


Hilti HSV-F Stud anchor

| Anchor version | Benefits |
|--|--|
|  <p>HSV-F Carbon steel, hot dipped galvanised, min 42 microns coating thickness</p> <p>DIN 125 washer</p> | <ul style="list-style-type: none"> ■ torque-controlled mechanical expansion allows immediate load application ■ setting mark ■ cold-formed to prevent breaking during installation ■ raised impact section prevents thread damage during installation ■ drill bit size is same as anchor size for easy installation. ■ Hot dipped galvanised material for increased corrosion resistance |



Concrete

Basic loading data (for a single anchor)

All data in this section applies to

- 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 32/40 $f_{c,cyl} = 32$ MPa

Design resistance

| Anchor size | M10 | | M12 | | M16 | |
|--|------|------|------|------|------|------|
| Effective anchorage depth $h_{ef} \geq$ [mm] | 40 | 50 | 50 | 65 | 65 | 80 |
| Tensile N_{Rd} [kN] | 6.7 | 9.3 | 9.7 | 13.3 | 16.6 | 20.8 |
| Shear V_{Rd} [kN] | 10.8 | 11.5 | 15.1 | 18.1 | 33.9 | 33.9 |

Recommended loads

| Anchor size | M10 | | M12 | | M16 | |
|--|-----|-----|------|------|------|------|
| Effective anchorage depth $h_{ef} \geq$ [mm] | 40 | 50 | 50 | 65 | 65 | 80 |
| Tensile $N_{rec}^{a)}$ [kN] | 4.8 | 6.6 | 6.9 | 9.5 | 11.9 | 14.9 |
| Shear $V_{rec}^{a)}$ [kN] | 7.7 | 8.2 | 10.8 | 12.9 | 24.2 | 24.2 |

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

Materials

Mechanical properties of HSV-F

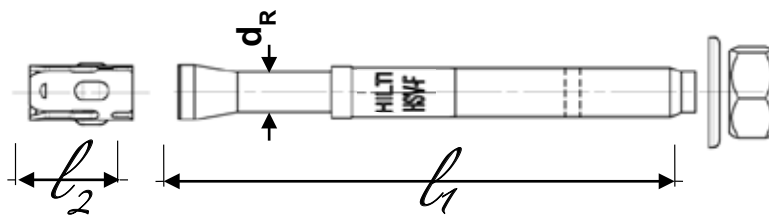
| Anchor size | | M10 | M12 | M16 |
|--------------------------------|---------------------------------|------|-------|-------|
| Nominal tensile strength | f_{uk} [N/mm ²] | 660 | 660 | 660 |
| Yield strength | f_{yk} [N/mm ²] | 528 | 528 | 528 |
| Stressed cross-section, thread | A_s [mm ²] | 58,0 | 84,3 | 157 |
| Stressed cross-section, neck | $A_{s,neck}$ [mm ²] | 39,6 | 63,6 | 105,7 |
| Moment of resistance | W [mm ³] | 62,3 | 109,2 | 277,5 |
| Char. bending resistance | $M_{Rk,s}^0$ [Nm] | 41,1 | 72,1 | 166,5 |

Material quality

| Part | Material |
|------|---|
| Bolt | Carbon steel, hot dip galvanised to min. 42 μ m |

Anchor dimensions

| Anchor size | | M10 | M12 | M16 |
|------------------------------|------------|------|------|------|
| Shaft diameter at the cone | d_R [mm] | 7,1 | 9 | 11,6 |
| Maximum length of the anchor | l_1 [mm] | 100 | 150 | 140 |
| Length of expansion sleeve | l_2 [mm] | 17,6 | 20,6 | 24 |

