit (HDB)                                                                   |                                        |                                   |                                                |                                                   |      |      |      |      |      |      |      |      |            |      |     |     |
| Temperature range<br>I: 24°C/40°C<br>II: 50°C/72°C<br>III: 60°C/80°C                                                                                                              | Dry or wet concrete                    | τ <sub>Rk,ucr,100</sub>           | [N/mm²]                                        | 14                                                | 14   | 13   | 13   | 13   | 13   | 13   | 13   | 13   | 13         | 3)   |     |     |
|                                                                                                                                                                                   |                                        |                                   |                                                | 12                                                | 12   | 12   | 11   | 11   | 11   | 11   | 11   | 11   | 11         |      |     |     |
|                                                                                                                                                                                   |                                        |                                   |                                                | 5,5                                               | 5,5  | 5,5  | 5,5  | 5,5  | 5,5  | 5,0  | 5,0  | 5,0  | 5,0        |      |     |     |
|                                                                                                                                                                                   | flooded bore hole                      |                                   |                                                | 13                                                | 13   | 13   | 13   | 13   | 13   | 13   | 13   | 13   | 13         |      |     |     |
|                                                                                                                                                                                   |                                        |                                   |                                                | 11                                                | 11   | 11   | 11   | 11   | 11   | 11   | 11   | 11   | 11         |      |     |     |
|                                                                                                                                                                                   |                                        |                                   |                                                | 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) |                                        |                                   |                                                |                                                   |      |      |      |      |      |      |      |      |            |      |     |     |
| Temp.-range<br>I: 24°C/40°C<br>II: 50°C/72°C<br>III: 60°C/80°C                                                                                                                    | Dry, wet concrete or flooded bore hole | τ <sub>Rk,cr,100</sub>            | [N/mm²]                                        | 6,5                                               | 6,5  | 7,5  | 7,5  | 7,5  | 7,5  | 7,5  | 7,5  | 7,5  | 7,5        | 3)   |     |     |
|                                                                                                                                                                                   |                                        |                                   |                                                | 5,5                                               | 5,5  | 6,5  | 6,5  | 6,5  | 6,5  | 6,5  | 6,5  | 6,5  | 6,5        |      |     |     |
|                                                                                                                                                                                   |                                        |                                   |                                                | 4,5                                               | 4,5  | 4,5  | 4,5  | 4,5  | 4,5  | 4,5  | 4,5  | 4,5  | 4,5        |      |     |     |
| Reduction factor 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) |                                        |                                   |                                                |                                                   |      |      |      |      |      |      |      |      |            |      |     |     |
| Temp.-range<br>I: 24°C/40°C<br>II: 50°C/72°C<br>III: 60°C/80°C                                                                                                                    | Dry, wet concrete or flooded bore hole | ψ <sup>0</sup> <sub>sus,100</sub> | [-]                                            | 0,97                                              |      |      |      |      |      |      |      |      |            |      |     |     |
|                                                                                                                                                                                   |                                        |                                   |                                                | 0,68                                              |      |      |      |      |      |      |      |      |            |      |     |     |
|                                                                                                                                                                                   |                                        |                                   |                                                | 0,70                                              |      |      |      |      |      |      |      |      |            |      |     |     |
| Increasing factors for concrete                                                                                                                                                   | ≤ C50/60                               | ψ <sub>c</sub>                    | [-]                                            | (f <sub>ck</sub> / 20) <sup>0,1</sup>             |      |      |      |      |      |      |      |      |            |      |     |     |
|                                                                                                                                                                                   | > C50/60                               |                                   |                                                | 1,1                                               |      |      |      |      |      |      |      |      |            |      |     |     |
| Characteristic bond resistance depending on the concrete strength class                                                                                                           |                                        | τ <sub>Rk,ucr,100</sub> =         |                                                | ψ <sub>c</sub> · τ <sub>Rk,ucr,100,(C20/25)</sub> |      |      |      |      |      |      |      |      |            |      |     |     |
|                                                                                                                                                                                   |                                        | τ <sub>Rk,cr,100</sub> =          |                                                | ψ <sub>c</sub> · τ <sub>Rk,cr,100,(C20/25)</sub>  |      |      |      |      |      |      |      |      |            |      |     |     |
| Concrete cone failure or Splitting                                                                                                                                                |                                        |                                   |                                                |                                                   |      |      |      |      |      |      |      |      |            |      |     |     |
| Relevant parameter                                                                                                                                                                |                                        |                                   | see Table C2                                   |                                                   |      |      |      |      |      |      |      |      |            |      |     |     |
| Installation factor (HD; HDB, CD)                                                                                                                                                 |                                        |                                   |                                                |                                                   |      |      |      |      |      |      |      |      |            |      |     |     |
| for dry and wet concrete                                                                                                                                                          |                                        | γ <sub>inst</sub>                 | [-]                                            | 1,0                                               |      |      |      |      |      |      |      |      |            |      |     | 1,2 |
| for flooded bore hole                                                                                                                                                             |                                        |                                   |                                                | 1,2                                               |      |      |      |      |      |      |      |      |            |      |     | 3)  |
| 1) f <sub>uk</sub> shall be taken from the specifications of reinforcing bars<br>2) in absence of national regulation<br>3) no performance assessed                               |                                        |                                   |                                                |                                                   |      |      |      |      |      |      |      |      |            |      |     |     |
| G&B Fissaggi Injection system Gebofix EPO PLUS RE for concrete                                                                                                                    |                                        |                                   |                                                |                                                   |      |      |      |      |      |      |      |      | Annex C 14 |      |     |     |
| Performances<br>Characteristic values of tension loads under static and quasi-static action for a working life of 100 years (reinforcing bar)                                     |                                        |                                   |                                                |                                                   |      |      |      |      |      |      |      |      |            |      |     |     |

**Table C15: Characteristic values of tension loads under static and quasi-static action for a working life of 50 years**

| Reinforcing bar                                                                                                                                     |                                        |                               | Ø 8                                            | 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 tension resistance                                                                                                                   | N <sub>Rk,s</sub>                      | [kN]                          | A <sub>s</sub> · f <sub>uk</sub> <sup>1)</sup> |                                                   |      |      |      |      |      |      |            |      |      |      |     |
| Cross section area                                                                                                                                  | A <sub>s</sub>                         | [mm²]                         | 50                                             | 79                                                | 113  | 154  | 201  | 314  | 452  | 491  | 616        | 804  | 1018 | 1256 |     |
| Partial factor                                                                                                                                      | γ <sub>Ms,N</sub>                      | [-]                           | 1,4 <sup>2)</sup>                              |                                                   |      |      |      |      |      |      |            |      |      |      |     |
| Combined pull-out and concrete failure                                                                                                              |                                        |                               |                                                |                                                   |      |      |      |      |      |      |            |      |      |      |     |
| Characteristic bond resistance in uncracked concrete C20/25 in diamond drilled holes (DD)                                                           |                                        |                               |                                                |                                                   |      |      |      |      |      |      |            |      |      |      |     |
| Temperature range<br>I: 24°C/40°C<br>II: 50°C/72°C<br>III:60°C/80°C                                                                                 | Dry, wet concrete or flooded bore hole | τ <sub>Rk,ucr</sub>           | [N/mm²]                                        | 14                                                | 13   | 13   | 13   | 12   | 12   | 11   | 11         | 11   | 11   | 11   | 10  |
|                                                                                                                                                     |                                        |                               |                                                | 11                                                | 11   | 10   | 10   | 10   | 9,5  | 9,5  | 9,5        | 9,0  | 9,0  | 8,5  | 8,5 |
|                                                                                                                                                     |                                        |                               |                                                | 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 in uncracked concrete C20/25 in diamond drilled holes (DD)                                                                         |                                        |                               |                                                |                                                   |      |      |      |      |      |      |            |      |      |      |     |
| Temperature range<br>I: 24°C/40°C<br>II: 50°C/72°C<br>III:60°C/80°C                                                                                 | Dry, wet concrete or flooded bore hole | ψ <sup>0</sup> <sub>sus</sub> | [-]                                            | 0,77                                              |      |      |      |      |      |      |            |      |      |      |     |
|                                                                                                                                                     |                                        |                               |                                                | 0,72                                              |      |      |      |      |      |      |            |      |      |      |     |
|                                                                                                                                                     |                                        |                               |                                                | 0,72                                              |      |      |      |      |      |      |            |      |      |      |     |
| Increasing factors for concrete                                                                                                                     | ≤ C50/60                               | ψ <sub>c,ucr</sub>            | [-]                                            | (f <sub>ck</sub> / 20) <sup>0,2</sup>             |      |      |      |      |      |      |            |      |      |      |     |
|                                                                                                                                                     | > C50/60                               |                               |                                                | 1,2                                               |      |      |      |      |      |      |            |      |      |      |     |
| Characteristic bond resistance depending on the concrete strength class                                                                             |                                        | τ <sub>Rk,ucr</sub> =         |                                                | ψ <sub>c,ucr</sub> · τ <sub>Rk,ucr</sub> (C20/25) |      |      |      |      |      |      |            |      |      |      |     |
| Concrete cone failure or Splitting                                                                                                                  |                                        |                               |                                                |                                                   |      |      |      |      |      |      |            |      |      |      |     |
| Relevant parameter                                                                                                                                  |                                        |                               | see Table C2                                   |                                                   |      |      |      |      |      |      |            |      |      |      |     |
| Installation factor (DD)                                                                                                                            |                                        |                               |                                                |                                                   |      |      |      |      |      |      |            |      |      |      |     |
| for dry and wet concrete                                                                                                                            | γ <sub>inst</sub>                      | [-]                           | 1,0                                            |                                                   |      |      |      |      |      |      |            |      | 1,2  |      |     |
| for flooded bore hole                                                                                                                               |                                        |                               | 1,2                                            |                                                   |      |      |      | 1,4  |      |      |            |      | 3)   |      |     |
| 1) f <sub>uk</sub> shall be taken from the specifications of reinforcing bars<br>2) in absence of national regulation<br>3) no performance assessed |                                        |                               |                                                |                                                   |      |      |      |      |      |      |            |      |      |      |     |
| G&B Fissaggi Injection system Gebofix EPO PLUS RE for concrete                                                                                      |                                        |                               |                                                |                                                   |      |      |      |      |      |      | Annex C 15 |      |      |      |     |
| Performances<br>Characteristic values of tension loads under static and quasi-static action for a working life of 50 years (reinforcing bar)        |                                        |                               |                                                |                                                   |      |      |      |      |      |      |            |      |      |      |     |

