# HSC-A Safety anchor

| | Anchor version | Benefits |
|---|---|---|
|  | Bolt version<br>HSC-A Carbon Steel version<br>HSC-AR Stainless steel version | - the perfect solution for small edge and space distance<br>- suitable for thin concrete blocks due to low embedment depth<br>- suitable for cracked concrete<br>- self-cutting undercut anchor<br>- available as bolt version for through applications<br>- stainless steel available for external applications |


| Concrete | Tensile zone | Shock | Small edge distance and spacing | Fire resistance | Corrosion resistance | European Technical Approval | CE conformity | PROFIS Anchor design software |
|---|---|---|---|---|---|---|---|---|

## Approvals / certificates

| Description | Authority / Laboratory | No. / date of issue |
|---|---|---|
| European technical approval [a)] | CSTB, Paris | ETA-02/0027 / 2012-09-20 |
| Shockproof fastenings in civil defence installations | Federal Office for Cicil Protection, Bern | BZS D 06-601 / 2006-07-10 |
| Fire test report | IBMB, Braunschweig | UB 3177/1722-1 / 2006-06-28 |
| Assessment report (fire) | warringtonfire | WF 327804/A / 2013-07-10 |

a) All data given in this section according ETA-02/0027 issue 2012-09-20.

## Basic loading data

**All data in this section applies to**

For details see Simplified design method

- Correct setting (See setting instruction)
- No edge distance and spacing influence
- Concrete as specified in the table
- *Steel* failure
- Minimum base material thickness
- Concrete C 20/25, $f_{ck,cube}$ = 25 N/mm²

## Mean ultimate resistance

| | | Non-cracked concrete | | | | Cracked concrete | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Anchor size** | | **M8x40** | **M10x40** | **M8x50** | **M12x60** | **M8x40** | **M10x40** | **M8x50** | **M12x 60** |
| Tensile $N_{Ru,m}$ | | | | | | | | | |
| HSC-A<br>HSC-AR | [kN] | 16,6 | 16,6 | 23,3 | 30,6 | 13,3 | 13,3 | 18,6 | 24,5 |
| Shear $V_{Ru,m}$ | | | | | | | | | |
| HSC-A | [kN] | 19,0 | 30,2 | 19,0 | 43,8 | 19,0 | 30,2 | 19,0 | 43,8 |
| HSC-AR | [kN] | 16,6 | 26,4 | 16,6 | 38,4 | 16,6 | 26,4 | 16,6 | 38,4 |

## Characteristic resistance

| | | Non-cracked concrete | | | | Cracked concrete | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Anchor size** | | **M8x40** | **M10x40** | **M8x50** | **M12x60** | **M8x40** | **M10x40** | **M8x50** | **M12x 60** |
| Tensile $N_{Rk}$ | | | | | | | | | |
| HSC-A | [kN] | 12,8 | 12,8 | 17,8 | 23,4 | 9,1 | 9,1 | 12,7 | 16,7 |
| HSC-AR | [kN] | 12,8 | 12,8 | 17,8 | 23,4 | 9,1 | 9,1 | 12,7 | 16,7 |
| Shear $V_{Rk}$ | | | | | | | | | |
| HSC-A | [kN] | 14,6 | 23,2 | 14,6 | 33,7 | 14,6 | 18,2 | 14,6 | 33,5 |
| HSC-AR | [kN] | 12,8 | 20,3 | 12,8 | 29,5 | 12,8 | 18,2 | 12,8 | 29,5 |

## Design resistance

| | | Non-cracked concrete | | | | Cracked concrete | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Anchor size** | | **M8x40** | **M10x40** | **M8x50** | **M12x60** | **M8x40** | **M10x40** | **M8x50** | **M12x 60** |
| Tensile $N_{Rd}$ | | | | | | | | | |
| HSC-A | [kN] | 8,5 | 8,5 | 11,9 | 15,6 | 6,1 | 6,1 | 8,5 | 11,2 |
| HSC-AR | [kN] | 8,5 | 8,5 | 11,9 | 15,6 | 6,1 | 6,1 | 8,5 | 11,2 |
| Shear $V_{Rd}$ | | | | | | | | | |
| HSC-A | [kN] | 11,7 | 17,0 | 11,7 | 27,0 | 11,7 | 12,1 | 11,7 | 22,3 |
| HSC-AR | [kN] | 8,2 | 13,0 | 8,2 | 18,9 | 8,2 | 12,1 | 8,2 | 18,9 |