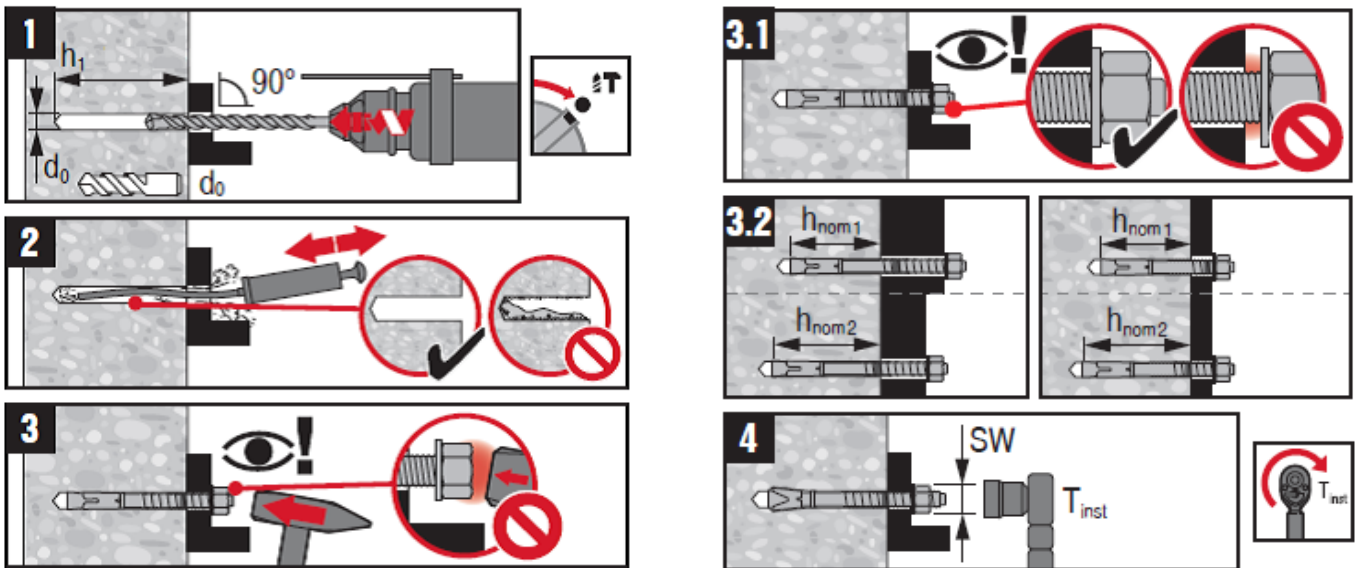


Setting

Installation equipment

| Anchor size | M10 | M12 | M16 |
|---------------|--------------------------------------|-----|-----|
| Rotary hammer | TE1 – TE30 | | |
| Other tools | blow out pump, hammer, torque wrench | | |

Setting instruction

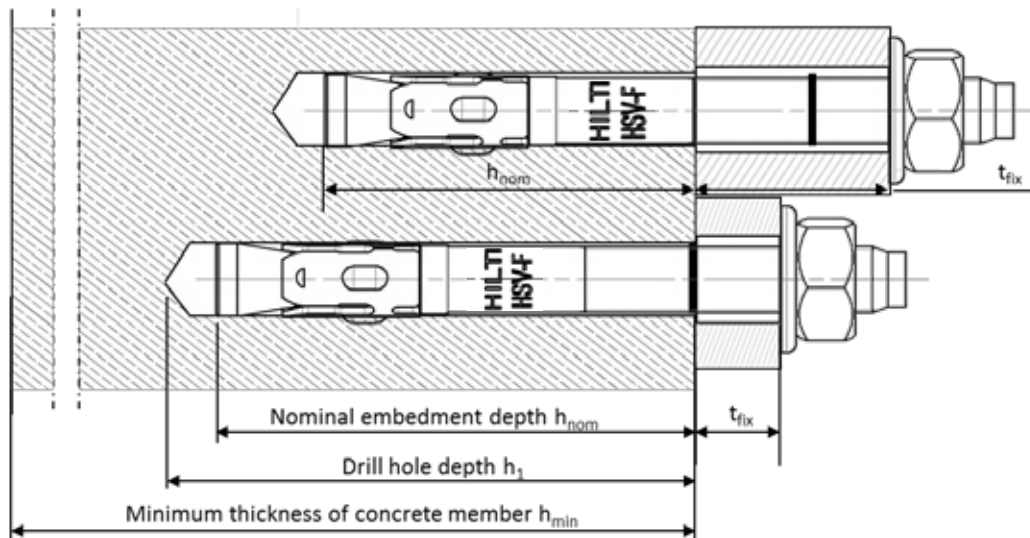


For detailed information on installation see instruction for use given with the package of the product.

