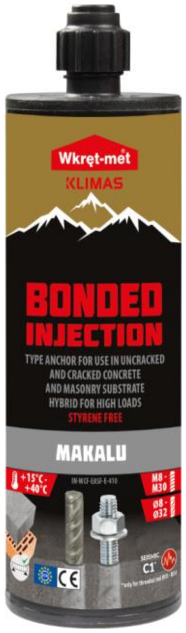
## Section 1. PRODUCT DESCRIPTION

### Description

WCF-EASF bonded anchoring system is a 100% acrylate polymer with very low VOC content offering very high performance in both cracked and uncracked concrete, and under seismic conditions (C1). WCF-EASF together with its variations is one of the most versatile anchoring systems in our range.

### Storage

Cartridges should be stored in their original packaging, the correct way up, in cool conditions (+5°C to +25°C) out of direct sunlight. When stored correctly, the product shelf life will be 18 months from the date of manufacture.




### Base materials

-Cracked and uncracked concrete
-Solid and hollow masonry
-Solid rock
-Hard natural stone
-Voided stone or rock

### Safety

For health and safety information, please refer to the relevant Safety Data Sheet.

### Accessories

-Applicators
-Mixing nozzles
-Cleaning blow pump
-Cleaning brushes
-Extension tubes
-Resin stoppers

### Features

-Suitable for use with close edge distance and small anchor spacings
-Suitable for dry, wet & flooded holes
-Reduced drilling diameters, 22mm for M20 and 26mm for M24; results in significant material and labour savings.
-Variable embedment depths 8d to 20d
-Available in co-axial cartridges (410 ml)
- Available with various drilling & cleaning methods - ( Hammer drilling, Dustless drilling , Diamond drilling ) & ( Manual pump cleaning , Compressed air cleaning , Hollow Drill Bit cleaning system, Flushing with pressurised water )

### Approvals & Tests

-ETA Option 1 for cracked and uncracked concrete; EAD 330499-01-0601

-ETA according to ETAG 001, Part 1 and Part 5 , edition 2013 and Technical Report TR023 for post-installed rebar connections

-ETA for EAD 330076-00-0604, injection anchors for use in masonry

-Meets the requirements of LEED v4.1 specifications

-Approved for seismic action Categories C1 according to EN 1992-4

-Approved for 100 years design working life

-New improved installation temperature range

### Uses/Applications

- Anchoring of steel constructions to concrete structural components
- Anchoring of base plates, brackets, consoles in high/medium load applications
- Strengthening and reinforcement of concrete members in existing superstructure ( old buildings restoration, bridges renovation, etc.)
- Wide range of post-installed rebar connections including anchorage and overlap joint applications ( e.g. slab to slab at support, overlap joint at a foundation of column or wall, etc.)

-Canopies
-Boilers
-Bicycle Racks
-Hand Rails
-Safety Barriers
-Balcony Fences
-Racking
-Machinery
-Satellite Dishes

## Section 2. WORKING & LOADING TIMES

**WORKING & LOADING TIMES FOR APPLICATIONS ACCORDING TO EN-1992-4 - DESIGN OF FASTENINGS FOR USE IN CONCRETE AND MASONRY BASE MATERIAL APPLICATIONS**

| WCF-EASF - Working & Loading Times | | | |
|---|---|---|---|
| **Resin cartridge temperature [°C]** | **T Work [min]** | **Base material Temperature [°C]** | **T Load [min]** |
| +10 | 30 mins | -10 do -5 | 24 hours |
| +5 | 20 mins | -5 do 0 | 300 mins |
| 0 do +5 | 15 mins | 0 do +5 | 210 mins |
| +5 do +10 | 10 mins | +5 do +10 | 145 mins |
| +10 do +15 | 8 mins | +10 do +15 | 85 mins |
| +15 do +20 | 6 mins | +15 do +20 | 75 mins |
| +20 do +25 | 5 mins | +20 do +25 | 50 mins |
| +25 do +30 | 4 mins | +25 do +30 | 40 mins |

| WCF-EASF-C - Working & Loading Times | | | |
|---|---|---|---|
| **Resin cartridge temperature [°C]** | **T Work [min]** | **Base material Temperature [°C]** | **T Load [min]** |
| +20 | 40 min | -20 do -15 | 24 godz. |
| +20 | 30 min | -15 do -10 | 18 godz. |
| +5 | 20 min | -10 do -5 | 12 godz. |
| +5 | 15 min | -5 do 0 | 100 min |
| 0 do +5 | 10 min | 0 do +5 | 75 min |
| +5 do +20 | 5 min | +5 do +20 | 50 min |
| +20 | 100 sekund | +20 | 20 min |

| WCF-EASF-E - Working & Loading Times | | | |
|---|---|---|---|
| **Resin cartridge temperature [°C]** | **T Work [min]** | **Base material Temperature [°C]** | **T Load [min]** |
| +15 do +20 | 15 min | +15 do +20 | 5 godz. |
| +20 do +25 | 10 min | +20 do +25 | 145 min |
| +25 do +30 | 7,5 min | +25 do +30 | 85 min |
| +30 do +35 | 5 min | +30 do +35 | 50 min |
| +35 do +40 | 3,5 min | +35 do +40 | 40 min |
| T work - is typical gel time at highest temperature | | T load - is set at the lowest temperature | |

**WORKING & LOADING TIMES FOR POST-INSTALLED REBAR APPLICATIONS**

| WCF-EASF - Working & Loading Times | | | |
|---|---|---|---|
| **Cartridge Temperature** | **T Work** | **Base Material Temperature** | **T Load** |
| 5°C | 10 Minutes | 5°C to 10°C | 145 Minutes |
| | 8 Minutes | 10°C to 15°C | 85 Minutes |
| | 6 Minutes | 15°C to 20°C | 75 Minutes |
| | 5 Minutes | 20°C to 25°C | 50 Minutes |
| | 4 Minutes | 25°C to 30°C | 40 Minutes |

*Note: 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 base material temperature in the range.*

| WCF-EASF-C - Working & Loading Times | | | |
|---|---|---|---|
| **Cartridge Temperature** | **T Work** | **Base Material Temperature** | **T Load** |
| 0°C | 10 Minutes | 0°C to 5°C | 75 Minutes |
| | 5 Minutes | 5°C to 20°C | 50 Minutes |
| | 100 seconds | +20°C | 20 Minutes |

*Note: 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 base material temperature in the range.*

| WCF-EASF-E - Working & Loading Times | | | |
|---|---|---|---|
| **Cartridge Temperature** | **T Work** | **Base Material Temperature** | **T Load** |
| +15°C | 15 Minutes | 15°C to 20°C | 5 hours |
| | 10 Minutes | 20°C to 25°C | 145 Minutes |
| | 7.5 Minutes | 25°C to 30°C | 85 Minutes |
| | 5 Minutes | 30°C to 35°C | 50 Minutes |
| | 3.5 Minutes | 35°C to 40°C | 40 Minutes |

*Note: 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 base material temperature in the range.*

## Section 3. PHYSICAL PROPERTIES

| Physical Properties | | | | |
|---|---|---|---|---|
| **Property** | | **Value** | **Unit** | **Test Standard** |
| Compressive Strength | 24 hrs | 72.3 | $N/mm^2$ | BS6319 |
| | 7 days | 77.8 | | |
| Tensile Strength | 24 hrs | 13.5 | $N/mm^2$ | ASTM D 638 @ +20°C |
| | 7 days | 15.2 | | |
| Elongation at Break | 24 hrs | 6 | % | ASTM D 638 @ +20°C |
| | 7 days | 6.7 | | |
| Tensile Modulus | 24 hrs | 3.75 | $GN/m^2$ | ASTM D 638 @ +20°C |
| | 7 days | 3.8 | | |
| Flexural Strength | 7 days | 28.3 | $N/mm^2$ | ASTM D 790 @ +20°C |

## Section 4. CHEMICAL RESISTANCE

| Chemical Resistance | | | | | |
|---|---|---|---|---|---|
| **Chemical Environment** | **Concentration** | **Result** | **Chemical Environment** | **Concentration** | **Result** |
| Aqueous Solution Acetic Acid | 10% | C | Hexane | 100% | C |
| Acetone | 100% | × | Hydrochloric Acid | 10% | ✓ |
| Aqueous Solution Aluminium Chloride | Saturated | ✓ | | 15% | ✓ |
| Aqueous Solution Aluminium Nitrate | 10% | ✓ | | 20% | C |
| Ammonia Solution | 5% | × | Hydrogen Sulphide Gas | 100% | ✓ |
| Jet Fuel | 100% | × | Linseed Oil | 100% | ✓ |
| Benzoic Acid | Saturated | ✓ | Lubricating Oil | 100% | ✓ |
| Sodium Hypochlorite Solution | 5 - 15% | ✓ | Mineral Oil | 100% | ✓ |
| Butyl Alcohol | 100% | C | Paraffin / Kerosene (Domestic) | 100% | C |
| Calcium Sulphate Aqueous Solution | Saturated | ✓ | Phenol Aqueous Solution | 1% | × |
| Carbon Monoxide | Gas | ✓ | Phosphoric Acid | 50% | ✓ |
| Carbon Tetrachloride | 100% | C | Potassium Hydroxide | 10% / pH13 | ✓ |
| Chlorine Water | Saturated | × | Sea Water | 100% | C |
| Chloro Benzene | 100% | C | Sulphur Dioxide Solution | 10% | ✓ |
| Citric Acid Aqueous Solution | Saturated | ✓ | Sulphur Dioxide (40°C) | 5% | ✓ |
| Cyclohexanol | 100% | ✓ | Sulphuric Acid | 10% | ✓ |
| Diesel Fuel | 100% | C | | 30% | ✓ |
| Diethylene Glycol | 100% | ✓ | Turpentine | 100% | C |
| Ethanol | 95% | × | White Spirit | 100% | ✓ |
| Heptane | 100% | C | Xylene | 100% | × |

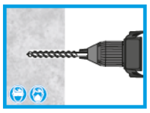
*✓ = Resistant to 75°C with at least 80% of physical properties retained.*

*C = Contact only to a maximum of 25°C. × = Not resistant.*

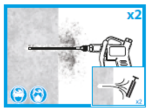
## Section 5. SOLID SUBSTRATE INSTALLATION METHOD

### SOLID SUBSTRATE INSTALLATION METHOD

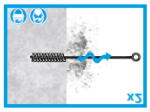
1. Using the SDS hammer drill (HD) in rotary hammer mode for drilling, with a carbide tipped drill bit of the appropriate size, drill the hole to the specified hole diameter and depth



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.

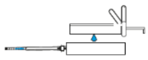


3. Select the correct size hole cleaning brush. Ensure that the brush is in good condition and of the correct diameter. Insert the brush to the bottom of the hole, using a brush extension if needed to reach the bottom. Withdraw with a twisting motion. There should be a positive interaction between the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



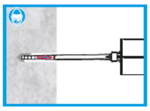
4. Repeat step 2 (blowing operation x2)
5. Repeat step 3 (brushing operation x2)
6. Repeat step 2 (blowing operation x2)

7. Select the most appropriate static mixer nozzle, checking that the mixing elements are present and 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.

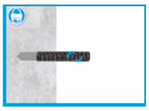


8. Extrude some resin to waste until an even coloured mixture is achieved. The cartridge is now ready for use.

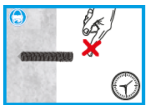
9. Insert the mixing nozzle to the bottom of the hole. Extrude the resin and slowly withdraw the nozzle from the hole. Ensure no air voids are created as the nozzle is withdrawn. Inject resin until the hole is approximately ¾ full and remove the nozzle from the hole.



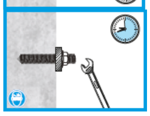
10. Select the steel anchor element ensuring it is free from oil or other contaminants, and mark with the required embedment depth. Insert the steel element into the hole using a back and forth twisting motion to ensure complete cover, until it reaches the bottom of the hole. Excess resin will be expelled 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.



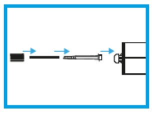
13. Position the fixture and tighten the anchor to the appropriate installation torque. Do not over-torque the anchor, as this could adversely affect its performance.



### 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.



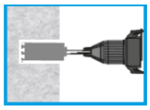
3a. Push the resin stopper and extension tube to the back of the drill hole.

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

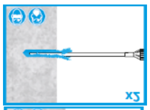
5a. Continue from step 10 under “solid substrate installation method”.

### DIAMOND CORE DRILLING

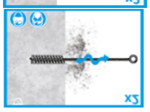
1b. Using a diamond core drill (DD) and following the manufacturer’s instructions, drill the specified diameter hole to the correct embedment depth then remove the concrete core.