**Table C16: Characteristic values of tension loads under static and quasi-static action for a working life of 100 years**

| Reinforcing bar                                                                                                                                                               |                                        |                                   | Ø 8                                            | 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 tension resistance                                                                                                                                             | N <sub>Rk,s</sub>                      | [kN]                              | A <sub>s</sub> · f <sub>uk</sub> <sup>1)</sup> |                                                       |      |      |      |      |      |      |            |      |      |      |     |
| Cross section area                                                                                                                                                            | A <sub>s</sub>                         | [mm²]                             | 50                                             | 79                                                    | 113  | 154  | 201  | 314  | 452  | 491  | 616        | 804  | 1018 | 1256 |     |
| Partial factor                                                                                                                                                                | γ <sub>Ms,N</sub>                      | [-]                               | 1,4 <sup>2)</sup>                              |                                                       |      |      |      |      |      |      |            |      |      |      |     |
| Combined pull-out and concrete failure                                                                                                                                        |                                        |                                   |                                                |                                                       |      |      |      |      |      |      |            |      |      |      |     |
| Characteristic bond resistance in uncracked concrete C20/25 in diamond drilled holes (DD)                                                                                     |                                        |                                   |                                                |                                                       |      |      |      |      |      |      |            |      |      |      |     |
| Temperature range<br>I: 24°C/40°C<br>II: 50°C/72°C<br>III:60°C/80°C                                                                                                           | Dry, wet concrete or flooded bore hole | τ <sub>Rk,ucr,100</sub>           | [N/mm²]                                        | 14                                                    | 13   | 13   | 13   | 12   | 12   | 11   | 11         | 11   | 11   | 11   | 10  |
|                                                                                                                                                                               |                                        |                                   |                                                | 11                                                    | 10   | 10   | 10   | 9,5  | 9,0  | 9,0  | 9,0        | 8,5  | 8,5  | 8,0  | 8,0 |
|                                                                                                                                                                               |                                        |                                   |                                                | 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 in uncracked concrete C20/25 in diamond drilled holes (DD)                                                                                                   |                                        |                                   |                                                |                                                       |      |      |      |      |      |      |            |      |      |      |     |
| Temperature range<br>I: 24°C/40°C<br>II: 50°C/72°C<br>III:60°C/80°C                                                                                                           | Dry, wet concrete or flooded bore hole | ψ <sup>0</sup> <sub>sus,100</sub> | [-]                                            | 0,73                                                  |      |      |      |      |      |      |            |      |      |      |     |
|                                                                                                                                                                               |                                        |                                   |                                                | 0,70                                                  |      |      |      |      |      |      |            |      |      |      |     |
|                                                                                                                                                                               |                                        |                                   |                                                | 0,72                                                  |      |      |      |      |      |      |            |      |      |      |     |
| Increasing factors for concrete                                                                                                                                               | ≤ C50/60                               | ψ <sub>C,ucr</sub>                | [-]                                            | (f <sub>ck</sub> / 20) <sup>0,2</sup>                 |      |      |      |      |      |      |            |      |      |      |     |
|                                                                                                                                                                               | > C50/60                               |                                   |                                                | 1,2                                                   |      |      |      |      |      |      |            |      |      |      |     |
| Characteristic bond resistance depending on the concrete strength class                                                                                                       |                                        | τ <sub>Rk,ucr,100</sub> =         |                                                | ψ <sub>C,ucr</sub> · τ <sub>Rk,ucr,100,(C20/25)</sub> |      |      |      |      |      |      |            |      |      |      |     |
| Concrete cone failure or Splitting                                                                                                                                            |                                        |                                   |                                                |                                                       |      |      |      |      |      |      |            |      |      |      |     |
| Relevant parameter                                                                                                                                                            |                                        |                                   | see Table C2                                   |                                                       |      |      |      |      |      |      |            |      |      |      |     |
| Installation factor (DD)                                                                                                                                                      |                                        |                                   |                                                |                                                       |      |      |      |      |      |      |            |      |      |      |     |
| for dry and wet concrete                                                                                                                                                      | γ <sub>inst</sub>                      | [-]                               | 1,0                                            |                                                       |      |      |      |      |      |      |            |      | 1,2  |      |     |
| for flooded bore hole                                                                                                                                                         |                                        |                                   | 1,2                                            |                                                       |      |      |      | 1,4  |      |      |            |      | 3)   |      |     |
| <div>1) f<sub>uk</sub> shall be taken from the specifications of reinforcing bars</div> <div>2) in absence of national regulation</div> <div>3) no performance assessed</div> |                                        |                                   |                                                |                                                       |      |      |      |      |      |      |            |      |      |      |     |
| G&B Fissaggi Injection system Gebofix EPO PLUS RE for concrete                                                                                                                |                                        |                                   |                                                |                                                       |      |      |      |      |      |      | Annex C 16 |      |      |      |     |
| <b>Performances</b><br>Characteristic values of tension loads under static and quasi-static action for a working life of 100 years (reinforcing bar)                          |                                        |                                   |                                                |                                                       |      |      |      |      |      |      |            |      |      |      |     |

**Table C17: Characteristic values of shear loads under static and quasi-static action for a working life of 50 and 100 years**

| Reinforcing bar                                                                                                                                    |                 |       | Ø 8                                  | 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                                                                                                                    | $V_{Rk,s}^0$    | [kN]  | $0,5 \cdot A_s \cdot f_{uk}^{1)}$    |      |      |      |      |      |      |                       |            |      |      |      |
| Cross section area                                                                                                                                 | $A_s$           | [mm²] | 50                                   | 79   | 113  | 154  | 201  | 314  | 452  | 491                   | 616        | 804  | 1018 | 1256 |
| Partial factor                                                                                                                                     | $\gamma_{Ms,V}$ | [-]   | $1,5^{2)}$                           |      |      |      |      |      |      |                       |            |      |      |      |
| Ductility factor                                                                                                                                   | $k_7$           | [-]   | 1,0                                  |      |      |      |      |      |      |                       |            |      |      |      |
| Steel failure with lever arm                                                                                                                       |                 |       |                                      |      |      |      |      |      |      |                       |            |      |      |      |
| Characteristic bending moment                                                                                                                      | $M_{Rk,s}^0$    | [Nm]  | $1,2 \cdot W_{el} \cdot f_{uk}^{1)}$ |      |      |      |      |      |      |                       |            |      |      |      |
| Elastic section modulus                                                                                                                            | $W_{el}$        | [mm³] | 50                                   | 98   | 170  | 269  | 402  | 785  | 1357 | 1534                  | 2155       | 3217 | 4580 | 6283 |
| Partial factor                                                                                                                                     | $\gamma_{Ms,V}$ | [-]   | $1,5^{2)}$                           |      |      |      |      |      |      |                       |            |      |      |      |
| Concrete pry-out failure                                                                                                                           |                 |       |                                      |      |      |      |      |      |      |                       |            |      |      |      |
| Factor                                                                                                                                             | $k_8$           | [-]   | 2,0                                  |      |      |      |      |      |      |                       |            |      |      |      |
| Installation factor                                                                                                                                | $\gamma_{inst}$ | [-]   | 1,0                                  |      |      |      |      |      |      |                       |            |      |      |      |
| Concrete edge failure                                                                                                                              |                 |       |                                      |      |      |      |      |      |      |                       |            |      |      |      |
| Effective length of fastener                                                                                                                       | $l_f$           | [mm]  | $\min(h_{ef}; 12 \cdot d_{nom})$     |      |      |      |      |      |      | $\min(h_{ef}; 300mm)$ |            |      |      |      |
| Outside diameter of fastener                                                                                                                       | $d_{nom}$       | [mm]  | 8                                    | 10   | 12   | 14   | 16   | 20   | 24   | 25                    | 28         | 32   | 36   | 40   |
| Installation factor                                                                                                                                | $\gamma_{inst}$ | [-]   | 1,0                                  |      |      |      |      |      |      |                       |            |      |      |      |
| 1) $f_{uk}$ shall be taken from the specifications of reinforcing bars<br>2) in absence of national regulation                                     |                 |       |                                      |      |      |      |      |      |      |                       |            |      |      |      |
| G&B Fissaggi Injection system Gebofix EPO PLUS RE for concrete                                                                                     |                 |       |                                      |      |      |      |      |      |      |                       | Annex C 17 |      |      |      |
| Performances<br>Characteristic values of shear loads under static and quasi-static action for a working life of 50 and 100 years (reinforcing bar) |                 |       |                                      |      |      |      |      |      |      |                       |            |      |      |      |

**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                                                                                          |                            |                           | M8    | M10   | M12   | M16   | M20   | M24   | M27   | M30   |
|-------------------------------------------------------------------------------------------------------|----------------------------|---------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| <b>Uncracked concrete under static and quasi-static action for a working life of 50 and 100 years</b> |                            |                           |       |       |       |       |       |       |       |       |
| Temperature range I:<br>24°C/40°C                                                                     | $\delta_{N0}$ -factor      | [mm/(N/mm <sup>2</sup> )] | 0,028 | 0,029 | 0,030 | 0,033 | 0,035 | 0,038 | 0,039 | 0,041 |
|                                                                                                       | $\delta_{N\infty}$ -factor | [mm/(N/mm <sup>2</sup> )] | 0,028 | 0,029 | 0,030 | 0,033 | 0,035 | 0,038 | 0,039 | 0,041 |
| Temperature range II:<br>50°C/72°C                                                                    | $\delta_{N0}$ -factor      | [mm/(N/mm <sup>2</sup> )] | 0,038 | 0,039 | 0,040 | 0,044 | 0,047 | 0,051 | 0,052 | 0,055 |
|                                                                                                       | $\delta_{N\infty}$ -factor | [mm/(N/mm <sup>2</sup> )] | 0,047 | 0,049 | 0,051 | 0,055 | 0,059 | 0,064 | 0,067 | 0,070 |
| Temperature range III:<br>60°C/80°C                                                                   | $\delta_{N0}$ -factor      | [mm/(N/mm <sup>2</sup> )] | 0,038 | 0,039 | 0,040 | 0,044 | 0,047 | 0,051 | 0,052 | 0,055 |
|                                                                                                       | $\delta_{N\infty}$ -factor | [mm/(N/mm <sup>2</sup> )] | 0,047 | 0,049 | 0,051 | 0,055 | 0,059 | 0,064 | 0,067 | 0,070 |
| <b>Cracked concrete under static and quasi-static action for a working life of 50 and 100 years</b>   |                            |                           |       |       |       |       |       |       |       |       |
| Temperature range I:<br>24°C/40°C                                                                     | $\delta_{N0}$ -factor      | [mm/(N/mm <sup>2</sup> )] | 0,069 | 0,071 | 0,072 | 0,074 | 0,076 | 0,079 | 0,081 | 0,082 |
|                                                                                                       | $\delta_{N\infty}$ -factor | [mm/(N/mm <sup>2</sup> )] | 0,100 | 0,115 | 0,122 | 0,128 | 0,135 | 0,142 | 0,155 | 0,171 |
| Temperature range II:<br>50°C/72°C                                                                    | $\delta_{N0}$ -factor      | [mm/(N/mm <sup>2</sup> )] | 0,092 | 0,095 | 0,096 | 0,099 | 0,102 | 0,106 | 0,109 | 0,110 |
|                                                                                                       | $\delta_{N\infty}$ -factor | [mm/(N/mm <sup>2</sup> )] | 0,134 | 0,154 | 0,163 | 0,172 | 0,181 | 0,189 | 0,207 | 0,229 |
| Temperature range III:<br>60°C/80°C                                                                   | $\delta_{N0}$ -factor      | [mm/(N/mm <sup>2</sup> )] | 0,092 | 0,095 | 0,096 | 0,099 | 0,102 | 0,106 | 0,109 | 0,110 |
|                                                                                                       | $\delta_{N\infty}$ -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:  $\delta_{N0} = \delta_{N0}\text{-factor} \cdot \tau$ ;  $\delta_{N\infty} = \delta_{N\infty}\text{-factor} \cdot \tau$ ;  $\tau$ : action bond stress for tension