Setting details

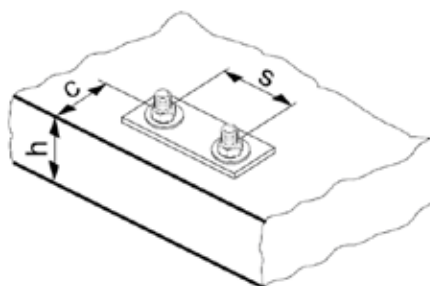
| Anchor size | | | M10 | | M12 | | M16 | |
|--|----------------|------|-------|----|------|----|------|-----|
| Effective anchorage depth | h_{ef} | [mm] | 40 | 50 | 50 | 65 | 65 | 80 |
| Nominal embedment depth | h_{nom} | [mm] | 51 | 61 | 62 | 77 | 81 | 96 |
| Nominal Diameter of drill bit | d_0 | [mm] | 10 | | 12 | | 16 | |
| Cutting diameter of drill bit | $d_{cut} \leq$ | [mm] | 10,45 | | 12,5 | | 16,5 | |
| Depth of drill hole | $h_1 \geq$ | [mm] | 60 | 70 | 70 | 85 | 90 | 105 |
| Diameter of clearance hole in the fixture | $d_f \leq$ | [mm] | 12 | | 14 | | 18 | |
| Minimum thickness of fixture ^{a)} | $t_{fix,min}$ | [mm] | 5 | 0 | 5 | 0 | 5 | 0 |
| Maximum thickness of fixture ^{a)} | $t_{fix,max}$ | [mm] | 55 | 45 | 60 | 45 | 35 | 20 |
| Torque moment | T_{inst} | [Nm] | 30 | | 50 | | 100 | |
| Width across nut flats | SW | [mm] | 17 | | 19 | | 24 | |

a) The values are only valid for HSV-F with standard washer.



Setting parameters ^{a)}

| Anchor size | | M10 | | M12 | | M16 | |
|--|---------------------|-----|-----|-----|------|------|-----|
| Effective anchorage depth | h_{ef} [mm] | 40 | 50 | 50 | 65 | 65 | 80 |
| Minimum base material thickness | $h_{min} \geq$ [mm] | 120 | 120 | 140 | 140 | 170 | 170 |
| Minimum spacing | $s_{min} \geq$ [mm] | 105 | 105 | 120 | 120 | 190 | 190 |
| Minimum edge distance | $c_{min} \geq$ [mm] | 105 | 105 | 140 | 140 | 140 | 140 |
| Critical spacing for splitting failure | $s_{cr,sp}$ [mm] | 240 | 300 | 300 | 390 | 390 | 480 |
| Critical edge distance for splitting failure | $c_{cr,sp}$ [mm] | 120 | 150 | 150 | 195 | 195 | 240 |
| Critical spacing for concrete cone failure | $s_{cr,N}$ [mm] | 120 | 150 | 150 | 195 | 195 | 240 |
| Critical edge distance for concrete cone failure | $c_{cr,N}$ [mm] | 60 | 75 | 75 | 97,5 | 97,5 | 120 |



a) In case of smaller edge distance and spacing than $c_{cr,sp}$, $s_{cr,sp}$, $c_{cr,N}$ and $s_{cr,N}$ the load values shall be reduced according ETAG 001, Annex C

Simplified design method

Simplified version of the design method according ETAG 001, Annex C.

- 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 same side: They will be lower than the exact values according ETAG 001, Annex C.

The design method is based on the following simplification:

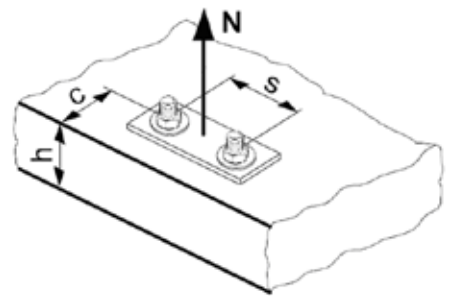
- No different loads are acting on individual anchors (no eccentricity)

The values are valid for one anchor.

Tension loading

The design tensile resistance is the lower value of

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



Basic design tensile resistance

Design steel resistance $N_{Rd,s}$

| Anchor size | M10 | | M12 | | M16 | |
|---|------|----|------|----|------|----|
| Effective anchorage depth h_{ef} [mm] | 40 | 50 | 50 | 65 | 65 | 80 |
| $N_{Rd,s}$ [kN] | 17,4 | | 28,0 | | 46,5 | |

Design pull-out resistance $N_{Rd,p} = N_{Rd,p}^0 \cdot f_B$

| Anchor size | M10 | | M12 | | M16 | |
|---|-----|-----|-----|------|------|------|
| Effective anchorage depth h_{ef} [mm] | 40 | 50 | 50 | 65 | 65 | 80 |
| $N_{Rd,p}^0$ [kN] | 6,7 | 9,3 | 9,7 | 13,3 | 16,6 | 20,8 |