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



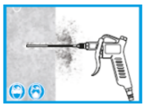
3b. Select the correct size hole cleaning brush. Ensure that the brush is in good condition and of the correct diameter. Insert the brush to the bottom of the hole, using a brush extension if needed to reach the bottom. Withdraw with a twisting motion. There should be a positive interaction between the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

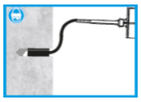


4b. Repeat step 2b (flushing operation x2).

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.

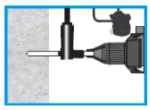




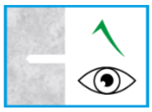
7a. Continue from step 7 under “solid substrate installation method”.

### DUSTLESS DRILLING

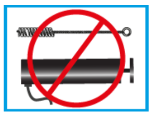
1c. Using the specified hollow drill bit (HDB) and vacuum system and following the manufacturer’s instructions, drill the specified diameter hole to the correct embedment depth. Ensure that the minimum vacuum specifications are met and that the vacuum is turned on.



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”.



## Section 6. INSTALLATION PARAMETERS – THREADED ROD

**Installation parameters of threaded rod**

| Size | | | M8 | M10 | M12 | M16 | M20 | M24 | M27 | M30 |
|---|---|---|---|---|---|---|---|---|---|---|
| Nominal drill hole diameter | $\Phi d_0$ | [mm] | 10 | 12 | 14 | 18 | 22 | 26 | 30 | 35 |
| Diameter of cleaning brush | $d_b$ | [mm] | 14 | 14 | 20 | 20 | 29 | 29 | 40 | 40 |
| Manual pump cleaning | | | $h_{ef} < 300$ mm | | | | | | | |
| Torque moment | max $T_{fix}$ | [Nm] | 10 | 20 | 40 | 80 | 150 | 200 | 240 | 275 |
| Depth of drill hole for $h_{ef,min}$ | $h_0 = h_{ef}$ | [mm] | 64 | 80 | 96 | 128 | 160 | 192 | 216 | 240 |
| Depth of drill hole for $h_{ef,max}$ | $h_0 = h_{ef}$ | [mm] | 160 | 200 | 240 | 320 | 400 | 480 | 540 | 600 |
| Minimum edge distance | $c_{min}$ | [mm] | 35 | 40 | 50 | 65 | 80 | 96 | 110 | 120 |
| Minimum spacing | $s_{min}$ | [mm] | 35 | 40 | 50 | 65 | 80 | 96 | 110 | 120 |
| Minimum thickness of member | $h_{min}$ | [mm] | $h_{ef}$ + 30 mm ≥ 100 mm | | | | $h_{ef} + 2d_0$ | | | |

## Section 7. CHARACTERISTIC RESISTANCE – COMBINED PULL-OUT & CONCRETE CONE FAILURE USING THREADED RODS – HAMMER DRILLING METHOD & DUSTLESS DRILLING METHOD

**Characteristic values of resistance to tension load of threaded rod**

**Combined pullout and concrete cone failure in concrete C20/25**

**Hammer drilling**

| **Size** | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** | **M27** | **M30** |
|---|---|---|---|---|---|---|---|---|---|---|
| **Characteristic bond resistance in uncracked concrete for a working life of 50 years and 100 years** | | | | | | | | | | |
| **Dry and wet concrete** | $\tau_{Rk,ucr}$ | [N/mm²] | 10,0 | 9,5 | 9,5 | 9,0 | 8,5 | 8,0 | 6,5 | 5,5 |
| Installation safety factor | $\gamma_{inst}$ | [-] | 1,2 | | | | | | 1,4 | |
| **Flooded hole** | $\tau_{Rk,ucr}$ | [N/mm²] | 8,5 | 7,5 | 7,0 | 7,0 | 6,5 | 5,5 | | |
| Installation safety factor | $\gamma_{inst}$ | [-] | 1,4 | | | | | | | |

| **Rozmiar** | | | **M10** | **M12** | **M16** | **M20** | **M24** |
|---|---|---|---|---|---|---|---|
| **Characteristic bond resistance in cracked concrete for a working life of 50 years** | | | | | | | |
| **Dry and wet concrete** | $\tau_{Rk,cr}$ | [N/mm²] | 4,5 | 4,5 | 4,5 | 4,0 | 4,0 |
| Installation safety factor | $\gamma_{inst}$ | [-] | 1,2 | | | | |
| **Flooded hole** | $\tau_{Rk,cr}$ | [N/mm²] | 4,5 | 4,5 | 4,5 | 4,0 | 4,0 |
| Installation safety factor | $\gamma_{inst}$ | [-] | 1,4 | | | | |
| **Characteristic bond resistance in cracked concrete for a working life of 100 years** | | | | | | | |
| **Dry and wet concrete** | $\tau_{Rk,cr}$ | [N/mm²] | 3,0 | 3,0 | 3,0 | 2,5 | 2,5 |
| Installation safety factor | $\gamma_{inst}$ | [-] | 1,2 | | | | |
| **Flooded hole** | $\tau_{Rk,cr}$ | [N/mm²] | 3,0 | 3,0 | 3,0 | 2,5 | 2,5 |
| Installation safety factor | $\gamma_{inst}$ | [-] | 1,4 | | | | |

**Dustless drilling**

| **Size** | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** | **M27** | **M30** |
|---|---|---|---|---|---|---|---|---|---|---|
| **Characteristic bond resistance in uncracked concrete for a working life of 50 years and 100 years** | | | | | | | | | | |
| **Dry and wet concrete** | $\tau_{Rk,ucr}$ | [N/mm²] | 10,0 | 9,5 | 9,5 | 9,0 | 8,5 | 8,0 | 6,5 | 5,5 |
| Installation safety factor | $\gamma_{inst}$ | [-] | 1,2 | | | | | | | |
| **Flooded hole** | $\tau_{Rk,ucr}$ | [N/mm²] | 8,5 | 7,5 | 7,0 | 7,0 | 6,5 | 5,5 | 4,5 | 4,0 |
| Installation safety factor | $\gamma_{inst}$ | [-] | 1,4 | | | | | | | |

| **Rozmiar** | | | **M10** | **M12** | **M16** | **M20** | **M24** |
|---|---|---|---|---|---|---|---|
| **Characteristic bond resistance in cracked concrete for a working life of 50 years** | | | | | | | |
| **Dry and wet concrete** | $\tau_{Rk,cr}$ | [N/mm²] | 4,5 | 4,5 | 4,5 | 4,0 | 4,0 |
| Installation safety factor | $\gamma_{inst}$ | [-] | 1,2 | | | | |
| **Flooded hole** | $\tau_{Rk,cr}$ | [N/mm²] | 4,5 | 4,5 | 4,5 | 4,0 | 4,0 |
| Installation safety factor | $\gamma_{inst}$ | [-] | 1,4 | | | | |
| **Characteristic bond resistance in cracked concrete for a working life of 100 years** | | | | | | | |
| **Dry and wet concrete** | $\tau_{Rk,cr}$ | [N/mm²] | 3,0 | 3,0 | 3,0 | 2,5 | 2,5 |
| Installation safety factor | $\gamma_{inst}$ | [-] | 1,2 | | | | |
| **Flooded hole** | $\tau_{Rk,cr}$ | [N/mm²] | 3,0 | 3,0 | 3,0 | 2,5 | 2,5 |
| Installation safety factor | $\gamma_{inst}$ | [-] | 1,4 | | | | |

| | | | | |
|---|---|---|---|---|
| Factor for uncracked concrete | C50/60 | $\psi_c$ | [-] | 1 |
| Factor for cracked concrete | C30/37 | $\psi_c$ | [-] | 1,12 |
| | C40/50 | | | 1,23 |
| | C50/60 | | | 1,30 |
| Factor for influence of sustained load for a working life 50 years | T1: 24°C / 40°C | $\psi^0_{sus}$ | [-] | 0,75 |
| | T2: 50°C / 80°C | | | 0,73 |
| **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] | $1,5h_{ef}$ |

## Section 8. CHARACTERISTIC RESISTANCE – COMBINED PULL-OUT & CONCRETE CONE FAILURE USING THREADED RODS – HAMMER DRILLING METHOD & DUSTLESS DRILLING METHOD FOR WCF-EASF-C WITH INSTALLATION TEMPERATURE < - 10 °C

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

**Combined pullout and concrete cone failure in concrete C20/25**

**Hammer drilling**

| **Size** | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** | **M27** | **M30** |
|---|---|---|---|---|---|---|---|---|---|---|
| **Characteristic bond resistance in uncracked concrete for a working life of 50 years and 100 years** | | | | | | | | | | |
| **Dry and wet concrete** | $\tau_{Rk,ucr}$ | [N/mm²] | 9,5 | 9,0 | 9,0 | 8,5 | 8,0 | 7,5 | 6,0 | 5,0 |
| Installation safety factor | $\gamma_{inst}$ | [-] | 1,2 | | | | | | 1,4 | |
| **Otwór zalany wodą** | $\tau_{Rk,ucr}$ | [N/mm²] | 8,0 | 7,0 | 6,5 | 6,5 | 6,0 | 6,0 | | |
| Installation safety factor | $\gamma_{inst}$ | [-] | 1,4 | | | | | | | |

| **Rozmiar** | | | **M10** | **M12** | **M16** | **M20** | **M24** |
|---|---|---|---|---|---|---|---|
| **Characteristic bond resistance in cracked concrete for a working life of 50 years** | | | | | | | |
| **Dry and wet concrete** | $\tau_{Rk,cr}$ | [N/mm²] | 4,0 | 4,0 | 4,0 | 3,5 | 3,5 |
| Installation safety factor | $\gamma_{inst}$ | [-] | 1,2 | | | | |
| **Flooded hole** | $\tau_{Rk,cr}$ | [N/mm²] | 4,0 | 4,0 | 4,0 | 3,5 | 3,5 |
| Installation safety factor | $\gamma_{inst}$ | [-] | 1,4 | | | | |
| **Characteristic bond resistance in cracked concrete for a working life of 100 years** | | | | | | | |
| **Dry and wet concrete** | $\tau_{Rk,cr}$ | [N/mm²] | 2,5 | 2,5 | 2,5 | 2,0 | 2,0 |
| Installation safety factor | $\gamma_{inst}$ | [-] | 1,2 | | | | |
| **Flooded hole** | $\tau_{Rk,cr}$ | [N/mm²] | 2,5 | 2,5 | 2,5 | 2,0 | 2,0 |
| Installation safety factor | $\gamma_{inst}$ | [-] | 1,4 | | | | |

**Dustless drilling**

| **Size** | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** | **M27** | **M30** |
|---|---|---|---|---|---|---|---|---|---|---|
| **Characteristic bond resistance in uncracked concrete for a working life of 50 years and 100 years** | | | | | | | | | | |
| **Dry and wet concrete** | $\tau_{Rk,ucr}$ | [N/mm²] | 9,5 | 9,0 | 9,0 | 8,5 | 8,0 | 7,5 | 6,0 | 5,0 |
| Installation safety factor | $\gamma_{inst}$ | [-] | 1,2 | | | | | | | |
| **Flooded hole** | $\tau_{Rk,ucr}$ | [N/mm²] | 8,0 | 7,0 | 6,5 | 6,5 | 6,0 | 5,0 | 4,0 | 3,5 |
| Installation safety factor | $\gamma_{inst}$ | [-] | 1,4 | | | | | | | |

| **Rozmiar** | | | **M10** | **M12** | **M16** | **M20** | **M24** |
|---|---|---|---|---|---|---|---|
| **Characteristic bond resistance in cracked concrete for a working life of 50 years** | | | | | | | |
| **Dry and wet concrete** | $\tau_{Rk,cr}$ | [N/mm²] | 4,0 | 4,0 | 4,0 | 3,5 | 3,5 |
| Installation safety factor | $\gamma_{inst}$ | [-] | 1,2 | | | | |
| **Flooded hole** | $\tau_{Rk,cr}$ | [N/mm²] | 4,0 | 4,0 | 4,0 | 3,5 | 3,5 |
| Installation safety factor | $\gamma_{inst}$ | [-] | 1,4 | | | | |
| **Characteristic bond resistance in cracked concrete for a working life of 100 years** | | | | | | | |
| **Dry and wet concrete** | $\tau_{Rk,cr}$ | [N/mm²] | 2,5 | 2,5 | 2,5 | 2,0 | 2,0 |
| Installation safety factor | $\gamma_{inst}$ | [-] | 1,2 | | | | |
| **Flooded hole** | $\tau_{Rk,cr}$ | [N/mm²] | 2,5 | 2,5 | 2,5 | 2,0 | 2,0 |
| Installation safety factor | $\gamma_{inst}$ | [-] | 1,4 | | | | |

| | | | | |
|---|---|---|---|---|
| Factor for uncracked concrete | C50/60 | $\psi_c$ | [-] | 1 |
| Factor for cracked concrete | C30/37 | $\psi_c$ | [-] | 1,12 |
| | C40/50 | | | 1,23 |
| | C50/60 | | | 1,30 |
| Factor for influence of sustained load for a working life 50 years | T1: 24°C / 40°C | $\psi^0_{sus}$ | [-] | 0,75 |
| | T2: 50°C / 80°C | | | 0,73 |

**Concrete cone failure**

See Section 7.

