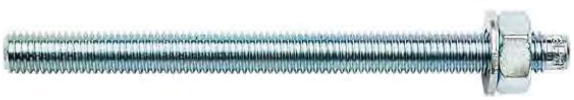
# Hilti HIT-ICE with HIT-V / HAS

| Injection mortar system | | Benefits |
| --- | --- | --- |
|  | Hilti<br>HIT-ICE<br>296 ml cartridge | - suitable for non-cracked concrete C 20/25 to C 50/60<br>- high loading capacity<br>- suitable for dry and water saturated concrete<br>- high corrosion resistant<br>- odourless resin<br>- low installation temperature (range -23 ℃ to +32 ℃) |
|  | Statik mixer | |
|  | HAS rod | |
|  | HAS-E rod | |
|  | HIT-V rod | |


| Concrete | Small edge distance and spacing | Corrosion resistance | High corrosion resistance | PROFIS Anchor design software |
| --- | --- | --- | --- | --- |

## Basic loading data (for a single anchor)

**All data in this section applies to**

For details see Simplified design method

- Correct setting (See setting instruction)
- No edge distance and spacing influence
- *Steel* failure
- Base material thickness, as specified in the table
- One typical embedment depth, as specified in the table
- One anchor material, as specified in the tables
- Concrete C 20/25, $f_{ck,cube}$ = 25 N/mm²
- Installation temperature range -18℃ to +32℃

### Embedment depth a) and base material thickness for the basic loading data. Mean ultimate resistance, characteristic resistance, design resistance, recommended loads.

| Anchor size | M8 | M10 | M12 | M16 | M20 | M24 |
| --- | --- | --- | --- | --- | --- | --- |
| Embedment depth [mm] | 80 | 90 | 110 | 125 | 170 | 210 |
| Base material thickness [mm] | 110 | 120 | 140 | 165 | 220 | 270 |

a) The allowed range of embedment depth is shown in the setting details. The corresponding load values can be calculated according to the simplified design method.

## Mean ultimate resistance: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm², anchor HIT-V 5.8

| | | | Hilti technical data | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Anchor size** | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** |
| Tensile $N_{Ru,m}$ | HIT-V 5.8 | [kN] | *18,9* | *30,5* | *44,1* | 59,9 | 101,9 | 127,1 |
| Shear $V_{Ru,m}$ | HIT-V 5.8 | [kN] | *9,5* | *15,8* | *22,1* | *41,0* | *64,1* | *92,4* |

## Characteristic resistance: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm², anchor HIT-V 5.8

| | | | Hilti technical data | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Anchor size** | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** |
| Tensile $N_{Rk}$ | HIT-V 5.8 | [kN] | 17,6 | 23,5 | 35,3 | 44,9 | 76,4 | 95,3 |
| Shear $V_{Rk}$ | HIT-V 5.8 | [kN] | *9,0* | *15,0* | *21,0* | *39,0* | *61,0* | *88,0* |

## Design resistance: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm², anchor HIT-V 5.8

| | | | Hilti technical data | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Anchor size** | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** |
| Tensile $N_{Rd}$ | HIT-V 5.8 | [kN] | 8,4 | 11,2 | 16,8 | 21,4 | 36,4 | 45,4 |
| Shear $V_{Rd}$ | HIT-V 5.8 | [kN] | 7,2 | 12,0 | 16,8 | 31,2 | 48,8 | 70,4 |

## Recommended loads [a)]: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm², anchor HIT-V 5.8

| | | | Hilti technical data | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Anchor size** | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** |
| Tensile $N_{rec}$ | HIT-V 5.8 | [kN] | 6,0 | 8,0 | 12,0 | 15,3 | 26,0 | 32,4 |
| Shear $V_{rec}$ | HIT-V 5.8 | [kN] | 5,1 | 8,6 | 12,0 | 22,3 | 34,9 | 50,3 |

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.

