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European Technical Assessment

ETA 23/0310 of 29/01/2026

General Part

Technical Assessment Body issuing the European Technical Assessment:

Technical and Test Institute for Construction Prague

Trade name of the construction product

WB300
 WB300 Desert
 WB300W
 WB300T
 WB300T Desert

Product family to which the construction product belongs

Bonded fasteners for use in concrete

Manufacturer

J. van Walraven Holding B.V.
 Industrieweg 5
 3641 RK Mijdrecht
 The Netherlands

Manufacturing plant

Walraven Factory A1

This European Technical Assessment contains

37 pages including 34 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
 Bonded fasteners and bonded expansion fasteners for use in concrete

This version replaces

ETA 23/0310 issued on 28/11/2024

Translations of this European Technical Assessment in other languages shall fully correspond to the original issued document and should be identified as such.

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Specific parts

1. Technical description of the product

The WB300, WB300 Desert, WB300W (faster curing time) and WB300T, WB300T Desert (extended curing time) with steel elements is bonded anchor (injection type).

Steel elements can be galvanized or stainless steel threaded rods or rebars.

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

The illustration and the description of the product are given in Annex A.

2. Specification of the intended use in accordance with the applicable European Assessment Document (hereinafter EAD)

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 provisions made in this European Technical Assessment are based on an assumed working life of the anchor of 50 years and 100 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the 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 13 |
| Characteristic resistance to shear load (static and quasi-static loading) | See Annex C 14 to C 16 |
| Displacements under short-term and long-term loading | See Annex C 17 |
| Characteristic resistance for seismic performance categories C1 and C2 | See Annex C 18 to C 21 |

3.2 Safety in case of fire (BWR 2)

| Essential characteristic | Performance |
|--------------------------|---|
| Reaction to fire | Satisfy the requirements for performance class A1 |
| Resistance to fire | See Annex C 22 to C 24 |

3.3 Hygiene, health and environment (BWR 3)

No performance determined.

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

According to the Decision 96/582/EC of the European Commission the system of assessment verification of constancy of performance (see Annex IX to Regulation (EU) 2024/3110) is system 1.

5. Technical details necessary for the implementation of the AVCP system, as provided in the applicable EAD

The factory production control shall be in accordance with the control plan which is a part of the technical documentation of this European Technical Assessment. The control plan is laid down in the context of the factory production control system operated by the manufacturer and deposited at Technical and Test Institute for Construction Prague. The results of factory production control shall be recorded and evaluated in accordance with the provisions of the control plan.

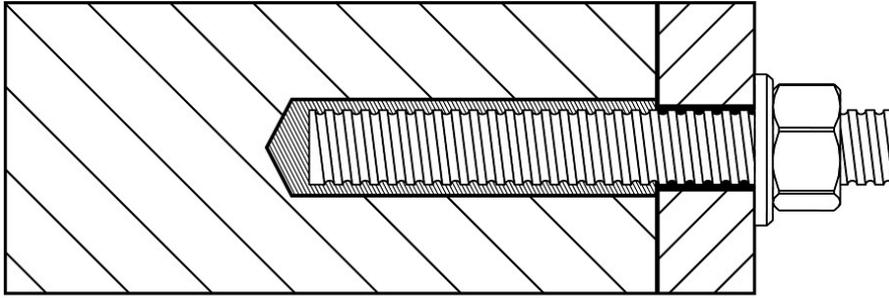
Issued in Prague on 29.01.2026

By

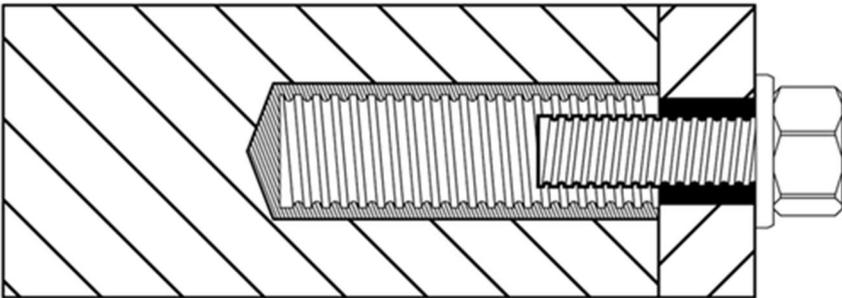
Ing. Jiří Studnička, Ph.D.
Head of the Technical Assessment Body



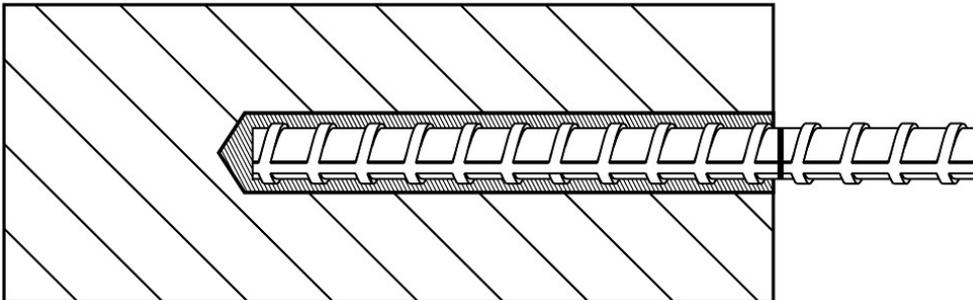
Threaded rod



Threaded socket



Reinforcing bar



WB300, WB300W, WB300T, WB300 Desert, WB300T Desert

Product description
Installed conditions

Annex A 1

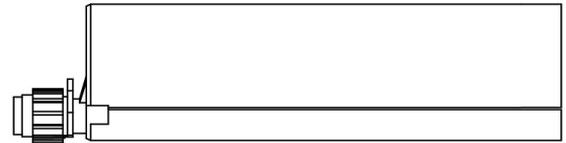
Coaxial cartridge

WB300, Desert, W, T, T Desert
 150 ml
 380 ml
 400 ml
 410 ml
 420 ml



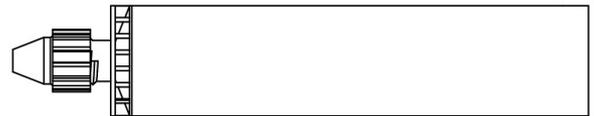
Side by side cartridge

WB300, Desert, W, T, T Desert
 345 ml
 825 ml



Two part foil in a single piston component cartridge

WB300, Desert, W, T, T Desert
 170 ml
 300 ml
 550 ml
 850 ml

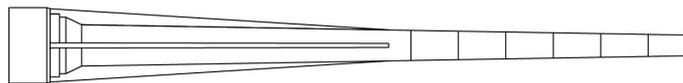


Marking of the mortar cartridges

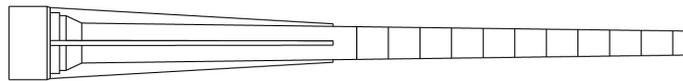
Identifying mark of the producer, Trade name, Charge code number, Storage life, Curing and processing time

Mixing nozzle

Standard Nozzle



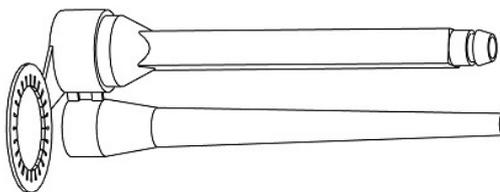
Wide-outlet Nozzle



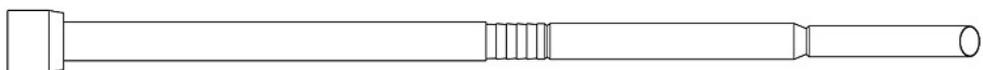
Mixer Nozzle EF



Short Nozzle



Long Nozzle



Nozzle 850

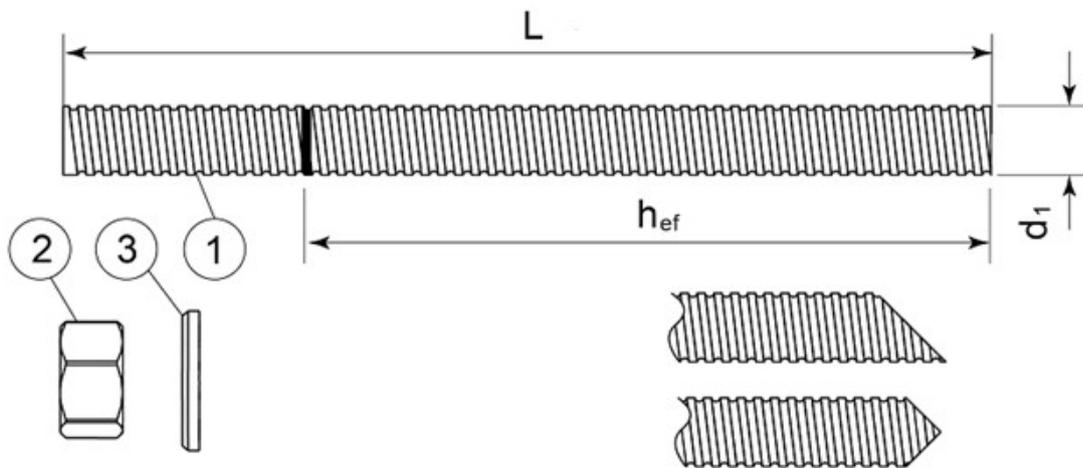


WB300, WB300W, WB300T, WB300 Desert, WB300T Desert

Product description
 Injection system

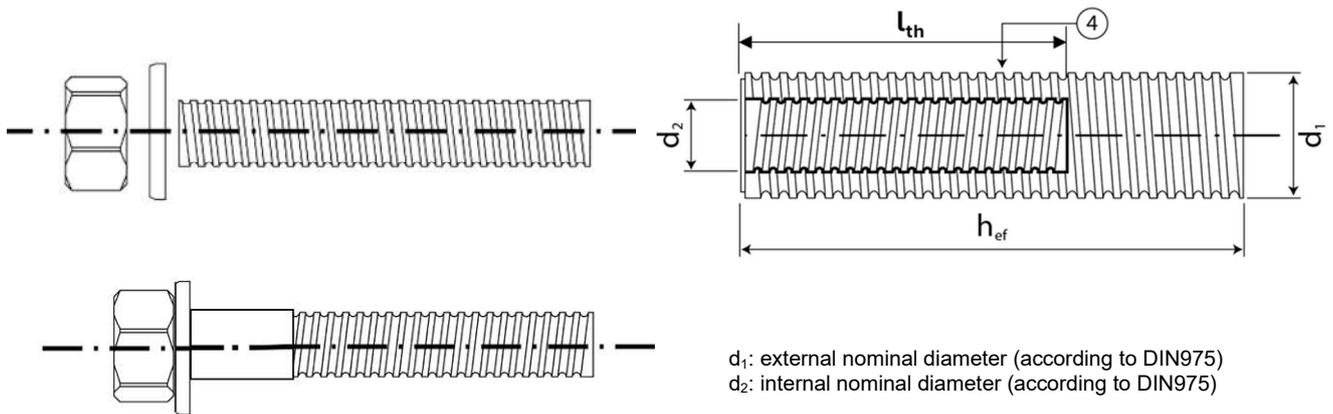
Annex A 2

Threaded rod M8, M10, M12, M16, M20, M24



Standard commercial threaded rod with marked embedment depth.

Threaded socket M6, M8, M10, M12, M16



d_1 : external nominal diameter (according to DIN975)
 d_2 : internal nominal diameter (according to DIN975)

Standard commercial threaded socket.

WB300, WB300W, WB300T, WB300 Desert, WB300T Desert

Product description
 Threaded rod
 Threaded socket

Annex A 3

| Part | Designation | Material |
|---|--|---|
| Steel, zinc plated $\geq 5 \mu\text{m}$ acc. to EN ISO 4042 or Steel, Hot-dip galvanized $\geq 40 \mu\text{m}$ acc. to EN ISO 1461 and EN ISO 10684 or Steel, zinc diffusion coating $\geq 15 \mu\text{m}$ acc. to EN 13811 | | |
| 1 | Anchor rod | Steel, EN 10087 or EN 10263 Property class 4.6, 4.8, 5.6, 5.8, 8.8, 10.9* EN ISO 898-1 |
| 2 | Hexagon nut EN ISO 4032 | According to threaded rod, EN 20898-2 |
| 3 | Washer EN ISO 887, EN ISO 7089, EN ISO 7093 or EN ISO 7094 | According to threaded rod |
| 4 | Threaded socket | Steel, EN 10087 or EN 10263 Property class 4.6, 4.8, 5.6, 5.8, 8.8, 10.9* EN ISO 898-1 |
| Stainless steel | | |
| 1 | Anchor rod | Material: A2-70, A4-70, A4-80, EN ISO 3506 |
| 2 | Hexagon nut EN ISO 4032 | According to threaded rod |
| 3 | Washer EN ISO 887, EN ISO 7089, EN ISO 7093 or EN ISO 7094 | According to threaded rod |
| 4 | Threaded socket | Material: A2-70, A4-70, A4-80, EN ISO 3506 |
| High corrosion resistant steel | | |
| 1 | Anchor rod | Material: 1.4529, 1.4565, EN 10088-1 |
| 2 | Hexagon nut EN ISO 4032 | According to threaded rod |
| 3 | Washer EN ISO 887, EN ISO 7089, EN ISO 7093 or EN ISO 7094 | According to threaded rod |
| 4 | Threaded socket | Material: 1.4529, 1.4565, EN 10088-1 |

*Galvanized rod of high strength are sensitive to hydrogen induced brittle failure

WB300, WB300W, WB300T, WB300 Desert, WB300T Desert

Product description
Materials

Annex A 4

Rebar Ø8, Ø10, Ø12, Ø16, Ø20, Ø25



Standard commercial reinforcing bar with marked embedment depth

| Product form | | Bars and de-coiled rods | |
|--|-----------------------|--------------------------------|-----------------------|
| Class | | B | C |
| Characteristic yield strength f_{yk} or $f_{0,2k}$ (MPa) | | 400 to 600 | |
| Minimum value of $k = (f_t/f_y)_k$ | | $\geq 1,08$ | $\geq 1,15$ < 1,35 |
| Characteristic strain at maximum force ϵ_{uk} (%) | | $\geq 5,0$ | $\geq 7,5$ |
| Bendability | | Bend/Rebend test | |
| Maximum deviation from nominal mass (individual bar) (%) | Nominal bar size (mm) | $\pm 6,0$ $\pm 4,5$ | |
| | ≤ 8 > 8 | | |
| Bond: Minimum relative rib area, $f_{R,min}$ | Nominal bar size (mm) | 0,040 0,056 | |
| | 8 to 12 > 12 | | |

WB300, WB300W, WB300T, WB300 Desert, WB300T Desert

Product description
Rebars and materials

Annex A 5

Specifications of intended use

Anchorage subject to:

- Static and quasi-static load:
 - threaded rod
 - threaded socket
 - rebar
- Fire exposure
- Seismic actions category C1: only threaded rod size M8, M10, M12, M16, M20, M24
- Seismic actions category C2: only threaded rod size M12, M16

Base materials

- Cracked and uncracked concrete
- Reinforced or unreinforced normal weight concrete without fibres of strength class C20/25 at minimum and C50/60 at maximum according EN 206:2013 + A2:2021.