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

| Threaded rod                                                                                              |                            |                           | M8    | M10   | M12   | M16   | M20   | M24   | M27   | M30   |
|-----------------------------------------------------------------------------------------------------------|----------------------------|---------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| <b>Cracked and uncracked concrete under static and quasi-static action for a working life of 50 years</b> |                            |                           |       |       |       |       |       |       |       |       |
| Temperature range I:<br>24°C/40°C                                                                         | $\delta_{N0}$ -factor      | [mm/(N/mm <sup>2</sup> )] | 0,011 | 0,012 | 0,012 | 0,013 | 0,014 | 0,014 | 0,015 | 0,015 |
|                                                                                                           | $\delta_{N\infty}$ -factor | [mm/(N/mm <sup>2</sup> )] | 0,018 | 0,019 | 0,019 | 0,020 | 0,022 | 0,023 | 0,024 | 0,025 |
| Temperature range II:<br>50°C/72°C                                                                        | $\delta_{N0}$ -factor      | [mm/(N/mm <sup>2</sup> )] | 0,013 | 0,014 | 0,014 | 0,015 | 0,016 | 0,016 | 0,018 | 0,018 |
|                                                                                                           | $\delta_{N\infty}$ -factor | [mm/(N/mm <sup>2</sup> )] | 0,052 | 0,053 | 0,055 | 0,058 | 0,062 | 0,065 | 0,068 | 0,070 |
| Temperature range III:<br>60°C/80°C                                                                       | $\delta_{N0}$ -factor      | [mm/(N/mm <sup>2</sup> )] | 0,013 | 0,014 | 0,014 | 0,015 | 0,016 | 0,016 | 0,018 | 0,018 |
|                                                                                                           | $\delta_{N\infty}$ -factor | [mm/(N/mm <sup>2</sup> )] | 0,052 | 0,053 | 0,055 | 0,058 | 0,062 | 0,065 | 0,068 | 0,070 |
| <b>Uncracked concrete under static and quasi-static action for a working life of 100 years</b>            |                            |                           |       |       |       |       |       |       |       |       |
| Temperature range I:<br>24°C/40°C                                                                         | $\delta_{N0}$ -factor      | [mm/(N/mm <sup>2</sup> )] | 0,011 | 0,012 | 0,012 | 0,013 | 0,014 | 0,014 | 0,015 | 0,015 |
|                                                                                                           | $\delta_{N\infty}$ -factor | [mm/(N/mm <sup>2</sup> )] | 0,020 | 0,021 | 0,021 | 0,023 | 0,024 | 0,025 | 0,026 | 0,027 |
| Temperature range II:<br>50°C/72°C                                                                        | $\delta_{N0}$ -factor      | [mm/(N/mm <sup>2</sup> )] | 0,013 | 0,014 | 0,014 | 0,015 | 0,016 | 0,016 | 0,018 | 0,018 |
|                                                                                                           | $\delta_{N\infty}$ -factor | [mm/(N/mm <sup>2</sup> )] | 0,038 | 0,039 | 0,040 | 0,043 | 0,045 | 0,047 | 0,049 | 0,051 |
| Temperature range III:<br>60°C/80°C                                                                       | $\delta_{N0}$ -factor      | [mm/(N/mm <sup>2</sup> )] | 0,013 | 0,014 | 0,014 | 0,015 | 0,016 | 0,016 | 0,018 | 0,018 |
|                                                                                                           | $\delta_{N\infty}$ -factor | [mm/(N/mm <sup>2</sup> )] | 0,038 | 0,039 | 0,040 | 0,043 | 0,045 | 0,047 | 0,049 | 0,051 |

<sup>1)</sup> Calculation of the displacement:  $\delta_{N0} = \delta_{N0}\text{-factor} \cdot \tau$ ;  $\delta_{N\infty} = \delta_{N\infty}\text{-factor} \cdot \tau$ ;  $\tau$ : 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  |
|-------------------------------------------------------------------------------------------------------------------|----------------------------|---------|------|------|------|------|------|------|------|------|
| <b>Uncracked and cracked concrete under static and quasi-static action for a working life of 50 and 100 years</b> |                            |         |      |      |      |      |      |      |      |      |
| All temperature ranges                                                                                            | $\delta_{V0}$ -factor      | [mm/kN] | 0,06 | 0,06 | 0,05 | 0,04 | 0,04 | 0,03 | 0,03 | 0,03 |
|                                                                                                                   | $\delta_{V\infty}$ -factor | [mm/kN] | 0,09 | 0,08 | 0,08 | 0,06 | 0,06 | 0,05 | 0,05 | 0,05 |

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

**G&B Fissaggi Injection system Gebofix EPO PLUS RE 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)                        |                            |              |       |       |        |        |            |        |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|--------------|-------|-------|--------|--------|------------|--------|
| Internal threaded anchor rods                                                                                                                                                                       |                            |              | BI-M6 | BI-M8 | BI-M10 | BI-M12 | BI-M16     | BI-M20 |
| Uncracked concrete under static and quasi-static action for a working life of 50 and 100 years                                                                                                      |                            |              |       |       |        |        |            |        |
| Temperature range I:<br>24°C/40°C                                                                                                                                                                   | $\delta_{N0}$ -factor      | [mm/(N/mm²)] | 0,029 | 0,030 | 0,033  | 0,035  | 0,038      | 0,041  |
|                                                                                                                                                                                                     | $\delta_{N\infty}$ -factor | [mm/(N/mm²)] | 0,029 | 0,030 | 0,033  | 0,035  | 0,038      | 0,041  |
| Temperature range II:<br>50°C/72°C                                                                                                                                                                  | $\delta_{N0}$ -factor      | [mm/(N/mm²)] | 0,039 | 0,040 | 0,044  | 0,047  | 0,051      | 0,055  |
|                                                                                                                                                                                                     | $\delta_{N\infty}$ -factor | [mm/(N/mm²)] | 0,049 | 0,051 | 0,055  | 0,059  | 0,064      | 0,070  |
| Temperature range III:<br>60°C/80°C                                                                                                                                                                 | $\delta_{N0}$ -factor      | [mm/(N/mm²)] | 0,039 | 0,040 | 0,044  | 0,047  | 0,051      | 0,055  |
|                                                                                                                                                                                                     | $\delta_{N\infty}$ -factor | [mm/(N/mm²)] | 0,049 | 0,051 | 0,055  | 0,059  | 0,064      | 0,070  |
| Cracked concrete under static and quasi-static action for a working life of 50 and 100 years                                                                                                        |                            |              |       |       |        |        |            |        |
| Temperature range I:<br>24°C/40°C                                                                                                                                                                   | $\delta_{N0}$ -factor      | [mm/(N/mm²)] | 0,071 | 0,072 | 0,074  | 0,076  | 0,079      | 0,082  |
|                                                                                                                                                                                                     | $\delta_{N\infty}$ -factor | [mm/(N/mm²)] | 0,115 | 0,122 | 0,128  | 0,135  | 0,142      | 0,171  |
| Temperature range II:<br>50°C/72°C                                                                                                                                                                  | $\delta_{N0}$ -factor      | [mm/(N/mm²)] | 0,095 | 0,096 | 0,099  | 0,102  | 0,106      | 0,110  |
|                                                                                                                                                                                                     | $\delta_{N\infty}$ -factor | [mm/(N/mm²)] | 0,154 | 0,163 | 0,172  | 0,181  | 0,189      | 0,229  |
| Temperature range III:<br>60°C/80°C                                                                                                                                                                 | $\delta_{N0}$ -factor      | [mm/(N/mm²)] | 0,095 | 0,096 | 0,099  | 0,102  | 0,106      | 0,110  |
|                                                                                                                                                                                                     | $\delta_{N\infty}$ -factor | [mm/(N/mm²)] | 0,154 | 0,163 | 0,172  | 0,181  | 0,189      | 0,229  |
| 1) Calculation of the displacement: $\delta_{N0} = \delta_{N0}\text{-factor} \cdot \tau$ ; $\delta_{N\infty} = \delta_{N\infty}\text{-factor} \cdot \tau$ ; $\tau$ : action bond stress for tension |                            |              |       |       |        |        |            |        |
| Table C22: Displacements under tension load <sup>1)</sup> in diamond drilled holes (DD)                                                                                                             |                            |              |       |       |        |        |            |        |
| Internal threaded anchor rods                                                                                                                                                                       |                            |              | BI-M6 | BI-M8 | BI-M10 | BI-M12 | BI-M16     | BI-M20 |
| Cracked and uncracked concrete under static and quasi-static action for a working life of 50 years                                                                                                  |                            |              |       |       |        |        |            |        |
| Temperature range I:<br>24°C/40°C                                                                                                                                                                   | $\delta_{N0}$ -factor      | [mm/(N/mm²)] | 0,012 | 0,012 | 0,013  | 0,014  | 0,014      | 0,015  |
|                                                                                                                                                                                                     | $\delta_{N\infty}$ -factor | [mm/(N/mm²)] | 0,019 | 0,019 | 0,020  | 0,022  | 0,023      | 0,025  |
| Temperature range II:<br>50°C/72°C                                                                                                                                                                  | $\delta_{N0}$ -factor      | [mm/(N/mm²)] | 0,014 | 0,014 | 0,015  | 0,016  | 0,016      | 0,018  |
|                                                                                                                                                                                                     | $\delta_{N\infty}$ -factor | [mm/(N/mm²)] | 0,053 | 0,055 | 0,058  | 0,062  | 0,065      | 0,070  |
| Temperature range III:<br>60°C/80°C                                                                                                                                                                 | $\delta_{N0}$ -factor      | [mm/(N/mm²)] | 0,014 | 0,014 | 0,015  | 0,016  | 0,016      | 0,018  |
|                                                                                                                                                                                                     | $\delta_{N\infty}$ -factor | [mm/(N/mm²)] | 0,053 | 0,055 | 0,058  | 0,062  | 0,065      | 0,070  |
| Uncracked concrete under static and quasi-static action for a working life of 100 years                                                                                                             |                            |              |       |       |        |        |            |        |
| Temperature range I:<br>24°C/40°C                                                                                                                                                                   | $\delta_{N0}$ -factor      | [mm/(N/mm²)] | 0,012 | 0,012 | 0,013  | 0,014  | 0,014      | 0,015  |
|                                                                                                                                                                                                     | $\delta_{N\infty}$ -factor | [mm/(N/mm²)] | 0,021 | 0,021 | 0,023  | 0,024  | 0,025      | 0,027  |
| Temperature range II:<br>50°C/72°C                                                                                                                                                                  | $\delta_{N0}$ -factor      | [mm/(N/mm²)] | 0,014 | 0,014 | 0,015  | 0,016  | 0,016      | 0,018  |
|                                                                                                                                                                                                     | $\delta_{N\infty}$ -factor | [mm/(N/mm²)] | 0,039 | 0,040 | 0,043  | 0,045  | 0,047      | 0,051  |
| Temperature range III:<br>60°C/80°C                                                                                                                                                                 | $\delta_{N0}$ -factor      | [mm/(N/mm²)] | 0,014 | 0,014 | 0,015  | 0,016  | 0,016      | 0,018  |
|                                                                                                                                                                                                     | $\delta_{N\infty}$ -factor | [mm/(N/mm²)] | 0,039 | 0,040 | 0,043  | 0,045  | 0,047      | 0,051  |
| 1) Calculation of the displacement: $\delta_{N0} = \delta_{N0}\text{-factor} \cdot \tau$ ; $\delta_{N\infty} = \delta_{N\infty}\text{-factor} \cdot \tau$ ; $\tau$ : action bond stress for tension |                            |              |       |       |        |        |            |        |
| Table C23: Displacements under shear load <sup>1)</sup> for all drilling methods                                                                                                                    |                            |              |       |       |        |        |            |        |
| Internal threaded anchor rods                                                                                                                                                                       |                            |              | BI-M6 | BI-M8 | BI-M10 | BI-M12 | BI-M16     | BI-M20 |
| Uncracked and cracked concrete under static and quasi-static action for a working life of 50 and 100 years                                                                                          |                            |              |       |       |        |        |            |        |
| All temperature ranges                                                                                                                                                                              | $\delta_{V0}$ -factor      | [mm/kN]      | 0,07  | 0,06  | 0,06   | 0,05   | 0,04       | 0,04   |
|                                                                                                                                                                                                     | $\delta_{V\infty}$ -factor | [mm/kN]      | 0,10  | 0,09  | 0,08   | 0,08   | 0,06       | 0,06   |
| 1) Calculation of the displacement $\delta_{V0} = \delta_{V0}\text{-factor} \cdot V$ ; $\delta_{V\infty} = \delta_{V\infty}\text{-factor} \cdot V$ ; $V$ : action shear load                        |                            |              |       |       |        |        |            |        |
| G&B Fissaggi Injection system Gebofix EPO PLUS RE for concrete                                                                                                                                      |                            |              |       |       |        |        | Annex C 19 |        |
| Performances                                                                                                                                                                                        |                            |              |       |       |        |        |            |        |
| Displacements under static and quasi-static action for a working life of 50 and 100 years (Internal threaded anchor rod)                                                                            |                            |              |       |       |        |        |            |        |