## Recommended loads

| | | Non-cracked concrete | | | | Cracked concrete | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Anchor size** | | **M8x40** | **M10x40** | **M8x50** | **M12x60** | **M8x40** | **M10x40** | **M8x50** | **M12x 60** |
| Tensile $N_{rec}$ a) | | | | | | | | | |
| HSC-A | [kN] | 6,1 | 6,1 | 8,5 | 11,2 | 4,3 | 4,3 | 6,1 | 8,0 |
| HSC-AR | [kN] | 6,1 | 6,1 | 8,5 | 11,2 | 4,3 | 4,3 | 6,1 | 8,0 |
| Shear $V_{rec}$ a) | | | | | | | | | |
| HSC-A | [kN] | 8,3 | 12,1 | 8,3 | 19,3 | 8,3 | 8,7 | 8,3 | 15,9 |
| HSC-AR | [kN] | 5,9 | 9,3 | 5,9 | 13,5 | 5,9 | 8,7 | 5,9 | 13,5 |

a) With overall partial safety factor for action γ = 1,4. The partial safety factors for action depend on the type of loading and shall be taken from national regulations.

## Materials

### Mechanical properties

| Anchor size | | HSC | M8x40 | M10x40 | M8x50 | M12x60 |
|---|---|---|---|---|---|---|
| Nominal tensile strength $f_{uk}$ | [N/mm²] | -A | 800 | 800 | 800 | 800 |
| | | -AR | 700 | 700 | 700 | 700 |
| Yield strength $f_{yk}$ | [N/mm²] | -A | 640 | 640 | 640 | 640 |
| | | -AR | 450 | 450 | 450 | 450 |
| Stressed cross-section for bolt version $A_{s,A}$ | [mm²] | -A, AR | 36,6 | 58,0 | 36,6 | 84,3 |
| Moment of resistance W | [mm³] | -A, AR | 31,2 | 62,3 | 31,2 | 109,2 |
| Design bending resistance without sleeve $M_{Rd,s}$ | [Nm] | -A | 24 | 48 | 24 | 84 |
| | | -AR | 16,7 | 33,3 | 16,7 | 59,0 |

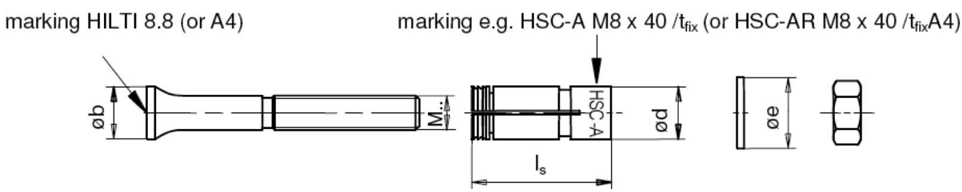
### Material quality

| Part | | Material |
|---|---|---|
| Carbon steel | | |
| HSC-A | Cone bolt with , with internal or external thread | steel strength 8.8, galvanised to min. 5 µm |
| | Expansion sleeve and washer | Galvanised steel |
| | Hexagon nut | Strength 8 |
| Sainless steel | | |
| HSC-AR | Cone bolt with , with internal or external thread | steel grade 1.4401, 1.4571 A4-70 |
| | Expansion sleeve and washer | steel grade 1.4401, 1.4571 |
| | Hexagon nut | steel grade 1.4401, 1.4571 A4-70 |