Temperature range:

- -40°C to +80°C (max. short. term temperature +80°C and max. long term temperature +50°C)

Use conditions (Environmental conditions)

- Structures subject to dry, internal conditions (all materials)
- For all other conditions according to EN 1993-1-4 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

Concrete conditions:

- I1 – installation in dry or wet (water saturated) concrete and use in service in dry or wet concrete.
- I2 – installation in water-filled (not sea water) and use in service in dry or wet concrete

Design:

- The anchorages are designed in accordance with the EN 1992-4 under the responsibility of an engineer experienced in anchorages and concrete work.
- Verifiable calculation notes and drawings are prepared taking account of the loads to be anchored. The position of the anchor is indicated on the design drawings.
- Anchorages under seismic actions (cracked concrete) have to be designed in accordance with EN 1992-4.
- For applications with resistance to fire exposure, the fasteners are designed in accordance with EOTA TR 082 "Design of bonded fasteners in concrete under fire conditions"

Installation:

- Hole drilling by hammer drilling, dustless drilling or diamond core drilling mode.
- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.

Installation direction:

- D3 – downward and horizontal and upwards (e.g. overhead) installation

WB300, WB300W, WB300T, WB300 Desert, WB300T Desert

Intended use
Specifications

Annex B 1

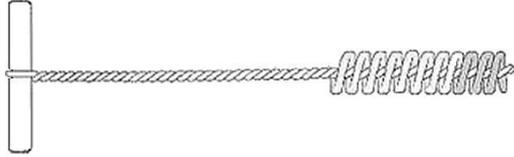
HDB – Hollow Drill Bit System

Heller Duster Expert hollow drill bit
 SDS-Plus ≤ 16mm
 SDS-Max ≥ 16mm

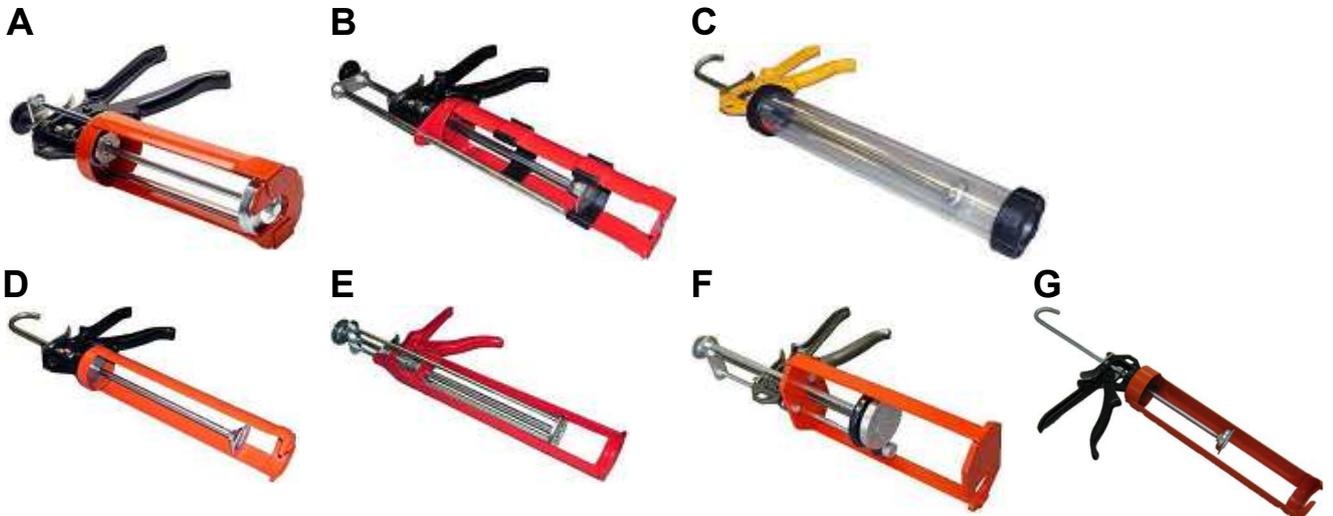


Class M vacuum
 Minimum flow rate 266 m³/h (74 l/s)

Cleaning brush



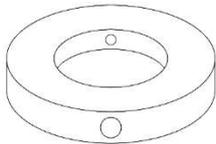
Applicator gun



| Applicator gun | A | B | C | D | E | F | G |
|----------------|---|-----------------------|---|--------------------------------|------------------|-----------------------|-----------------------|
| Cartridge | Coaxial 380ml 400ml 410ml 420ml | Side by side 345ml | Foil capsule 170ml 300ml 550ml | Foil capsule 170ml 300ml | Coaxial 150ml | Side by side 825ml | Foil capsule 850ml |

Gap filling washer

Filling washer and mixer reduction nozzle for filling gap between anchor and fixture



WB300, WB300W, WB300T, WB300 Desert, WB300T Desert

Intended use
 Installation tools

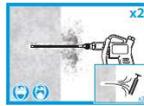
Annex B 2

SOLID SUBSTRATE INSTALLATION METHOD

1. Using the SDS hammer drill (HD) in rotary hammer mode for drilling, with a carbide tipped drill bit of the appropriate size, drill the hole to the specified hole diameter and depth.



2. Select the correct air lance, insert to the bottom of the hole, and depress the trigger for 2 seconds. The compressed air must be clean and free from water and oil, with a minimum pressure of 90 psi (6 bar). A manual pump may be used for certain diameters and depths; check the approval document. Perform the blowing operation twice.



3. Select the correct size hole cleaning brush. Ensure that the brush is in good condition and of the correct diameter. Insert the brush to the bottom of the hole, using a brush extension if needed to reach the bottom. Withdraw with a twisting motion. There should be a positive interaction between the bristles of the brush and the sides of the drilled hole. Perform the brushing operation twice.



4. Repeat step 2 (blowing operation x2)

5. Repeat step 3 (brushing operation x2)

6. Repeat step 2 (blowing operation x2)

7. Select the most appropriate static mixer nozzle, checking that the mixing elements are present and fit for purpose. Never modify the mixer. Attach the mixer nozzle to the cartridge. Check the dispensing tool is in good working order. Place the cartridge into the dispensing tool.



8. Extrude some resin to waste until an even coloured mixture is achieved. The cartridge is now ready for use.



9. Insert the mixing nozzle to the bottom of the hole. Extrude the resin and slowly withdraw the nozzle from the hole. Ensure no air voids are created as the nozzle is withdrawn. Inject resin until the hole is approximately 3/4 full and remove the nozzle from the hole.



10. Select the steel anchor element ensuring it is free from oil or other contaminants, and mark with the required embedment depth. Insert the steel element into the hole using a back and forth twisting motion to ensure complete cover, until it reaches the bottom of the hole. Excess resin will be expelled from the hole evenly around the steel element and there shall be no gaps between the anchor element and the wall of the drilled hole.



11. Clean any excess resin from around the mouth of the hole.

12. Refer to the working and loading times within the tables to determine the appropriate cure time.



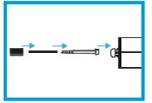
13. Position the fixture and tighten the anchor to the appropriate installation torque. Do not over-torque the anchor, as this could adversely affect its performance.



DEEP EMBEDMENT & OVERHEAD INSTALLATION METHOD

1a. Perform steps 1-8 under "solid substrate installation method".

2a. Attach the correct diameter and length extension tube to the nozzle. Select the correct diameter resin stopper for the application, then push and screw the extension tube into the resin stopper. This is held in place with a coarse internal thread. The resin stopper is a reusable accessory.



3a. Push the resin stopper and extension tube to the back of the drill hole.

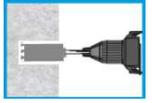
4a. Ensure the extension tube is angled to allow free movement of the resin stopper as the resin is extruded.



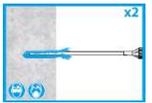
5a. Continue from step 10 under "solid substrate installation method".

DIAMOND CORE DRILLING

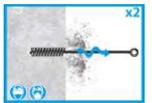
1b. Using a diamond core drill (DD) and following the manufacturer's instructions, drill the specified diameter hole to the correct embedment depth then remove the concrete core.



2b. Starting from the back of the hole, flush with pressurised water a minimum of two times and until there is only clean water.



3b. Select the correct size hole cleaning brush. Ensure that the brush is in good condition and of the correct diameter. Insert the brush to the bottom of the hole, using a brush extension if needed to reach the bottom. Withdraw with a twisting motion. There should be a positive interaction between the bristles of the brush and the sides of the drilled hole. Perform the brushing operation twice.

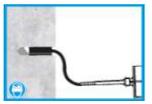


4b. Repeat step 2b (flushing operation x2).

5b. Repeat step 3b (brushing operation x2).



6a. Using the correct air lance and starting from the back of the hole and withdrawing, perform a minimum of two blowing operations and ensure that the hole is clear of debris and excess water.



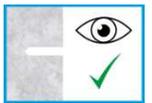
7a. Continue from step 7 under "solid substrate installation method".

DUSTLESS DRILLING

1c. Using the specified hollow drill bit (HDB) and vacuum system and following the manufacturer's instructions, drill the specified diameter hole to the correct embedment depth. Ensure that the minimum vacuum specifications are met and that the vacuum is turned on.



2c. The hole should be inspected to ensure the system has worked correctly. If the hole is clear of dust and debris, no further cleaning is required.



3c. Continue from step 7 under "solid substrate installation method".



WB300, WB300W, WB300T, WB300 Desert, WB300T Desert

Intended use
Installation procedure

Annex B 3

Table B1: Installation parameters of threaded rod

| Size | | M8 | M10 | M12 | M16 | M20 | M24 |
|--------------------------------------|------------------------|--------------------------------|------------|------------|-----------------|------------|------------|
| Nominal drill hole diameter | $\varnothing d_0$ [mm] | 10 | 12 | 14 | 18 | 22 | 26 |
| Diameter of cleaning brush | d_b [mm] | 14 | 14 | 20 | 20 | 29 | 29 |
| Manual pump cleaning | | $h_{ef} < 300$ mm | | | | | |
| Torque moment | $\max T_{fix}$ [Nm] | 10 | 20 | 40 | 80 | 120 | 160 |
| Depth of drill hole for $h_{ef,min}$ | h_{ef} [mm] | 60 | 60 | 70 | 80 | 90 | 96 |
| Depth of drill hole for $h_{ef,max}$ | h_{ef} [mm] | 160 | 200 | 240 | 320 | 400 | 480 |
| Depth of drill hole | h_0 [mm] | $h_{ef}+5$ | $h_{ef}+5$ | $h_{ef}+5$ | $h_{ef}+5$ | $h_{ef}+5$ | $h_{ef}+5$ |
| Minimum edge distance | c_{min} [mm] | 40 | 40 | 50 | 70 | 80 | 100 |
| Minimum spacing | s_{min} [mm] | 40 | 40 | 50 | 70 | 80 | 100 |
| Minimum thickness of member | h_{min} [mm] | $h_{ef} + 30$ mm \geq 100 mm | | | $h_{ef} + 2d_0$ | | |

Table B2: Installation parameters of threaded socket

| Size | | M6 | M8 | M10 | M12 | M16 |
|-------------------------------------|------------------------|--------------------------------|------------|------------|-----------------|------------|
| Nominal drill hole diameter | $\varnothing d_0$ [mm] | 12 | 14 | 18 | 22 | 26 |
| Cleaning brush | | 14 | 20 | 20 | 29 | 29 |
| Nominal Internal diameter of socket | d_2 [mm] | M6 | M8 | M10 | M12 | M16 |
| Nominal external diameter of socket | d_1 [mm] | M10 | M12 | M16 | M20 | M24 |
| Torque moment | $\max T_{fix}$ [Nm] | 10 | 10 | 20 | 40 | 80 |
| Embedment depth for $h_{ef,min}$ | h_{ef} [mm] | 60 | 70 | 80 | 90 | 96 |
| Embedment depth for $h_{ef,max}$ | h_{ef} [mm] | 200 | 240 | 320 | 400 | 480 |
| Threaded engagement length min/max | l_{th} [mm] | 8/20 | 8/20 | 10/25 | 12/30 | 16/40 |
| Depth of drill hole | h_0 [mm] | $h_{ef}+5$ | $h_{ef}+5$ | $h_{ef}+5$ | $h_{ef}+5$ | $h_{ef}+5$ |
| Minimum edge distance | c_{min} [mm] | 40 | 40 | 40 | 50 | 50 |
| Minimum spacing | s_{min} [mm] | 40 | 40 | 40 | 50 | 50 |
| Minimum thickness of member | h_{min} [mm] | $h_{ef} + 30$ mm \geq 100 mm | | | $h_{ef} + 2d_0$ | |

Table B3: Installation parameters of rebar

| Size | | $\varnothing 8$ | $\varnothing 10$ | $\varnothing 12$ | $\varnothing 16$ | $\varnothing 20$ | $\varnothing 25$ | | |
|--------------------------------------|------------------------|--------------------------------|------------------|------------------|------------------|------------------|------------------|-----|----|
| Nominal drill hole diameter | $\varnothing d_0$ [mm] | 12 | 14 | 16 | 20 | 22* | 25 | 30* | 32 |
| Diameter of cleaning brush | d_b [mm] | 14 | 14 | 19 | 22 | 29 | 40 | | |
| Manual pump cleaning | | $h_{ef} < 300$ mm | | | | | | | |
| Depth of drill hole for $h_{ef,min}$ | h_{ef} [mm] | 60 | 60 | 70 | 80 | 90 | 100 | | |
| Depth of drill hole for $h_{ef,max}$ | h_{ef} [mm] | 160 | 200 | 240 | 320 | 400 | 480 | | |
| Depth of drill hole | h_0 [mm] | $h_{ef}+5$ | $h_{ef}+5$ | $h_{ef}+5$ | $h_{ef}+5$ | $h_{ef}+5$ | $h_{ef}+5$ | | |
| Minimum edge distance | c_{min} [mm] | 40 | 40 | 50 | 70 | 80 | 100 | | |
| Minimum spacing | s_{min} [mm] | 40 | 40 | 50 | 70 | 80 | 100 | | |
| Minimum thickness of member | h_{min} [mm] | $h_{ef} + 30$ mm \geq 100 mm | | | | $h_{ef} + 2d_0$ | | | |

* Only for hammer and dustless drilling

WB300, WB300W, WB300T, WB300 Desert, WB300T Desert

Intended use
Installation parameters

Annex B 4

Table B4.1: Minimum curing time WB300

| Resin cartridge temperature [°C] | T Work [mins] | Base material Temperature [°C] | T Load [mins] |
|----------------------------------|---------------|--------------------------------|---------------|
| min +5 | 18 | min +5 | 145 |
| +5 to +10 | 10 | +5 to +10 | |
| +10 to +20 | 6 | +10 to +20 | 85 |
| +20 to +25 | 5 | +20 to +25 | 50 |
| +25 to +30 | 4 | +25 to +30 | 40 |
| +30 | | +30 | 35 |

Table B4.2: Minimum curing time WB300 Desert

| Resin cartridge temperature [°C] | T Work [mins] | Base material Temperature [°C] | T Load [mins] |
|----------------------------------|---------------|--------------------------------|---------------|
| +20 to +25 | 5 | +20 to +25 | 50 |
| +25 to +30 | 4 | +25 to +30 | 40 |
| +30 | | +30 | 35 |

Table B4.3: Minimum curing time WB300W

| Resin cartridge temperature [°C] | T Work [mins] | Base material Temperature [°C] | T Load [mins] |
|----------------------------------|---------------|--------------------------------|---------------|
| +20 | 90 | -20 to -15 ¹⁾ | 110 hours |
| +20 | 35 | -15 to -10 ¹⁾ | 55 hours |
| +5 | 10 | -10 to -5 | 30 hours |
| +5 | 3,5 | -5 to 0 | 9 hours |
| +5 | 2 | 0 to +5 | 125 |
| +5 to +10 | 2 | +5 to +10 | 60 |
| +10 to +20 | 2 | +10 to +20 | 40 |
| +20 to +25 | 1,5 | +20 to +25 | 20 |
| +25 to +30 | 1 | +25 to +30 | 15 |
| +30 | 1 | +30 | 10 |

¹⁾ characteristic values of resistance see Annexes C 3, C 5, C 7, C 9, C 11, C 13

Table B4.4: Minimum curing time WB300T

| Resin cartridge temperature [°C] | T Work [mins] | Base material Temperature [°C] | T Load [mins] |
|----------------------------------|---------------|--------------------------------|---------------|
| min +10 | 30 | min +10 | 5 hours |
| +10 to +20 | 15 | +10 to +20 | |
| +20 to +25 | 10 | +20 to +25 | 145 |
| +25 to +30 | 7,5 | +25 to +30 | 85 |
| +30 to +35 | 5 | +30 to +35 | 50 |
| +35 to +40 | 3,5 | +35 to +40 | 40 |
| +40 to +45 | 2,5 | +40 to +45 | 35 |
| +45 | | +45 | 12 |

Table B4.5: Minimum curing time WB300T Desert

| Resin cartridge temperature [°C] | T Work [mins] | Base material Temperature [°C] | T Load [mins] |
|----------------------------------|---------------|--------------------------------|---------------|
| +20 to +25 | 10 | +20 to +25 | 145 |
| +25 to +30 | 7,5 | +25 to +30 | 85 |
| +30 to +35 | 5 | +30 to +35 | 50 |
| +35 to +40 | 3,5 | +35 to +40 | 40 |
| +40 to +45 | 2,5 | +40 to +45 | 35 |
| +45 | | +45 | 12 |

T Work is typical gel time at highest base material temperature in the range.