**Table C24: 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)**

| Reinforcing bar                                                                                |                            |                           | Ø 8   | Ø 10  | Ø 12  | Ø 14  | Ø 16  | Ø 20  | Ø 24  | Ø 25  | Ø 28  | Ø 32  | Ø 36  | Ø 40  |
|------------------------------------------------------------------------------------------------|----------------------------|---------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Uncracked concrete under static and quasi-static action for a working life of 50 and 100 years |                            |                           |       |       |       |       |       |       |       |       |       |       |       |       |
| Temp.- range<br>I: 24°C/40°C                                                                   | $\delta_{NO}$ -factor      | [mm/(N/mm <sup>2</sup> )] | 0,028 | 0,029 | 0,030 | 0,031 | 0,033 | 0,035 | 0,038 | 0,038 | 0,040 | 0,043 | 0,045 | 0,047 |
|                                                                                                | $\delta_{N\infty}$ -factor | [mm/(N/mm <sup>2</sup> )] | 0,028 | 0,029 | 0,030 | 0,031 | 0,033 | 0,035 | 0,038 | 0,038 | 0,040 | 0,043 | 0,045 | 0,047 |
| Temp.- range<br>II: 50°C/72°C                                                                  | $\delta_{NO}$ -factor      | [mm/(N/mm <sup>2</sup> )] | 0,038 | 0,039 | 0,040 | 0,042 | 0,044 | 0,047 | 0,051 | 0,051 | 0,054 | 0,058 | 0,060 | 0,063 |
|                                                                                                | $\delta_{N\infty}$ -factor | [mm/(N/mm <sup>2</sup> )] | 0,047 | 0,049 | 0,051 | 0,053 | 0,055 | 0,059 | 0,065 | 0,065 | 0,068 | 0,072 | 0,074 | 0,079 |
| Temp.- range<br>III: 60°C/80°C                                                                 | $\delta_{NO}$ -factor      | [mm/(N/mm <sup>2</sup> )] | 0,038 | 0,039 | 0,040 | 0,042 | 0,044 | 0,047 | 0,051 | 0,051 | 0,054 | 0,058 | 0,060 | 0,063 |
|                                                                                                | $\delta_{N\infty}$ -factor | [mm/(N/mm <sup>2</sup> )] | 0,047 | 0,049 | 0,051 | 0,053 | 0,055 | 0,059 | 0,065 | 0,065 | 0,068 | 0,072 | 0,074 | 0,079 |
| Cracked concrete under static and quasi-static action for a working life of 50 and 100 years   |                            |                           |       |       |       |       |       |       |       |       |       |       |       |       |
| Temp.- range<br>I: 24°C/40°C                                                                   | $\delta_{NO}$ -factor      | [mm/(N/mm <sup>2</sup> )] | 0,069 | 0,071 | 0,072 | 0,073 | 0,074 | 0,076 | 0,079 | 0,079 | 0,081 | 0,084 | 2)    |       |
|                                                                                                | $\delta_{N\infty}$ -factor | [mm/(N/mm <sup>2</sup> )] | 0,115 | 0,122 | 0,128 | 0,135 | 0,142 | 0,155 | 0,171 | 0,171 | 0,181 | 0,194 |       |       |
| Temp.- range<br>II: 50°C/72°C                                                                  | $\delta_{NO}$ -factor      | [mm/(N/mm <sup>2</sup> )] | 0,092 | 0,095 | 0,096 | 0,098 | 0,099 | 0,102 | 0,106 | 0,106 | 0,109 | 0,113 |       |       |
|                                                                                                | $\delta_{N\infty}$ -factor | [mm/(N/mm <sup>2</sup> )] | 0,154 | 0,163 | 0,172 | 0,181 | 0,189 | 0,207 | 0,229 | 0,229 | 0,242 | 0,260 |       |       |
| Temp.- range<br>III: 60°C/80°C                                                                 | $\delta_{NO}$ -factor      | [mm/(N/mm <sup>2</sup> )] | 0,092 | 0,095 | 0,096 | 0,098 | 0,099 | 0,102 | 0,106 | 0,106 | 0,109 | 0,113 |       |       |
|                                                                                                | $\delta_{N\infty}$ -factor | [mm/(N/mm <sup>2</sup> )] | 0,154 | 0,163 | 0,172 | 0,181 | 0,189 | 0,207 | 0,229 | 0,229 | 0,242 | 0,260 |       |       |

<sup>1)</sup> Calculation of the displacement:  $\delta_{NO} = \delta_{NO\text{-factor}} \cdot \tau$ ;  $\delta_{N\infty} = \delta_{N\infty\text{-factor}} \cdot \tau$ ;  $\tau$ : action bond stress for tension

<sup>2)</sup> No performance assessed

**Table C25: Displacements under tension load<sup>1)</sup> in diamond drilled holes (DD)**

| Reinforcing bar                                                                         |                            |                           | Ø 8   | Ø 10  | Ø 12  | Ø 14  | Ø 16  | Ø 20  | Ø 24  | Ø 25  | Ø 28  | Ø 32  | Ø 36  | Ø 40  |
|-----------------------------------------------------------------------------------------|----------------------------|---------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Uncracked concrete under static and quasi-static action for a working life of 50 years  |                            |                           |       |       |       |       |       |       |       |       |       |       |       |       |
| Temp.- range<br>I: 24°C/40°C                                                            | $\delta_{NO}$ -factor      | [mm/(N/mm <sup>2</sup> )] | 0,008 | 0,009 | 0,009 | 0,01  | 0,011 | 0,012 | 0,013 | 0,013 | 0,014 | 0,015 | 0,016 | 0,017 |
|                                                                                         | $\delta_{N\infty}$ -factor | [mm/(N/mm <sup>2</sup> )] | 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<br>II: 50°C/72°C                                                           | $\delta_{NO}$ -factor      | [mm/(N/mm <sup>2</sup> )] | 0,009 | 0,011 | 0,011 | 0,012 | 0,013 | 0,014 | 0,015 | 0,015 | 0,016 | 0,018 | 0,019 | 0,020 |
|                                                                                         | $\delta_{N\infty}$ -factor | [mm/(N/mm <sup>2</sup> )] | 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<br>III: 60°C/80°C                                                          | $\delta_{NO}$ -factor      | [mm/(N/mm <sup>2</sup> )] | 0,009 | 0,011 | 0,011 | 0,012 | 0,013 | 0,014 | 0,015 | 0,015 | 0,016 | 0,018 | 0,019 | 0,020 |
|                                                                                         | $\delta_{N\infty}$ -factor | [mm/(N/mm <sup>2</sup> )] | 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 concrete under static and quasi-static action for a working life of 100 years |                            |                           |       |       |       |       |       |       |       |       |       |       |       |       |
| Temp.- range<br>I: 24°C/40°C                                                            | $\delta_{NO}$ -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 |
|                                                                                         | $\delta_{N\infty}$ -factor | [mm/(N/mm <sup>2</sup> )] | 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<br>II: 50°C/72°C                                                           | $\delta_{NO}$ -factor      | [mm/(N/mm <sup>2</sup> )] | 0,009 | 0,011 | 0,011 | 0,012 | 0,013 | 0,014 | 0,015 | 0,015 | 0,016 | 0,018 | 0,019 | 0,020 |
|                                                                                         | $\delta_{N\infty}$ -factor | [mm/(N/mm <sup>2</sup> )] | 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<br>III: 60°C/80°C                                                          | $\delta_{NO}$ -factor      | [mm/(N/mm <sup>2</sup> )] | 0,009 | 0,011 | 0,011 | 0,012 | 0,013 | 0,014 | 0,015 | 0,015 | 0,016 | 0,018 | 0,019 | 0,020 |
|                                                                                         | $\delta_{N\infty}$ -factor | [mm/(N/mm <sup>2</sup> )] | 0,035 | 0,037 | 0,040 | 0,042 | 0,045 | 0,049 | 0,055 | 0,055 | 0,059 | 0,064 | 0,066 | 0,070 |

<sup>1)</sup> Calculation of the displacement:  $\delta_{NO} = \delta_{NO\text{-factor}} \cdot \tau$ ;  $\delta_{N\infty} = \delta_{N\infty\text{-factor}} \cdot \tau$ ;  $\tau$ : action bond stress for tension