## Anchor dimensions

### Dimensions of HSC-A and HSC-AR

| Anchor version | Thread size | $t_{fix}$ [mm] max | b [mm] | $l_s$ [mm] | d [mm] | e [mm] |
|---|---|---|---|---|---|---|
| HSC-A(R) M8x40 | M8 | 150 | 13,5 | 40,8 | 13,5 | 16 |
| HSC-A(R) M10x40 | M10 | 200 | 15,5 | 40,8 | 15,5 | 20 |
| HSC-A(R) M8x50 | M8 | 150 | 13,5 | 50,8 | 13,5 | 16 |
| HSC-A(R) M12x60 | M12 | 200 | 17,5 | 60,8 | 17,5 | 24 |

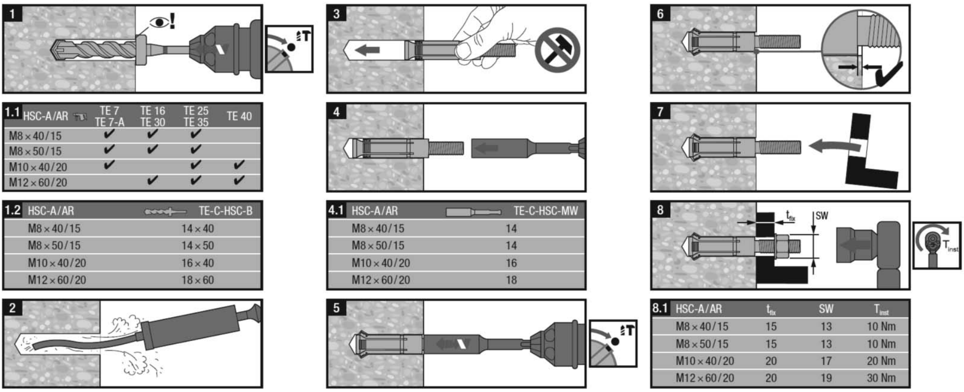


# Setting

## Installation equipment

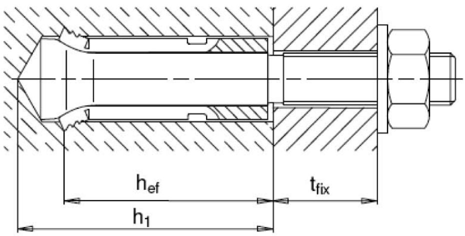
| Anchor size | | HSC-A/AR M8x40 | HSC-A/AR M8x50 | HSC-A/AR M10x40 | HSC-A/AR M12x60 |
|---|---|---|---|---|---|
| Rotary hammer for setting | | TE 7-C; TE 7-A; TE 16; TE 16-C; TE 16-M; TE 25; TE 30; TE 35 | | TE 7-C; TE 7-A; TE 25; TE 35 | TE 16; TE 16-C; TE 16-M; TE 25; TE 30; TE 35; TE 40; TE 40-AVR |
| Stop drill bit | TE-C-HSC-B | 14x40 | 14x50 | 16x40 | 18x60 |
| Setting Tool | TE-C-HSC-MW | 14 | 14 | 16 | 18 |

## Setting instruction




For detailed information on installation see instruction for use given with the package of the product.

## Setting details: depth of drill hole $h_1$ and effective anchorage depth $h_{ef}$

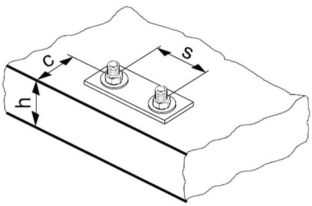


## Setting details HSC-A (R)

| Anchor version | | | M8x40 | M10x40 | M8x50 | M12x60 |
|---|---|---|---|---|---|---|
| Nominal diameter of drill bit | $d_o$ | [mm] | 14 | 16 | 14 | 18 |
| Cutting diameter of drill bit | $d_{cut} \leq$ | [mm] | 14,5 | 16,5 | 14,5 | 18,5 |
| Depth of drill hole | $h_1 \geq$ | [mm] | 46 | 46 | 56 | 68 |
| Diameter of clearance hole in the fixture | $d_f \leq$ | [mm] | 9 | 12 | 10 | 30 |
| Effective anchorage depth | $h_{ef}$ | [mm] | 40 | 40 | 50 | 60 |
| Maximum fastening thickness | $t_{fix}$ | [mm] | 15 | 20 | 15 | 20 |
| Torque moment | $T_{inst}$ | [Nm] | 10 | 20 | 10 | 30 |
| Width across | SW | [mm] | 13 | 17 | 13 | 19 |