## Service temperature range

Hilti HIT-ICE injection mortar may be applied in the temperature range given below. An elevated base material temperature may lead to a reduction of the design bond resistance.

| Temperature range | Base material temperature | Maximum long term base material temperature | Maximum short term base material temperature |
|---|---|---|---|
| Temperature range I | -40 °C to +70 °C | +43 °C | +70 °C |

**Max short term base material temperature**
Short-term elevated base material temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

**Max long term base material temperature**
Long-term elevated base material temperatures are roughly constant over significant periods of time.

# Materials

## Mechanical properties of HIT-V / HAS

| | | | Hilti technical data | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Anchor size** | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** |
| Nominal tensile strength $f_{uk}$ | HIT-V/HAS 5.8 | [N/mm²] | 500 | 500 | 500 | 500 | 500 | 500 |
| | HIT-V 8.8 | [N/mm²] | 800 | 800 | 800 | 800 | 800 | 800 |
| | HIT-V/HAS -R | [N/mm²] | 700 | 700 | 700 | 700 | 700 | 700 |
| | HIT-V/HAS -HCR | [N/mm²] | 800 | 800 | 800 | 800 | 800 | 700 |
| Yield strength $f_{yk}$ | HIT-V/HAS 5.8 | [N/mm²] | 400 | 400 | 400 | 400 | 400 | 400 |
| | HIT-V 8.8 | [N/mm²] | 640 | 640 | 640 | 640 | 640 | 640 |
| | HIT-V/HAS -R | [N/mm²] | 450 | 450 | 450 | 450 | 450 | 450 |
| | HIT-V/HAS -HCR | [N/mm²] | 600 | 600 | 600 | 600 | 600 | 400 |
| Stressed cross-section $A_s$ | HAS | [mm²] | 32,8 | 52,3 | 76,2 | 144 | 225 | 324 |
| | HIT-V | [mm²] | 36,6 | 58,0 | 84,3 | 157 | 245 | 353 |
| Moment of resistance W | HAS | [mm³] | 27,0 | 54,1 | 93,8 | 244 | 474 | 809 |
| | HIT-V | [mm³] | 31,2 | 62,3 | 109 | 277 | 541 | 935 |

## Material quality

| Part | Material |
|---|---|
| Threaded rod HIT-V(F), HAS 5.8 | Strength class 5.8, $A_5$ > 8% ductile<br>steel galvanized ≥ 5 µm,<br>(F) hot dipped galvanized ≥ 45 µm, |
| Threaded rod HIT-V(F) 8.8 | Strength class 8.8, $A_5$ > 8% ductile<br>steel galvanized ≥ 5 µm,<br>(F) hot dipped galvanized ≥ 45 µm, |
| Threaded rod HIT-V-R, HAS-R | Stainless steel grade A4, $A_5$ > 8% ductile<br>strength class 70,<br>1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362 |
| Threaded rod HIT-V-HCR, HAS-HCR | High corrosion resistant steel, 1.4529; 1.4565<br>strength ≤ M20: $R_m$ = 800 N/mm², $R_{p\ 0.2}$ = 640 N/mm², $A_5$ > 8% ductile<br>M24: $R_m$ = 700 N/mm², $R_{p\ 0.2}$ = 400 N/mm², $A_5$ > 8% ductile |
| Washer ISO 7089 | Steel galvanized, hot dipped galvanized, |
| | Stainless steel, 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362 |
| | High corrosion resistant steel, 1.4529; 1.4565 |
| Nut EN ISO 4032 | Strength class 8,<br>steel galvanized ≥ 5 µm,<br>hot dipped galvanized ≥ 45 µm, |
| | Strength class 70, stainless steel grade A4,<br>1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362 |
| | Strength class 70, high corrosion resistant steel,<br>1.4529; 1.4565 |

## Anchor dimensions

| Anchor size | M8 | M10 | M12 | M16 | M20 | M24 |
|---|---|---|---|---|---|---|
| Anchor rod<br>HAS, HAS-E,<br>HAS-R, HAS-ER<br>HAS-HCR | M8x80 | M10x90 | M12x110 | M16x125 | M20x170 | M24x210 |
| Anchor embedment depth [mm] | 80 | 90 | 110 | 125 | 170 | 210 |
| Anchor rod<br>HIT-V, HIT-V-R, HIT-V-HCR | Anchor rods HIT-V (-R / -HCR) are available in variable length | | | | | |