**Table C26: Displacements under shear load<sup>1)</sup> for all drilling methods**

| Reinforcing bar                                                                                            |                            |         | Ø 8  | Ø 10 | Ø 12 | Ø 14 | Ø 16 | Ø 20 | Ø 24 | Ø 25 | Ø 28 | Ø 32 | Ø 36 | Ø 40 |
|------------------------------------------------------------------------------------------------------------|----------------------------|---------|------|------|------|------|------|------|------|------|------|------|------|------|
| Uncracked and cracked concrete under static and quasi-static action for a working life of 50 and 100 years |                            |         |      |      |      |      |      |      |      |      |      |      |      |      |
| All temperature ranges                                                                                     | $\delta_{V0}$ -factor      | [mm/kN] | 0,06 | 0,05 | 0,05 | 0,04 | 0,04 | 0,04 | 0,03 | 0,03 | 0,03 | 0,03 | 0,03 | 0,03 |
|                                                                                                            | $\delta_{V\infty}$ -factor | [mm/kN] | 0,09 | 0,08 | 0,08 | 0,06 | 0,06 | 0,05 | 0,05 | 0,05 | 0,04 | 0,04 | 0,04 | 0,04 |

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

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**Performances**

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

**Annex C 20**

**Table C27: Characteristic values of tension loads under seismic action (performance category C1) for a working life of 50 years**

| Threaded rod                                                                                                                                                                                    |                |                                         |                     |         | M8                                      | M10 | M12 | M16 | M20 | M24 | M27 | M30 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-----------------------------------------|---------------------|---------|-----------------------------------------|-----|-----|-----|-----|-----|-----|-----|
| Steel failure                                                                                                                                                                                   |                |                                         |                     |         |                                         |     |     |     |     |     |     |     |
| Characteristic tension resistance                                                                                                                                                               |                |                                         | $N_{Rk,s,eq,C1}$    | [kN]    | $1,0 \cdot N_{Rk,s}$                    |     |     |     |     |     |     |     |
| Partial factor                                                                                                                                                                                  |                |                                         | $\gamma_{Ms,N}$     | [-]     | see Table 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) |                |                                         |                     |         |                                         |     |     |     |     |     |     |     |
| Temperature range                                                                                                                                                                               | I: 24°C/40°C   | Dry, wet concrete and flooded bore hole | $\tau_{Rk,eq,C1}$   | [N/mm²] | 7,0                                     | 7,0 | 8,5 | 8,5 | 8,5 | 8,5 | 8,5 | 8,5 |
|                                                                                                                                                                                                 | II: 50°C/72°C  |                                         | $\tau_{Rk,eq,C1}$   | [N/mm²] | 6,0                                     | 6,0 | 7,0 | 7,0 | 7,0 | 7,0 | 7,0 | 7,0 |
|                                                                                                                                                                                                 | III: 60°C/80°C |                                         | $\tau_{Rk,eq,C1}$   | [N/mm²] | 5,0                                     | 5,0 | 5,0 | 4,5 | 4,5 | 4,5 | 4,5 | 4,5 |
| Increasing factors for concrete                                                                                                                                                                 |                |                                         | $\psi_c$            | [-]     | 1,0                                     |     |     |     |     |     |     |     |
| Characteristic bond resistance depending on the concrete strength class                                                                                                                         |                |                                         | $\tau_{Rk,eq,C1} =$ |         | $\psi_c \cdot \tau_{Rk,eq,C1,(C20/25)}$ |     |     |     |     |     |     |     |
| Installation factor                                                                                                                                                                             |                |                                         |                     |         |                                         |     |     |     |     |     |     |     |
| for dry and wet concrete (HD; HDB, CD)                                                                                                                                                          |                |                                         | $\gamma_{inst}$     | [-]     | 1,0                                     |     |     |     |     |     |     |     |
| for flooded bore hole (HD; HDB, CD)                                                                                                                                                             |                |                                         |                     |         | 1,2                                     |     |     |     |     |     |     |     |
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**Table C28: Characteristic values of tension loads under seismic action (performance category C1) for a working life of 100 years**

| Threaded rod                                                                                                                                                                                    |                |                                         |                   | M8                                      | M10 | M12 | M16 | M20 | M24 | M27 | M30 |     |
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| Steel failure                                                                                                                                                                                   |                |                                         |                   |                                         |     |     |     |     |     |     |     |     |
| Characteristic tension resistance                                                                                                                                                               |                | $N_{Rk,s,eq,C1}$                        | [kN]              | $1,0 \cdot N_{Rk,s}$                    |     |     |     |     |     |     |     |     |
| Partial factor                                                                                                                                                                                  |                | $\gamma_{Ms,N}$                         | [-]               | see Table 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) |                |                                         |                   |                                         |     |     |     |     |     |     |     |     |
| Temperature range                                                                                                                                                                               | I: 24°C/40°C   | Dry, wet concrete and flooded bore hole | $\tau_{Rk,eq,C1}$ | [N/mm²]                                 | 6,5 | 6,5 | 7,5 | 7,5 | 7,5 | 7,5 | 7,5 | 7,5 |
|                                                                                                                                                                                                 | II: 50°C/72°C  |                                         | $\tau_{Rk,eq,C1}$ | [N/mm²]                                 | 5,5 | 5,5 | 6,5 | 6,5 | 6,5 | 6,5 | 6,5 | 6,5 |
|                                                                                                                                                                                                 | III: 60°C/80°C |                                         | $\tau_{Rk,eq,C1}$ | [N/mm²]                                 | 5,0 | 5,0 | 5,0 | 4,5 | 4,5 | 4,5 | 4,5 | 4,5 |
| Increasing factors for concrete                                                                                                                                                                 |                | $\psi_c$                                | [-]               | 1,0                                     |     |     |     |     |     |     |     |     |
| Characteristic bond resistance depending on the concrete strength class                                                                                                                         |                | $\tau_{Rk,eq,C1} =$                     |                   | $\psi_c \cdot \tau_{Rk,eq,C1,(C20/25)}$ |     |     |     |     |     |     |     |     |
| Installation factor                                                                                                                                                                             |                |                                         |                   |                                         |     |     |     |     |     |     |     |     |
| for dry and wet concrete (HD; HDB, CD)                                                                                                                                                          |                | $\gamma_{inst}$                         | [-]               | 1,0                                     |     |     |     |     |     |     |     |     |
| for flooded bore hole (HD; HDB, CD)                                                                                                                                                             |                |                                         |                   | 1,2                                     |     |     |     |     |     |     |     |     |
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**Table C29: Characteristic values of shear loads under seismic action  
(performance category C1) for a working life of 50 and 100 years**

| Threaded rod                                                                                                                                                                        |                  |      | M8                      | M10 | M12 | M16 | M20 | M24 | M27 | M30 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|------|-------------------------|-----|-----|-----|-----|-----|-----|-----|
| Steel failure                                                                                                                                                                       |                  |      |                         |     |     |     |     |     |     |     |
| Characteristic shear resistance (Seismic C1)                                                                                                                                        | $V_{Rk,s,eq,C1}$ | [kN] | $0,70 \cdot V^0_{Rk,s}$ |     |     |     |     |     |     |     |
| Partial factor                                                                                                                                                                      | $\gamma_{Ms,V}$  | [-]  | see Table C1            |     |     |     |     |     |     |     |
| Factor for annular gap                                                                                                                                                              | $\alpha_{gap}$   | [-]  | $0,5 (1,0)^1$           |     |     |     |     |     |     |     |
| <div><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.</div> |                  |      |                         |     |     |     |     |     |     |     |
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|                                                                                                                                                                                     |                  |      |                         |     |     |     |     |     |     |     |
|                                                                                                                                                                                     |                  |      |                         |     |     |     |     |     |     |     |
|                                                                                                                                                                                     |                  |      |                         |     |     |     |     |     |     |     |
|                                                                                                                                                                                     |                  |      |                         |     |     |     |     |     |     |     |
|                                                                                                                                                                                     |                  |      |                         |     |     |     |     |     |     |     |
|                                                                                                                                                                                     |                  |      |                         |     |     |     |     |     |     |     |
|                                                                                                                                                                                     |                  |      |                         |     |     |     |     |     |     |     |
|                                                                                                                                                                                     |                  |      |                         |     |     |     |     |     |     |     |
|                                                                                                                                                                                     |                  |      |                         |     |     |     |     |     |     |     |
|                                                                                                                                                                                     |                  |      |                         |     |     |     |     |     |     |     |
|                                                                                                                                                                                     |                  |      |                         |     |     |     |     |     |     |     |
|                                                                                                                                                                                     |                  |      |                         |     |     |     |     |     |     |     |
|                                                                                                                                                                                     |                  |      |                         |     |     |     |     |     |     |     |
|                                                                                                                                                                                     |                  |      |                         |     |     |     |     |     |     |     |
|                                                                                                                                                                                     |                  |      |                         |     |     |     |     |     |     |     |
|                                                                                                                                                                                     |                  |      |                         |     |     |     |     |     |     |     |
|                                                                                                                                                                                     |                  |      |                         |     |     |     |     |     |     |     |
|                                                                                                                                                                                     |                  |      |                         |     |     |     |     |     |     |     |
|                                                                                                                                                                                     |                  |      |                         |     |     |     |     |     |     |     |
|                                                                                                                                                                                     |                  |      |                         |     |     |     |     |     |     |     |
|                                                                                                                                                                                     |                  |      |                         |     |     |     |     |     |     |     |
|                                                                                                                                                                                     |                  |      |                         |     |     |     |     |     |     |     |
|                                                                                                                                                                                     |                  |      |                         |     |     |     |     |     |     |     |
|                                                                                                                                                                                     |                  |      |                         |     |     |     |     |     |     |     |
|                                                                                                                                                                                     |                  |      |                         |     |     |     |     |     |     |     |
|                                                                                                                                                                                     |                  |      |                         |     |     |     |     |     |     |     |
|                                                                                                                                                                                     |                  |      |                         |     |     |     |     |     |     |     |
|                                                                                                                                                                                     |                  |      |                         |     |     |     |     |     |     |     |
|                                                                                                                                                                                     |                  |      |                         |     |     |     |     |     |     |     |