**Splitting failure**

See Section 11.

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## Section 9. CHARACTERISTIC RESISTANCE – COMBINED PULL-OUT & CONCRETE CONE FAILURE USING THREADED RODS – DIAMOND CORE DRILLING METHOD

| Characteristic values of resistance to tension load of threaded rod – Diamond core drilling method | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Combined pullout and concrete cone failure in concrete C20/25** | | | | | | | | | | | |
| **Diamond core drilling** | | | | | | | | | | | |
| **Size** | | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** | **M27** | **M30** |
| **Characteristic bond resistance in uncracked concrete for a working life of 50 years and 100 years** | | | | | | | | | | | |
| **Dry and wet concrete** | | $\tau_{Rk,ucr}$ | [N/mm²] | 9,0 | 8,5 | 8,5 | 8,0 | 7,5 | 7,0 | 5,5 | 4,5 |
| Installation safety factor | | $\gamma_{inst}$ | [-] | 1,0 | | | | | | | |
| **Flooded hole** | | $\tau_{Rk,ucr}$ | [N/mm²] | 8,0 | 7,0 | 6,5 | 6,5 | 6,0 | 5,0 | 4,0 | 3,5 |
| Installation safety factor | | $\gamma_{inst}$ | [-] | 1,4 | | | | | | | |
| Factor for uncracked concrete | C30/37 | $\psi_c$ | [-] | 1,04 | | | | | | | |
| | C40/50 | | | 1,07 | | | | | | | |
| | C50/60 | | | 1,09 | | | | | | | |
| Factor for influence of sustained load for a working life 50 years | | $\psi^0_{sus}$ | [-] | 0,77 | | | | | | | |
| **Concrete cone failure** | | | | | | | | | | | |
| Factor for concrete cone failure for uncracked concrete | | $k_{ucr,N}$ | [-] | 11 | | | | | | | |
| Edge distance | | $c_{cr,N}$ | [mm] | $1{,}5h_{ef}$ | | | | | | | |
| **Splitting failure** | | | | | | | | | | | |
| **Size** | | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** | **M27** | **M30** |
| Edge distance | | $c_{cr,sp}$ | [mm] | $1{,}5h_{ef}$ | | | | | | | |
| Spacing | | $s_{cr,sp}$ | [mm] | $3{,}0h_{ef}$ | | | | | | | |

## Section 10. CHARACTERISTIC RESISTANCE – COMBINED PULL-OUT & CONCRETE CONE FAILURE USING THREADED RODS – DIAMOND CORE DRILLING METHOD FOR WCF-EASF-C WITH INSTALLATION TEMPERATURE < - 10 °C

| Characteristic values of resistance to tension load of threaded rod for WCF-EASF-C with installation temperature < - 10 °C | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Combined pullout and concrete cone failure in concrete C20/25** | | | | | | | | | | | |
| **Diamond core drilling** | | | | | | | | | | | |
| **Size** | | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** | **M27** | **M30** |
| **Characteristic bond resistance in uncracked concrete for a working life of 50 years and 100 years** | | | | | | | | | | | |
| **Dry and wet concrete** | | $\tau_{Rk,ucr}$ | [N/mm²] | 8,5 | 8,0 | 8,0 | 7,5 | 7,0 | 6,5 | 5,0 | 4,0 |
| Installation safety factor | | $\gamma_{inst}$ | [-] | 1,0 | | | | | | | |
| **Flooded hole** | | $\tau_{Rk,ucr}$ | [N/mm²] | 7,5 | 6,5 | 6,0 | 6,0 | 5,5 | 4,5 | 3,5 | 3,0 |
| Installation safety factor | | $\gamma_{inst}$ | [-] | 1,4 | | | | | | | |
| Factor for uncracked concrete | C30/37 | $\psi_c$ | [-] | 1,04 | | | | | | | |
| | C40/50 | | | 1,07 | | | | | | | |
| | C50/60 | | | 1,09 | | | | | | | |
| Factor for influence of sustained load for a working life 50 years | | $\psi^0_{sus}$ | [-] | 0,77 | | | | | | | |
| **Concrete cone failure** | | | | | | | | | | | |
| See Section 9. | | | | | | | | | | | |
| **Splitting failure** | | | | | | | | | | | |
| See Section 11. | | | | | | | | | | | |

## Section 11. SPLITTING FAILURE

| Splitting failure | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Size** | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** | **M27** | **M30** |
| Edge distance | $c_{cr,sp}$ | [mm] | $1{,}5h_{ef}$ | | | | | | | |
| Spacing | $s_{cr,sp}$ | [mm] | $3{,}0h_{ef}$ | | | | | | | |

## Section 12. RESISTANCE VALUES FOR THREADED ROD IN UNCRACKED CONCRETE -50 YEARS WORKING LIFE – HAMMER DRILLING METHOD

**Resistance Values for Threaded Rod in Uncracked Concrete - 50 Years Working Life**
Combined Pullout & Concrete Cone Failure and Concrete Cone Failure
Temperature Range: -40°C to 80°C

| Property | Unit | | Anchor Diameter | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** | **M27** | **M30** |
| Effective Embedment Depth = MIN = 8d | $h_{ef}$ | mm | 64 | 80 | 96 | 128 | 160 | 192 | 216 | 240 |
| Design Resistance | $N_{Rd}$ | kN | 8.5 | 13.0 | 19.0 | 32.0 | 47.0 | 64.0 | 56.5 | 59.0 |
| Effective Embedment Depth = 8d | $h_{ef}$ | mm | 64 | 80 | 96 | 128 | 160 | 192 | 216 | 240 |
| Design Resistance | $N_{Rd}$ | kN | 8.5 | 13.0 | 19.0 | 32.0 | 47.0 | 64.0 | 56.5 | 59.0 |
| Effective Embedment Depth = 10d | $h_{ef}$ | mm | 80 | 100 | 120 | 160 | 200 | 240 | 324 | 360 |
| Design Resistance | $N_{Rd}$ | kN | 11.0 | 16.5 | 23.5 | 40.0 | 59.0 | 80.0 | 85.0 | 88.5 |
| Effective Embedment Depth = 12d | $h_{ef}$ | mm | 96 | 120 | 144 | 192 | 240 | 288 | 540 | 600 |
| Design Resistance | $N_{Rd}$ | kN | 13.0 | 19.5 | 28.5 | 48.0 | 71.0 | 96.5 | 141.5 | 148 |

*1. Resistance values are based on combined pullout & concrete cone failure and concrete cone failure according to EC2-4. Resistance for steel failure must also be considered - the lowest value controls.*
*2. Resistance values are for single anchors without close edges or eccentric loading considerations.*
*3. Tabulated values correspond to the above stated temperature range and installation conditions only.*
*4. Long term temperatures are those that remain roughly constant over prolonged periods. Short term temperatures occur over brief intervals, e.g.: diurnal cycling.*
*5. The cylinder compressive strength of the concrete (fck),is assumed to be 20 N/mm2.*
*6. Tabulated resistance values assume that the geometry of the anchor(s) and concrete member is sufficient to avoid splitting failure.*

## Section 13. RESISTANCE VALUES FOR THREADED ROD IN CRACKED CONCRETE -50 YEARS WORKING LIFE – HAMMER DRILLING METHOD

**Resistance Values for Threaded Rod in Cracked Concrete - 50 Years Working life**
Combined Pullout & Concrete Cone Failure and Concrete Cone Failure
Temperature Range: -40°C to 80°C

| Property | Unit | | Anchor Diameter | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | M8 | M10 | M12 | M16 | M20 | M24 | - | - |
| Effective Embedment Depth = MIN = 8d | $h_{ef}$ | mm | - | 80 | 96 | 128 | 160 | 192 | - | - |
| Design Resistance | $N_{Rd}$ | kN | - | 6.0 | 9.0 | 16.0 | 22.0 | 32.0 | - | - |
| Effective Embedment Depth = 12d | $h_{ef}$ | mm | - | 120 | 144 | 192 | 240 | 288 | - | - |
| Design Resistance | $N_{Rd}$ | kN | - | 9.0 | 13.5 | 24.0 | 33.5 | 48.0 | - | - |
| Effective Embedment Depth = 20d | $h_{ef}$ | mm | - | 200 | 240 | 320 | 400 | 480 | - | - |
| Design Resistance | $N_{Rd}$ | kN | - | 15.5 | 22.5 | 40.0 | 55.5 | 80.0 | - | - |

*1. Resistance values are based on combined pullout & concrete cone failure and concrete cone failure according to EC2-4. Resistance for steel failure must also be considered - the lowest value controls.*
*2. Resistance values are for single anchors without close edges or eccentric loading considerations.*
*3. Tabulated values correspond to the above stated temperature range and installation conditions only.*
*4. Long term temperatures are those that remain roughly constant over prolonged periods. Short term temperatures occur over brief intervals, e.g.: diurnal cycling.*
*5. The cylinder compressive strength of the concrete (fck),is assumed to be 20 N/mm2.*
*6. Tabulated resistance values assume that the geometry of the anchor(s) and concrete member is sufficient to avoid splitting failure.*

## Section 14. THREADED RODS – CHARACTERISTIC VALUES FOR STEEL FAILURE (TENSION)

| Threaded Rods - Characteristic Values for Steel Failure (Tension) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Size** | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** | **M27** | **M30** |
| Steel Grade **KPG 4.6** | $N_{Rk,s}$ | kN | 15 | 23 | 34 | 63 | 98 | 141 | 184 | 224 |
| Partial Safety Factor | $\gamma_{Ms}$ | [-] | 2,00 | | | | | | | |
| Steel Grade **KPG 5.8** | $N_{Rk,s}$ | kN | 18 | 29 | 42 | 79 | 123 | 177 | 230 | 281 |
| Partial Safety Factor | $\gamma_{Ms}$ | [-] | 1.50 | | | | | | | |
| Steel Grade **KPG 8.8** | $N_{Rk,s}$ | kN | 29 | 46 | 67 | 126 | 196 | 282 | 367 | 449 |
| Partial Safety Factor | $\gamma_{Ms}$ | [-] | 1.50 | | | | | | | |
| Steel Grade **KPG 10.9*** | $N_{Rk,s}$ | kN | 37 | 58 | 84 | 157 | 245 | 353 | 459 | 561 |
| Partial Safety Factor | $\gamma_{Ms}$ | [-] | 1.33 | | | | | | | |
| Stainless Steel Grade **KPG A2-70, KPG A4-70** | $N_{Rk,s}$ | kN | 26 | 41 | 59 | 110 | 172 | 247 | 321 | 393 |
| Partial Safety Factor | $\gamma_{Ms}$ | [-] | 1.87 | | | | | | | |
| Stainless Steel Grade **KPG A4-80** | $N_{Rk,s}$ | kN | 29 | 46 | 67 | 126 | 196 | 282 | 367 | 449 |
| Partial Safety Factor | $\gamma_{Ms}$ | [-] | 1.60 | | | | | | | |
| Stainless Steel Grade **KPG HCR** | $N_{Rk,s}$ | kN | 26 | 41 | 59 | 110 | 172 | 247 | 321 | 393 |
| Partial Safety Factor | $\gamma_{Ms}$ | [-] | 1.50 | | | | | | | |
| Stainless Steel Grade **KPG UHCR** | $N_{Rk,s}$ | kN | 26 | 41 | 59 | 110 | 172 | 247 | 321 | 393 |
| Partial Safety Factor | $\gamma_{Ms}$ | [-] | 1,87 | | | | | | | |