T Load is minimum set time required until load can be applied at the lowest temperature in the range.

WB300, WB300W, WB300T, WB300 Desert, WB300T Desert

Intended use
Curing time

Annex B 5

Table C1: Design method EN 1992-4
Steel failure - Characteristic values of resistance to tension load of threaded rod

| Steel failure – Characteristic resistance | | | | | | | | | |
|---|---------------|------|------|-----|-----|-----|-----|-----|--|
| Size | | | M8 | M10 | M12 | M16 | M20 | M24 | |
| Steel grade 4.6 | $N_{Rk,s}$ | [kN] | 15 | 23 | 34 | 63 | 98 | 141 | |
| Partial safety factor | γ_{Ms} | [-] | 2,00 | | | | | | |
| Steel grade 4.8 | $N_{Rk,s}$ | [kN] | 15 | 23 | 34 | 63 | 98 | 141 | |
| Partial safety factor | γ_{Ms} | [-] | 1,50 | | | | | | |
| Steel grade 5.6 | $N_{Rk,s}$ | [kN] | 18 | 29 | 42 | 79 | 123 | 177 | |
| Partial safety factor | γ_{Ms} | [-] | 2,00 | | | | | | |
| Steel grade 5.8 | $N_{Rk,s}$ | [kN] | 18 | 29 | 42 | 79 | 123 | 177 | |
| Partial safety factor | γ_{Ms} | [-] | 1,50 | | | | | | |
| Steel grade 8.8 | $N_{Rk,s}$ | [kN] | 29 | 46 | 67 | 126 | 196 | 282 | |
| Partial safety factor | γ_{Ms} | [-] | 1,50 | | | | | | |
| Steel grade 10.9 | $N_{Rk,s}$ | [kN] | 37 | 58 | 84 | 157 | 245 | 353 | |
| Partial safety factor | γ_{Ms} | [-] | 1,40 | | | | | | |
| Stainless steel grade A2-70, A4-70 | $N_{Rk,s}$ | [kN] | 26 | 41 | 59 | 110 | 172 | 247 | |
| Partial safety factor | γ_{Ms} | [-] | 1,87 | | | | | | |
| Stainless steel grade A4-80 | $N_{Rk,s}$ | [kN] | 29 | 46 | 67 | 126 | 196 | 282 | |
| Partial safety factor | γ_{Ms} | [-] | 1,60 | | | | | | |
| High corrosion resistant steel grade 1.4529 | $N_{Rk,s}$ | [kN] | 26 | 41 | 59 | 110 | 172 | 247 | |
| Partial safety factor | γ_{Ms} | [-] | 1,50 | | | | | | |
| High corrosion resistant steel grade 1.4565 | $N_{Rk,s}$ | [kN] | 26 | 41 | 59 | 110 | 172 | 247 | |
| Partial safety factor | γ_{Ms} | [-] | 1,87 | | | | | | |

Table C2: Design method EN 1992-4
Steel failure - Characteristic values of resistance to tension load of threaded socket

| Steel failure – Characteristic resistance | | | | | | | | |
|---|---------------|------|------|----|-----|-----|-----|--|
| Size | | | M6 | M8 | M10 | M12 | M16 | |
| Steel grade 4.6 | $N_{Rk,s}$ | [kN] | 8 | 15 | 23 | 34 | 63 | |
| Partial safety factor | γ_{Ms} | [-] | 2,00 | | | | | |
| Steel grade 4.8 | $N_{Rk,s}$ | [kN] | 8 | 15 | 23 | 34 | 63 | |
| Partial safety factor | γ_{Ms} | [-] | 1,50 | | | | | |
| Steel grade 5.6 | $N_{Rk,s}$ | [kN] | 10 | 18 | 29 | 42 | 79 | |
| Partial safety factor | γ_{Ms} | [-] | 2,00 | | | | | |
| Steel grade 5.8 | $N_{Rk,s}$ | [kN] | 10 | 18 | 29 | 42 | 79 | |
| Partial safety factor | γ_{Ms} | [-] | 1,50 | | | | | |
| Steel grade 8.8 | $N_{Rk,s}$ | [kN] | 16 | 29 | 46 | 67 | 126 | |
| Partial safety factor | γ_{Ms} | [-] | 1,50 | | | | | |
| Steel grade 10.9 | $N_{Rk,s}$ | [kN] | 20 | 37 | 58 | 84 | 157 | |
| Partial safety factor | γ_{Ms} | [-] | 1,33 | | | | | |
| Stainless steel grade A2-70, A4-70 | $N_{Rk,s}$ | [kN] | 14 | 26 | 41 | 59 | 110 | |
| Partial safety factor | γ_{Ms} | [-] | 1,87 | | | | | |
| Stainless steel grade A4-80 | $N_{Rk,s}$ | [kN] | 16 | 29 | 46 | 67 | 126 | |
| Partial safety factor | γ_{Ms} | [-] | 1,60 | | | | | |
| High corrosion resistant steel grade 1.4529 | $N_{Rk,s}$ | [kN] | 14 | 26 | 41 | 59 | 110 | |
| Partial safety factor | γ_{Ms} | [-] | 1,50 | | | | | |
| High corrosion resistant steel grade 1.4565 | $N_{Rk,s}$ | [kN] | 14 | 26 | 41 | 59 | 110 | |
| Partial safety factor | γ_{Ms} | [-] | 1,87 | | | | | |

Table C3: Design method EN 1992-4
Steel failure - Characteristic values of resistance to tension load of rebar

| Steel failure – Characteristic resistance | | | | | | | | | |
|---|---------------|------|-----|-----|-----|-----|-----|-----|--|
| Size | | | Ø8 | Ø10 | Ø12 | Ø16 | Ø20 | Ø25 | |
| Rebar BSt 500 S | $N_{Rk,s}$ | [kN] | 28 | 43 | 62 | 111 | 173 | 270 | |
| Partial safety factor | γ_{Ms} | [-] | 1,4 | | | | | | |

WB300, WB300W, WB300T, WB300 Desert, WB300T Desert

Performances
Steel failure characteristic resistance

Annex C 1

Table C4: Design method EN 1992-4
Characteristic values of resistance to tension load of threaded rod

| Hammer drilling, Dustless drilling | | | | | | | | |
|--|--------------------------------------|----------|------|------|------|------------------------|-----|------|
| Combined pullout and concrete cone failure in concrete C20/25 | | | | | | | | |
| Size | | | M8 | M10 | M12 | M16 | M20 | M24 |
| Characteristic bond resistance in uncracked concrete for a working life of 50 years and 100 years | | | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,ucr}$ [N/mm ²] | | 11,0 | 10,0 | 10,0 | 9,0 | 7,5 | 7,0 |
| Installation safety factor | | | | | | | | |
| Dry, wet concrete | γ_{inst} | [-] | | | | 1,2 | | |
| Hammer drilling - flooded hole | γ_{inst} | [-] | | | | 1,2 | | |
| Dustless drilling - flooded hole | γ_{inst} | [-] | | | | 1,4 | | |
| Characteristic bond resistance in cracked concrete for a working life of 50 years | | | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,cr}$ [N/mm ²] | | 5,0 | 5,0 | 4,5 | 4,0 | 4,0 | 4,0 |
| Characteristic bond resistance in cracked concrete for a working life of 100 years | | | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,cr}$ [N/mm ²] | | 4,0 | 4,0 | 3,5 | 3,5 | 3,5 | 3,5 |
| Installation safety factor | | | | | | | | |
| Dry, wet concrete | γ_{inst} | [-] | | | | 1,2 | | |
| Hammer drilling - flooded hole | γ_{inst} | [-] | | | | 1,2 | | |
| Dustless drilling - flooded hole | γ_{inst} | [-] | | | | 1,4 | | |
| Factor for influence of sustained load for a working life 50 and 100 years | ψ^{0}_{sus} | [-] | | | | 0,75 | | |
| Factor for concrete | C25/30 | ψ_c | [-] | | | | | 1,04 |
| | C30/37 | | | | | | | 1,08 |
| | C35/45 | | | | | | | 1,12 |
| | C40/50 | | | | | | | 1,15 |
| | C45/55 | | | | | | | 1,17 |
| | C50/60 | | | | | | | 1,19 |
| Concrete cone failure | | | | | | | | |
| Factor for concrete cone failure for uncracked concrete | $k_{ucr,N}$ | | | | | 11 | | |
| Factor for concrete cone failure for cracked concrete | $k_{cr,N}$ | | | | | 7,7 | | |
| Edge distance | $c_{cr,N}$ | [mm] | | | | 1,5h _{ef} | | |
| Splitting failure | | | | | | | | |
| Size | | | M8 | M10 | M12 | M16 | M20 | M24 |
| Edge distance | $c_{cr,sp}$ | [mm] | | | | 2 • h _{ef} | | |
| Spacing | $s_{cr,sp}$ | [mm] | | | | 2 • c _{cr,sp} | | |

WB300, WB300W, WB300T, WB300 Desert, WB300T Desert

Performances

Hammer drilling, Dustless drilling
Characteristic resistance for tension loads - threaded rod

Annex C 2

Table C5: Design method EN 1992-4

Characteristic values of resistance to tension load of threaded rod for
WB300W with installation temperature < -10°C

| Hammer drilling, Dustless drilling | | | | | | | | |
|--|-----------------|----------------------|------|-----|-----|------|-----|-----|
| Combined pullout and concrete cone failure in concrete C20/25 | | | | | | | | |
| Size | | | M8 | M10 | M12 | M16 | M20 | M24 |
| Characteristic bond resistance in uncracked concrete for a working life of 50 years and 100 years | | | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,ucr}$ | [N/mm ²] | 10,0 | 9,5 | 9,5 | 8,5 | 7,0 | 6,5 |
| Installation safety factor | | | | | | | | |
| Dry, wet concrete | γ_{inst} | [-] | | | | 1,2 | | |
| Hammer drilling - flooded hole | γ_{inst} | [-] | | | | 1,2 | | |
| Dustless drilling - flooded hole | γ_{inst} | [-] | | | | 1,4 | | |
| Characteristic bond resistance in cracked concrete for a working life of 50 years | | | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,cr}$ | [N/mm ²] | 4,5 | 4,5 | 4,0 | 3,5 | 3,5 | 3,5 |
| Characteristic bond resistance in cracked concrete for a working life of 100 years | | | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,cr}$ | [N/mm ²] | 3,5 | 3,5 | 3,0 | 3,0 | 3,0 | 3,0 |
| Installation safety factor | | | | | | | | |
| Dry, wet concrete | γ_{inst} | [-] | | | | 1,2 | | |
| Hammer drilling - flooded hole | γ_{inst} | [-] | | | | 1,2 | | |
| Dustless drilling - flooded hole | γ_{inst} | [-] | | | | 1,4 | | |
| Factor for influence of sustained load for a working life 50 and 100 years | ψ_{sus}^0 | [-] | | | | 0,75 | | |
| Factor for concrete | C25/30 | ψ_c | [-] | | | 1,04 | | |
| | C30/37 | | | | | 1,08 | | |
| | C35/45 | | | | | 1,12 | | |
| | C40/50 | | | | | 1,15 | | |
| | C45/55 | | | | | 1,17 | | |
| | C50/60 | | | | | 1,19 | | |
| Concrete cone failure | | | | | | | | |
| See Annex C 2 | | | | | | | | |
| Splitting failure | | | | | | | | |
| See Annex C 2 | | | | | | | | |

WB300W**Performances**

Hammer drilling, Dustless drilling
Characteristic resistance for tension loads - threaded rod

Annex C 3

Table C6: Design method EN 1992-4

Characteristic values of resistance to tension load of threaded socket

| Hammer drilling, Dustless drilling | | | | | | | |
|--|--------------------------------------|----------|-----------|-----------|-----------------|------------|------------|
| Combined pullout and concrete cone failure in concrete C20/25 | | | | | | | |
| Size | | | M6 | M8 | M10 | M12 | M16 |
| Nominal external diameter of socket | | | M10 | M12 | M16 | M20 | M24 |
| Characteristic bond resistance in uncracked concrete for a working life of 50 years and 100 years | | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,ucr}$ [N/mm ²] | | 10,0 | 10,0 | 9,0 | 7,5 | 7,0 |
| Installation safety factor | | | | | | | |
| Dry, wet concrete | γ_{inst} | [-] | | | 1,2 | | |
| Hammer drilling - flooded hole | γ_{inst} | [-] | | | 1,2 | | |
| Dustless drilling - flooded hole | γ_{inst} | [-] | | | 1,4 | | |
| Characteristic bond resistance in cracked concrete for a working life of 50 years | | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,cr}$ [N/mm ²] | | 5,0 | 4,5 | 4,0 | 4,0 | 4,0 |
| Characteristic bond resistance in cracked concrete for a working life of 100 years | | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,cr}$ [N/mm ²] | | 4,0 | 3,5 | 3,5 | 3,5 | 3,5 |
| Installation safety factor | | | | | | | |
| Dry, wet concrete | γ_{inst} | [-] | | | 1,2 | | |
| Hammer drilling - flooded hole | γ_{inst} | [-] | | | 1,2 | | |
| Dustless drilling - flooded hole | γ_{inst} | [-] | | | 1,4 | | |
| Factor for influence of sustained load for a working life 50 and 100 years | ψ_{sus}^0 | [-] | | | 0,75 | | |
| Factor for concrete | C25/30 | ψ_c | [-] | | 1,04 | | |
| | C30/37 | | | 1,08 | | | |
| | C35/45 | | | 1,12 | | | |
| | C40/50 | | | 1,15 | | | |
| | C45/55 | | | 1,17 | | | |
| | C50/60 | | | 1,19 | | | |
| Concrete cone failure | | | | | | | |
| Factor for concrete cone failure for uncracked concrete | $k_{ucr,N}$ | | | | 11 | | |
| Factor for concrete cone failure for cracked concrete | $k_{cr,N}$ | | | | 7,7 | | |
| Edge distance | $c_{cr,N}$ [mm] | | | | 1,5 h_{ef} | | |
| Splitting failure | | | | | | | |
| Size | | | M6 | M8 | M10 | M12 | M16 |
| Edge distance | $c_{cr,sp}$ | [mm] | | | 2 • h_{ef} | | |
| Spacing | $s_{cr,sp}$ | [mm] | | | 2 • $c_{cr,sp}$ | | |