## Base material thickness, anchor spacing and edge distance

| Anchor size | | | M8x40 | M10x40 | M8x50 | M12x60 |
|---|---|---|---|---|---|---|
| Minimum base material thickness | $h_{min}$ | [mm] | 100 | 100 | 100 | 130 |
| Minimum spacing | $s_{min}$ | [mm] | 40 | 40 | 50 | 60 |
| Minimum edge distance | $c_{min}$ | [mm] | 40 | 40 | 50 | 60 |
| Critical spacing for concrete cone failure | $s_{cr,N}$ | [mm] | 120 | 120 | 150 | 180 |
| Critical edge distance for concrete cone failure | $c_{cr,N}$ | [mm] | 60 | 60 | 75 | 90 |
| Critical spacing for splitting failure | $s_{cr,sp}$ | [mm] | 130 | 120 | 170 | 180 |
| Critical edge distance for splitting failure | $c_{cr,sp}$ | [mm] | 65 | 60 | 85 | 90 |




For spacing (edge distance) smaller than critical spacing (critical edge distance) the design loads have to be reduced.

Critical spacing and critical edge distance for splitting failure apply only for non-cracked concrete. For cracked concrete only the critical spacing and critical edge distance for concrete cone failure are decisive.

## Simplified design method

Simplified version of the design method according ETAG 001, Annex C. Design resistance according data given in ETA-02/0027 issue 2012-09-20.

- Influence of concrete strength
- Influence of edge distance
- Influence of spacing
- Valid for a group of two anchors. (The method may also be applied for anchor groups with more than two anchors or more than one edge. The influencing factors must then be considered for each edge distance and spacing. The calculated design loads are then on the save side: They will be lower than the exact values according ETAG 001, Annex C. To avoid this, it is recommended to use the anchor design software PROFIS anchor)

The design method is based on the following simplification:

- No different loads are acting on individual anchors (no eccentricity)

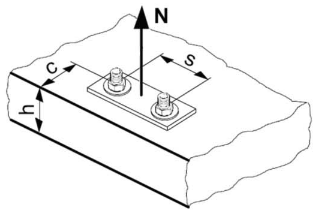
The values are valid for one anchor.

For more complex fastening applications please use the anchor design software PROFIS Anchor.

## Tension loading

### The design tensile resistance is the lower value of

- Steel resistance: $N_{Rd,s}$
- Concrete pull-out resistance: $N_{Rd,p} = N^0_{Rd,p} \cdot f_B$
- Concrete cone resistance: $N_{Rd,c} = N^0_{Rd,c} \cdot f_B \cdot f_{1,N} \cdot f_{2,N} \cdot f_{3,N} \cdot f_{re,N}$
- Concrete splitting resistance (only non-cracked concrete):
  $N_{Rd,sp} = N^0_{Rd,c} \cdot f_B \cdot f_{1,sp} \cdot f_{2,sp} \cdot f_{3,sp} \cdot f_{h,sp} \cdot f_{re,N}$




### Basic design tensile resistance

#### Design steel resistance $N_{Rd,s}$

| Anchor size | | | M8x40 | M10x40 | M8x50 | M12x60 |
|---|---|---|---|---|---|---|
| $N_{Rd,s}$ | HSC-A | [kN] | 19,5 | 30,9 | 19,5 | 44,9 |
| | HSC-AR | [kN] | 13,7 | 21,7 | 13,7 | 31,6 |