## Section 15. THREADED RODS – CHARACTERISTIC VALUES FOR STEEL FAILURE ( SHEAR – WITHOUT LEVER ARM)

| Threaded Rods - Characteristic Values for Steel Failure (Shear – without lever arm) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Size** | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** | **M27** | **M30** |
| Steel Grade **KPG 4.6** | $V_{Rk,s}$ | kN | 7 | 12 | 17 | 31 | 49 | 71 | 92 | 112 |
| Partial Safety Factor | $\gamma_{Ms}$ | [-] | 1.67 | | | | | | | |
| Steel Grade **KPG 5.8** | $V_{Rk,s}$ | kN | 9 | 15 | 21 | 39 | 61 | 88 | 115 | 140 |
| Partial Safety Factor | $\gamma_{Ms}$ | [-] | 1.25 | | | | | | | |
| Steel Grade **KPG 8.8** | $V_{Rk,s}$ | kN | 15 | 23 | 34 | 63 | 98 | 141 | 184 | 224 |
| Partial Safety Factor | $\gamma_{Ms}$ | [-] | 1.25 | | | | | | | |
| Steel Grade **KPG 10.9*** | $V_{Rk,s}$ | kN | 18 | 29 | 42 | 79 | 123 | 177 | 230 | 281 |
| Partial Safety Factor | $\gamma_{Ms}$ | [-] | 1.50 | | | | | | | |
| Stainless Steel Grade **KPG A2-70, KPG A4-70** | $V_{Rk,s}$ | kN | 13 | 20 | 30 | 55 | 86 | 124 | 161 | 196 |
| Partial Safety Factor | $\gamma_{Ms}$ | [-] | 1.56 | | | | | | | |
| Stainless Steel Grade **KPG A4-80** | $V_{Rk,s}$ | kN | 15 | 23 | 34 | 63 | 98 | 141 | 184 | 224 |
| Partial Safety Factor | $\gamma_{Ms}$ | [-] | 1.33 | | | | | | | |
| Stainless Steel Grade **KPG HCR** | $V_{Rk,s}$ | kN | 13 | 20 | 30 | 55 | 86 | 124 | 161 | 196 |
| Partial Safety Factor | $\gamma_{Ms}$ | [-] | 1.25 | | | | | | | |
| Stainless Steel Grade **KPG UHCR** | $V_{Rk,s}$ | kN | 13 | 20 | 30 | 55 | 86 | 124 | 161 | 196 |
| Partial Safety Factor | $\gamma_{Ms}$ | [-] | 1,56 | | | | | | | |

## Section 16. THREADED RODS – CHARACTERISTIC VALUES FOR STEEL FAILURE ( SHEAR – WITH LEVER ARM)

| Threaded Rods - Characteristic Values for Steel Failure (Shear – with lever arm) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Size** | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** | **M27** | **M30** |
| Steel Grade **4.6** | $M^0_{Rk,s}$ | N.m | 15 | 30 | 52 | 133 | 260 | 449 | 666 | 900 |
| Partial Safety Factor | $\gamma_{Ms}$ | [-] | 1.67 | | | | | | | |
| Steel Grade **5.8** | $M^0_{Rk,s}$ | N.m | 19 | 37 | 66 | 166 | 325 | 561 | 832 | 1125 |
| Partial Safety Factor | $\gamma_{Ms}$ | [-] | 1.25 | | | | | | | |
| Steel Grade **8.8** | $M^0_{Rk,s}$ | N.m | 30 | 60 | 105 | 266 | 519 | 898 | 1332 | 1799 |
| Partial Safety Factor | $\gamma_{Ms}$ | [-] | 1.25 | | | | | | | |
| Steel Grade **10.9*** | $M^0_{Rk,s}$ | N.m | 37 | 75 | 131 | 333 | 649 | 1123 | 1664 | 2249 |
| Partial Safety Factor | $\gamma_{Ms}$ | [-] | 1.50 | | | | | | | |
| Stainless Steel Grade **A4-70** | $M^0_{Rk,s}$ | N.m | 26 | 52 | 92 | 233 | 454 | 786 | 1165 | 1574 |
| Partial Safety Factor | $\gamma_{Ms}$ | [-] | 1.56 | | | | | | | |
| Stainless Steel Grade **A4-80** | $M^0_{Rk,s}$ | N.m | 30 | 60 | 105 | 266 | 519 | 898 | 1332 | 1799 |
| Partial Safety Factor | $\gamma_{Ms}$ | [-] | 1.33 | | | | | | | |
| Stainless Steel Grade **1.4529** | $M^0_{Rk,s}$ | N.m | 26 | 52 | 92 | 233 | 454 | 786 | 1165 | 1574 |
| Partial Safety Factor | $\gamma_{Ms}$ | [-] | 1.25 | | | | | | | |
| Stainless Steel Grade **1.4565** | $M^0_{Rk,s}$ | N.m | 26 | 52 | 92 | 233 | 454 | 786 | 1165 | 1574 |
| Partial Safety Factor | $\gamma_{Ms}$ | [-] | 1,56 | | | | | | | |
| **Concrete pry-out failure** | | | | | | | | | | |
| Factor for resistance to pry-out failure | $K_8$ | [-] | 2 | | | | | | | |

## Section 17. INSTALLATION PARAMETERS - REBAR

| Installation parameters of rebar | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Size** | | | **Φ8** | **Φ10** | **Φ12** | **Φ16** | **Φ20** | **Φ25** | **Φ32** |
| Nominal drill hole diameter | $\Phi d_0$ | [mm] | 12 | 14 | 16 | 20 | 25 | 32 | 40 |
| Diameter of cleaning brush | $d_b$ | [mm] | 14 | 14 | 19 | 22 | 29 | 40 | 42 |
| Manual pump cleaning | | | $h_{ef} < 300$ mm | | | | | | |
| Depth of drill hole for $h_{ef,min}$ | $h_0 = h_{ef}$ | [mm] | 64 | 80 | 96 | 128 | 160 | 200 | 256 |
| Depth of drill hole for $h_{ef,max}$ | $h_0 = h_{ef}$ | [mm] | 160 | 200 | 240 | 320 | 400 | 500 | 640 |
| Minimum edge distance | $c_{min}$ | [mm] | 35 | 40 | 50 | 65 | 80 | 100 | 130 |
| Minimum spacing | $s_{min}$ | [mm] | 35 | 40 | 50 | 65 | 80 | 100 | 130 |
| Minimum thickness of member | $h_{min}$ | [mm] | $h_{ef}$ + 30 mm ≥ 100 mm | | | | $h_{ef} + 2d_0$ | | |

## Section 18. CHARACTERISTIC RESISTANCE – COMBINED PULL-OUT & CONCRETE CONE FAILURE FOR REBAR - HAMMER DRILLING METHOD & DUSTLESS DRILLING METHOD

| Characteristic values of resistance to tension load of rebar | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Combined pullout and concrete cone failure in uncracked concrete C20/25** | | | | | | | | | | |
| **Hammer drilling** | | | | | | | | | | |
| **Size** | | | | **Φ8** | **Φ10** | **Φ12** | **Φ 16** | **Φ20** | **Φ25** | **Φ32** |
| **Characteristic bond resistance in uncracked concrete for a working life of 50 years and 100 years** | | | | | | | | | | |
| **Dry and wet concrete** | | $\tau_{Rk,ucr}$ | [N/mm²] | 11,0 | 9,5 | 9,5 | 9,0 | 8,5 | 8,5 | 5,5 |
| Installation safety factor | | $\gamma_{inst}$ | [-] | 1,2 | | | | | | |
| **Flooded hole** | | $\tau_{Rk,ucr}$ | [N/mm²] | 11,0 | 9,5 | 9,5 | 9,0 | 8,5 | 8,5 | 5,5 |
| Installation safety factor | | $\gamma_{inst}$ | [-] | 1,4 | | | | | | |
| Factor for influence of sustained load for a working life 50 years | T1: 24°C / 40°C | $\psi^0_{sus}$ | [-] | 0,75 | | | | | | |
| | T2: 50°C / 80°C | | | 0,73 | | | | | | |
| **Dustless drilling** | | | | | | | | | | |
| **Size** | | | | **Φ8** | **Φ10** | **Φ12** | **Φ 16** | **Φ20** | **Φ25** | **Φ32** |
| **Characteristic bond resistance in uncracked concrete for a working life of 50 years and 100 years** | | | | | | | | | | |
| **Dry and wet concrete** | | $\tau_{Rk,ucr}$ | [N/mm²] | 11,0 | 9,5 | 9,5 | 9,0 | 8,5 | 8,5 | 5,5 |
| Installation safety factor | | $\gamma_{inst}$ | [-] | 1,2 | | | | | | |
| **Flooded hole** | | $\tau_{Rk,ucr}$ | [N/mm²] | 11,0 | 9,5 | 9,5 | 9,0 | 8,5 | 8,5 | 5,5 |
| Installation safety factor | | $\gamma_{inst}$ | [-] | 1,4 | | | | | | |
| Factor for concrete C50/60 | | $\psi_c$ | [-] | 1 | | | | | | |
| Factor for influence of sustained | T1: 24°C / 40°C | | [-] | 0,75 | | | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| load for a working life 50 years | T2: 50°C / 80°C | $\psi^0_{sus}$ | | 0,73 | | | | | | |
| **Concrete cone failure** | | | | | | | | | | |
| Factor for concrete cone failure | | $K_{ucr,N}$ | [-] | 11 | | | | | | |
| Edge distance | | $C_{cr,N}$ | [mm] | $1{,}5h_{ef}$ | | | | | | |
| **Splitting failure** | | | | | | | | | | |
| **Size** | | | | **Φ8** | **Φ10** | **Φ12** | **Φ 16** | **Φ20** | **Φ25** | **Φ32** |
| Edge distance | | $C_{cr,sp}$ | [mm] | $1{,}5h_{ef}$ | | | | | | |
| Spacing | | $S_{cr,sp}$ | [mm] | $3{,}0h_{ef}$ | | | | | | |

## Section 19. CHARACTERISTIC RESISTANCE – COMBINED PULL-OUT & CONCRETE CONE FAILURE FOR REBAR - HAMMER DRILLING METHOD & DUSTLESS DRILLING METHOD FOR WCF-EASF-C WITH INSTALLATION TEMPERATURE < - 10 °C

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Characteristic values of resistance to tension load of rebar for WCF-EASF-C with installation temperature < - 10 °C** | | | | | | | | | | |
| **Combined pullout and concrete cone failure in uncracked concrete C20/25** | | | | | | | | | | |
| **Hammer drilling** | | | | | | | | | | |
| **Size** | | | | **Φ8** | **Φ10** | **Φ12** | **Φ 16** | **Φ20** | **Φ25** | **Φ32** |
| **Characteristic bond resistance in uncracked concrete for a working life of 50 years and 100 years** | | | | | | | | | | |
| **Dry and wet concrete** | | $\tau_{Rk,ucr}$ | [N/mm²] | 10,0 | 9,0 | 9,0 | 8,5 | 8,0 | 8,0 | 5,0 |
| Installation safety factor | | $\gamma_{inst}$ | [-] | 1,2 | | | | | | |
| **Flooded hole** | | $\tau_{Rk,ucr}$ | [N/mm²] | 10,0 | 9,0 | 9,0 | 8,5 | 8,0 | 8,0 | 5,0 |
| Installation safety factor | | $\gamma_{inst}$ | [-] | 1,4 | | | | | | |
| **Dustless drilling** | | | | | | | | | | |
| **Rozmiar** | | | | **Φ8** | **Φ10** | **Φ12** | **Φ 16** | **Φ20** | **Φ25** | **Φ32** |
| **Characteristic bond resistance in uncracked concrete for a working life of 50 years and 100 years** | | | | | | | | | | |
| **Dry and wet concrete** | | $\tau_{Rk,ucr}$ | [N/mm²] | 10,0 | 9,0 | 9,0 | 8,5 | 8,0 | 8,0 | 5,0 |
| Installation safety factor | | $\gamma_{inst}$ | [-] | 1,2 | | | | | | |
| **Flooded hole** | | $\tau_{Rk,ucr}$ | [N/mm²] | 10,0 | 9,0 | 9,0 | 8,5 | 8,0 | 8,0 | 5,0 |
| Installation safety factor | | $\gamma_{inst}$ | [-] | 1,4 | | | | | | |
| Factor for concrete C50/60 | | $\psi_c$ | [-] | 1 | | | | | | |
| Factor for influence of sustained load for a working life 50 years | T1: 24°C / 40°C | $\psi^0_{sus}$ | [-] | 0,75 | | | | | | |
| | T2: 50°C / 80°C | | | 0,73 | | | | | | |
| **Concrete cone failure** | | | | | | | | | | |
| See Section 18. | | | | | | | | | | |
| **Splitting failure** | | | | | | | | | | |
| See Section 18. | | | | | | | | | | |