WB300, WB300W, WB300T, WB300 Desert, WB300T Desert

Performances

Hammer drilling, Dustless drilling

Characteristic resistance for tension loads - threaded socket

Annex C 4

Table C7: Design method EN 1992-4

Characteristic values of resistance to tension load of threaded socket for WB300W with installation temperature < -10°C

| Hammer drilling, Dustless drilling | | | | | | | |
|--|-----------------|----------------------|-----------|-----------|------------|------------|------------|
| Combined pullout and concrete cone failure in concrete C20/25 | | | | | | | |
| Size | | | M6 | M8 | M10 | M12 | M16 |
| Nominal external diameter of socket | | | M10 | M12 | M16 | M20 | M24 |
| Characteristic bond resistance in uncracked concrete for a working life of 50 years and 100 years | | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,ucr}$ | [N/mm ²] | 9,5 | 9,5 | 8,5 | 7,0 | 6,5 |
| Installation safety factor | | | | | | | |
| Dry, wet concrete | γ_{inst} | [-] | | | 1,2 | | |
| Hammer drilling - flooded hole | γ_{inst} | [-] | | | 1,2 | | |
| Dustless drilling - flooded hole | γ_{inst} | [-] | | | 1,4 | | |
| Characteristic bond resistance in cracked concrete for a working life of 50 years | | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,cr}$ | [N/mm ²] | 4,5 | 4,0 | 3,5 | 3,5 | 3,5 |
| Characteristic bond resistance in cracked concrete for a working life of 100 years | | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,cr}$ | [N/mm ²] | 3,5 | 3,5 | 3,0 | 3,0 | 3,0 |
| Installation safety factor | | | | | | | |
| Dry, wet concrete | γ_{inst} | [-] | | | 1,2 | | |
| Hammer drilling - flooded hole | γ_{inst} | [-] | | | 1,2 | | |
| Dustless drilling - flooded hole | γ_{inst} | [-] | | | 1,4 | | |
| Factor for influence of sustained load for a working life 50 and 100 years | ψ_{sus}^0 | [-] | | | 0,75 | | |
| Factor for concrete | C25/30 | ψ_c | [-] | | | | 1,04 |
| | C30/37 | | | | | | 1,08 |
| | C35/45 | | | | | | 1,12 |
| | C40/50 | | | | | | 1,15 |
| | C45/55 | | | | | | 1,17 |
| | C50/60 | | | | | | 1,19 |
| Concrete cone failure | | | | | | | |
| See Annex C 4 | | | | | | | |
| Splitting failure | | | | | | | |
| See Annex C 4 | | | | | | | |

WB300W

Performances

Hammer drilling, Dustless drilling
Characteristic resistance for tension loads - threaded socket

Annex C 5

Table C8: Design method EN 1992-4
Characteristic values of resistance to tension load of rebar

| Hammer drilling, Dustless drilling | | | | | | | | |
|--|-----------------|----------------------|------------------------|------|-----|-----|-----|-----|
| Combined pullout and concrete cone failure in concrete C20/25 | | | | | | | | |
| Size | | | Ø8 | Ø10 | Ø12 | Ø16 | Ø20 | Ø25 |
| Characteristic bond resistance in uncracked concrete for a working life of 50 years and 100 years | | | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,ucr}$ | [N/mm ²] | 8,5 | 8,0 | 8,0 | 7,0 | 7,0 | 5,5 |
| Installation safety factor | | | | | | | | |
| Dry, wet concrete | γ_{inst} | [-] | 1,2 | | | | | |
| Hammer drilling - flooded hole | γ_{inst} | [-] | 1,2 | | | | | |
| Dustless drilling - flooded hole | γ_{inst} | [-] | 1,4 | | | | | |
| Characteristic bond resistance in cracked concrete for a working life of 50 years | | | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,cr}$ | [N/mm ²] | 4,0 | 3,5 | 3,5 | 3,5 | 3,5 | 2,5 |
| Characteristic bond resistance in cracked concrete for a working life of 100 years | | | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,cr}$ | [N/mm ²] | 3,0 | 3,0 | 2,5 | 2,5 | 2,5 | 2,0 |
| Installation safety factor | | | | | | | | |
| Dry, wet concrete | γ_{inst} | [-] | 1,2 | | | | | |
| Hammer drilling - flooded hole | γ_{inst} | [-] | 1,2 | | | | | |
| Dustless drilling - flooded hole | γ_{inst} | [-] | 1,4 | | | | | |
| Factor for influence of sustained load for a working life 50 and 100 years | ψ^0_{sus} | [-] | 0,75 | | | | | |
| Factor for concrete | C25/30 | ψ_c | [-] | 1,04 | | | | |
| | C30/37 | | | 1,08 | | | | |
| | C35/45 | | | 1,12 | | | | |
| | C40/50 | | | 1,15 | | | | |
| | C45/55 | | | 1,17 | | | | |
| C50/60 | 1,19 | | | | | | | |
| Concrete cone failure | | | | | | | | |
| Factor for concrete cone failure for uncracked concrete | $k_{ucr,N}$ | [-] | 11 | | | | | |
| Factor for concrete cone failure for cracked concrete | $k_{cr,N}$ | | 7,7 | | | | | |
| Edge distance | $c_{cr,N}$ | [mm] | 1,5h _{ef} | | | | | |
| Splitting failure | | | | | | | | |
| Size | | | Ø8 | Ø10 | Ø12 | Ø16 | Ø20 | Ø25 |
| Edge distance | $c_{cr,sp}$ | [mm] | 2 • h _{ef} | | | | | |
| Spacing | $s_{cr,sp}$ | [mm] | 2 • c _{cr,sp} | | | | | |

WB300, WB300W, WB300T, WB300 Desert, WB300T Desert

Performances
Hammer drilling, Dustless drilling
Characteristic resistance for tension loads - rebar

Annex C 6

Table C9: Design method EN 1992-4
 Characteristic values of resistance to tension load of rebar
 WB300W with installation temperature < -10°C

| Hammer drilling, Dustless drilling | | | | | | | | | |
|--|-----------------|----------------------|-----|-----|-----|-----|------|------|------|
| Combined pullout and concrete cone failure in concrete C20/25 | | | | | | | | | |
| Size | | | Ø8 | Ø10 | Ø12 | Ø16 | Ø20 | Ø25 | |
| Characteristic bond resistance in uncracked concrete for a working life of 50 years and 100 years | | | | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,ucr}$ | [N/mm ²] | 8,0 | 7,0 | 7,5 | 6,0 | 6,0 | 5,0 | |
| Installation safety factor | | | | | | | | | |
| Dry, wet concrete | γ_{inst} | [-] | | | | | | 1,2 | |
| Hammer drilling - flooded hole | γ_{inst} | [-] | | | | | | 1,2 | |
| Dustless drilling - flooded hole | γ_{inst} | [-] | | | | | | 1,4 | |
| Characteristic bond resistance in cracked concrete for a working life of 50 years | | | | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,cr}$ | [N/mm ²] | 3,5 | 3,5 | 3,0 | 3,0 | 3,0 | 2,5 | |
| Characteristic bond resistance in cracked concrete for a working life of 100 years | | | | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,cr}$ | [N/mm ²] | 2,5 | 2,5 | 2,5 | 2,0 | 2,0 | 2,0 | |
| Installation safety factor | | | | | | | | | |
| Dry, wet concrete | γ_{inst} | [-] | | | | | | 1,2 | |
| Hammer drilling - flooded hole | γ_{inst} | [-] | | | | | | 1,2 | |
| Dustless drilling - flooded hole | γ_{inst} | [-] | | | | | | 1,4 | |
| Factor for influence of sustained load for a working life 50 and 100 years | ψ^0_{sus} | [-] | | | | | | 0,75 | |
| Factor for concrete | C25/30 | ψ_c | [-] | | | | | | 1,04 |
| | C30/37 | | | | | | | | 1,08 |
| | C35/45 | | | | | | | | 1,12 |
| | C40/50 | | | | | | | | 1,15 |
| | C45/55 | | | | | | | | 1,17 |
| | C50/60 | | | | | | 1,19 | | |

Concrete cone failure
 See Annex C 6

Splitting failure
 See Annex C 6

| | |
|--|------------------|
| WB300W | Annex C 7 |
| Performances Hammer drilling, Dustless drilling Characteristic resistance for tension loads - rebar | |

Table C10: Design method EN 1992-4
 Characteristic values of resistance to tension load of threaded rod

| Diamond core drilling | | | | | | | | |
|--|--------------------------------------|----------|-----|-----|-----|------------------------|-----|-----|
| Combined pullout and concrete cone failure in concrete C20/25 | | | | | | | | |
| Size | | | M8 | M10 | M12 | M16 | M20 | M24 |
| Characteristic bond resistance in uncracked concrete for a working life of 50 years and 100 years | | | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,ucr}$ [N/mm ²] | | 9,5 | 9,0 | 9,0 | 7,5 | 6,5 | 6,0 |
| Installation safety factor | | | | | | | | |
| Dry, wet concrete | γ_{inst} | [-] | | | | 1,0 | | |
| Flooded hole | γ_{inst} | [-] | | | | 1,4 | | |
| Characteristic bond resistance in cracked concrete for a working life of 50 years | | | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,cr}$ [N/mm ²] | | 5,5 | 5,5 | 5,5 | 4,5 | 5,0 | 5,0 |
| Characteristic bond resistance in cracked concrete for a working life of 100 years | | | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,cr}$ [N/mm ²] | | 5,0 | 4,5 | 5,0 | 3,5 | 3,5 | 3,5 |
| Installation safety factor | | | | | | | | |
| Dry, wet concrete | γ_{inst} | [-] | | | | 1,0 | | |
| Flooded hole | γ_{inst} | [-] | | | | 1,4 | | |
| Factor for influence of sustained load for a working life 50 and 100 years | ψ^0_{sus} | [-] | | | | 0,75 | | |
| Factor for concrete | C25/30 | ψ_c | [-] | | | 1,02 | | |
| | C30/37 | | | | | 1,04 | | |
| | C35/45 | | | | | 1,06 | | |
| | C40/50 | | | | | 1,07 | | |
| | C45/55 | | | | | 1,08 | | |
| | C50/60 | | | | | 1,09 | | |
| Concrete cone failure | | | | | | | | |
| Factor for concrete cone failure for uncracked concrete | $k_{ucr,N}$ | | | | | 11 | | |
| Factor for concrete cone failure for cracked concrete | $k_{cr,N}$ | | | | | 7,7 | | |
| Edge distance | $c_{cr,N}$ | [mm] | | | | 1,5h _{ef} | | |
| Splitting failure | | | | | | | | |
| Size | | | M8 | M10 | M12 | M16 | M20 | M24 |
| Edge distance | $c_{cr,sp}$ | [mm] | | | | 2 • h _{ef} | | |
| Spacing | $s_{cr,sp}$ | [mm] | | | | 2 • c _{cr,sp} | | |

WB300, WB300W, WB300T, WB300 Desert, WB300T Desert

Performances

Diamond core drilling
 Characteristic resistance for tension loads - threaded rod

Annex C 8

Table C11: Design method EN 1992-4

Characteristic values of resistance to tension load of threaded rod for
WB300W with installation temperature < -10°C

| Diamond core drilling | | | | | | | | |
|--|--------------------------------------|----------|-----|-----|------|------|-----|-----|
| Combined pullout and concrete cone failure in concrete C20/25 | | | | | | | | |
| Size | | | M8 | M10 | M12 | M16 | M20 | M24 |
| Characteristic bond resistance in uncracked concrete for a working life of 50 years and 100 years | | | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,ucr}$ [N/mm ²] | | 9,0 | 8,5 | 8,5 | 7,0 | 6,0 | 6,0 |
| Installation safety factor | | | | | | | | |
| Dry, wet concrete | γ_{inst} | [-] | | | | 1,0 | | |
| Flooded hole | γ_{inst} | [-] | | | | 1,4 | | |
| Characteristic bond resistance in cracked concrete for a working life of 50 years | | | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,cr}$ [N/mm ²] | | 5,0 | 5,0 | 5,0 | 4,0 | 4,5 | 4,5 |
| Characteristic bond resistance in cracked concrete for a working life of 100 years | | | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,cr}$ [N/mm ²] | | 4,5 | 4,5 | 4,5 | 3,5 | 3,5 | 3,5 |
| Installation safety factor | | | | | | | | |
| Dry, wet concrete | γ_{inst} | [-] | | | | 1,0 | | |
| Flooded hole | γ_{inst} | [-] | | | | 1,4 | | |
| Factor for influence of sustained load for a working life 50 and 100 years | ψ_{sus}^0 | [-] | | | | 0,75 | | |
| Factor for concrete | C25/30 | ψ_c | [-] | | | 1,02 | | |
| | C30/37 | | | | | 1,04 | | |
| | C35/45 | | | | | 1,06 | | |
| | C40/50 | | | | | 1,07 | | |
| | C45/55 | | | | | 1,08 | | |
| | C50/60 | | | | 1,09 | | | |
| Concrete cone failure | | | | | | | | |
| See Annex C 8 | | | | | | | | |
| Splitting failure | | | | | | | | |
| See Annex C 8 | | | | | | | | |

WB300W**Performances**

Diamond core drilling
Characteristic resistance for tension loads - threaded rod

Annex C 9

Table C12: Design method EN 1992-4

Characteristic values of resistance to tension load of threaded socket

| Diamond core drilling | | | | | | | |
|--|-----------------|----------------------|-----------|-----------|------------------------|------------|------------|
| Combined pullout and concrete cone failure in concrete C20/25 | | | | | | | |
| Size | | | M6 | M8 | M10 | M12 | M16 |
| Nominal external diameter of socket | | | M10 | M12 | M16 | M20 | M24 |
| Characteristic bond resistance in uncracked concrete for a working life of 50 years and 100 years | | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,ucr}$ | [N/mm ²] | 9,0 | 9,0 | 7,5 | 6,5 | 6,0 |
| Installation safety factor | | | | | | | |
| Dry, wet concrete | γ_{inst} | [-] | | | 1,0 | | |
| Flooded hole | γ_{inst} | [-] | | | 1,4 | | |
| Characteristic bond resistance in cracked concrete for a working life of 50 years | | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,cr}$ | [N/mm ²] | 5,5 | 5,5 | 4,5 | 5,0 | 5,0 |
| Characteristic bond resistance in cracked concrete for a working life of 100 years | | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,cr}$ | [N/mm ²] | 4,5 | 5,0 | 3,5 | 3,5 | 3,5 |
| Installation safety factor | | | | | | | |
| Dry, wet concrete | γ_{inst} | [-] | | | 1,0 | | |
| Flooded hole | γ_{inst} | [-] | | | 1,4 | | |
| Factor for influence of sustained load for a working life 50 and 100 years | ψ_{sus}^0 | [-] | | | 0,75 | | |
| Factor for concrete | C25/30 | ψ_c | [-] | | 1,02 | | |
| | C30/37 | | | 1,04 | | | |
| | C35/45 | | | 1,06 | | | |
| | C40/50 | | | 1,07 | | | |
| | C45/55 | | | 1,08 | | | |
| | C50/60 | | | 1,09 | | | |
| Concrete cone failure | | | | | | | |
| Factor for concrete cone failure for uncracked concrete | $k_{ucr,N}$ | | | | 11 | | |
| Factor for concrete cone failure for cracked concrete | $k_{cr,N}$ | | | | 7,7 | | |
| Edge distance | $c_{cr,N}$ | [mm] | | | 1,5h _{ef} | | |
| Splitting failure | | | | | | | |
| Size | | | | | | | |
| Edge distance | $c_{cr,sp}$ | [mm] | | | 2 • h _{ef} | | |
| Spacing | $s_{cr,sp}$ | [mm] | | | 2 • c _{cr,sp} | | |