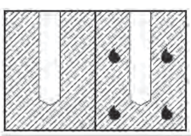
## Setting

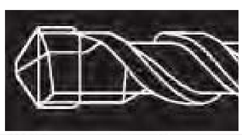
### installation equipment

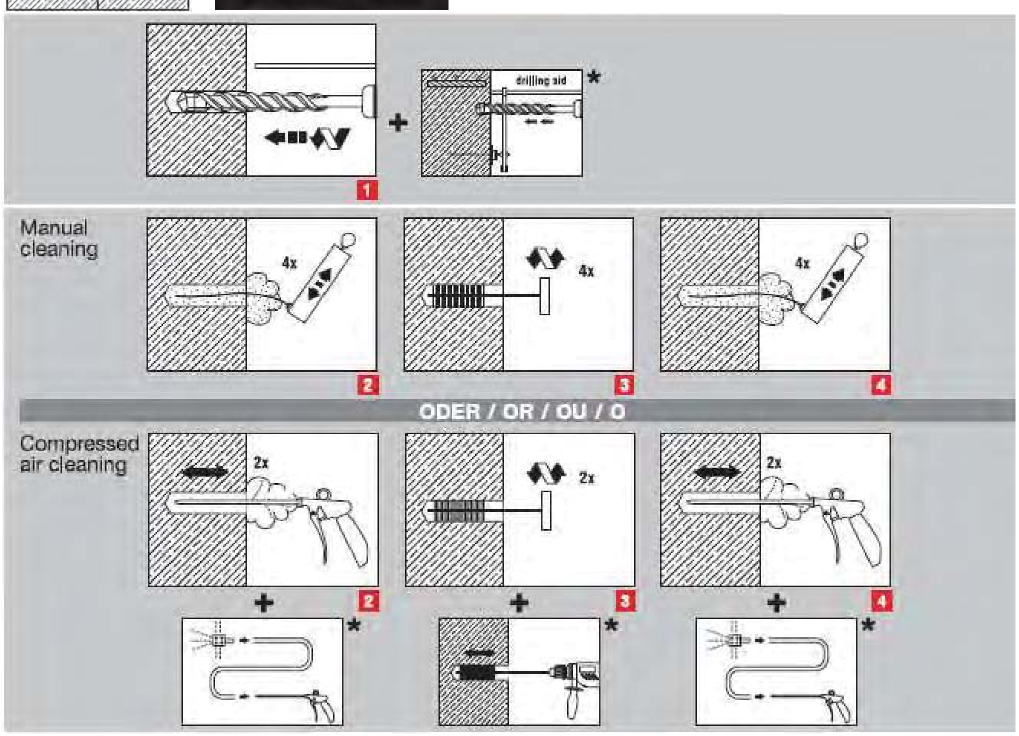
| Anchor size | M8 | M10 | M12 | M16 | M20 | M24 |
|---|---|---|---|---|---|---|
| Rotary hammer | TE 2 – TE 16 | | | | TE 40 – TE 50 | |
| Other tools | compressed air gun or blow out pump, set of cleaning brushes, dispenser | | | | | |