## Section 20. CHARACTERISTIC RESISTANCE – COMBINED PULL-OUT & CONCRETE CONE FAILURE FOR REBAR – DIAMOND DRILLING METHOD

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Characteristic values of resistance to tension load of rebar – diamond drilling method** | | | | | | | | | | |
| **Combined pullout and concrete cone failure in uncracked concrete C20/25** | | | | | | | | | | |
| **Diamond core drilling** | | | | | | | | | | |
| **Size** | | | | **Φ8** | **Φ10** | **Φ12** | **Φ 16** | **Φ20** | **Φ25** | **Φ32** |
| **Characteristic bond resistance in uncracked concrete for a working life of 50 years and 100 years** | | | | | | | | | | |
| **Dry and wet concrete** | | $\tau_{Rk,ucr}$ | [N/mm²] | 9,0 | 8,5 | 8,0 | 7,5 | 7,0 | 6,0 | 3,0 |
| Installation safety factor | | $\gamma_{inst}$ | [-] | 1,2 | | | | | | |
| **Flooded hole** | | $\tau_{Rk,ucr}$ | [N/mm²] | 9,0 | 8,5 | 8,0 | 7,5 | 7,0 | 5,5 | 2,5 |
| Installation safety factor | | $\gamma_{inst}$ | [-] | 1,4 | | | | | | |
| Factor for uncracked concrete | C30/37 | $\psi_c$ | [-] | 1,04 | | | | | | |
| | C40/50 | | | 1,07 | | | | | | |
| | C50/60 | | | 1,09 | | | | | | |
| Factor for influence of sustained load for a working life 50 years | | $\psi^0_{sus}$ | [-] | 0,77 | | | | | | |
| **Concrete cone failure** | | | | | | | | | | |
| Factor for concrete cone failure | | $K_{ucr,N}$ | [-] | 11 | | | | | | |
| Edge distance | | $C_{cr,N}$ | [mm] | $1{,}5h_{ef}$ | | | | | | |
| **Splitting failure** | | | | | | | | | | |
| **Size** | | | | **Φ8** | **Φ10** | **Φ12** | **Φ 16** | **Φ20** | **Φ25** | **Φ32** |
| Edge distance | | $C_{cr,sp}$ | [mm] | $1{,}5h_{ef}$ | | | | | | |
| Spacing | | $S_{cr,sp}$ | [mm] | $3{,}0h_{ef}$ | | | | | | |

## Section 21. CHARACTERISTIC RESISTANCE – COMBINED PULL-OUT & CONCRETE CONE FAILURE FOR REBAR – DIAMOND DRILLING METHOD FOR WCF-EASF-C WITH INSTALLATION TEMPERATURE < - 10 °C

| Characteristic values of resistance to tension load of rebar – diamond drilling method for WCF-EASF-C with installation temperature < - 10 °C | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Combined pullout and concrete cone failure in uncracked concrete C20/25** | | | | | | | | | | |
| **Diamond core drilling** | | | | | | | | | | |
| **Size** | | | | Φ8 | Φ10 | Φ12 | Φ 16 | Φ20 | Φ25 | Φ32 |
| **Characteristic bond resistance in uncracked concrete for a working life of 50 years and 100 years** | | | | | | | | | | |
| **Dry and wet concrete** | | $\tau_{Rk,ucr}$ | [N/mm$^2$] | 8,5 | 8,0 | 7,5 | 7,0 | 6,5 | 5,5 | 2,5 |
| Installation safety factor | | $\gamma_{inst}$ | [-] | 1,2 | | | | | | |
| **Otwór zalany wodą** | | $\tau_{Rk,ucr}$ | [N/mm$^2$] | 8,5 | 8,0 | 7,5 | 7,0 | 6,5 | 5,0 | 2,0 |
| Installation safety factor | | $\gamma_{inst}$ | [-] | 1,4 | | | | | | |
| Factor for uncracked concrete | C30/37 | $\psi_c$ | [-] | 1,04 | | | | | | |
| | C40/50 | | | 1,07 | | | | | | |
| | C50/60 | | | 1,09 | | | | | | |
| Factor for influence of sustained load for a working life 50 years | | $\psi^0_{sus}$ | [-] | 0,77 | | | | | | |
| **Concrete cone failure** | | | | | | | | | | |
| See Section 20. | | | | | | | | | | |
| **Splitting failure** | | | | | | | | | | |
| See Section 20. | | | | | | | | | | |

## Section 22. RESISTANCE VALUES FOR REINFORCING BARS IN UNCRACKED CONCRETE – 50 YEARS WORKING LIFE – HAMMER DRILLING METHOD

**Resistance Values for Reinforcing Bars in Uncracked Concrete - 50 years working life**
Combined Pullout & Concrete Cone Failure and Concrete Cone Failure Temperature Range: -40°C to 80°C

| Property | | | Rebar Diameter | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 8mm | 10mm | 12mm | 16mm | 20mm | 25mm | 32mm |
| Effective Embedment Depth = MIN = 8d | $h_{ef}$ | mm | 64 | 80 | 96 | 128 | 160 | 200 | 256 |
| Design Resistance | $N_{Rd}$ | kN | 9.5 | 13.0 | 19.0 | 32.0 | 47.0 | 74.0 | 78.5 |
| Effective Embedment Depth = 12d | $h_{ef}$ | mm | 96 | 120 | 144 | 192 | 240 | 300 | 384 |
| Design Resistance | $N_{Rd}$ | kN | 14.5 | 19.5 | 28.5 | 48.0 | 71.0 | 111.0 | 117.5 |
| Effective Embedment Depth = 20d | $h_{ef}$ | mm | 160 | 200 | 240 | 320 | 400 | 500 | 640 |
| Design Resistance | $N_{Rd}$ | kN | 24.5 | 33.0 | 47.5 | 80.0 | 118.5 | 185.0 | 196.5 |

*1. Resistance values are based on combined pullout & concrete cone failure and concrete cone failure according to EC2-4 Resistance for steel failure must also be considered - the lowest value controls.*
*2. Resistance values are for single anchors without close edges or eccentric loading considerations.*
*3. Tabulated values correspond to the above stated temperature range and installation conditions only.*
*4. Long term temperatures are those that remain roughly constant over prolonged periods. Short term temperatures occur over brief intervals, e.g.: diurnal cycling.*
*5. The cylinder compressive strength of the concrete (fck),is assumed to be 20 N/mm2.*
*6. Tabulated resistance values assume that the geometry of the anchor(s) and concrete member is sufficient to avoid splitting failure.*

## Section 23. CHARACTERISTIC RESISTANCE FOR SEISMIC LOADING CATEGORY C1 – COMBINED PULL-OUT & CONCRETE CONE FAILURE USING THREADED RODS – HAMMER DRILLING , DUSTLESS DRILLING

| Seismic performance category C1 - Hammer drilling, Dustless drilling | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Size** | | | **M10** | **M12** | **M16** | **M20** | **M24** |
| **Characteristic resistance to pull-out for a working life of 50 years** | | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,C1}$ | [N/mm²] | 3,5 | 3,5 | 3,5 | 3,5 | 3,5 |
| WCF-EASF-C with installation temperature < -10 °C | | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,C1}$ | [N/mm²] | 3,3 | 3,3 | 3,3 | 3,3 | 3,3 |
| **Characteristic resistance to pull-out for a working life of 100 years** | | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,C1}$ | [N/mm²] | 3,0 | 3,0 | 3,0 | 2,2 | 2,2 |
| WCF-EASF-C with installation temperature < -10 °C | | | | | | | |
| Dry, wet concrete and flooded hole | $\tau_{Rk,C1}$ | [N/mm²] | 2,8 | 2,8 | 2,8 | 2,1 | 2,1 |
| Installation safety factor – Dry and wet concrete | $\gamma_{inst}$ | [-] | 1,2 | | | | |
| Installation safety factor – Flooded hole | $\gamma_{inst}$ | [-] | 1,4 | | | | |

Note: Rebars are not qualified for seismic design

## Section 24. CHARACTERISTIC RESISTANCE FOR SEISMIC LOADING CATEGORY C1 – THREADED RODS – CHARACTERISTIC VALUES FOR STEEL FAILURE (TENSION)- HAMMER DRILLING , DUSTLESS DRILLING

| Seismic performance category C1 - Hammer drilling, Dustless drilling | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Size** | | | **M10** | **M12** | **M16** | **M20** | **M24** |
| **Tension load** | | | | | | | |
| **Steel failure** | | | | | | | |
| Characteristic resistance KPG 4.6 | $N_{Rk,s,eq}$ | [kN] | 23 | 34 | 63 | 98 | 141 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 2,00 | | | | |
| Characteristic resistance KPG 5.8 | $N_{Rk,s,eq}$ | [kN] | 29 | 42 | 79 | 123 | 177 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,50 | | | | |
| Characteristic resistance KPG 8.8 | $N_{Rk,s,eq}$ | [kN] | 46 | 67 | 126 | 196 | 282 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,50 | | | | |
| Characteristic resistance KPG 10.9 | $N_{Rk,s,eq}$ | [kN] | 58 | 84 | 157 | 245 | 353 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,33 | | | | |
| Characteristic resistance KPG A2-70, A4-70 | $N_{Rk,s,eq}$ | [kN] | 41 | 59 | 110 | 172 | 247 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,87 | | | | |
| Characteristic resistance KPG A4-80 | $N_{Rk,s,eq}$ | [kN] | 46 | 67 | 126 | 196 | 282 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,60 | | | | |
| Characteristic resistance KPG HCR | $N_{Rk,s,eq}$ | [kN] | 41 | 59 | 110 | 172 | 247 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,50 | | | | |
| Characteristic resistance KPG UHCR | $N_{Rk,s,eq}$ | [kN] | 41 | 59 | 110 | 172 | 247 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,87 | | | | |

## Section 25. CHARACTERISTIC RESISTANCE FOR SEISMIC LOADING CATEGORY C1 – THREADED RODS – CHARACTERISTIC VALUES FOR STEEL FAILURE (SHEAR-WITHOUT LEVER ARM) -HAMMER DRILLING , DUSTLESS DRILLING

| Seismic performance category C1 - Hammer drilling, Dustless drilling | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Size** | | | **M10** | **M12** | **M16** | **M20** | **M24** |
| **Shear load** | | | | | | | |
| **Steel failure without lever arm** | | | | | | | |
| Characteristic resistance KPG 4.6 | $V_{Rk,s,eq}$ | [kN] | 7 | 10 | 23 | 30 | 40 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,67 | | | | |
| Characteristic resistance KPG 5.8 | $V_{Rk,s,eq}$ | [kN] | 9 | 13 | 28 | 38 | 51 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,25 | | | | |
| Characteristic resistance KPG 8.8 | $V_{Rk,s,eq}$ | [kN] | 14 | 21 | 45 | 61 | 81 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,25 | | | | |
| Characteristic resistance KPG 10.9 | $V_{Rk,s,eq}$ | [kN] | 18 | 26 | 56 | 76 | 101 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,50 | | | | |
| Characteristic resistance KPG A2-70, A4-70 | $V_{Rk,s,eq}$ | [kN] | 12 | 18 | 39 | 53 | 71 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,56 | | | | |
| Characteristic resistance KPG A4-80 | $V_{Rk,s,eq}$ | [kN] | 14 | 21 | 45 | 61 | 81 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,33 | | | | |
| Characteristic resistance KPG HCR | $V_{Rk,s,eq}$ | [kN] | 12 | 18 | 39 | 53 | 71 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,25 | | | | |
| Characteristic resistance KPG UHCR | $V_{Rk,s,eq}$ | [kN] | 12 | 18 | 39 | 53 | 71 |
| Partial safety factor | $\gamma_{Ms}$ | [-] | 1,56 | | | | |
| Factor for annular gap | $\alpha_{gap}$ | [-] | 0,50 | | | | |

Note: Rebars are not qualified for seismic design

## Section 26. RESISTANCE VALUES FOR THREADED ROD IN SEISMIC CATEGORY C1 - 50 YEARS WORKING LIFE - Combined Pull-out & Concrete Cone Failure and Concrete Cone Failure – HAMMER DRILLING METHOD

**Resistance Values for Threaded Rod in Seismic Category C1 - 50 years working life**

Combined Pullout & Concrete Cone Failure and Concrete Cone Failure
Temperature Range: -40°C to 80°C

| Property | Unit | | Anchor Diameter | | | | |
|---|---|---|---|---|---|---|---|
| | | | M10 | M12 | M16 | M20 | M24 |
| Effective Embedment Depth = MIN = 8d | $h_{ef}$ | mm | 80 | 96 | 128 | 160 | 192 |
| Design Resistance | $N_{Rd}$ | kN | 4,5 | 7,0 | 12,5 | 19,5 | 29,0 |
| Effective Embedment Depth = 12d | $h_{ef}$ | mm | 120 | 144 | 192 | 240 | 288 |
| Design Resistance | $N_{Rd}$ | kN | 7,0 | 10,5 | 18,5 | 29,0 | 42,0 |
| Effective Embedment Depth = STD | $h_{ef}$ | mm | 90 | 110 | 128 | 170 | 210 |
| Design Resistance | $N_{Rd}$ | kN | 5,0 | 8,0 | 12,5 | 20,5 | 30,5 |
| Effective Embedment Depth = MAX = 20d | $h_{ef}$ | mm | 200 | 240 | 320 | 400 | 480 |
| Design Resistance | $N_{Rd}$ | kN | 12,0 | 17,5 | 31,0 | 48,5 | 70,0 |