WB300, WB300W, WB300T, WB300 Desert, WB300T Desert

Performances

Diamond core drilling

Characteristic resistance for tension loads - threaded rod

Annex C 10

Table C13: Design method EN 1992-4

Characteristic values of resistance to tension load of threaded socket for WB300W with installation temperature < -10°C

| Diamond core drilling | | | | | | |
|--|--------------------------------------|--------------|-----------|------------|------------|------------|
| Combined pullout and concrete cone failure in concrete C20/25 | | | | | | |
| Size | | M6 | M8 | M10 | M12 | M16 |
| Nominal external diameter of socket | | M10 | M12 | M16 | M20 | M24 |
| Characteristic bond resistance in uncracked concrete for a working life of 50 years and 100 years | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,ucr}$ [N/mm ²] | 8,5 | 8,5 | 7,0 | 6,0 | 6,0 |
| Installation safety factor | | | | | | |
| Dry, wet concrete | γ_{inst} [-] | | | 1,0 | | |
| Flooded hole | γ_{inst} [-] | | | 1,4 | | |
| Characteristic bond resistance in cracked concrete for a working life of 50 years | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,cr}$ [N/mm ²] | 5,0 | 5,0 | 5,0 | 4,0 | 4,5 |
| Characteristic bond resistance in cracked concrete for a working life of 100 years | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,cr}$ [N/mm ²] | 4,5 | 4,5 | 4,5 | 3,5 | 3,5 |
| Installation safety factor | | | | | | |
| Dry, wet concrete | γ_{inst} [-] | | | 1,0 | | |
| Flooded hole | γ_{inst} [-] | | | 1,4 | | |
| Factor for influence of sustained load for a working life 50 and 100 years | ψ_{sus}^0 [-] | | | 0,75 | | |
| Factor for concrete | C25/30 | ψ_c [-] | | 1,02 | | |
| | C30/37 | | | 1,04 | | |
| | C35/45 | | | 1,06 | | |
| | C40/50 | | | 1,07 | | |
| | C45/55 | | | 1,08 | | |
| | C50/60 | | | 1,09 | | |
| Concrete cone failure | | | | | | |
| See Annex C 10 | | | | | | |
| Splitting failure | | | | | | |
| See Annex C 10 | | | | | | |

WB300W

Performances

Diamond core drilling
Characteristic resistance for tension loads - threaded socket

Annex C 11

Table C14: Design method EN 1992-4
Characteristic values of resistance to tension load of rebar

| Diamond core drilling | | | | | | | |
|--|--------------------------------------|--------------|------|-----|-----|-----|-----|
| Combined pullout and concrete cone failure in concrete C20/25 | | | | | | | |
| Size | Ø8 | Ø10 | Ø12 | Ø16 | Ø20 | Ø25 | |
| Characteristic bond resistance in uncracked concrete for a working life of 50 years and 100 years | | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,ucr}$ [N/mm ²] | 8,0 | 8,0 | 7,5 | 7,5 | 6,5 | 5,5 |
| Installation safety factor | | | | | | | |
| Dry, wet concrete | γ_{inst} [-] | 1,0 | | | | | |
| Flooded hole | γ_{inst} [-] | 1,4 | | | | | |
| Characteristic bond resistance in uncracked concrete for a working life of 50 years | | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,cr}$ [N/mm ²] | 5,5 | 6,0 | 6,0 | 4,5 | 4,5 | 4,5 |
| Characteristic bond resistance in uncracked concrete for a working life of 100 years | | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,cr}$ [N/mm ²] | 5,0 | 5,0 | 5,5 | 3,5 | 3,0 | 3,5 |
| Installation safety factor | | | | | | | |
| Dry, wet concrete | γ_{inst} [-] | 1,0 | | | | | |
| Flooded hole | γ_{inst} [-] | 1,4 | | | | | |
| Factor for influence of sustained load for a working life 50 and 100 years | ψ_{sus}^0 [-] | 0,87 | | | | | |
| Factor for concrete | C25/30 | ψ_c [-] | 1,02 | | | | |
| | C30/37 | | 1,04 | | | | |
| | C35/45 | | 1,06 | | | | |
| | C40/50 | | 1,07 | | | | |
| | C45/55 | | 1,08 | | | | |
| C50/60 | 1,09 | | | | | | |

| Concrete cone failure | | | |
|---|-----------------|--------------|--|
| Factor for concrete cone failure for uncracked concrete | $k_{ucr,N}$ [-] | 11 | |
| Factor for concrete cone failure for cracked concrete | $k_{cr,N}$ [-] | 7,7 | |
| Edge distance | $c_{cr,N}$ [mm] | 1,5 h_{ef} | |

| Splitting failure | | | | | | | |
|-------------------|------------------|-----------------|-----|-----|-----|-----|--|
| Size | Ø8 | Ø10 | Ø12 | Ø16 | Ø20 | Ø25 | |
| Edge distance | $c_{cr,sp}$ [mm] | 2 • h_{ef} | | | | | |
| Spacing | $s_{cr,sp}$ [mm] | 2 • $c_{cr,sp}$ | | | | | |

WB300, WB300W, WB300T, WB300 Desert, WB300T Desert

Performances
Diamond core drilling
Characteristic resistance for tension loads - rebar

Annex C 12

Table C15: Design method EN 1992-4
 Characteristic values of resistance to tension load of rebar
 WB300W with installation temperature < -10°C

| Diamond core drilling | | | | | | | | | | |
|--|-----------------|----------------------|------|------|-----|-----|-----|-----|--|--|
| Combined pullout and concrete cone failure in concrete C20/25 | | | | | | | | | | |
| Size | | | Ø8 | Ø10 | Ø12 | Ø16 | Ø20 | Ø25 | | |
| Characteristic bond resistance in uncracked concrete for a working life of 50 years and 100 years | | | | | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,ucr}$ | [N/mm ²] | 8,0 | 8,0 | 7,5 | 7,0 | 6,0 | 5,5 | | |
| Installation safety factor | | | | | | | | | | |
| Dry, wet concrete | γ_{inst} | [-] | 1,0 | | | | | | | |
| Flooded hole | γ_{inst} | [-] | 1,4 | | | | | | | |
| Characteristic bond resistance in uncracked concrete for a working life of 50 years | | | | | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,cr}$ | [N/mm ²] | 5,0 | 5,5 | 5,5 | 4,5 | 4,0 | 4,0 | | |
| Characteristic bond resistance in uncracked concrete for a working life of 100 years | | | | | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,cr}$ | [N/mm ²] | 4,5 | 4,5 | 5,0 | 3,5 | 3,0 | 3,0 | | |
| Installation safety factor | | | | | | | | | | |
| Dry, wet concrete | γ_{inst} | [-] | 1,0 | | | | | | | |
| Flooded hole | γ_{inst} | [-] | 1,4 | | | | | | | |
| Factor for influence of sustained load for a working life 50 and 100 years | ψ_{sus}^0 | [-] | 0,87 | | | | | | | |
| Factor for concrete | C25/30 | ψ_c | [-] | 1,02 | | | | | | |
| | C30/37 | | | 1,04 | | | | | | |
| | C35/45 | | | 1,06 | | | | | | |
| | C40/50 | | | 1,07 | | | | | | |
| | C45/55 | | | 1,08 | | | | | | |
| | C50/60 | | | 1,09 | | | | | | |
| Concrete cone failure | | | | | | | | | | |
| See Annex C 12 | | | | | | | | | | |
| Splitting failure | | | | | | | | | | |
| See Annex C 12 | | | | | | | | | | |

WB300W

Performances

Diamond core drilling
 Characteristic resistance for tension loads - rebar

Annex C 13

Table C16: Design method EN 1992-4
Characteristic values of resistance to shear load of threaded rod

| Steel failure without lever arm | | | | | | | | | |
|--|---------------|-------|--------------------------------|-----|-----|-----|-----|------|--|
| Size | | | M8 | M10 | M12 | M16 | M20 | M24 | |
| Steel grade 4.6 | $V_{Rk,s}$ | [kN] | 9 | 14 | 20 | 38 | 59 | 85 | |
| Partial safety factor | γ_{Ms} | [-] | 1,67 | | | | | | |
| Steel grade 4.8 | $V_{Rk,s}$ | [kN] | 9 | 14 | 20 | 38 | 59 | 85 | |
| Partial safety factor | γ_{Ms} | [-] | 1,25 | | | | | | |
| Steel grade 5.6 | $V_{Rk,s}$ | [kN] | 11 | 17 | 25 | 47 | 74 | 106 | |
| Partial safety factor | γ_{Ms} | [-] | 1,67 | | | | | | |
| Steel grade 5.8 | $V_{Rk,s}$ | [kN] | 11 | 17 | 25 | 47 | 74 | 106 | |
| Partial safety factor | γ_{Ms} | [-] | 1,25 | | | | | | |
| Steel grade 8.8 | $V_{Rk,s}$ | [kN] | 15 | 23 | 34 | 63 | 98 | 141 | |
| Partial safety factor | γ_{Ms} | [-] | 1,25 | | | | | | |
| Steel grade 10.9 | $V_{Rk,s}$ | [kN] | 18 | 29 | 42 | 79 | 123 | 177 | |
| Partial safety factor | γ_{Ms} | [-] | 1,5 | | | | | | |
| Stainless steel grade A2-70, A4-70 | $V_{Rk,s}$ | [kN] | 13 | 20 | 30 | 55 | 86 | 124 | |
| Partial safety factor | γ_{Ms} | [-] | 1,56 | | | | | | |
| Stainless steel grade A4-80 | $V_{Rk,s}$ | [kN] | 15 | 23 | 34 | 63 | 98 | 141 | |
| Partial safety factor | γ_{Ms} | [-] | 1,33 | | | | | | |
| High corrosion resistant steel grade 1.4529 | $V_{Rk,s}$ | [kN] | 13 | 20 | 30 | 55 | 86 | 124 | |
| Partial safety factor | γ_{Ms} | [-] | 1,25 | | | | | | |
| High corrosion resistant steel grade 1.4565 | $V_{Rk,s}$ | [kN] | 13 | 20 | 30 | 55 | 86 | 124 | |
| Partial safety factor | γ_{Ms} | [-] | 1,56 | | | | | | |
| Characteristic resistance of group of fasteners | | | | | | | | | |
| Ductility factor $k_7 = 1,0$ for steel with rupture elongation $A_5 > 8\%$ | | | | | | | | | |
| Steel failure with lever arm | | | | | | | | | |
| Size | | | M8 | M10 | M12 | M16 | M20 | M24 | |
| Steel grade 4.6 | $M^o_{Rk,s}$ | [N.m] | 15 | 30 | 52 | 133 | 260 | 449 | |
| Partial safety factor | γ_{Ms} | [-] | 1,67 | | | | | | |
| Steel grade 4.8 | $M^o_{Rk,s}$ | [N.m] | 15 | 30 | 52 | 133 | 260 | 449 | |
| Partial safety factor | γ_{Ms} | [-] | 1,25 | | | | | | |
| Steel grade 5.6 | $M^o_{Rk,s}$ | [N.m] | 19 | 37 | 66 | 166 | 325 | 561 | |
| Partial safety factor | γ_{Ms} | [-] | 1,67 | | | | | | |
| Steel grade 5.8 | $M^o_{Rk,s}$ | [N.m] | 19 | 37 | 66 | 166 | 325 | 561 | |
| Partial safety factor | γ_{Ms} | [-] | 1,25 | | | | | | |
| Steel grade 8.8 | $M^o_{Rk,s}$ | [N.m] | 30 | 60 | 105 | 266 | 519 | 898 | |
| Partial safety factor | γ_{Ms} | [-] | 1,25 | | | | | | |
| Steel grade 10.9 | $M^o_{Rk,s}$ | [N.m] | 37 | 75 | 131 | 333 | 649 | 1123 | |
| Partial safety factor | γ_{Ms} | [-] | 1,50 | | | | | | |
| Stainless steel grade A2-70, A4-70 | $M^o_{Rk,s}$ | [N.m] | 26 | 52 | 92 | 233 | 454 | 786 | |
| Partial safety factor | γ_{Ms} | [-] | 1,56 | | | | | | |
| Stainless steel grade A4-80 | $M^o_{Rk,s}$ | [N.m] | 30 | 60 | 105 | 266 | 519 | 898 | |
| Partial safety factor | γ_{Ms} | [-] | 1,33 | | | | | | |
| High corrosion resistant steel grade 1.4529 | $M^o_{Rk,s}$ | [N.m] | 26 | 52 | 92 | 233 | 454 | 786 | |
| Partial safety factor | γ_{Ms} | [-] | 1,25 | | | | | | |
| High corrosion resistant steel grade 1.4565 | $M^o_{Rk,s}$ | [N.m] | 26 | 52 | 92 | 233 | 454 | 786 | |
| Partial safety factor | γ_{Ms} | [-] | 1,56 | | | | | | |
| Concrete pryout failure | | | | | | | | | |
| Factor for resistance to pry-out failure | | k_8 | [-] | 2 | | | | | |
| Concrete edge failure | | | | | | | | | |
| Size | | | M8 | M10 | M12 | M16 | M20 | M24 | |
| Outside diameter of fastener | d_{nom} | [mm] | 8 | 10 | 12 | 16 | 20 | 24 | |
| Effective length of fastener | l_f | [mm] | min (h_{ef} , 8 d_{nom}) | | | | | | |