**Table C30: Characteristic values of tension loads under seismic action  
(performance category C1) for a working life of 50 years**

| Reinforcing bar                                                                                                                                                                                 |                |                                         |                   | Ø 8                                     | Ø 10 | Ø 12 | Ø 14 | Ø 16 | Ø 20 | Ø 24 | Ø 25 | Ø 28 | Ø 32 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-----------------------------------------|-------------------|-----------------------------------------|------|------|------|------|------|------|------|------|------|
| Steel failure                                                                                                                                                                                   |                |                                         |                   |                                         |      |      |      |      |      |      |      |      |      |
| Characteristic tension resistance                                                                                                                                                               |                | $N_{Rk,s,eq,C1}$                        | [kN]              | $1,0 \cdot A_s \cdot f_{uk}^{1)}$       |      |      |      |      |      |      |      |      |      |
| Cross section area                                                                                                                                                                              |                | $A_s$                                   | [mm²]             | 50                                      | 79   | 113  | 154  | 201  | 314  | 452  | 491  | 616  | 804  |
| Partial factor                                                                                                                                                                                  |                | $\gamma_{Ms,N}$                         | [-]               | $1,4^{2)}$                              |      |      |      |      |      |      |      |      |      |
| Combined pull-out and concrete failure                                                                                                                                                          |                |                                         |                   |                                         |      |      |      |      |      |      |      |      |      |
| Characteristic bond resistance in cracked and uncracked concrete C20/25 in hammer drilled holes (HD), compressed air drilled holes (CD) and in hammer drilled holes with hollow drill bit (HDB) |                |                                         |                   |                                         |      |      |      |      |      |      |      |      |      |
| Temperature range                                                                                                                                                                               | I: 24°C/40°C   | Dry, wet concrete and flooded bore hole | $\tau_{Rk,eq,C1}$ | [N/mm²]                                 | 7,0  | 7,0  | 8,5  | 8,5  | 8,5  | 8,5  | 8,5  | 8,5  | 8,5  |
|                                                                                                                                                                                                 | II: 50°C/72°C  |                                         | $\tau_{Rk,eq,C1}$ | [N/mm²]                                 | 6,0  | 6,0  | 7,0  | 7,0  | 7,0  | 7,0  | 7,0  | 7,0  | 7,0  |
|                                                                                                                                                                                                 | III: 60°C/80°C |                                         | $\tau_{Rk,eq,C1}$ | [N/mm²]                                 | 4,5  | 4,5  | 4,5  | 4,5  | 4,5  | 4,5  | 4,5  | 4,5  | 4,5  |
| Increasing factors for concrete                                                                                                                                                                 |                | $\psi_c$                                | [-]               | $1,0$                                   |      |      |      |      |      |      |      |      |      |
| Characteristic bond resistance depending on the concrete strength class                                                                                                                         |                | $\tau_{Rk,eq,C1} =$                     |                   | $\psi_c \cdot \tau_{Rk,eq,C1,(C20/25)}$ |      |      |      |      |      |      |      |      |      |
| Installation factor                                                                                                                                                                             |                |                                         |                   |                                         |      |      |      |      |      |      |      |      |      |
| for dry and wet concrete (HD; HDB, CD)                                                                                                                                                          |                | $\gamma_{inst}$                         | [-]               | $1,0$                                   |      |      |      |      |      |      |      |      |      |
| for flooded bore hole (HD; HDB, CD)                                                                                                                                                             |                |                                         |                   | $1,2$                                   |      |      |      |      |      |      |      |      |      |

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

2) in absence of national regulation

**G&B Fissaggi Injection system Gebofix EPO PLUS RE 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**

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

| Reinforcing bar                                                                                                                                                                                 |                |                                         |                   | Ø 8                                     | Ø 10 | Ø 12 | Ø 14 | Ø 16 | Ø 20 | Ø 24 | Ø 25       | Ø 28 | Ø 32 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-----------------------------------------|-------------------|-----------------------------------------|------|------|------|------|------|------|------------|------|------|
| Steel failure                                                                                                                                                                                   |                |                                         |                   |                                         |      |      |      |      |      |      |            |      |      |
| Characteristic tension resistance                                                                                                                                                               |                | $N_{Rk,s,eq,C1}$                        | [kN]              | $1,0 \cdot A_s \cdot f_{uk}^{1)}$       |      |      |      |      |      |      |            |      |      |
| Cross section area                                                                                                                                                                              |                | $A_s$                                   | [mm²]             | 50                                      | 79   | 113  | 154  | 201  | 314  | 452  | 491        | 616  | 804  |
| Partial factor                                                                                                                                                                                  |                | $\gamma_{Ms,N}$                         | [-]               | $1,4^{2)}$                              |      |      |      |      |      |      |            |      |      |
| Combined pull-out and concrete failure                                                                                                                                                          |                |                                         |                   |                                         |      |      |      |      |      |      |            |      |      |
| Characteristic bond resistance in cracked and uncracked concrete C20/25 in hammer drilled holes (HD), compressed air drilled holes (CD) and in hammer drilled holes with hollow drill bit (HDB) |                |                                         |                   |                                         |      |      |      |      |      |      |            |      |      |
| Temperature range                                                                                                                                                                               | I: 24°C/40°C   | Dry, wet concrete and flooded bore hole | $\tau_{Rk,eq,C1}$ | [N/mm²]                                 | 6,5  | 6,5  | 7,5  | 7,5  | 7,5  | 7,5  | 7,5        | 7,5  | 7,5  |
|                                                                                                                                                                                                 | II: 50°C/72°C  |                                         | $\tau_{Rk,eq,C1}$ | [N/mm²]                                 | 5,5  | 5,5  | 6,5  | 6,5  | 6,5  | 6,5  | 6,5        | 6,5  | 6,5  |
|                                                                                                                                                                                                 | III: 60°C/80°C |                                         | $\tau_{Rk,eq,C1}$ | [N/mm²]                                 | 4,5  | 4,5  | 4,5  | 4,5  | 4,5  | 4,5  | 4,5        | 4,5  | 4,5  |
| Increasing factors for concrete                                                                                                                                                                 |                | $\psi_c$                                | [-]               | $1,0$                                   |      |      |      |      |      |      |            |      |      |
| Characteristic bond resistance depending on the concrete strength class                                                                                                                         |                | $\tau_{Rk,eq,C1} =$                     |                   | $\psi_c \cdot \tau_{Rk,eq,C1,(C20/25)}$ |      |      |      |      |      |      |            |      |      |
| Installation factor                                                                                                                                                                             |                |                                         |                   |                                         |      |      |      |      |      |      |            |      |      |
| for dry and wet concrete (HD; HDB, CD)                                                                                                                                                          |                | $\gamma_{inst}$                         | [-]               | $1,0$                                   |      |      |      |      |      |      |            |      |      |
| for flooded bore hole (HD; HDB, CD)                                                                                                                                                             |                |                                         |                   | $1,2$                                   |      |      |      |      |      |      |            |      |      |
| 1) $f_{uk}$ shall be taken from the specifications of reinforcing bars                                                                                                                          |                |                                         |                   |                                         |      |      |      |      |      |      |            |      |      |
| 2) in absence of national regulation                                                                                                                                                            |                |                                         |                   |                                         |      |      |      |      |      |      |            |      |      |
| G&B Fissaggi Injection system Gebofix EPO PLUS RE for concrete                                                                                                                                  |                |                                         |                   |                                         |      |      |      |      |      |      | Annex C 25 |      |      |
| Performances<br>Characteristic values of tension loads under seismic action (performance category C1) for a working life of 100 years (reinforcing bar)                                         |                |                                         |                   |                                         |      |      |      |      |      |      |            |      |      |

**Table C32: Characteristic values of shear loads under seismic action  
(performance category C1) for a working life of 50 and 100 years**

| Reinforcing bar                                                                                                                                                                                                                                                                                                       |                  |       | Ø 8                                | Ø 10 | Ø 12 | Ø 14 | Ø 16 | Ø 20 | Ø 24 | Ø 25       | Ø 28 | Ø 32 |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-------|------------------------------------|------|------|------|------|------|------|------------|------|------|
| Steel failure                                                                                                                                                                                                                                                                                                         |                  |       |                                    |      |      |      |      |      |      |            |      |      |
| Characteristic shear resistance                                                                                                                                                                                                                                                                                       | $V_{Rk,s,eq,C1}$ | [kN]  | $0,35 \cdot A_s \cdot f_{uk}^{1)}$ |      |      |      |      |      |      |            |      |      |
| Cross section area                                                                                                                                                                                                                                                                                                    | $A_s$            | [mm²] | 50                                 | 79   | 113  | 154  | 201  | 314  | 452  | 491        | 616  | 804  |
| Partial factor                                                                                                                                                                                                                                                                                                        | $\gamma_{Ms,V}$  | [-]   | $1,5^{2)}$                         |      |      |      |      |      |      |            |      |      |
| Factor for annular gap                                                                                                                                                                                                                                                                                                | $\alpha_{gap}$   | [-]   | $0,5 (1,0)^{3)}$                   |      |      |      |      |      |      |            |      |      |
| <div>1) <math>f_{uk}</math> shall be taken from the specifications of reinforcing bars</div> <div>2) in absence of national regulation</div> <div>3) 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.</div> |                  |       |                                    |      |      |      |      |      |      |            |      |      |
| G&B Fissaggi Injection system Gebofix EPO PLUS RE for concrete                                                                                                                                                                                                                                                        |                  |       |                                    |      |      |      |      |      |      | Annex C 26 |      |      |
| <div>Performances</div> <div>Characteristic values of shear loads under seismic action (performance category C1) for a working life of 50 and 100 years (reinforcing bar)</div>                                                                                                                                       |                  |       |                                    |      |      |      |      |      |      |            |      |      |

| Table C33: Characteristic values of tension loads under seismic action<br>(performance category C2) for a working life of 50 and 100 years                                                      |                |                                                  |                         |         |                                                 |     |     |            |     |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|--------------------------------------------------|-------------------------|---------|-------------------------------------------------|-----|-----|------------|-----|-----|
| Threaded rod                                                                                                                                                                                    |                |                                                  |                         | M12     | M16                                             | M20 | M24 | M27        | M30 |     |
| Steel failure                                                                                                                                                                                   |                |                                                  |                         |         |                                                 |     |     |            |     |     |
| Characteristic tension resistance,<br>Steel, strength class 8.8<br>Stainless Steel A4 and HCR,<br>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 Table 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) |                |                                                  |                         |         |                                                 |     |     |            |     |     |
| Temperature<br>range                                                                                                                                                                            | I: 24°C/40°C   | Dry, wet<br>concrete and<br>flooded bore<br>hole | τ <sub>Rk,eq,C2</sub>   | [N/mm²] | 5,8                                             | 4,8 | 5,0 | 5,1        | 4,8 | 5,0 |
|                                                                                                                                                                                                 | II: 50°C/72°C  |                                                  | τ <sub>Rk,eq,C2</sub>   | [N/mm²] | 5,0                                             | 4,1 | 4,3 | 4,4        | 4,1 | 4,3 |
|                                                                                                                                                                                                 | III: 60°C/80°C |                                                  | τ <sub>Rk,eq,C2</sub>   | [N/mm²] | 1,9                                             | 1,6 | 1,6 | 1,7        | 1,5 | 1,6 |
| Increasing factors for concrete                                                                                                                                                                 |                |                                                  | ψ <sub>c</sub>          | [-]     | 1,0                                             |     |     |            |     |     |
| Characteristic bond resistance depending<br>on the concrete strength class                                                                                                                      |                |                                                  | τ <sub>Rk,eq,C2</sub> = |         | ψ <sub>c</sub> · τ <sub>Rk,eq,C2,(C20/25)</sub> |     |     |            |     |     |
| Installation factor                                                                                                                                                                             |                |                                                  |                         |         |                                                 |     |     |            |     |     |
| for dry and wet concrete (HD; HDB, CD)                                                                                                                                                          |                |                                                  | γ <sub>inst</sub>       | [-]     | 1,0                                             |     |     |            |     |     |
| for flooded bore hole (HD; HDB, CD)                                                                                                                                                             |                |                                                  |                         |         | 1,2                                             |     |     |            |     |     |
| Table C34: Characteristic values of shear loads under seismic action<br>(performance category C2) for a working life of 50 and 100 years                                                        |                |                                                  |                         |         |                                                 |     |     |            |     |     |
| Threaded rod                                                                                                                                                                                    |                |                                                  |                         | M12     | M16                                             | M20 | M24 | M27        | M30 |     |
| Steel failure                                                                                                                                                                                   |                |                                                  |                         |         |                                                 |     |     |            |     |     |
| Characteristic shear resistance<br>Steel, strength class 8.8<br>Stainless Steel A4 and HCR,<br>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                                                                                                                                                                          |                |                                                  | α <sub>gap</sub>        | [-]     | 0,5 (1,0) <sup>1)</sup>                         |     |     |            |     |     |
| 1) 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.                                   |                |                                                  |                         |         |                                                 |     |     |            |     |     |
| G&B Fissaggi Injection system Gebofix EPO PLUS RE for concrete                                                                                                                                  |                |                                                  |                         |         |                                                 |     |     | Annex C 27 |     |     |
| Performances<br>Characteristic values of tension and shear loads under seismic action<br>(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  | M27  | M30  |
|-------------------------------------------------------------------------------------------------------------------------|-----------------------------|------|------|------|------|------|------|------|
| Uncracked and cracked concrete under seismic action (performance category C2)<br>for a working life of 50 and 100 years |                             |      |      |      |      |      |      |      |
| All temperature ranges                                                                                                  | $\delta_{N,eq,C2(50\%)} =$  | [mm] | 0,21 | 0,24 | 0,27 | 0,36 | 0,92 | 0,70 |
|                                                                                                                         | $\delta_{N,eq,C2(DLS)}$     |      |      |      |      |      |      |      |
|                                                                                                                         | $\delta_{N,eq,C2(100\%)} =$ | [mm] | 0,54 | 0,51 | 0,54 | 0,63 | 1,70 | 0,92 |
|                                                                                                                         | $\delta_{N,eq,C2(ULS)}$     |      |      |      |      |      |      |      |