Design concrete cone resistance $N_{Rd,c} = N_{Rd,c}^0 \cdot f_B \cdot f_{1,N} \cdot f_{2,N} \cdot f_{3,N} \cdot f_{re,N}$

Design splitting resistance ^{a)} $N_{Rd,sp} = N_{Rd,c}^0 \cdot f_B \cdot f_{1,sp} \cdot f_{2,sp} \cdot f_{3,sp} \cdot f_{h,sp} \cdot f_{re,N}$

Concrete C 20/25

| Anchor size | | M10 | | M12 | | M16 | |
|---|--|-----|------|------|------|------|------|
| Effective anchorage depth h_{ef} [mm] | | 40 | 50 | 50 | 65 | 65 | 80 |
| $N_{Rd,c}^0$ [kN] | | 8,5 | 11,9 | 11,9 | 17,6 | 14,7 | 20,1 |

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 |
|--|---------|---------|---------|---------|---------|---------|---------|
| Pull-out resistance | | | | | | | |
| $f_B =$ | 1 | | | | | | |
| Concrete cone and splitting resistance | | | | | | | |
| $f_B = (f_{ck,cube}/25N/mm^2)^{1/2}$ ^{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)}

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

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)}

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

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

Influence of reinforcement

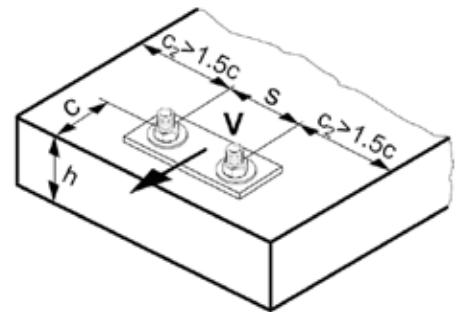
| Anchor size | M10 | | M12 | | M16 | |
|---|-------------------|--------------------|--------------------|---------------------|---------------------|-------------------|
| Effective anchorage depth h_{ef} [mm] | 40 | 50 | 50 | 65 | 65 | 80 |
| $f_{re,N} = 0,5 + h_{ef}/200\text{mm} \leq 1$ | 0,7 ^{a)} | 0,75 ^{a)} | 0,75 ^{a)} | 0,825 ^{a)} | 0,825 ^{a)} | 0,9 ^{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: $V_{Rd,s}$
- Concrete pryout resistance: $V_{Rd,cp} = k \cdot N_{Rd,c}$
- Concrete edge resistance: $V_{Rd,c} = V_{Rd,c}^0 \cdot f_B \cdot f_{\beta} \cdot f_h \cdot f_4 \cdot f_{hef} \cdot f_c$



Basic design shear resistance

Design steel resistance $V_{Rd,s}$

| Anchor size | M10 | | M12 | | M16 | |
|---|------|----|------|----|------|----|
| Effective anchorage depth h_{ef} [mm] | 40 | 50 | 50 | 65 | 65 | 80 |
| $V_{Rd,s}$ [kN] | 11,5 | | 18,1 | | 33,9 | |

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

| Anchor size | M10 | | M12 | | M16 | |
|---|-----|----|-----|----|-----|----|
| Effective anchorage depth h_{ef} [mm] | 40 | 50 | 50 | 65 | 65 | 80 |
| k | 1 | | | | 2 | |

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

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

| Anchor size | M10 | | M12 | | M16 | |
|---|------|------|------|------|------|------|
| Effective anchorage depth h_{ef} [mm] | 40 | 50 | 50 | 65 | 65 | 80 |
| $V_{Rd,c}^0$ [kN] | 13,0 | 13,0 | 17,6 | 17,6 | 28,3 | 28,2 |

a) For anchor groups only the anchors close to the edge must be considered.
Concrete C 20/25

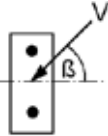
Influencing factors

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 β | 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 | M10 | | M12 | | M16 | |
|--|------|------|------|------|------|------|
| Effective anchorage depth h_{ef} [mm] | 40 | 50 | 50 | 65 | 65 | 80 |
| $f_{hef} = 0,05 \cdot (h_{ef} / d)^{1,68}$ | 0,51 | 0,75 | 0,55 | 0,85 | 0,53 | 0,75 |

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".