WB300, WB300W, WB300T, WB300 Desert, WB300T Desert

Performances

Design according to EN 1992-4

Characteristic resistance for shear loads - threaded rod

Annex C 14

Table C17: Design method EN 1992-4

Characteristic values of resistance to shear load of threaded socket

| Steel failure without lever arm | | | | | | |
|--|--------------------|-----------------------------|-----------|------------|------------|------------|
| Size | | M6 | M8 | M10 | M12 | M16 |
| Nominal external diameter of socket | | M10 | M12 | M16 | M20 | M24 |
| Steel grade 4.6 | $V_{Rk,s}$ [kN] | 5 | 9 | 14 | 20 | 38 |
| Partial safety factor | γ_{Ms} [-] | 1,67 | | | | |
| Steel grade 4.8 | $V_{Rk,s}$ [kN] | 5 | 9 | 14 | 20 | 38 |
| Partial safety factor | γ_{Ms} [-] | 1,25 | | | | |
| Steel grade 5.6 | $V_{Rk,s}$ [kN] | 6 | 11 | 17 | 25 | 47 |
| Partial safety factor | γ_{Ms} [-] | 1,67 | | | | |
| Steel grade 5.8 | $V_{Rk,s}$ [kN] | 6 | 11 | 17 | 25 | 47 |
| Partial safety factor | γ_{Ms} [-] | 1,25 | | | | |
| Steel grade 8.8 | $V_{Rk,s}$ [kN] | 8 | 15 | 23 | 34 | 63 |
| Partial safety factor | γ_{Ms} [-] | 1,25 | | | | |
| Steel grade 10.9 | $V_{Rk,s}$ [kN] | 10 | 18 | 29 | 42 | 79 |
| Partial safety factor | γ_{Ms} [-] | 1,5 | | | | |
| Stainless steel grade A2-70, A4-70 | $V_{Rk,s}$ [kN] | 7 | 13 | 20 | 30 | 55 |
| Partial safety factor | γ_{Ms} [-] | 1,56 | | | | |
| Stainless steel grade A4-80 | $V_{Rk,s}$ [kN] | 8 | 15 | 23 | 34 | 63 |
| Partial safety factor | γ_{Ms} [-] | 1,33 | | | | |
| High corrosion resistant steel grade 1.4529 | $V_{Rk,s}$ [kN] | 7 | 13 | 20 | 30 | 55 |
| Partial safety factor | γ_{Ms} [-] | 1,25 | | | | |
| High corrosion resistant steel grade 1.4565 | $V_{Rk,s}$ [kN] | 7 | 13 | 20 | 30 | 55 |
| Partial safety factor | γ_{Ms} [-] | 1,56 | | | | |
| Characteristic resistance of group of fasteners | | | | | | |
| Ductility factor $k_7 = 1,0$ for steel with rupture elongation $A_6 > 8\%$ | | | | | | |
| Steel failure with lever arm | | | | | | |
| Size | | M6 | M8 | M10 | M12 | M16 |
| Nominal external diameter of socket | | M10 | M12 | M16 | M20 | M24 |
| Steel grade 4.6 | $M^o_{Rk,s}$ [N.m] | 6 | 15 | 30 | 52 | 133 |
| Partial safety factor | γ_{Ms} [-] | 1,67 | | | | |
| Steel grade 4.8 | $M^o_{Rk,s}$ [N.m] | 6 | 15 | 30 | 52 | 133 |
| Partial safety factor | γ_{Ms} [-] | 1,25 | | | | |
| Steel grade 5.6 | $M^o_{Rk,s}$ [N.m] | 8 | 19 | 37 | 66 | 166 |
| Partial safety factor | γ_{Ms} [-] | 1,67 | | | | |
| Steel grade 5.8 | $M^o_{Rk,s}$ [N.m] | 8 | 19 | 37 | 66 | 166 |
| Partial safety factor | γ_{Ms} [-] | 1,25 | | | | |
| Steel grade 8.8 | $M^o_{Rk,s}$ [N.m] | 12 | 30 | 60 | 105 | 266 |
| Partial safety factor | γ_{Ms} [-] | 1,25 | | | | |
| Steel grade 10.9 | $M^o_{Rk,s}$ [N.m] | 15 | 37 | 75 | 131 | 333 |
| Partial safety factor | γ_{Ms} [-] | 1,50 | | | | |
| Stainless steel grade A2-70, A4-70 | $M^o_{Rk,s}$ [N.m] | 11 | 26 | 52 | 92 | 233 |
| Partial safety factor | γ_{Ms} [-] | 1,56 | | | | |
| Stainless steel grade A4-80 | $M^o_{Rk,s}$ [N.m] | 12 | 30 | 60 | 105 | 266 |
| Partial safety factor | γ_{Ms} [-] | 1,33 | | | | |
| High corrosion resistant steel grade 1.4529 | $M^o_{Rk,s}$ [N.m] | 11 | 26 | 52 | 92 | 233 |
| Partial safety factor | γ_{Ms} [-] | 1,25 | | | | |
| High corrosion resistant steel grade 1.4565 | $M^o_{Rk,s}$ [N.m] | 11 | 26 | 52 | 92 | 233 |
| Partial safety factor | γ_{Ms} [-] | 1,56 | | | | |
| Concrete pryout failure | | | | | | |
| Factor for resistance to pry-out failure | | k_B [-] | 2 | | | |
| Concrete edge failure | | | | | | |
| Size | | M6 | M8 | M10 | M12 | M16 |
| Nominal external diameter of socket | | M10 | M12 | M16 | M20 | M24 |
| Outside diameter of fastener | d_{nom} [mm] | 10 | 12 | 16 | 20 | 24 |
| Effective length of fastener | l_f [mm] | min ($h_{ef}, 8 d_{nom}$) | | | | |

WB300, WB300W, WB300T, WB300 Desert, WB300T Desert

Performances

Design according to EN 1992-4

Characteristic resistance for shear loads - threaded socket

Annex C 15

Table C18: Design method EN 1992-4
Characteristic values of resistance to shear load of rebar

| Steel failure without lever arm | | | | | | | |
|--|---|-----|-----|-----|-----|-----|-----|
| Size | | Ø8 | Ø10 | Ø12 | Ø16 | Ø20 | Ø25 |
| Rebar BSt 500 S | $V_{Rk,s}$ [kN] | 14 | 22 | 31 | 55 | 86 | 135 |
| Partial safety factor | γ_{Ms} [-] | 1,5 | | | | | |
| Characteristic resistance of group of fasteners | | | | | | | |
| Ductility factor | $k_7 = 1,0$ for steel with rupture elongation $A_5 > 8\%$ | | | | | | |

| Steel failure with lever arm | | | | | | | |
|--|--------------------|-----|-----|-----|-----|-----|------|
| Size | | Ø8 | Ø10 | Ø12 | Ø16 | Ø20 | Ø25 |
| Rebar BSt 500 S | $M^o_{Rk,s}$ [N.m] | 33 | 65 | 112 | 265 | 518 | 1013 |
| Partial safety factor | γ_{Ms} [-] | 1,5 | | | | | |
| Concrete pryout failure | | | | | | | |
| Factor for resistance to pry-out failure | k_8 [-] | 2 | | | | | |

| Concrete edge failure | | | | | | | |
|------------------------------|----------------|--------------------------------|-----|-----|-----|-----|-----|
| Size | | Ø8 | Ø10 | Ø12 | Ø16 | Ø20 | Ø25 |
| Outside diameter of fastener | d_{nom} [mm] | 8 | 10 | 12 | 16 | 20 | 25 |
| Effective length of fastener | l_f [mm] | min (h_{ef} , 8 d_{nom}) | | | | | |

WB300, WB300W, WB300T, WB300 Desert, WB300T Desert

Performances

Design according to EN 1992-4
Characteristic resistance for shear loads - rebar

Annex C 16

Table C19: Displacement of threaded rod under tension and shear load
Hammer drilling, dustless drilling

| Size | M8 | M10 | M12 | M16 | M20 | M24 |
|----------------------------|-------|-------|-------|-------|-------|-------|
| Tension load | | | | | | |
| Uncracked concrete | | | | | | |
| δ_{N0} [mm/kN] | 0,030 | 0,024 | 0,026 | 0,026 | 0,022 | 0,023 |
| $\delta_{N\infty}$ [mm/kN] | 0,103 | 0,083 | 0,059 | 0,045 | 0,038 | 0,032 |
| Cracked concrete | | | | | | |
| δ_{N0} [mm/kN] | 0,056 | 0,044 | 0,058 | 0,063 | 0,044 | 0,035 |
| $\delta_{N\infty}$ [mm/kN] | 0,694 | 0,556 | 0,577 | 0,469 | 0,278 | 0,217 |
| Shear load | | | | | | |
| δ_{V0} [mm/kN] | 0,021 | 0,016 | 0,013 | 0,010 | 0,008 | 0,007 |
| $\delta_{V\infty}$ [mm/kN] | 0,031 | 0,024 | 0,020 | 0,015 | 0,012 | 0,010 |

Table C20: Displacement of threaded rod under tension and shear load
Diamond core drilling

| Size | M8 | M10 | M12 | M16 | M20 | M24 |
|----------------------------|-------|-------|-------|-------|-------|-------|
| Tension load | | | | | | |
| Uncracked concrete | | | | | | |
| δ_{N0} [mm/kN] | 0,035 | 0,032 | 0,024 | 0,026 | 0,023 | 0,024 |
| $\delta_{N\infty}$ [mm/kN] | 0,106 | 0,086 | 0,063 | 0,048 | 0,038 | 0,031 |
| Cracked concrete | | | | | | |
| δ_{N0} [mm/kN] | 0,075 | 0,088 | 0,057 | 0,066 | 0,056 | 0,060 |
| $\delta_{N\infty}$ [mm/kN] | 0,629 | 0,547 | 0,348 | 0,287 | 0,200 | 0,159 |
| Shear load | | | | | | |
| δ_{V0} [mm/kN] | 0,021 | 0,016 | 0,013 | 0,010 | 0,008 | 0,007 |
| $\delta_{V\infty}$ [mm/kN] | 0,031 | 0,024 | 0,020 | 0,015 | 0,012 | 0,010 |

Table C21: Displacement of rebar under tension and shear load
Hammer drilling, dustless drilling

| Size | Ø8 | Ø10 | Ø12 | Ø16 | Ø20 | Ø25 |
|----------------------------|-------|-------|-------|-------|-------|-------|
| Tension load | | | | | | |
| Uncracked concrete | | | | | | |
| δ_{N0} [mm/kN] | 0,037 | 0,033 | 0,036 | 0,031 | 0,025 | 0,023 |
| $\delta_{N\infty}$ [mm/kN] | 0,126 | 0,113 | 0,081 | 0,053 | 0,043 | 0,031 |
| Cracked concrete | | | | | | |
| δ_{N0} [mm/kN] | 0,067 | 0,054 | 0,071 | 0,047 | 0,044 | 0,043 |
| $\delta_{N\infty}$ [mm/kN] | 0,820 | 0,630 | 0,660 | 0,372 | 0,272 | 0,266 |
| Shear load | | | | | | |
| δ_{V0} [mm/kN] | 0,020 | 0,016 | 0,013 | 0,010 | 0,008 | 0,006 |
| $\delta_{V\infty}$ [mm/kN] | 0,030 | 0,025 | 0,019 | 0,015 | 0,012 | 0,008 |

Table C22: Displacement of rebar under tension and shear load
Diamond core drilling

| Size | Ø8 | Ø10 | Ø12 | Ø16 | Ø20 | Ø25 |
|----------------------------|-------|-------|-------|-------|-------|-------|
| Tension load | | | | | | |
| Uncracked concrete | | | | | | |
| δ_{N0} [mm/kN] | 0,045 | 0,037 | 0,044 | 0,039 | 0,037 | 0,041 |
| $\delta_{N\infty}$ [mm/kN] | 0,116 | 0,091 | 0,068 | 0,049 | 0,038 | 0,041 |
| Cracked concrete | | | | | | |
| δ_{N0} [mm/kN] | 0,107 | 0,092 | 0,075 | 0,075 | 0,057 | 0,050 |
| $\delta_{N\infty}$ [mm/kN] | 0,609 | 0,459 | 0,343 | 0,287 | 0,204 | 0,144 |
| Shear load | | | | | | |
| δ_{V0} [mm/kN] | 0,020 | 0,016 | 0,013 | 0,010 | 0,008 | 0,006 |
| $\delta_{V\infty}$ [mm/kN] | 0,030 | 0,025 | 0,019 | 0,015 | 0,012 | 0,008 |

WB300, WB300W, WB300T, WB300 Desert, WB300T Desert

Performances
Displacement for threaded rod and rebar

Annex C 17

Table C23: Seismic performance category C1 - Hammer drilling, Dustless drilling

| Size | | | M8 | M10 | M12 | M16 | M20 | M24 |
|--|----------------|----------------------|---------------|-----|-----|-----|-----|-----|
| Tension load | | | | | | | | |
| Steel failure | | | | | | | | |
| Characteristic resistance grade 4.6 | $N_{RK,s,eq}$ | [kN] | 15 | 23 | 34 | 63 | 98 | 141 |
| Partial safety factor | γ_{Ms} | [-] | 2,00 | | | | | |
| Characteristic resistance grade 4.8 | $N_{RK,s,eq}$ | [kN] | 15 | 23 | 34 | 63 | 98 | 141 |
| Partial safety factor | γ_{Ms} | [-] | 1,50 | | | | | |
| Characteristic resistance grade 5.6 | $N_{RK,s,eq}$ | [kN] | 18 | 29 | 42 | 79 | 123 | 177 |
| Partial safety factor | γ_{Ms} | [-] | 2,00 | | | | | |
| Characteristic resistance grade 5.8 | $N_{RK,s,eq}$ | [kN] | 18 | 29 | 42 | 79 | 123 | 177 |
| Partial safety factor | γ_{Ms} | [-] | 1,50 | | | | | |
| Characteristic resistance grade 8.8 | $N_{RK,s,eq}$ | [kN] | 29 | 46 | 67 | 126 | 196 | 282 |
| Partial safety factor | γ_{Ms} | [-] | 1,50 | | | | | |
| Characteristic resistance grade 10.9 | | | Not qualified | | | | | |
| Characteristic resistance A2-70, A4-70 | $N_{RK,s,eq}$ | [kN] | 25 | 41 | 59 | 110 | 172 | 247 |
| Partial safety factor | γ_{Ms} | [-] | 1,87 | | | | | |
| Characteristic resistance A4-80 | $N_{RK,s,eq}$ | [kN] | 29 | 46 | 67 | 126 | 196 | 282 |
| Partial safety factor | γ_{Ms} | [-] | 1,60 | | | | | |
| Characteristic resistance 1.4529 | $N_{RK,s,eq}$ | [kN] | 25 | 41 | 59 | 110 | 172 | 247 |
| Partial safety factor | γ_{Ms} | [-] | 1,50 | | | | | |
| Characteristic resistance 1.4565 | $N_{RK,s,eq}$ | [kN] | 25 | 41 | 59 | 110 | 172 | 247 |
| Partial safety factor | γ_{Ms} | [-] | 1,87 | | | | | |
| Characteristic resistance to pull-out for a working life of 50 years | | | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{RK,C1}$ | [N/mm ²] | 3,1 | 3,0 | 2,4 | 2,6 | 3,0 | 3,0 |
| Characteristic resistance to pull-out for a working life of 100 years | | | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{RK,C1}$ | [N/mm ²] | 2,3 | 2,4 | 2,0 | 2,1 | 2,4 | 2,4 |
| Installation safety factor | | | See Annex C 2 | | | | | |
| Shear load | | | | | | | | |
| Steel failure without lever arm | | | | | | | | |
| Characteristic resistance grade 4.6 | $V_{RK,s,eq}$ | [kN] | 5 | 6 | 10 | 21 | 34 | 43 |
| Partial safety factor | γ_{Ms} | [-] | 1,67 | | | | | |
| Characteristic resistance grade 4.8 | $V_{RK,s,eq}$ | [kN] | 5 | 6 | 10 | 21 | 34 | 43 |
| Partial safety factor | γ_{Ms} | [-] | 1,25 | | | | | |
| Characteristic resistance grade 5.6 | $V_{RK,s,eq}$ | [kN] | 6 | 8 | 12 | 26 | 42 | 54 |
| Partial safety factor | γ_{Ms} | [-] | 1,67 | | | | | |
| Characteristic resistance grade 5.8 | $V_{RK,s,eq}$ | [kN] | 6 | 8 | 12 | 26 | 42 | 54 |
| Partial safety factor | γ_{Ms} | [-] | 1,25 | | | | | |
| Characteristic resistance grade 8.8 | $V_{RK,s,eq}$ | [kN] | 8 | 11 | 17 | 35 | 56 | 72 |
| Partial safety factor | γ_{Ms} | [-] | 1,25 | | | | | |
| Characteristic resistance grade 10.9 | | | Not qualified | | | | | |
| Characteristic resistance A2-70, A4-70 | $V_{RK,s,eq}$ | [kN] | 7 | 9 | 15 | 31 | 49 | 53 |
| Partial safety factor | γ_{Ms} | [-] | 1,56 | | | | | |
| Characteristic resistance A4-80 | $V_{RK,s,eq}$ | [kN] | 8 | 11 | 17 | 35 | 56 | 72 |
| Partial safety factor | γ_{Ms} | [-] | 1,33 | | | | | |
| Characteristic resistance 1.4529 | $V_{RK,s,eq}$ | [kN] | 7 | 9 | 15 | 31 | 49 | 63 |
| Partial safety factor | γ_{Ms} | [-] | 1,25 | | | | | |
| Characteristic resistance 1.4565 | $V_{RK,s,eq}$ | [kN] | 7 | 9 | 15 | 31 | 49 | 63 |
| Partial safety factor | γ_{Ms} | [-] | 1,56 | | | | | |
| Factor for annular gap without filling gap | α_{gap} | [-] | 0,5 | | | | | |
| Factor for annular gap with filling gap | α_{gap} | [-] | 1,0 | | | | | |