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

| Threaded rod                                                                                                            |                             |      | M12 | M16 | M20 | M24  | M27  | M30  |
|-------------------------------------------------------------------------------------------------------------------------|-----------------------------|------|-----|-----|-----|------|------|------|
| Uncracked and cracked concrete under seismic action (performance category C2)<br>for a working life of 50 and 100 years |                             |      |     |     |     |      |      |      |
| All temperature ranges                                                                                                  | $\delta_{V,eq,C2(50\%)} =$  | [mm] | 3,1 | 3,4 | 3,5 | 4,2  | 4,0  | 3,8  |
|                                                                                                                         | $\delta_{V,eq,C2(DLS)}$     |      |     |     |     |      |      |      |
|                                                                                                                         | $\delta_{V,eq,C2(100\%)} =$ | [mm] | 6,0 | 7,6 | 7,3 | 10,9 | 11,1 | 11,2 |
|                                                                                                                         | $\delta_{V,eq,C2(ULS)}$     |      |     |     |     |      |      |      |

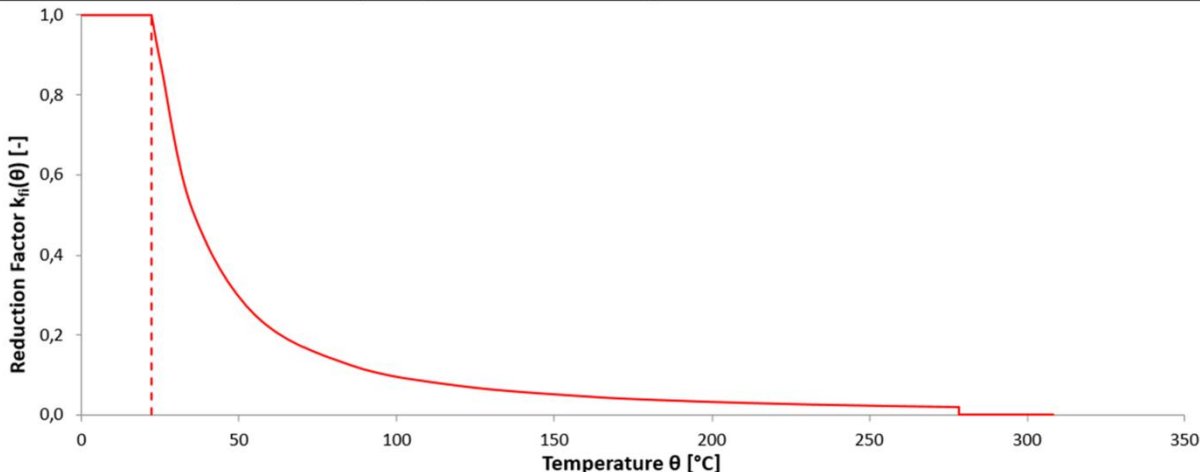
**G&B Fissaggi Injection system Gebofix EPO PLUS RE for concrete**

**Performances**

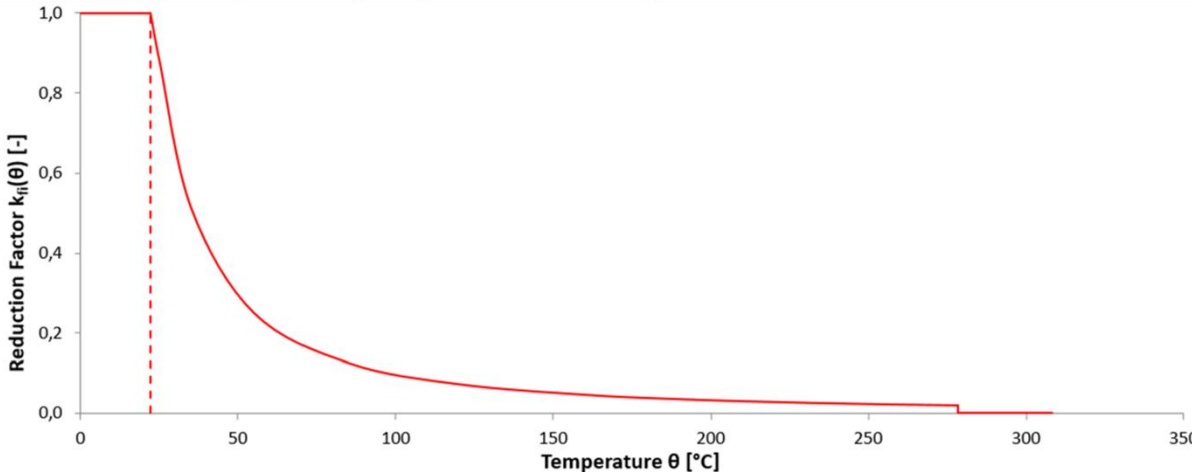
Displacements under seismic action (performance category C2)  
for a working life of 50 and 100 years (threaded rod)

**Annex C 28**

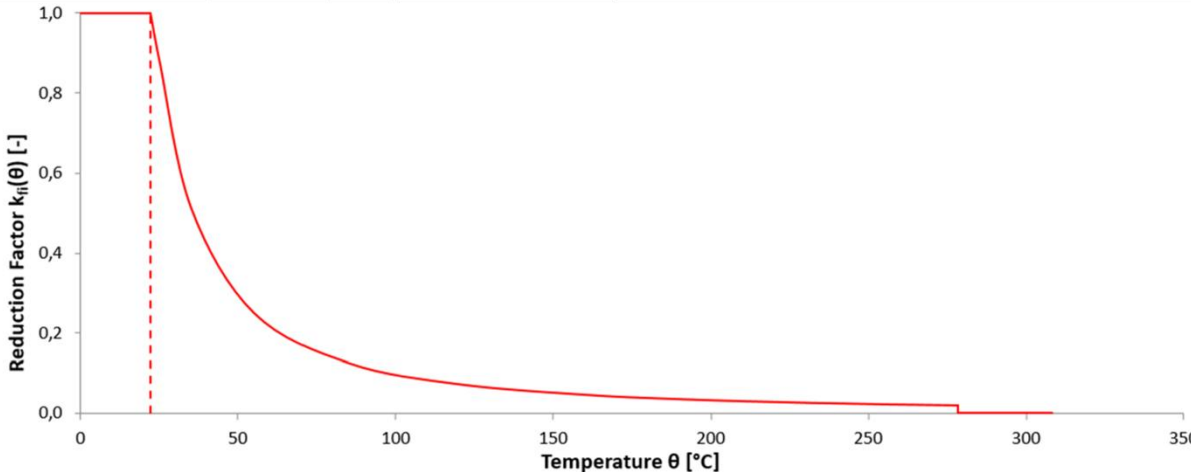
**Table C37: Characteristic values of tension and shear loads under fire exposure in hammer drilled holes (HD), compressed air drilled holes (CD) and in hammer drilled holes with hollow drill bit (HDB)**

| Threaded rod                                                                                                                                                           |                        |                      |                                                           |     | M8                                                  | 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                                                       | $N_{Rk,s,fi}$          | [kN]                 | Fire exposure time [min]                                  | 30  | 1,1                                                 | 1,7 | 3,0 | 5,7  | 8,8        | 12,7 | 16,5 | 20,2 |
|                                                                                                                                                                        |                        |                      |                                                           | 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 $\theta$                            |                        |                      |                                                           |     |                                                     |     |     |      |            |      |      |      |
| Temperature reduction factor                                                                                                                                           | $k_{fi,p}(\theta)$     | [-]                  | $\theta < 23^{\circ}\text{C}$                             |     | 1,0                                                 |     |     |      |            |      |      |      |
|                                                                                                                                                                        |                        |                      | $23^{\circ}\text{C} \leq \theta \leq 278^{\circ}\text{C}$ |     | $150,28 \cdot \theta^{-1,598} \leq 1,0$             |     |     |      |            |      |      |      |
|                                                                                                                                                                        |                        |                      | $\theta > 278^{\circ}\text{C}$                            |     | 0,0                                                 |     |     |      |            |      |      |      |
|                                                                                     |                        |                      |                                                           |     |                                                     |     |     |      |            |      |      |      |
| Characteristic bond resistance for a given temperature ( $\theta$ )                                                                                                    | $\tau_{Rk,fi}(\theta)$ | [N/mm <sup>2</sup> ] |                                                           |     | $k_{fi,p}(\theta) \cdot \tau_{Rk,cr,(C20/25)}^{1)}$ |     |     |      |            |      |      |      |
| Steel failure without lever arm                                                                                                                                        |                        |                      |                                                           |     |                                                     |     |     |      |            |      |      |      |
| Characteristic shear resistance; Steel, Stainless Steel A2, A4 and HCR, strength class 5.8 resp. 50 and higher                                                         | $V_{Rk,s,fi}$          | [kN]                 | Fire exposure time [min]                                  | 30  | 1,1                                                 | 1,7 | 3,0 | 5,7  | 8,8        | 12,7 | 16,5 | 20,2 |
|                                                                                                                                                                        |                        |                      |                                                           | 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  |
| Steel failure with lever arm                                                                                                                                           |                        |                      |                                                           |     |                                                     |     |     |      |            |      |      |      |
| Characteristic bending moment; Steel, Stainless Steel A2, A4 and HCR, strength class 5.8 resp. 50 and higher                                                           | $M^0_{Rk,s,fi}$        | [Nm]                 | Fire exposure time [min]                                  | 30  | 1,1                                                 | 2,2 | 4,7 | 12,0 | 23,4       | 40,4 | 59,9 | 81,0 |
|                                                                                                                                                                        |                        |                      |                                                           | 60  | 0,9                                                 | 1,8 | 3,5 | 9,0  | 17,5       | 30,3 | 44,9 | 60,7 |
|                                                                                                                                                                        |                        |                      |                                                           | 90  | 0,7                                                 | 1,3 | 2,5 | 6,3  | 12,3       | 21,3 | 31,6 | 42,7 |
|                                                                                                                                                                        |                        |                      |                                                           | 120 | 0,5                                                 | 1,0 | 1,8 | 4,7  | 9,1        | 15,7 | 23,3 | 31,5 |
| 1) $\tau_{Rk,cr,(C20/25)}$ characteristic bond resistance for cracked concrete for concrete strength class C20/25 for the relevant temperature range and working life. |                        |                      |                                                           |     |                                                     |     |     |      |            |      |      |      |
| G&B Fissaggi Injection system Gebofix EPO PLUS RE for concrete                                                                                                         |                        |                      |                                                           |     |                                                     |     |     |      | Annex C 29 |      |      |      |
| Performances<br>Characteristic values of tension and shear loads under fire exposure (threaded rod)                                                                    |                        |                      |                                                           |     |                                                     |     |     |      |            |      |      |      |