*1. Resistance values are based on combined pullout & concrete cone failure and concrete cone failure according to EC2-4. Resistance for steel failure must also be considered - the lowest value controls.*

*2. Resistance values are for single anchors without close edges or eccentric loading considerations.*

*3. Tabulated values correspond to the above stated temperature range and installation conditions only.*

*4. Long term temperatures are those that remain roughly constant over prolonged periods. Short term temperatures occur over brief intervals, e.g.: diurnal cycling.*

*5. The cylinder compressive strength of the concrete (fck),is assumed to be 20 N/mm2.*

*6. Tabulated resistance values assume that the geometry of the anchor(s) and concrete member is sufficient to avoid splitting failure.*

## Section 27. POST INSTALLED REBAR – INSTALLATION PARAMETERS

**Post Installed Rebar - Installation Parameters**

| Rebar | | Drill hole Diameter (mm) | Diameter of Cleaning Brush (mm) | Min. Anchorage Length (mm) | Min. Lap/Splice Length (mm) | Max. Embedment Depth (mm) |
|---|---|---|---|---|---|---|
| Diameter (mm) | $f_{yk}$ (N/mm²) | | | | | |
| 8 | 500 | 12 (10) | 14 | 113 | 200 | 400 |
| 10 | 500 | 14 (12) | 14 | 141 | 215 | 500 |
| 12 | 500 | 16 | 19 | 170 | 260 | 600 |
| 14 | 500 | 18 | 22 | 198 | 300 | 700 |
| 16 | 500 | 20 | 22 | 226 | 345 | 800 |
| 20 | 500 | 25 | 29 | 283 | 430 | 1000 |
| 25 | 500 | 32 | 40 | 354 | 535 | 1000 |

Note - Installation parameters are based on C20/25 concrete

Minimum Anchorage Length:

$l_{bPIR} = \alpha_{lb} \bullet \ell_{b,min}$

$\alpha_{lb}$ = amplification factor for minimum anchorage length

$\ell_{b,min}$ = minimum anchorage length of cast-in rebar according to EN 1992-1-1, eq. 8.6

## Section 28. DESIGN BOND STRENGTH FOR 50 YEARS WORKING LIFE

**Design Bond Strength for 50 years working life**

| Rebar Diameter (mm) | Concrete Class | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | C12/15 | C16/20 | C20/25 | C25/30 | C30/37 | C35/45 | C40/50 | C45/55 | C50/60 |
| 8 | 1.60 | 2.00 | 2.30 | 2.70 | 3.00 | 3.40 | 3.70 | 4.00 | 4.30 |
| 10 | 1.60 | 2.00 | 2.30 | 2.70 | 3.00 | 3.40 | 3.70 | 4.00 | 4.30 |
| 12 | 1.60 | 2.00 | 2.30 | 2.70 | 3.00 | 3.40 | 3.70 | 4.00 | 4.30 |
| 14 | 1.60 | 2.00 | 2.30 | 2.70 | 3.00 | 3.40 | 3.70 | 4.00 | 4.30 |
| 16 | 1.60 | 2.00 | 2.30 | 2.70 | 3.00 | 3.40 | 3.70 | 4.00 | 4.30 |
| 20 | 1.60 | 2.00 | 2.30 | 2.70 | 3.00 | 3.40 | 3.70 | | |
| 25 | 1.60 | 2.00 | 2.30 | 2.70 | 3.00 | | | | |

Note:
Tabulated values are valid for good bond conditions according to EN 1992-1-1. For all other bond conditions multiply the values by 0.7.
Values for bond strengths have had reduction factors applied.

**Amplification Factor For Embedment Depth**

| Rebar | Amplification Factor | C12/15 | C16/20 | C20/25 | C25/30 | C30/37 | C35/45 | C40/50 | C45/55 | C50/60 |
|---|---|---|---|---|---|---|---|---|---|---|
| 8 | $\alpha_{lb}$ | 1 | | | | | | | | |
| 10 | | | | | | | | | | |
| 12 | | | | | | | | | | |
| 14 | | | | | | | | | | |
| 16 | | | | | | | | | | |
| 20 | | | | | | | | | | |
| 25 | | | | | | | | | | |

## Section 29. TYPES AND DIMENSIONS OF BLOCK AND BRICKS

**Brick N° 1**

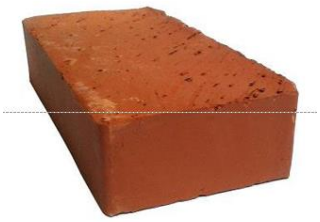
Hollow clay brick Hueco Doble according to EN 771-1
length/width/height = 245 mm / 110 mm / 88 mm
fb ≥ 2,5 N/mm² / ρ≥ 0,74 kg/dm³

**Brick N° 2**

Hollow clay brick Porotherm P+W according to EN 771-1
length/width/height = 373 mm/250 mm/238 mm
fb ≥ 12 N/mm2 / ρ ≥ 0,9 kg/dm3

**Brick N° 3**

**Brick N° 4**



Solid clay brick Mz-NF according to EN 771-1
length/width/height = 240 mm / 115 mm / 71 mm
fb ≥ 20 N/mm2 / ρ ≥ 1,9 kg/dm3

Solid calcium silicate brick KSV-NF according to EN 771-2
length/width/height = 240 mm / 115 mm / 71 mm
fb ≥ 25 N/mm2 / ρ≥ 1,8 kg/dm3

**Brick N° 5**

Perforated calcium silicate brick KSL-R-12-1,2-16DF
according to EN 771-2
length/width/height = 239 mm / 248 mm / 239 mm
fb ≥ 15 N/mm2 / ρ ≥ 1,3 kg/dm3

| Brick N° | Strength class acc. to EN 771-4 | L/W/H (mm) | $f_b$ ($N/mm^2$) | ρ ($kg/dm^3$) |
|---|---|---|---|---|
| **N° 6** | Autoclaved aerated concrete AAC2 | 599/375/249 | ≥ 2,0 | ≥ 0,35 |
| **N° 7** | Autoclaved aerated concrete AAC3 | 599/375/249 | ≥ 3,0 | ≥ 0,40 |
| **N° 8** | Autoclaved aerated concrete AAC4 | 599/375/249 | ≥ 4,0 | ≥ 0,50 |
| **N° 9** | Autoclaved aerated concrete AAC5 | 599/375/249 | ≥ 5,0 | ≥ 0,60 |
| **N° 10** | Autoclaved aerated concrete AAC6 | 499/240/250 | ≥ 6,0 | ≥ 0,65 |

## Section 30. INSTALLATION PARAMETERS IN SOLID OR HOLLOW MASONRY WITH SLEEVE

| Anchor type | | | Anchor rod with sleeve | | | | |
|---|---|---|---|---|---|---|---|
| Size | | | M8 | M10 | M12 | | M16 |
| Sieve sleeve | $l_s$ | [mm] | 85 | 85 | 85 | | 85 |
| | $d_s$ | [mm] | 16 | 16 | 16 | 20 | 20 |
| Nominal drill hole diameter | $d_0$ | [mm] | 16 | 16 | 16 | 20 | 20 |
| Diameter of cleaning brush | $d_b$ | [mm] | $20^{\pm1}$ | $20^{\pm1}$ | $20^{\pm1}$ | $22^{\pm1}$ | $22^{\pm1}$ |
| Depth of the drill hole | $h_0$ | [mm] | 90 | | | | |
| Effective anchorage depth | $h_{ef}$ | [mm] | 85 | | | | |
| Diameter of clearance hole in the fixture | $d_f \leq$ | [mm] | 9 | 12 | 14 | | 18 |
| Torque moment | $T_{inst} \leq$ | [Nm] | 2 | | | | |

## Section 31. EDGE DISTANCES AND SPACING IN SOLID OR HOLLOW MASONRY WITH SLEEVE

| Base material [1)] | Anchor rod | | | | | |
|---|---|---|---|---|---|---|
| | M8, M10, M12 [2)] | | | M12[3)], M16 | | |
| | $C_{cr} = C_{min}$ | $S_{cr\,II} = S_{min\,II}$ | $S_{cr\perp} = S_{min\perp}$ | $C_{cr} = C_{min}$ | $S_{cr\,II} = S_{min\,II}$ | $S_{cr\perp} = S_{min\perp}$ |
| | [mm] | [mm] | [mm] | [mm] | [mm] | [mm] |
| Brick N° 1 | 100 | 245 | 110 | 120 | 245 | 110 |
| Brick N° 2 | 100 | 373 | 238 | 120 | 373 | 238 |
| Brick N° 3 | 128 | 255 | 255 | 128 | 255 | 255 |
| Brick N° 4 | 128 | 255 | 255 | 125 | 255 | 255 |
| Brick N° 5 | 100 | 239 | 248 | 120 | 239 | 248 |

2) M12 with sleeve TSN 16/85
3) M12 with sleeve TSN 20/85

## Section 32. INSTALLATION PARAMETERS IN SOLID MASONRY WITHOUT SLEEVE

| Anchor type | | | Anchor rod without sleeve | | | | |
|---|---|---|---|---|---|---|---|
| Size | | | M6 | M8 | M10 | M12 | M16 |
| Nominal drill hole diameter | $d_0$ | [mm] | 8 | 10 | 12 | 14 | 18 |
| Diameter of cleaning brush | $d_b$ | [mm] | $9^{\pm1}$ | $14^{\pm1}$ | $14^{\pm1}$ | $14^{\pm1}$ | $20^{\pm1}$ |
| Depth of the drill hole | $h_0$ | [mm] | 80 | 90 | | | |
| Effective anchorage depth | $h_{ef}$ | [mm] | 80 | 90 | | | |
| Diameter of clearance hole in the fixture | $d_f \leq$ | [mm] | 7 | 9 | 12 | 14 | 18 |
| Torque moment | $T_{inst} \leq$ | [Nm] | 2 | | | | |

## Section 33. EDGE DISTANCES AND SPACING IN SOLID MASONRY WITHOUT SLEEVE

| Base material [1] | Anchor rod | | | | | |
|---|---|---|---|---|---|---|
| | M6 | | | M8, M10, M12, M16 | | |
| | $c_{cr} = c_{min}$ | $s_{cr\,II} = s_{min\,II}$ | $s_{cr\perp} = s_{min\perp}$ | $c_{cr} = c_{min}$ | $s_{cr\,II} = s_{min\,II}$ | $s_{cr\perp} = s_{min\perp}$ |
| | [mm] | [mm] | [mm] | [mm] | [mm] | [mm] |
| Brick N° 3 | 120 | 240 | 240 | 135 | 270 | 270 |
| Brick N° 3 | 120 | 240 | 240 | 135 | 270 | 270 |

## Section 34. INSTALLATION PARAMETERS IN AUTOCLAVED AERATED CONCRETE

| Base material | | | Brick No. 6 - 10 | | | | |
|---|---|---|---|---|---|---|---|
| Anchor type | | | Anchor rod without sleeve | | | | |
| Size | | | M6 | M8 | M10 | M12 | M16 |
| Nominal drill hole diameter | $d_0$ | [mm] | 8 | 10 | 12 | 14 | 18 |
| Diameter of cleaning brush | $d_b$ | [mm] | $9^{\pm1}$ | $14^{\pm1}$ | $14^{\pm1}$ | $20^{\pm1}$ | $20^{\pm1}$ |
| Depth of the drill hole | $h_0$ | [mm] | 80 | | | 95 | 105 |
| Effective anchorage depth | $h_{ef}$ | [mm] | 75 | | | 90 | 100 |
| Diameter of clearance hole in the fixture | $d_f \leq$ | [mm] | 7 | 9 | 12 | 14 | 18 |
| Torque moment | $T_{inst} \leq$ | [Nm] | 2 | | | | |