WB300, WB300W, WB300T, WB300 Desert, WB300T Desert

Performances

Hammer drilling, Dustless drilling
Seismic performance category C1 of threaded rod

Annex C 18

Table C24: Seismic performance category C1 for WB300W with installation temperature < -10°C
Hammer drilling, Dustless drilling

| Size | | | M8 | M10 | M12 | M16 | M20 | M24 |
|--|----------------|----------------------|---------------|-----|-----|-----|-----|-----|
| Tension load | | | | | | | | |
| Steel failure | | | | | | | | |
| Characteristic resistance grade 4.6 | $N_{RK,s,eq}$ | [kN] | 15 | 23 | 34 | 63 | 98 | 141 |
| Partial safety factor | γ_{Ms} | [-] | 2,00 | | | | | |
| Characteristic resistance grade 4.8 | $N_{RK,s,eq}$ | [kN] | 15 | 23 | 34 | 63 | 98 | 141 |
| Partial safety factor | γ_{Ms} | [-] | 1,50 | | | | | |
| Characteristic resistance grade 5.6 | $N_{RK,s,eq}$ | [kN] | 18 | 29 | 42 | 79 | 123 | 177 |
| Partial safety factor | γ_{Ms} | [-] | 2,00 | | | | | |
| Characteristic resistance grade 5.8 | $N_{RK,s,eq}$ | [kN] | 18 | 29 | 42 | 79 | 123 | 177 |
| Partial safety factor | γ_{Ms} | [-] | 1,50 | | | | | |
| Characteristic resistance grade 8.8 | $N_{RK,s,eq}$ | [kN] | 29 | 46 | 67 | 126 | 196 | 282 |
| Partial safety factor | γ_{Ms} | [-] | 1,50 | | | | | |
| Characteristic resistance grade 10.9 | | | Not qualified | | | | | |
| Characteristic resistance A2-70, A4-70 | $N_{RK,s,eq}$ | [kN] | 25 | 41 | 59 | 110 | 172 | 247 |
| Partial safety factor | γ_{Ms} | [-] | 1,87 | | | | | |
| Characteristic resistance A4-80 | $N_{RK,s,eq}$ | [kN] | 29 | 46 | 67 | 126 | 196 | 282 |
| Partial safety factor | γ_{Ms} | [-] | 1,60 | | | | | |
| Characteristic resistance 1.4529 | $N_{RK,s,eq}$ | [kN] | 25 | 41 | 59 | 110 | 172 | 247 |
| Partial safety factor | γ_{Ms} | [-] | 1,50 | | | | | |
| Characteristic resistance 1.4565 | $N_{RK,s,eq}$ | [kN] | 25 | 41 | 59 | 110 | 172 | 247 |
| Partial safety factor | γ_{Ms} | [-] | 1,87 | | | | | |
| Characteristic resistance to pull-out for a working life of 50 years | | | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{RK,C1}$ | [N/mm ²] | 2,9 | 2,8 | 2,3 | 2,4 | 2,8 | 2,9 |
| Characteristic resistance to pull-out for a working life of 100 years | | | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{RK,C1}$ | [N/mm ²] | 2,2 | 2,3 | 1,9 | 2,0 | 2,3 | 2,3 |
| Installation safety factor | | | See Annex C 2 | | | | | |
| Shear load | | | | | | | | |
| Steel failure without lever arm | | | | | | | | |
| Characteristic resistance grade 4.6 | $V_{RK,s,eq}$ | [kN] | 5 | 6 | 10 | 21 | 34 | 43 |
| Partial safety factor | γ_{Ms} | [-] | 1,67 | | | | | |
| Characteristic resistance grade 4.8 | $V_{RK,s,eq}$ | [kN] | 5 | 6 | 10 | 21 | 34 | 43 |
| Partial safety factor | γ_{Ms} | [-] | 1,25 | | | | | |
| Characteristic resistance grade 5.6 | $V_{RK,s,eq}$ | [kN] | 6 | 8 | 12 | 26 | 42 | 54 |
| Partial safety factor | γ_{Ms} | [-] | 1,67 | | | | | |
| Characteristic resistance grade 5.8 | $V_{RK,s,eq}$ | [kN] | 6 | 8 | 12 | 26 | 42 | 54 |
| Partial safety factor | γ_{Ms} | [-] | 1,25 | | | | | |
| Characteristic resistance grade 8.8 | $V_{RK,s,eq}$ | [kN] | 8 | 11 | 17 | 35 | 56 | 72 |
| Partial safety factor | γ_{Ms} | [-] | 1,25 | | | | | |
| Characteristic resistance grade 10.9 | | | Not qualified | | | | | |
| Characteristic resistance A2-70, A4-70 | $V_{RK,s,eq}$ | [kN] | 7 | 9 | 15 | 31 | 49 | 53 |
| Partial safety factor | γ_{Ms} | [-] | 1,56 | | | | | |
| Characteristic resistance A4-80 | $V_{RK,s,eq}$ | [kN] | 8 | 11 | 17 | 35 | 56 | 72 |
| Partial safety factor | γ_{Ms} | [-] | 1,33 | | | | | |
| Characteristic resistance 1.4529 | $V_{RK,s,eq}$ | [kN] | 7 | 9 | 15 | 31 | 49 | 63 |
| Partial safety factor | γ_{Ms} | [-] | 1,25 | | | | | |
| Characteristic resistance 1.4565 | $V_{RK,s,eq}$ | [kN] | 7 | 9 | 15 | 31 | 49 | 63 |
| Partial safety factor | γ_{Ms} | [-] | 1,56 | | | | | |
| Factor for annular gap without filling gap | α_{gap} | [-] | 0,5 | | | | | |
| Factor for annular gap with filling gap | α_{gap} | [-] | 1,0 | | | | | |

WB300W

Performances

Hammer drilling, Dustless drilling
Seismic performance category C1 of threaded rod

Annex C 19

Table C25: Seismic performance category C2 - Hammer drilling, Dustless drilling

| Size | M12 | M16 |
|--|-------------------------------------|-----------|
| Tension load | | |
| Steel failure | | |
| See Annex C 1 | | |
| Characteristic resistance to pull-out for a working life of 50 years | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,C2}$ [N/mm ²] | 0,9 0,6 |
| Characteristic resistance to pull-out for a working life of 100 years | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,C2}$ [N/mm ²] | 0,6 0,4 |
| Installation safety factor | | |
| Dry, wet concrete | γ_{inst} [-] | 1,2 |
| Hammer drilling - flooded hole | γ_{inst} [-] | 1,2 |
| Dustless drilling - flooded hole | γ_{inst} [-] | 1,4 |

| Shear load | | | |
|---|--------------------------|---------------|------|
| Steel failure without lever arm | | | |
| Characteristic resistance grade 4.6 | $V_{Rk,s,C2}$ [kN] | 13,6 | 27,3 |
| Partial safety factor | γ_{Ms} [-] | 1,67 | |
| Characteristic resistance grade 5.8 | $V_{Rk,s,C2}$ [kN] | 17,0 | 34,1 |
| Partial safety factor | γ_{Ms} [-] | 1,25 | |
| Characteristic resistance grade 8.8 | $V_{Rk,s,C2}$ [kN] | 27,1 | 54,6 |
| Partial safety factor | γ_{Ms} [-] | 1,25 | |
| Characteristic resistance grade 10.9 | | Not qualified | |
| Characteristic resistance A2-70, A4-70 | $V_{Rk,s,C2}$ [kN] | 23,8 | 47,8 |
| Partial safety factor | γ_{Ms} [-] | 1,56 | |
| Characteristic resistance A4-80 | $V_{Rk,s,C2}$ [kN] | 27,1 | 54,6 |
| Partial safety factor | γ_{Ms} [-] | 1,33 | |
| Characteristic resistance 1.4529 | $V_{Rk,s,C2}$ [kN] | 25,7 | 54,4 |
| Partial safety factor | γ_{Ms} [-] | 1,25 | |
| Characteristic resistance 1.4565 | $V_{Rk,s,C2}$ [kN] | 25,7 | 54,4 |
| Partial safety factor | γ_{Ms} [-] | 1,56 | |
| Characteristic shear load resistance $V_{Rk,s,eq}$ in the Table C8 shall be multiplied by following reduction factor for hot-dip galvanized commercial standard rods | | | |
| Reduction factor for hot-dip galvanized rods | $\alpha_{v,h-dg,c2}$ [-] | 0,46 | 0,61 |
| Factor for annular gap without filling gap | α_{gap} [-] | 0,5 | |
| Factor for annular gap with filling gap | α_{gap} [-] | 1,0 | |

Table C24: Displacement under tensile and shear load - seismic category C2

| Size | M12 | M16 |
|-----------------------------|------|------|
| $\delta_{N,C2(50\%)}$ [mm] | 0,13 | 0,12 |
| $\delta_{N,C2(100\%)}$ [mm] | 0,24 | 0,17 |
| $\delta_{V,C2(50\%)}$ [mm] | 4,68 | 4,07 |
| $\delta_{V,C2(100\%)}$ [mm] | 8,02 | 6,76 |

The anchor shall be used with minimum rupture elongation after fracture $A_5 \geq 9\%$.

Note: Threaded sockets and rebars are not qualified for seismic design

| | |
|--|-------------------|
| WB300, WB300W, WB300T, WB300 Desert, WB300T Desert | Annex C 20 |
| Performances Hammer drilling, Dustless drilling Seismic performance category C2 | |

Table C26: Seismic performance category C2 for WB300W with installation temperature < -10°C
 Hammer drilling, Dustless drilling

| Size | | | M12 | M16 |
|--|-----------------|----------------------|-----|-----|
| Tension load | | | | |
| Steel failure | | | | |
| See Annex C 1 | | | | |
| Characteristic resistance to pull-out for a working life of 50 years | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,C2}$ | [N/mm ²] | 0,8 | 0,6 |
| Characteristic resistance to pull-out for a working life of 100 years | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,C2}$ | [N/mm ²] | 0,6 | 0,4 |
| Installation safety factor | | | | |
| Dry, wet concrete | γ_{inst} | [-] | 1,2 | |
| Hammer drilling - flooded hole | γ_{inst} | [-] | 1,2 | |
| Dustless drilling - flooded hole | γ_{inst} | [-] | 1,4 | |

| | | | | |
|--|----------------|-----|-----|--|
| Shear load | | | | |
| Steel failure without lever arm | | | | |
| See Annex C 20 | | | | |
| Factor for annular gap without filling gap | α_{gap} | [-] | 0,5 | |
| Factor for annular gap with filling gap | α_{gap} | [-] | 1,0 | |

The anchor shall be used with minimum rupture elongation after fracture $A_5 \geq 9\%$.

Note: Threaded sockets and rebars are not qualified for seismic design

| | |
|--|-------------------|
| WB300W | Annex C 21 |
| Performances Hammer drilling, Dustless drilling Seismic performance category C2 | |

Characteristic resistance to combined pull-out and concrete failure $\tau_{RK,fi}(\theta)$ under fire exposure for threaded rods for hammer or dustless drilling

The characteristic resistance to combined pull-out and concrete failure under fire $\tau_{RK,fi,p}(\theta)$ shall be determined according to following equation:

$$\tau_{RK,fi,p}(\theta) = k_{fi,p}(\theta) \cdot \tau_{RK,cr}$$

$$k_{fi,p}(\theta) = 1 \quad \text{for } \theta < 23^\circ\text{C}$$

$$k_{fi,p}(\theta) = 114,574 \cdot \theta^{-1,514} \leq 1 \quad \text{for } 23^\circ\text{C} \leq \theta \leq 341^\circ\text{C}$$

$$k_{fi,p}(\theta) = 0 \quad \text{for } \theta > 341^\circ\text{C}$$

- $\tau_{RK,fi,p}$ = characteristic bond resistance for cracked concrete under fire exposure for given temperature (θ)
- $\tau_{RK,cr}$ = characteristic bond resistance for cracked concrete for concrete strength class C20/25
- $k_{fi,p}(\theta)$ = reduction factor for bond resistance under fire conditions

Reduction factor $k_{fi,p}(\theta)$

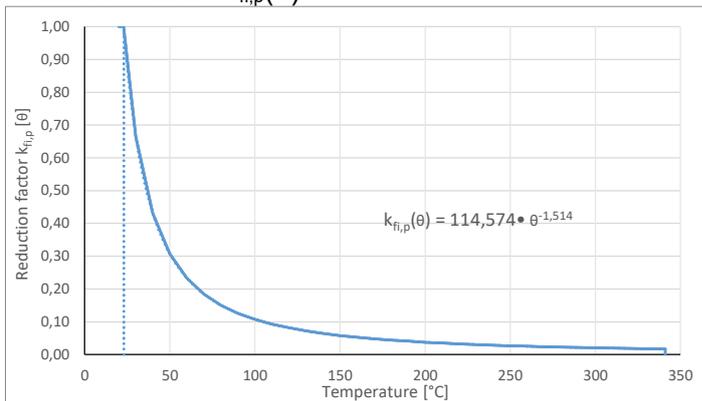


Table C27: Steel failure - Characteristic resistance under tension load under fire conditions

| Size | | M8 | M10 | M12 | M16 | M20 | M24 |
|---|-------------------------|------|------|------|------|------|-------|
| Steel grade: 4.6; 4.8; 5.6; 5.8; 8.8; 10.9 | $N_{RK,s,fi(30)}$ [kN] | 0,37 | 0,87 | 1,69 | 3,14 | 4,90 | 7,06 |
| | $N_{RK,s,fi(60)}$ [kN] | 0,33 | 0,75 | 1,26 | 2,36 | 3,68 | 5,30 |
| | $N_{RK,s,fi(90)}$ [kN] | 0,26 | 0,58 | 1,10 | 2,04 | 3,19 | 4,59 |
| | $N_{RK,s,fi(120)}$ [kN] | 0,18 | 0,46 | 0,84 | 1,57 | 2,45 | 3,53 |
| Stainless steel grade: A2-70; A4-70; A4-80 | $N_{RK,s,fi(30)}$ [kN] | 0,73 | 1,45 | 2,53 | 4,71 | 7,35 | 10,59 |
| | $N_{RK,s,fi(60)}$ [kN] | 0,59 | 1,16 | 2,11 | 3,93 | 6,13 | 8,83 |
| High corrosion resistant steel grade: 1.4529; 1.4565 | $N_{RK,s,fi(90)}$ [kN] | 0,44 | 0,93 | 1,69 | 3,14 | 4,90 | 7,06 |
| | $N_{RK,s,fi(120)}$ [kN] | 0,37 | 0,81 | 1,35 | 2,51 | 3,92 | 5,65 |