#### Design pull-out resistance $N_{Rd,p} = N^0_{Rd,p} \cdot f_B$ for HSC-A and HSC-AR

| | | Non-cracked concrete | | | | Cracked concrete | | | |
|---|---|---|---|---|---|---|---|---|---|
| Anchor size | | M8x40 | M10x40 | M8x50 | M12x60 | M8x40 | M10x40 | M8x50 | M12x60 |
| $N^0_{Rd,p}$ | [kN] | No pull-out failure | | | | No pull-out failure | | | |

#### Design concrete cone resistance $N_{Rd,c} = N^0_{Rd,c} \cdot f_B \cdot f_{1,N} \cdot f_{2,N} \cdot f_{3,N} \cdot f_{re,N}$
#### Design splitting resistance [a] $N_{Rd,sp} = N^0_{Rd,c} \cdot f_B \cdot f_{1,sp} \cdot f_{2,sp} \cdot f_{3,sp} \cdot f_{h,sp} \cdot f_{re,N}$

| | | Non-cracked concrete | | | | Cracked concrete | | | |
|---|---|---|---|---|---|---|---|---|---|
| Anchor size | | M8x40 | M10x40 | M8x50 | M12x60 | M8x40 | M10x40 | M8x50 | M12x60 |
| $N^0_{Rd,c}$ | [kN] | 8,5 | 8,5 | 11,9 | 15,6 | 6,1 | 6,1 | 8,5 | 11,2 |

a) Splitting resistance must only be considered for non-cracked concrete

# Influencing factors

## Influence of concrete strength

| Concrete strength designation (ENV 206) | C 20/25 | C 25/30 | C 30/37 | C 35/45 | C 40/50 | C 45/55 | C 50/60 |
|---|---|---|---|---|---|---|---|
| $f_B = (f_{ck,cube}/25N/mm^2)^{1/2}$ [a] | 1 | 1,1 | 1,22 | 1,34 | 1,41 | 1,48 | 1,55 |

a) $f_{ck,cube}$ = concrete compressive strength, measured on cubes with 150 mm side length

## Influence of edge distance [a]

| $c/c_{cr,N}$<br>$c/c_{cr,sp}$ | 0,1 | 0,2 | 0,3 | 0,4 | 0,5 | 0,6 | 0,7 | 0,8 | 0,9 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|
| $f_{1,N} = 0,7 + 0,3 \cdot c/c_{cr,N} \leq 1$<br>$f_{1,sp} = 0,7 + 0,3 \cdot c/c_{cr,sp} \leq 1$ | 0,73 | 0,76 | 0,79 | 0,82 | 0,85 | 0,88 | 0,91 | 0,94 | 0,97 | 1 |
| $f_{2,N} = 0,5 \cdot (1 + c/c_{cr,N}) \leq 1$<br>$f_{2,sp} = 0,5 \cdot (1 + c/c_{cr,sp}) \leq 1$ | 0,55 | 0,60 | 0,65 | 0,70 | 0,75 | 0,80 | 0,85 | 0,90 | 0,95 | 1 |

a) The edge distance shall not be smaller than the minimum edge distance $c_{min}$ given in the table with the setting details. These influencing factors must be considered for every edge distance.

## Influence of anchor spacing [a]

| $s/s_{cr,N}$<br>$s/s_{cr,sp}$ | 0,1 | 0,2 | 0,3 | 0,4 | 0,5 | 0,6 | 0,7 | 0,8 | 0,9 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|
| $f_{3,N} = 0,5 \cdot (1 + s/s_{cr,N}) \leq 1$<br>$f_{3,sp} = 0,5 \cdot (1 + s/s_{cr,sp}) \leq 1$ | 0,55 | 0,60 | 0,65 | 0,70 | 0,75 | 0,80 | 0,85 | 0,90 | 0,95 | 1 |

a) The anchor spacing shall not be smaller than the minimum anchor spacing $s_{min}$ given in the table with the setting details. This influencing factor must be considered for every anchor spacing.