## Section 35. EDGE DISTANCES AND SPACING IN AUTOCLAVED AERATED CONCRETE

| Base material [1] | Anchor rod | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | M6, M8, M10 | | | M12 | | | M16 | | |
| | $c_{cr} = c_{min}$ | $s_{cr\,II} = s_{min\,II}$ | $s_{cr\perp} = s_{min\perp}$ | $c_{cr} = c_{min}$ | $s_{cr\,II} = s_{min\,II}$ | $s_{cr\perp} = s_{min\perp}$ | $c_{cr} = c_{min}$ | $s_{cr\,II} = s_{min\,II}$ | $s_{cr\perp} = s_{min\perp}$ |
| | [mm] | [mm] | [mm] | [mm] | [mm] | [mm] | [mm] | [mm] | [mm] |
| Brick N° 6 | 113 | 225 | 225 | 135 | 270 | 270 | 150 | 300 | 300 |
| Brick N° 7 | 113 | 225 | 225 | 135 | 270 | 270 | 150 | 300 | 300 |
| Brick N° 8 | 113 | 225 | 225 | 135 | 270 | 270 | 150 | 300 | 300 |
| Brick N° 9 | 113 | 225 | 225 | 135 | 270 | 270 | 150 | 300 | 300 |
| Brick N° 10 | 113 | 225 | 225 | 135 | 270 | 270 | 150 | 300 | 300 |

## Section 36. CHARACTERISTIC RESISTANCE UNDER TENSION AND SHEAR LOADING

| Base material | Anchor rods with sleeve $N_{Rk}=V_{Rk}$ [kN] [1] | | | | | Anchor rods without sleeve $N_{Rk}=V_{Rk}$ [kN] [1] | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | M8 | M10 | M12 | M12 | M16 | M6 | M8 | M10 | M12 | M16 |
| Sleeve | 16/85 | 16/85 | 16/85 | 20/85 | 20/85 | | | | | |
| Brick N° 1 | 0,9 | 1,5 | 1,5 | 1,5 | 1,5 | | | | | |
| Brick N° 2 | 2,0 | 2,0 | 2,0 | 2,5 | 2,5 | | | | | |
| Brick N° 3 | 3,0 | 3,0 | 3,0 | 3,0 | 3,0 | 3,5 | 4,0 | 5,0 | 3,5 | 4,5 |
| Brick N° 4 | 3,0 | 3,0 | 3,0 | 3,0 | 3,0 | 6,0 | 7,0 | 8,0 | 5,5 | 8,0 |
| Brick N° 5 | 2,0 | 2,0 | 2,0 | 2,5 | 2,5 | | | | | |

[1] For design according TR054 : $N_{Rk} = N_{Rk,p} = N_{Rk,b} = N_{Rk,s}$ ; $N_{Rk,pb}$ according to TR 054
For $V_{Rk,s}$ see Section 37 ; Calculation of $V_{Rk,pb}$ i $V_{Rk,c}$ according to TR 054

## Section 37. CHARACTERISTIC RESISTANCE UNDER SHEAR LOADING – STEEL FAILURE

| Size | | | M6 | M8 | M10 | M12 | M16 | Partial safety factor $\gamma_{Ms}$ |
|---|---|---|---|---|---|---|---|---|
| Characteristic shear resistance | | | | | | | | |
| KPG 5.8 | $V_{Rk,s}$ | [kN] | 5 | 9 | 15 | 21 | 39 | 1,25 |
| KPG 8.8 | $V_{Rk,s}$ | [kN] | 8 | 15 | 23 | 34 | 63 | 1,25 |
| KPG 10.9 | $V_{Rk,s}$ | [kN] | 10 | 18 | 29 | 42 | 79 | 1,50 |
| KPG A2-70, KPG A4-70 | $V_{Rk,s}$ | [kN] | 7 | 13 | 20 | 30 | 55 | 1,56 |
| KPG A4-80 | $V_{Rk,s}$ | [kN] | 8 | 15 | 23 | 34 | 63 | 1,33 |
| KPG HCR | $V_{Rk,s}$ | [kN] | 7 | 13 | 20 | 30 | 55 | 1,25 |
| KPG UHCR | $V_{Rk,s}$ | [kN] | 7 | 13 | 20 | 30 | 55 | 1,56 |
| Characteristic bending moment | | | | | | | | |
| KPG 5.8 | $M_{Rk,s}$ | [Nm] | 8 | 19 | 37 | 66 | 166 | 1,25 |
| KPG 8.8 | $M_{Rk,s}$ | [Nm] | 12 | 30 | 60 | 105 | 266 | 1,25 |
| KPG 10.9 | $M_{Rk,s}$ | [Nm] | 15 | 37 | 75 | 131 | 333 | 1,50 |
| KPG A2-70, KPG A4-70 | $M_{Rk,s}$ | [Nm] | 11 | 26 | 52 | 92 | 233 | 1,56 |
| KPG A4-80 | $M_{Rk,s}$ | [Nm] | 12 | 30 | 60 | 105 | 266 | 1,33 |
| KPG HCR | $M_{Rk,s}$ | [Nm] | 11 | 26 | 52 | 92 | 233 | 1,25 |
| KPG UHCR | $M_{Rk,s}$ | [Nm] | 11 | 26 | 52 | 92 | 233 | 1,56 |

## Section 38. DISPLACEMENTS UNDER TENSION AND SHEAR LOAD

| Base material | F [kN] | With sleeve | | | | Without sleeve | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | $\delta_{N0}$ [mm] | $\delta_{N\infty}$ [mm] | $\delta_{V0}$ [mm] | $\delta_{N\infty}$ [mm] | $\delta_{N0}$ [mm] | $\delta_{N\infty}$ [mm] | $\delta_{V0}$ [mm] | $\delta_{N\infty}$ [mm] |
| Hollow clay brick | $N_{Rk} / (1,4 \cdot \gamma_M)$ | 0,5 | 1,0 | 1,0[1)] | 1,5[1)] | | | | |
| Solid clay brick | $N_{Rk} / (1,4 \cdot \gamma_M)$ | 0,06 | 0,12 | 0,7[1)] | 1,0[1)] | 0,3 | 0,6 | 0,7 | 1,1 |
| Solid calcium silicate brick | $N_{Rk} / (1,4 \cdot \gamma_M)$ | 0,12 | 0,24 | 0,9[1)] | 1,4[1)] | 0,3 | 0,5 | 0,8 | 1,3 |
| Perforated calcium silicate brick | $N_{Rk} / (1,4 \cdot \gamma_M)$ | 0,1 | 0,2 | 0,9[1)] | 1,4[1)] | | | | |

1) the hole gap between bolt and fixture shall be considered additionally

## Section 39. β – FACTORS FOR JOB SITE TESTS ACCORDING TO TR053

| Brick N° | N° 1 | N° 2 | N° 3 | N° 4 | N° 5 |
|---|---|---|---|---|---|
| β- factor | 0,78 | 0,83 | 0,85 | 0,85 | 0,85 |

## Section 40. CHARACTERISTIC RESISTANCE UNDER TENSION AND SHEAR LOADING WCF-EASF-C WITH INSTALLATION TEMPERATURE < -10°C

| Base material | Anchor rods with sleeve $N_{Rk}=V_{Rk}$ [kN] [1)] | | | | | Anchor rods without sleeve $N_{Rk}=V_{Rk}$ [kN] [1)] | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | M8 | M10 | M12 | M12 | M16 | M6 | M8 | M10 | M12 | M16 |
| Sleeve | 16/85 | 16/85 | 16/85 | 20/85 | 20/85 | | | | | |
| Brick N° 1 | 0,9 | 1,5 | 1,5 | 1,5 | 1,5 | | | | | |
| Brick N° 2 | 2,0 | 2,0 | 2,0 | 2,5 | 2,5 | | | | | |
| Brick N° 3 | 3,0 | 3,0 | 3,0 | 3,0 | 3,0 | 3,0 | 4,0 | 5,0 | 3,5 | 4,5 |
| Brick N° 4 | 3,0 | 3,0 | 3,0 | 3,0 | 3,0 | 6,0 | 7,0 | 7,5 | 5,5 | 7,5 |
| Brick N° 5 | 2,0 | 2,0 | 2,0 | 2,5 | 2,5 | | | | | |

1) For design according TR054 : $N_{Rk} = N_{Rk,p} = N_{Rk,b} = N_{Rk,s}$ ; $N_{Rk,pb}$ according to TR 054
For $V_{Rk,s}$ see Section 41 ; Calculation of $V_{Rk,pb}$ i $V_{Rk,c}$ according to TR 054

## Section 41. CHARACTERISTIC RESISTANCE UNDER SHEAR LOADING – steel failure – WCF-EASF-C WITH INSTALLATION TEMPERATURE < -10°C

| Size | M6 | M8 | M10 | M12 | M16 | Partial safety factor $\gamma_{Ms}$ |
|---|---|---|---|---|---|---|
| See Section 37 | | | | | | |

## Section 42. DISPLACEMENTS UNDER TENSION AND SHEAR LOAD – WCF-EASF-C WITH INSTALLATION TEMPERATURE < -10°C

| Base material | F [kN] | With sleeve | | | | Without sleeve | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | $\delta_{N0}$ [mm] | $\delta_{N\infty}$ [mm] | $\delta_{V0}$ [mm] | $\delta_{N\infty}$ [mm] | $\delta_{N0}$ [mm] | $\delta_{N\infty}$ [mm] | $\delta_{V0}$ [mm] | $\delta_{N\infty}$ [mm] |
| See Section 38 | | | | | | | | | |

## Section 43. β – FACTORS FOR JOB SITE TESTS ACCORDING TO TR053 – WCF-EASF-C WITH INSTALLATION TEMPERATURE < -10°C

| Brick N° | N° 1 | N° 2 | N° 3 | N° 4 | N° 5 |
|---|---|---|---|---|---|
| β- factor | 0,74 | 0,79 | 0,81 | 0,81 | 0,81 |

## Section 44. CHARACTERISTIC RESISTANCE UNDER TENSION AND SHEAR LOADING (AUTOCLAVED AERATED CONCRETE)

| Base material | Anchor rods $N_{Rk} = V_{Rk}$ [kN] [1) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Use conditions d/d | | | | | Use conditions w/d i w/w | | | | |
| | M6 | M8 | M10 | M12 | M16 | M6 | M8 | M10 | M12 | M16 |
| Brick N° 6 | 0,9 | 0,9 | 0,9 | 0,9 | 2,0 | 0,75 | 0,75 | 0,75 | 0,9 | 1,5 |
| Brick N° 7 | 0,9 | 1,5 | 1,5 | 2,0 | 3,0 | 0,9 | 1,2 | 1,2 | 1,5 | 2,5 |
| Brick N° 8 | 1,2 | 2,5 | 2,5 | 3,0 | 4,0 | 0,9 | 2,0 | 2,0 | 2,5 | 3,0 |
| Brick N° 9 | 1,5 | 3,0 | 3,0 | 4,0 | 5,0 | 1,2 | 2,5 | 2,5 | 3,5 | 4,0 |
| Brick N° 10 | 1,5 | 4,0 | 4,0 | 5,0 | 6,0 | 1,2 | 3,0 | 3,0 | 4,0 | 4,5 |

[1) For design according TR054 : $N_{Rk} = N_{Rk,p} = N_{Rk,b} = N_{Rk,s}$ ; $N_{Rk,pb}$ according to TR 054
For $V_{Rk,s}$ see Section 45 ; Calculation of $V_{Rk,pb}$ i $V_{Rk,c}$ according to TR 054

## Section 45. CHARACTERISTIC RESISTANCE UNDER SHEAR LOADING – steel failure (AUTOCLAVED AERATED CONCRETE)

| Size | | | M6 | M8 | M10 | M12 | M16 | Partial safety factor $\gamma_{Ms}$ |
|---|---|---|---|---|---|---|---|---|
| **Characteristic shear resistance** | | | | | | | | |
| KPG 4.6 | $V_{Rk,s}$ | [kN] | 4 | 7 | 12 | 17 | 31 | 1,67 |
| KPG 5.8 | $V_{Rk,s}$ | [kN] | 5 | 9 | 15 | 21 | 39 | 1,25 |
| KPG 8.8 | $V_{Rk,s}$ | [kN] | 8 | 15 | 23 | 34 | 63 | 1,25 |
| KPG 10.9 | $V_{Rk,s}$ | [kN] | 10 | 18 | 29 | 42 | 79 | 1,50 |
| KPG A2-70, KPG A4-70 | $V_{Rk,s}$ | [kN] | 7 | 13 | 20 | 30 | 55 | 1,56 |
| KPG A4-80 | $V_{Rk,s}$ | [kN] | 8 | 15 | 23 | 34 | 63 | 1,33 |
| KPG HCR | $V_{Rk,s}$ | [kN] | 7 | 13 | 20 | 30 | 55 | 1,25 |
| KPG UHCR | $V_{Rk,s}$ | [kN] | 7 | 13 | 20 | 30 | 55 | 1,56 |
| **Characteristic bending moment** | | | | | | | | |
| KPG 4.6 | $M_{Rk,s}$ | [Nm] | 6 | 15 | 30 | 52 | 133 | 1,67 |
| KPG 5.8 | $M_{Rk,s}$ | [Nm] | 8 | 19 | 37 | 66 | 166 | 1,25 |
| KPG 8.8 | $M_{Rk,s}$ | [Nm] | 12 | 30 | 60 | 105 | 266 | 1,25 |
| KPG 10.9 | $M_{Rk,s}$ | [Nm] | 15 | 37 | 75 | 131 | 333 | 1,50 |
| KPG A2-70, KPG A4-70 | $M_{Rk,s}$ | [Nm] | 11 | 26 | 52 | 92 | 233 | 1,56 |
| KPG A4-80 | $M_{Rk,s}$ | [Nm] | 12 | 30 | 60 | 105 | 266 | 1,33 |
| KPG HCR | $M_{Rk,s}$ | [Nm] | 11 | 26 | 52 | 92 | 233 | 1,25 |
| KPG UHCR | $M_{Rk,s}$ | [Nm] | 11 | 26 | 52 | 92 | 233 | 1,56 |