Table C28: Steel failure - Characteristic resistance under shear load under fire conditions

| Size | | M8 | M10 | M12 | M16 | M20 | M24 |
|---|------------------------------------|------|------|------|------|------|-------|
| Steel grade: 4.6; 4.8; 5.6; 5.8; 8.8; 10.9 | $V_{RK,s,fi(30)}$ [kN] | 0,37 | 0,87 | 1,69 | 3,14 | 4,90 | 7,06 |
| | $V_{RK,s,fi(60)}$ [kN] | 0,33 | 0,75 | 1,26 | 2,36 | 3,68 | 5,30 |
| | $V_{RK,s,fi(90)}$ [kN] | 0,26 | 0,58 | 1,10 | 2,04 | 3,19 | 4,59 |
| | $V_{RK,s,fi(120)}$ [kN] | 0,18 | 0,46 | 0,84 | 1,57 | 2,45 | 3,53 |
| | $M^{\circ}{}_{RK,s,fi(30)}$ [N.m] | 0,4 | 1,1 | 2,6 | 6,7 | 13,0 | 22,5 |
| | $M^{\circ}{}_{RK,s,fi(60)}$ [N.m] | 0,3 | 1,0 | 2,0 | 5,0 | 9,7 | 16,8 |
| | $M^{\circ}{}_{RK,s,fi(90)}$ [N.m] | 0,3 | 0,7 | 1,7 | 4,3 | 8,4 | 14,6 |
| | $M^{\circ}{}_{RK,s,fi(120)}$ [N.m] | 0,2 | 0,6 | 1,3 | 3,3 | 6,5 | 11,2 |
| Stainless steel grade: A2-70; A4-70; A4-80 | $V_{RK,s,fi(30)}$ [kN] | 0,73 | 1,45 | 2,53 | 4,71 | 7,35 | 10,59 |
| | $V_{RK,s,fi(60)}$ [kN] | 0,59 | 1,16 | 2,11 | 3,93 | 6,13 | 8,83 |
| | $V_{RK,s,fi(90)}$ [kN] | 0,44 | 0,93 | 1,69 | 3,14 | 4,90 | 7,06 |
| | $V_{RK,s,fi(120)}$ [kN] | 0,37 | 0,81 | 1,35 | 2,51 | 3,92 | 5,65 |
| | $M^{\circ}{}_{RK,s,fi(30)}$ [N.m] | 0,7 | 1,9 | 3,9 | 10,0 | 19,5 | 33,7 |
| | $M^{\circ}{}_{RK,s,fi(60)}$ [N.m] | 0,6 | 1,5 | 3,3 | 8,3 | 16,2 | 28,1 |
| | $M^{\circ}{}_{RK,s,fi(90)}$ [N.m] | 0,4 | 1,2 | 2,6 | 6,7 | 13,0 | 22,5 |
| | $M^{\circ}{}_{RK,s,fi(120)}$ [N.m] | 0,4 | 1,0 | 2,1 | 5,3 | 10,4 | 18,0 |

WB300, WB300W, WB300T, WB300 Desert, WB300T Desert

Performances
Bond resistance under fire conditions for threaded rods

Annex C 22

Characteristic resistance to combined pull-out and concrete failure $\tau_{Rk,fi}(\theta)$ under fire exposure for threaded sockets for hammer or dustless drilling

The characteristic resistance to combined pull-out and concrete failure under fire $\tau_{Rk,fi,p}(\theta)$ shall be determined according to following equation:

$$\tau_{Rk,fi,p}(\theta) = k_{fi,p}(\theta) \cdot \tau_{Rk,cr}$$

$$k_{fi,p}(\theta) = 1 \quad \text{for } \theta < 23^\circ\text{C}$$

$$k_{fi,p}(\theta) = 114,574 \cdot \theta^{-1,514} \leq 1 \quad \text{for } 23^\circ\text{C} \leq \theta \leq 341^\circ\text{C}$$

$$k_{fi,p}(\theta) = 0 \quad \text{for } \theta > 341^\circ\text{C}$$

- $\tau_{Rk,fi,p}$ = characteristic bond resistance for cracked concrete under fire exposure for given temperature (θ)
- $\tau_{Rk,cr}$ = characteristic bond resistance for cracked concrete for concrete strength class C20/25
- $k_{fi,p}(\theta)$ = reduction factor for bond resistance under fire conditions

Reduction factor $k_{fi,p}(\theta)$

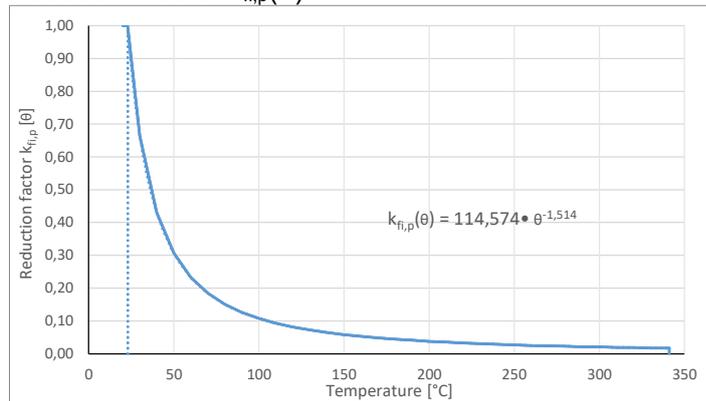


Table C29: Steel failure - Characteristic resistance under tension load under fire conditions

| Size | | M6 | M8 | M10 | M12 | M16 |
|---|-------------------------|------|------|------|------|------|
| Steel grade: 4.6; 4.8; 5.6; 5.8; 8.8; 10.9 | $N_{Rk,s,fi(30)}$ [kN] | 0,20 | 0,37 | 0,87 | 1,69 | 3,14 |
| | $N_{Rk,s,fi(60)}$ [kN] | 0,18 | 0,33 | 0,75 | 1,26 | 2,36 |
| | $N_{Rk,s,fi(90)}$ [kN] | 0,14 | 0,26 | 0,58 | 1,10 | 2,04 |
| | $N_{Rk,s,fi(120)}$ [kN] | 0,10 | 0,18 | 0,46 | 0,84 | 1,57 |
| Stainless steel grade: A2-70; A4-70; A4-80 | $N_{Rk,s,fi(30)}$ [kN] | 0,20 | 0,73 | 1,45 | 2,53 | 4,71 |
| | $N_{Rk,s,fi(60)}$ [kN] | 0,18 | 0,59 | 1,16 | 2,11 | 3,93 |
| High corrosion resistant steel grade: 1.4529; 1.4565 | $N_{Rk,s,fi(90)}$ [kN] | 0,14 | 0,44 | 0,93 | 1,69 | 3,14 |
| | $N_{Rk,s,fi(120)}$ [kN] | 0,10 | 0,37 | 0,81 | 1,35 | 2,51 |

Table C30: Steel failure - Characteristic resistance under shear load under fire conditions

| Size | | M6 | M8 | M10 | M12 | M16 |
|---|-------------------------------|------|------|------|------|------|
| Steel grade: 4.6; 4.8; 5.6; 5.8; 8.8; 10.9 | $V_{Rk,s,fi(30)}$ [kN] | 0,20 | 0,37 | 0,87 | 1,69 | 3,14 |
| | $V_{Rk,s,fi(60)}$ [kN] | 0,18 | 0,33 | 0,75 | 1,26 | 2,36 |
| | $V_{Rk,s,fi(90)}$ [kN] | 0,14 | 0,26 | 0,58 | 1,10 | 2,04 |
| | $V_{Rk,s,fi(120)}$ [kN] | 0,10 | 0,18 | 0,46 | 0,84 | 1,57 |
| | $M^{\circ}Rk,s,fi(30)$ [N.m] | 0,2 | 0,4 | 1,1 | 2,6 | 6,7 |
| | $M^{\circ}Rk,s,fi(60)$ [N.m] | 0,1 | 0,3 | 1,0 | 2,0 | 5,0 |
| | $M^{\circ}Rk,s,fi(90)$ [N.m] | 0,1 | 0,3 | 0,7 | 1,7 | 4,3 |
| | $M^{\circ}Rk,s,fi(120)$ [N.m] | 0,1 | 0,2 | 0,6 | 1,3 | 3,3 |
| Stainless steel grade: A2-70; A4-70; A4-80 | $V_{Rk,s,fi(30)}$ [kN] | 0,20 | 0,73 | 1,45 | 2,53 | 4,71 |
| | $V_{Rk,s,fi(60)}$ [kN] | 0,18 | 0,59 | 1,16 | 2,11 | 3,93 |
| High corrosion resistant steel grade: 1.4529; 1.4565 | $V_{Rk,s,fi(90)}$ [kN] | 0,14 | 0,44 | 0,93 | 1,69 | 3,14 |
| | $V_{Rk,s,fi(120)}$ [kN] | 0,10 | 0,37 | 0,81 | 1,35 | 2,51 |
| | $M^{\circ}Rk,s,fi(30)$ [N.m] | 0,2 | 0,7 | 1,9 | 3,9 | 10,0 |
| | $M^{\circ}Rk,s,fi(60)$ [N.m] | 0,1 | 0,6 | 1,5 | 3,3 | 8,3 |
| | $M^{\circ}Rk,s,fi(90)$ [N.m] | 0,1 | 0,4 | 1,2 | 2,6 | 6,7 |
| | $M^{\circ}Rk,s,fi(120)$ [N.m] | 0,1 | 0,4 | 1,0 | 2,1 | 5,3 |

WB300, WB300W, WB300T, WB300 Desert, WB300T Desert

Performances
Bond resistance under fire conditions for threaded sockets

Annex C 23

Characteristic resistance to combined pull-out and concrete failure $\tau_{RK,fi}(\theta)$ under fire exposure for rebars for hammer or dustless drilling

The characteristic resistance to combined pull-out and concrete failure under fire $\tau_{RK,fi,p}(\theta)$ shall be determined according to following equation:

$$\tau_{RK,fi,p}(\theta) = k_{fi,p}(\theta) \cdot \tau_{RK,cr}$$

$$k_{fi,p}(\theta) = 1 \quad \text{for } \theta < 23^\circ\text{C}$$

$$k_{fi,p}(\theta) = 114,574 \cdot \theta^{-1,514} \leq 1 \quad \text{for } 23^\circ\text{C} \leq \theta \leq 341^\circ\text{C}$$

$$k_{fi,p}(\theta) = 0 \quad \text{for } \theta > 341^\circ\text{C}$$

- $\tau_{RK,fi,p}$ = characteristic bond resistance for cracked concrete under fire exposure for given temperature (θ)
- $\tau_{RK,cr}$ = characteristic bond resistance for cracked concrete for concrete strength class C20/25
- $k_{fi,p}(\theta)$ = reduction factor for bond resistance under fire conditions

Reduction factor $k_{fi,p}(\theta)$

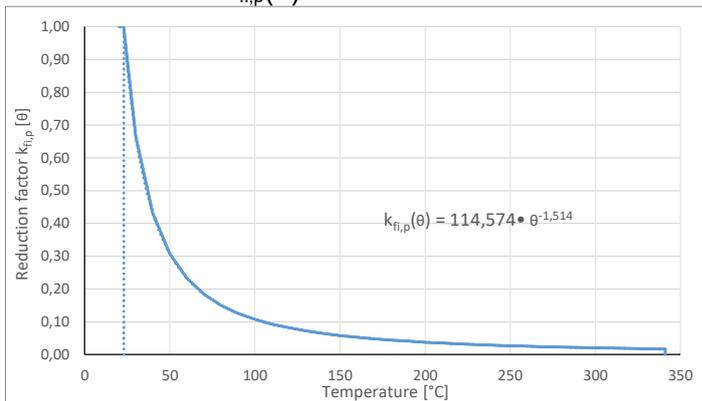


Table C31: Steel failure - Characteristic resistance under tension load under fire conditions

| Size | | $\varnothing 8$ | $\varnothing 10$ | $\varnothing 12$ | $\varnothing 16$ | $\varnothing 20$ | $\varnothing 25$ |
|-----------------|-------------------------|-----------------|------------------|------------------|------------------|------------------|------------------|
| Rebar BSt 500 S | $N_{RK,s,fi(30)}$ [kN] | 0,50 | 1,18 | 2,26 | 4,02 | 6,28 | 9,82 |
| | $N_{RK,s,fi(60)}$ [kN] | 0,45 | 1,02 | 1,70 | 3,02 | 4,71 | 7,36 |
| | $N_{RK,s,fi(90)}$ [kN] | 0,35 | 0,79 | 1,47 | 2,61 | 4,08 | 6,38 |
| | $N_{RK,s,fi(120)}$ [kN] | 0,25 | 0,63 | 1,13 | 2,01 | 3,14 | 4,91 |

Table C32: Steel failure - Characteristic resistance under shear load under fire conditions

| Size | | $\varnothing 8$ | $\varnothing 10$ | $\varnothing 12$ | $\varnothing 16$ | $\varnothing 20$ | $\varnothing 25$ |
|-----------------|----------------------------------|-----------------|------------------|------------------|------------------|------------------|------------------|
| Rebar BSt 500 S | $V_{RK,s,fi(30)}$ [kN] | 0,50 | 1,18 | 2,26 | 4,02 | 6,28 | 9,82 |
| | $V_{RK,s,fi(60)}$ [kN] | 0,45 | 1,02 | 1,70 | 3,02 | 4,71 | 7,36 |
| | $V_{RK,s,fi(90)}$ [kN] | 0,35 | 0,79 | 1,47 | 2,61 | 4,08 | 6,38 |
| | $V_{RK,s,fi(120)}$ [kN] | 0,25 | 0,63 | 1,13 | 2,01 | 3,14 | 4,91 |
| | $M^{\circ}_{RK,s,fi(30)}$ [N.m] | 0,6 | 1,8 | 4,1 | 9,7 | 18,9 | 36,8 |
| | $M^{\circ}_{RK,s,fi(60)}$ [N.m] | 0,5 | 1,5 | 3,1 | 7,2 | 14,1 | 27,6 |
| | $M^{\circ}_{RK,s,fi(90)}$ [N.m] | 0,4 | 1,2 | 2,6 | 6,3 | 12,3 | 23,9 |
| | $M^{\circ}_{RK,s,fi(120)}$ [N.m] | 0,3 | 0,9 | 2,0 | 4,8 | 9,4 | 18,4 |

WB300, WB300W, WB300T, WB300 Desert, WB300T Desert

Performances
Bond resistance under fire conditions for rebars

Annex C 24