**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                                                                                                                                          |                        |                      |                                                           |     | BI-M6                                               | BI-M8 | BI-M10 | BI-M12     | BI-M16 | BI-M20 |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|----------------------|-----------------------------------------------------------|-----|-----------------------------------------------------|-------|--------|------------|--------|--------|
| Steel failure                                                                                                                                                          |                        |                      |                                                           |     |                                                     |       |        |            |        |        |
| Characteristic tension resistance; Steel, Stainless Steel A4 and HCR, strength class 5.8 and 8.8 resp. 70                                                              | $N_{Rk,s,fi}$          | [kN]                 | Fire exposure time [min]                                  | 30  | 0,3                                                 | 1,1   | 1,7    | 3,0        | 5,7    | 8,8    |
|                                                                                                                                                                        |                        |                      |                                                           | 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    |
|                                                                                                                                                                        |                        |                      |                                                           | 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 $\theta$                            |                        |                      |                                                           |     |                                                     |       |        |            |        |        |
| Temperature reduction factor                                                                                                                                           | $k_{fi,p}(\theta)$     | [-]                  | $\theta < 23^{\circ}\text{C}$                             |     | 1,0                                                 |       |        |            |        |        |
|                                                                                                                                                                        |                        |                      | $23^{\circ}\text{C} \leq \theta \leq 278^{\circ}\text{C}$ |     | $150,28 \cdot \theta^{-1,598} \leq 1,0$             |       |        |            |        |        |
|                                                                                                                                                                        |                        |                      | $\theta > 278^{\circ}\text{C}$                            |     | 0,0                                                 |       |        |            |        |        |
|                                                                                     |                        |                      |                                                           |     |                                                     |       |        |            |        |        |
| Characteristic bond resistance for a given temperature ( $\theta$ )                                                                                                    | $\tau_{Rk,fi}(\theta)$ | [N/mm <sup>2</sup> ] |                                                           |     | $k_{fi,p}(\theta) \cdot \tau_{Rk,cr,(C20/25)}^{1)}$ |       |        |            |        |        |
| Steel failure without lever arm                                                                                                                                        |                        |                      |                                                           |     |                                                     |       |        |            |        |        |
| Characteristic shear resistance; Steel, Stainless Steel A4 and HCR, strength class 5.8 and 8.8 resp. 70                                                                | $V_{Rk,s,fi}$          | [kN]                 | Fire exposure time [min]                                  | 30  | 0,3                                                 | 1,1   | 1,7    | 3,0        | 5,7    | 8,8    |
|                                                                                                                                                                        |                        |                      |                                                           | 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    |
|                                                                                                                                                                        |                        |                      |                                                           | 120 | 0,1                                                 | 0,5   | 0,8    | 1,2        | 2,2    | 3,4    |
| Steel failure with lever arm                                                                                                                                           |                        |                      |                                                           |     |                                                     |       |        |            |        |        |
| Characteristic bending moment; Steel, Stainless Steel A4 and HCR, strength class 5.8 and 8.8 resp. 70                                                                  | $M^0_{Rk,s,fi}$        | [Nm]                 | Fire exposure time [min]                                  | 30  | 0,2                                                 | 1,1   | 2,2    | 4,7        | 12,0   | 23,4   |
|                                                                                                                                                                        |                        |                      |                                                           | 60  | 0,2                                                 | 0,9   | 1,8    | 3,5        | 9,0    | 17,5   |
|                                                                                                                                                                        |                        |                      |                                                           | 90  | 0,1                                                 | 0,7   | 1,3    | 2,5        | 6,3    | 12,3   |
|                                                                                                                                                                        |                        |                      |                                                           | 120 | 0,1                                                 | 0,5   | 1,0    | 1,8        | 4,7    | 9,1    |
| 1) $\tau_{Rk,cr,(C20/25)}$ characteristic bond resistance for cracked concrete for concrete strength class C20/25 for the relevant temperature range and working life. |                        |                      |                                                           |     |                                                     |       |        |            |        |        |
| G&B Fissaggi Injection system Gebofix EPO PLUS RE for concrete                                                                                                         |                        |                      |                                                           |     |                                                     |       |        | Annex C 30 |        |        |
| Performances<br>Characteristic values of tension and shear loads under fire exposure (internal threaded anchor rod )                                                   |                        |                      |                                                           |     |                                                     |       |        |            |        |        |

**Table C39: 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)**

| Reinforcing bar                                                                                                                                                        |                        |         |                                                           | Ø 8 | Ø 10                                             | Ø 12 | Ø 14 | Ø 16 | Ø 20 | Ø 24 | Ø 25       | Ø 28 | Ø 32 |      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|---------|-----------------------------------------------------------|-----|--------------------------------------------------|------|------|------|------|------|------------|------|------|------|
| Steel failure                                                                                                                                                          |                        |         |                                                           |     |                                                  |      |      |      |      |      |            |      |      |      |
| Characteristic tension resistance; BSt 500                                                                                                                             | $N_{Rk,s,fi}$          | [kN]    | Fire exposure time [min]                                  | 30  | 0,5                                              | 1,2  | 2,3  | 3,1  | 4,0  | 6,3  | 9,0        | 9,8  | 12,3 | 16,1 |
|                                                                                                                                                                        |                        |         |                                                           | 60  | 0,5                                              | 1,0  | 1,7  | 2,3  | 3,0  | 4,7  | 6,8        | 7,4  | 9,2  | 12,1 |
|                                                                                                                                                                        |                        |         |                                                           | 90  | 0,4                                              | 0,8  | 1,5  | 2,0  | 2,6  | 4,1  | 5,9        | 6,4  | 8,0  | 10,5 |
|                                                                                                                                                                        |                        |         |                                                           | 120 | 0,3                                              | 0,6  | 1,1  | 1,5  | 2,0  | 3,1  | 4,5        | 4,9  | 6,2  | 8,0  |
| Characteristic bond resistance in cracked and uncracked concrete C20/25 up to C50/60 under fire conditions for a given temperature $\theta$                            |                        |         |                                                           |     |                                                  |      |      |      |      |      |            |      |      |      |
| Temperature reduction factor                                                                                                                                           | $k_{fi,p}(\theta)$     | [-]     | $\theta < 25^{\circ}\text{C}$                             |     | 1,0                                              |      |      |      |      |      |            |      |      |      |
|                                                                                                                                                                        |                        |         | $25^{\circ}\text{C} \leq \theta \leq 278^{\circ}\text{C}$ |     | $176,37 \cdot \theta^{-1,598} \leq 1,0$          |      |      |      |      |      |            |      |      |      |
|                                                                                                                                                                        |                        |         | $\theta > 278^{\circ}\text{C}$                            |     | 0,0                                              |      |      |      |      |      |            |      |      |      |
|                                                                                     |                        |         |                                                           |     |                                                  |      |      |      |      |      |            |      |      |      |
| 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 arm                                                                                                                                        |                        |         |                                                           |     |                                                  |      |      |      |      |      |            |      |      |      |
| Characteristic shear resistance; BSt 500                                                                                                                               | $V_{Rk,s,fi}$          | [kN]    | Fire exposure time [min]                                  | 30  | 0,5                                              | 1,2  | 2,3  | 3,1  | 4,0  | 6,3  | 9,0        | 9,8  | 12,3 | 16,1 |
|                                                                                                                                                                        |                        |         |                                                           | 60  | 0,5                                              | 1,0  | 1,7  | 2,3  | 3,0  | 4,7  | 6,8        | 7,4  | 9,2  | 12,1 |
|                                                                                                                                                                        |                        |         |                                                           | 90  | 0,4                                              | 0,8  | 1,5  | 2,0  | 2,6  | 4,1  | 5,9        | 6,4  | 8,0  | 10,5 |
|                                                                                                                                                                        |                        |         |                                                           | 120 | 0,3                                              | 0,6  | 1,1  | 1,5  | 2,0  | 3,1  | 4,5        | 4,9  | 6,2  | 8,0  |
| Steel failure with lever arm                                                                                                                                           |                        |         |                                                           |     |                                                  |      |      |      |      |      |            |      |      |      |
| Characteristic bending moment; BSt 500                                                                                                                                 | $M^0_{Rk,s,fi}$        | [Nm]    | Fire exposure time [min]                                  | 30  | 0,6                                              | 1,8  | 4,1  | 6,5  | 9,7  | 18,8 | 32,6       | 36,8 | 51,7 | 77,2 |
|                                                                                                                                                                        |                        |         |                                                           | 60  | 0,5                                              | 1,5  | 3,1  | 4,8  | 7,2  | 14,1 | 24,4       | 27,6 | 38,8 | 57,9 |
|                                                                                                                                                                        |                        |         |                                                           | 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) $\tau_{Rk,cr,(C20/25)}$ characteristic bond resistance for cracked concrete for concrete strength class C20/25 for the relevant temperature range and working life. |                        |         |                                                           |     |                                                  |      |      |      |      |      |            |      |      |      |
| G&B Fissaggi Injection system Gebofix EPO PLUS RE for concrete                                                                                                         |                        |         |                                                           |     |                                                  |      |      |      |      |      | Annex C 31 |      |      |      |
| Performances<br>Characteristic values of tension and shear loads under fire exposure (reinforcing bar)                                                                 |                        |         |                                                           |     |                                                  |      |      |      |      |      |            |      |      |      |