## Section 46. DISPLACEMENTS UNDER TENSION AND SHEAR LOAD (AUTOCLAVED AERATED CONCRETE)

| Size | | | M6 | M8 | M10 | M12 | M16 |
|---|---|---|---|---|---|---|---|
| Load | F | [kN] | $N_{Rk} / (1{,}4 \cdot \gamma_M)$ | | | | |
| AAC2 | $\delta_{N0}$ | [mm] | 0,27 | 0,24 | 0,32 | 0,39 | 0,96 |
| | $\delta_{N\infty}$ | [mm] | 0,54 | 0,49 | 0,64 | 0,78 | 1,92 |
| | $\delta_{V0}$ | [mm] | 0,25 | 0,42 | 0,16 | 0,18 | 0,31 |
| | $\delta_{V\infty}$ | [mm] | 0,38 | 0,62 | 0,23 | 0,27 | 0,46 |
| AAC4 | $\delta_{N0}$ | [mm] | 0,64 | 0,24 | 0,32 | 0,39 | 0,96 |
| | $\delta_{N\infty}$ | [mm] | 1,28 | 0,49 | 0,64 | 0,78 | 1,92 |
| | $\delta_{V0}$ | [mm] | 0,32 | 0,73 | 0,54 | 0,29 | 0,32 |
| | $\delta_{V\infty}$ | [mm] | 0,47 | 1,09 | 0,81 | 0,44 | 0,48 |
| AAC6 | $\delta_{N0}$ | [mm] | 0,64 | 0,06 | 0,09 | 0,10 | 0,05 |
| | $\delta_{N\infty}$ | [mm] | 1,28 | 0,12 | 0,18 | 0,21 | 0,11 |
| | $\delta_{V0}$ | [mm] | 0,32 | 0,73 | 0,54 | 0,29 | 0,32 |
| | $\delta_{V\infty}$ | [mm] | 0,47 | 1,09 | 0,81 | 0,44 | 0,48 |

[1] the hole gap between bolt and fixture shall be considered additionally

## Section 47. β – FACTORS FOR JOB SITE TESTS ACCORDING TO TR053 (AUTOCLAVED AERATED CONCRETE)

| Brick N° | N° 6 | N° 7 | N° 8 | N° 9 | N° 10 |
|---|---|---|---|---|---|
| β – factor – Use conditions **d/d** | 0,98 | 0,98 | 0,98 | 0,98 | 0,98 |
| β – factor – Use conditions **d/w** and **w/w** | 0,78 | 0,78 | 0,78 | 0,78 | 0,78 |

## Section 48. CHARACTERISTIC RESISTANCE UNDER TENSION AND SHEAR LOADING (AUTOCLAVED AERATED CONCRETE) – WCF-EASF-C WITH INSTALLATION TEMPERATURE < -10°C

| **Materiał podłoża** | **Anchor rods $N_{Rk} = V_{Rk}$ [kN] [1]** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Use conditions d/d** | | | | | **Use conditions w/d and w/w** | | | | |
| | **M6** | **M8** | **M10** | **M12** | **M16** | **M6** | **M8** | **M10** | **M12** | **M16** |
| Brick N° 6 | 0,75 | 0,9 | 0,9 | 0,9 | 2,0 | 0,6 | 0,75 | 0,75 | 0,9 | 1,5 |
| Brick N° 7 | 0,9 | 1,5 | 1,5 | 2,0 | 3,0 | 0,75 | 1,2 | 1,2 | 1,5 | 2,0 |
| Brick N° 8 | 1,2 | 2,0 | 2,5 | 3,0 | 3,5 | 0,9 | 1,5 | 2,0 | 2,5 | 3,0 |
| Brick N° 9 | 1,5 | 3,0 | 3,0 | 4,0 | 4,5 | 0,9 | 2,5 | 2,5 | 3,0 | 3,5 |
| Brick N° 10 | 1,5 | 3,5 | 4,0 | 5,0 | 5,5 | 1,2 | 3,0 | 3,0 | 4,0 | 4,5 |

[1] For design according TR054 : $N_{Rk} = N_{Rk,p} = N_{Rk,b} = N_{Rk,s}$ ; $N_{Rk,pb}$ according to TR 054
For $V_{Rk,s}$ see Section 45 ; Calculation of $V_{Rk,pb}$ i $V_{Rk,c}$ according to TR 054

## Section 49. CHARACTERISTIC RESISTANCE UNDER SHEAR LOADING – steel failure (AUTOCLAVED AERATED CONCRETE) – WCF-EASF-C WITH INSTALLATION TEMPERATURE < -10°C

| **Size** | **M6** | **M8** | **M10** | **M12** | **M16** | **Partial safety factor $\gamma_{Ms}$** |
|---|---|---|---|---|---|---|
| See Section 45. | | | | | | |

## Section 50. DISPLACEMENTS UNDER TENSION AND SHEAR LOAD (AUTOCLAVED AERATED CONCRETE) – WCF-EASF-C WITH INSTALLATION TEMPERATURE < -10°C

| **Size** | **M6** | **M8** | **M10** | **M12** | **M16** |
|---|---|---|---|---|---|
| See Section 46. | | | | | |

[1] the hole gap between bolt and fixture shall be considered additionally

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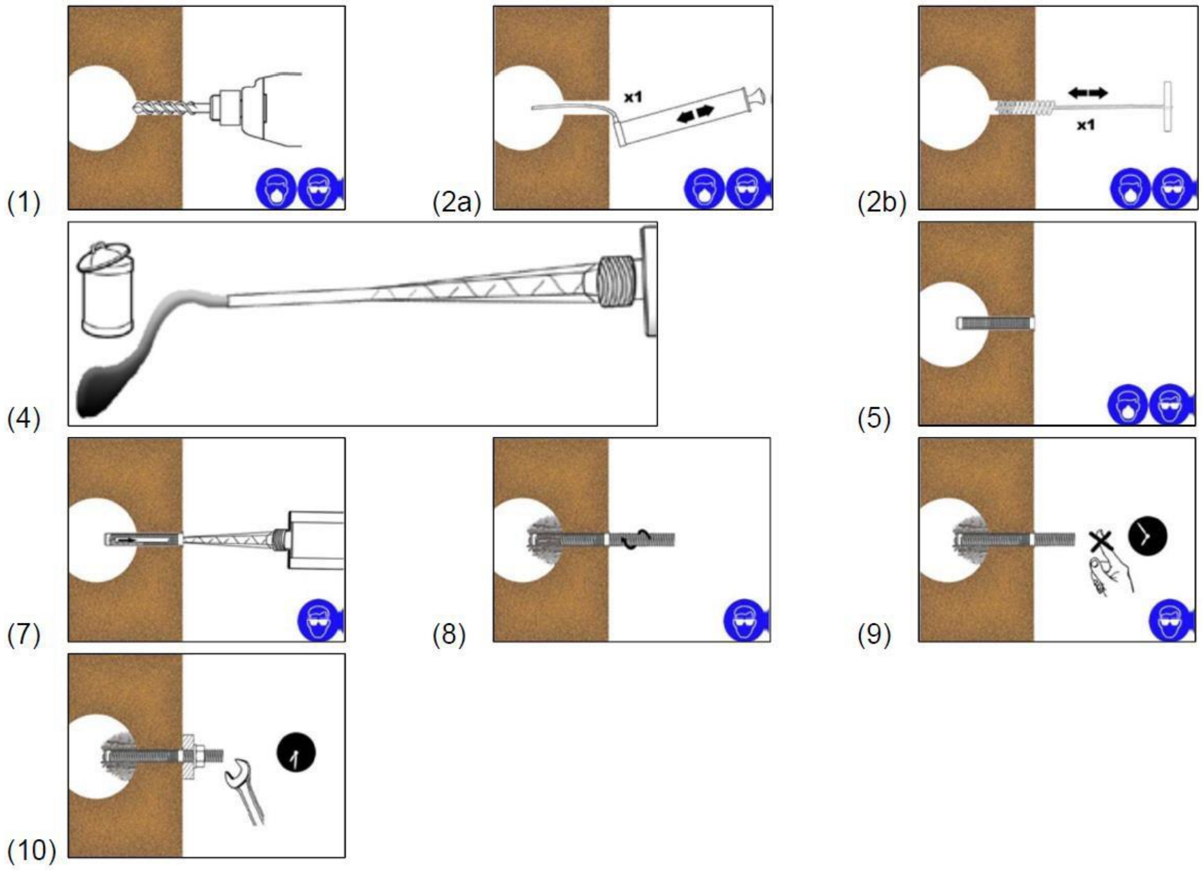
## Section 51. β – FACTORS FOR JOB SITE TESTS ACCORDING TO TR053 (AUTOCLAVED AERATED CONCRETE) – WCF-EASF-C WITH INSTALLATION TEMPERATURE < -10°C

| Brick N° | N° 6 | N° 7 | N° 8 | N° 9 | N° 10 |
|---|---|---|---|---|---|
| β – factor – Use conditions **d/d** | 0,95 | 0,95 | 0,95 | 0,95 | 0,95 |
| β – factor – Use conditions **d/w** and **w/w** | 0,74 | 0,74 | 0,74 | 0,74 | 0,74 |

## Section 52. HOLLOW MASONRY INSTALLATION METHOD

**Hollow Masonry Installation Method**

1. Drill the hole to the correct diameter and depth . This should be done with rotary percussion drilling machine to reduce spalling.
2. Thoroughly clean the hole in the following sequence using the Brush with the required extensions and a source of clean compressed air. For holes of 400 mm or less deep , a Blow Pump may be used: Brush Clean x1. Blow clean x1.
3. Select the appropriate static mixer nozzle for the installation , open the cartridge/foil pack and screw nozzle onto the mount of the cartridge. Insert the cartridge into a good quality applicator.
4. Extrude the first part of the cartridge to waste until an even colour has been achieved without streaking in the resin.
5. Select the appropriate perforated sleeve and insert into the hole.
6. Insert the mixer nozzle to the bottom of the perforated sleeve , withdraw 2-3 mm then begin to extrude the resin and slowly withdraw the mixer nozzle from the hole ensuring that there is no air voids as the mixer nozzle is withdrawn. Fill the perforated sleeve and withdraw the nozzle completely.
7. Insert the clean threaded bar , free from oil or other release agents, to the bottom of the hole using a back and forth twisting motion ensuring all the threads are thoroughly coated. Adjust to the correct position within the stated working time.
8. Any excess resin will be expelled from the hole evenly around the steel element showing that the hole is full. This excess resin should be removed from around the mount of the hole before it sets.
9. Leave the anchor to cure. Do not disturb the anchor until the appropriate loading time , has elapsed depending on the substrate conditions and ambient temperature.
10. Attach the fixture and tighten the nut to the recommended torque. Do not overtighten.




**Note : For solid masonry applications, please refer to 'Solid Substrate Installation Method'.**

## Section 53. IMPORTANT NOTES

**Important Notes:**

Use in Porous Substrates

This bonded anchor is not intended for use as a cosmetic or decorative product. When anchoring into porous or reconstituted stone it is recommended that technical assistance is sought. Due to the nature of the product, migration of the monomer in the resin may cause staining in certain materials. If you are still uncertain, it is advisable to test the resin by applying it in a small, discrete area and testing before using the resin on the project.

Important Note

Whilst all reasonable care is taken in compiling technical data on the Company's products, all recommendations or suggestions regarding the use of such products are made without guarantee, since the conditions of use are beyond the control of the Company. It is the customer's responsibility to satisfy himself that each product is fit for the purpose for which he intends to use it, that the actual conditions of use are suitable and that, in the light of our continual research and development programme the information relating to each product has not been superseded.