## Influence of base material thickness

| $h/h_{ef}$ | 2,0 | 2,2 | 2,4 | 2,6 | 2,8 | 3,0 | 3,2 | 3,4 | 3,6 | ≥ 3,68 |
|---|---|---|---|---|---|---|---|---|---|---|
| $f_{h,sp} = [h/(2 \cdot h_{ef})]^{2/3}$ | 1 | 1,07 | 1,13 | 1,19 | 1,25 | 1,31 | 1,37 | 1,42 | 1,48 | 1,5 |

## Influence of reinforcement

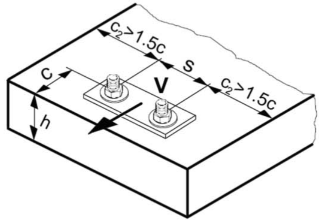
| Anchor size | M8x40 | M10x40 | M8x50 | M12x60 |
|---|---|---|---|---|
| $f_{re,N} = 0,5 + h_{ef}/200mm \leq 1$ | 0,7 [a] | 0,7 [a] | 0,75 [a] | 0,8 [a] |

a) This factor applies only for dense reinforcement. If in the area of anchorage there is reinforcement with a spacing ≥ 150 mm (any diameter) or with a diameter ≤ 10 mm and a spacing ≥ 100 mm, then a factor $f_{re,N}$ = 1 may be applied.

# Shear loading

### The design shear resistance is the lower value of

- Steel resistance: $\mathbf{V_{Rd,s}}$
- Concrete pryout resistance: $\mathbf{V_{Rd,cp} = k \cdot N_{Rd,c}}$
- Concrete edge resistance: $\mathbf{V_{Rd,c} = V^0_{Rd,c} \cdot f_B \cdot f_ß \cdot f_h \cdot f_4 \cdot f_{hef} \cdot f_c}$




## Basic design shear resistance

### Design steel resistance $V_{Rd,s}$

| Anchor size | | | M8x40 | M10x40 | M8x50 | M12x60 |
|---|---|---|---|---|---|---|
| $V_{Rd,s}$ | HSC-A | [kN] | 11,7 | 18,6 | 11,7 | 27,0 |
| | HSC-AR | [kN] | 8,2 | 13,0 | 8,2 | 18,9 |

### Design concrete pryout resistance $V_{Rd,cp} = k \cdot N_{Rd,c}$ a)

| Anchor size | M8x40 | M10x40 | M8x50 | M12x60 |
|---|---|---|---|---|
| k | 2,0 | | | |

a) $N_{Rd,c}$: Design concrete cone resistance

### Design concrete edge resistance a) $V_{Rd,c} = V^0_{Rd,c} \cdot f_B \cdot f_ß \cdot f_h \cdot f_4 \cdot f_{hef} \cdot f_c$

| | | Non-cracked concrete | | | | Cracked concrete | | | |
|---|---|---|---|---|---|---|---|---|---|
| Anchor size | | M8x40 | M10x40 | M8x50 | M12x60 | M8x40 | M10x40 | M8x50 | M12x60 |
| $V^0_{Rd,c}$ | [kN] | 14,9 | 18,5 | 15,0 | 22,7 | 10,5 | 13,1 | 10,6 | 16,1 |

a) For anchor groups only the anchors close to the edge must be considered.

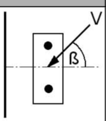
## Influencing factors

### Influence of concrete strength

| Concrete strength designation (ENV 206) | C 20/25 | C 25/30 | C 30/37 | C 35/45 | C 40/50 | C 45/55 | C 50/60 |
|---|---|---|---|---|---|---|---|
| $f_B = (f_{ck,cube}/25N/mm^2)^{1/2}$ a) | 1 | 1,1 | 1,22 | 1,34 | 1,41 | 1,48 | 1,55 |

a) $f_{ck,cube}$ = concrete compressive strength, measured on cubes with 150 mm side length

### Influence of angle between load applied and the direction perpendicular to the free edge

| Angle ß | 0° | 10° | 20° | 30° | 40° | 50° | 60° | 70° | 80° | ≥ 90° |
|---|---|---|---|---|---|---|---|---|---|---|
| $f_\beta = \frac{1}{\sqrt{(\cos\alpha_V)^2 + \left(\frac{\sin\alpha_V}{2,5}\right)^2}}$   | 1 | 1,01 | 1,05 | 1,13 | 1,24 | 1,40 | 1,64 | 1,97 | 2,32 | 2,50 |

## Influence of base material thickness

| h/c | 0,15 | 0,3 | 0,45 | 0,6 | 0,75 | 0,9 | 1,05 | 1,2 | 1,35 | ≥ 1,5 |
|---|---|---|---|---|---|---|---|---|---|---|
| $f_h = \{h/(1,5 \cdot c)\}^{1/2} \leq 1$ | 0,32 | 0,45 | 0,55 | 0,63 | 0,71 | 0,77 | 0,84 | 0,89 | 0,95 | 1,00 |

**Influence of anchor spacing and edge distance a) for concrete edge resistance: $f_4$**

**$f_4 = (c/h_{ef})^{1,5} \cdot (1 + s / [3 \cdot c]) \cdot 0,5$**

| $c/h_{ef}$ | Single anchor | Group of two anchors $s/h_{ef}$ | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0,75 | 1,50 | 2,25 | 3,00 | 3,75 | 4,50 | 5,25 | 6,00 | 6,75 | 7,50 | 8,25 | 9,00 | 9,75 | 10,50 | 11,25 |
| **0,50** | 0,35 | 0,27 | 0,35 | 0,35 | 0,35 | 0,35 | 0,35 | 0,35 | 0,35 | 0,35 | 0,35 | 0,35 | 0,35 | 0,35 | 0,35 | 0,35 |
| **0,75** | 0,65 | 0,43 | 0,54 | 0,65 | 0,65 | 0,65 | 0,65 | 0,65 | 0,65 | 0,65 | 0,65 | 0,65 | 0,65 | 0,65 | 0,65 | 0,65 |
| **1,00** | 1,00 | 0,63 | 0,75 | 0,88 | 1,00 | 1,00 | 1,00 | 1,00 | 1,00 | 1,00 | 1,00 | 1,00 | 1,00 | 1,00 | 1,00 | 1,00 |
| **1,25** | 1,40 | 0,84 | 0,98 | 1,12 | 1,26 | 1,40 | 1,40 | 1,40 | 1,40 | 1,40 | 1,40 | 1,40 | 1,40 | 1,40 | 1,40 | 1,40 |
| **1,50** | 1,84 | 1,07 | 1,22 | 1,38 | 1,53 | 1,68 | 1,84 | 1,84 | 1,84 | 1,84 | 1,84 | 1,84 | 1,84 | 1,84 | 1,84 | 1,84 |
| **1,75** | 2,32 | 1,32 | 1,49 | 1,65 | 1,82 | 1,98 | 2,15 | 2,32 | 2,32 | 2,32 | 2,32 | 2,32 | 2,32 | 2,32 | 2,32 | 2,32 |
| **2,00** | 2,83 | 1,59 | 1,77 | 1,94 | 2,12 | 2,30 | 2,47 | 2,65 | 2,83 | 2,83 | 2,83 | 2,83 | 2,83 | 2,83 | 2,83 | 2,83 |
| **2,25** | 3,38 | 1,88 | 2,06 | 2,25 | 2,44 | 2,63 | 2,81 | 3,00 | 3,19 | 3,38 | 3,38 | 3,38 | 3,38 | 3,38 | 3,38 | 3,38 |
| **2,50** | 3,95 | 2,17 | 2,37 | 2,57 | 2,77 | 2,96 | 3,16 | 3,36 | 3,56 | 3,76 | 3,95 | 3,95 | 3,95 | 3,95 | 3,95 | 3,95 |
| **2,75** | 4,56 | 2,49 | 2,69 | 2,90 | 3,11 | 3,32 | 3,52 | 3,73 | 3,94 | 4,15 | 4,35 | 4,56 | 4,56 | 4,56 | 4,56 | 4,56 |
| **3,00** | 5,20 | 2,81 | 3,03 | 3,25 | 3,46 | 3,68 | 3,90 | 4,11 | 4,33 | 4,55 | 4,76 | 4,98 | 5,20 | 5,20 | 5,20 | 5,20 |
| **3,25** | 5,86 | 3,15 | 3,38 | 3,61 | 3,83 | 4,06 | 4,28 | 4,51 | 4,73 | 4,96 | 5,18 | 5,41 | 5,63 | 5,86 | 5,86 | 5,86 |
| **3,50** | 6,55 | 3,51 | 3,74 | 3,98 | 4,21 | 4,44 | 4,68 | 4,91 | 5,14 | 5,38 | 5,61 | 5,85 | 6,08 | 6,31 | 6,55 | 6,55 |
| **3,75** | 7,26 | 3,87 | 4,12 | 4,36 | 4,60 | 4,84 | 5,08 | 5,33 | 5,57 | 5,81 | 6,05 | 6,29 | 6,54 | 6,78 | 7,02 | 7,26 |
| **4,00** | 8,00 | 4,25 | 4,50 | 4,75 | 5,00 | 5,25 | 5,50 | 5,75 | 6,00 | 6,25 | 6,50 | 6,75 | 7,00 | 7,25 | 7,50 | 7,75 |
| **4,25** | 8,76 | 4,64 | 4,90 | 5,15 | 5,41 | 5,67 | 5,93 | 6,18 | 6,44 | 6,70 | 6,96 | 7,22 | 7,47 | 7,73 | 7,99 | 8,25 |
| **4,50** | 9,55 | 5,04 | 5,30 | 5,57 | 5,83 | 6,10 | 6,36 | 6,63 | 6,89 | 7,16 | 7,42 | 7,69 | 7,95 | 8,22 | 8,49 | 8,75 |
| **4,75** | 10,35 | 5,45 | 5,72 | 5,99 | 6,27 | 6,54 | 6,81 | 7,08 | 7,36 | 7,63 | 7,90 | 8,17 | 8,45 | 8,72 | 8,99 | 9,26 |
| **5,00** | 11,18 | 5,87 | 6,15 | 6,43 | 6,71 | 6,99 | 7,27 | 7,55 | 7,83 | 8,11 | 8,39 | 8,66 | 8,94 | 9,22 | 9,50 | 9,78 |
| **5,25** | 12,03 | 6,30 | 6,59 | 6,87 | 7,16 | 7,45 | 7,73 | 8,02 | 8,31 | 8,59 | 8,88 | 9,17 | 9,45 | 9,74 | 10,02 | 10,31 |
| **5,50** | 12,90 | 6,74 | 7,04 | 7,33 | 7,62 | 7,92 | 8,21 | 8,50 | 8,79 | 9,09 | 9,38 | 9,67 | 9,97 | 10,26 | 10,55 | 10,85 |

a) The anchor spacing and the edge distance shall not be smaller than the minimum anchor spacing $s_{min}$ and the minimum edge distance $c_{min}$.

## Influence of embedment depth

| Anchor size | M8x40 | M10x40 | M8x50 | M12x60 |
|---|---|---|---|---|
| $f_{hef} = 0,05 \cdot (h_{ef} / d)^{1,68}$ | 0,29 | 0,23 | 0,42 | 0,38 |

## Influence of edge distance a)

| c/d | 4 | 6 | 8 | 10 | 15 | 20 | 30 | 40 |
|---|---|---|---|---|---|---|---|---|
| $f_c = (d / c)^{0,19}$ | 0,77 | 0,71 | 0,67 | 0,65 | 0,60 | 0,57 | 0,52 | 0,50 |

a) The edge distance shall not be smaller than the minimum edge distance $c_{min}$.

# Combined tension and shear loading

For combined tension and shear loading see section "Anchor Design".