### Setting instruction

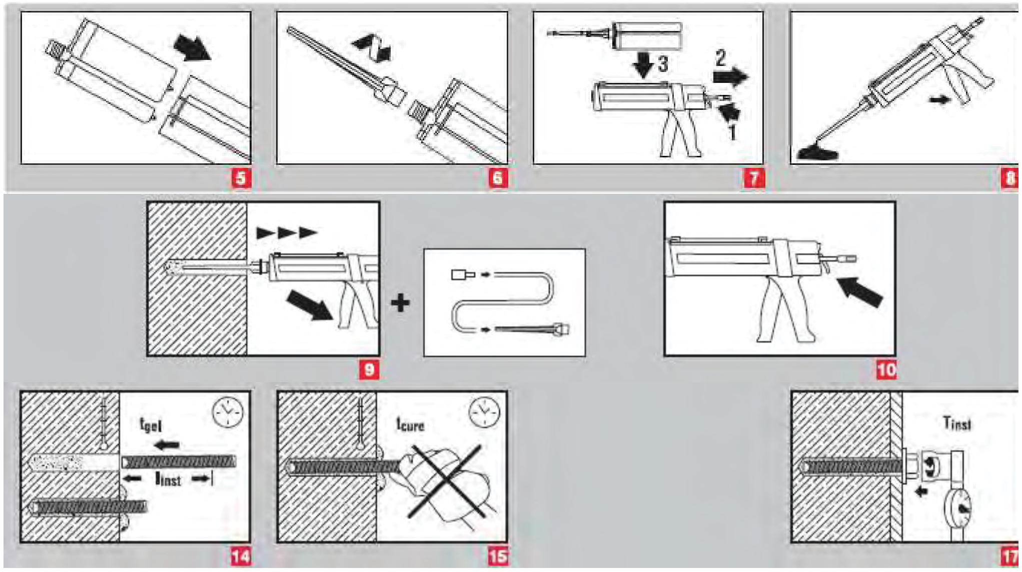
**Dry and water-saturated concrete, hammer drilling**








a)

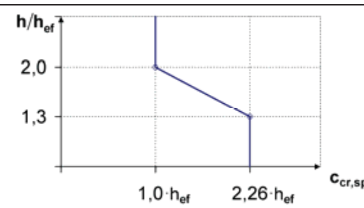


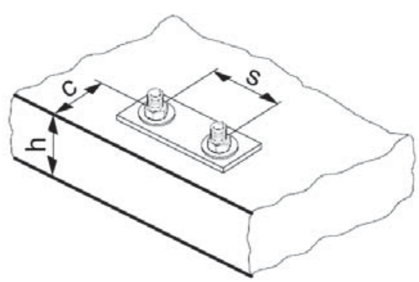

**<u>a) Note:</u> Manual cleaning for element sizes d ≤ 16mm and embedment depth $h_{ef}$ ≤ 10 d only!**
Brush bore hole with required steel brush HIT-RB
For detailed information on installation see instruction for use given with the package of the product.

## Curing time for general conditions

| Hilti technical data | | |
|---|---|---|
| **Temperature of the base material** | **Curing time before anchor can be fully loaded $t_{cure}$** | **Working time in which anchor can be inserted and adjusted $t_{gel}$** |
| 32 °C | 35 min | 1 min |
| 21 °C | 45 min | 2,5 min |
| 16 °C | 1 h | 5 min |
| 4 °C | 1 ½ h | 15 min |
| - 7 °C | 6 h | 1 h |
| - 18 °C | 24 h | 1,5 h |
| - 23 °C | 36 h | 1,5 h |

## Setting details

| | | | Hilti technical data | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Anchor size** | | | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** |
| Nominal diameter of drill bit | $d_0$ | [mm] | 10 | 12 | 14 | 18 | 24 | 28 |
| Effective anchorage and drill hole depth | $h_{ef}$ | [mm] | 80 | 90 | 110 | 125 | 170 | 210 |
| Minimum base material thickness b) | $h_{min}$ | [mm] | $h_{ef}$ + 30 mm ≥ 100 mm | | | $h_{ef} + 2\ d_0$ | | |
| Diameter of clearance hole in the fixture | $d_f$ | [mm] | 9 | 12 | 14 | 18 | 22 | 26 |
| Minimum spacing | $s_{min}$ | [mm] | 40 | 50 | 60 | 80 | 100 | 120 |
| Minimum edge distance | $c_{min}$ | [mm] | 40 | 50 | 60 | 80 | 100 | 120 |
| Critical spacing for splitting failure | $s_{cr,sp}$ | | $2\ c_{cr,sp}$ | | | | | |
| Critical edge distance for splitting failure c) | $c_{cr,sp}$ | [mm] | **$1,0 \cdot h_{ef}$** | for $h / h_{ef} \geq 2,0$ | |   | | |
| | | | **$4,6\ h_{ef}$ - $1,8\ h$** | for $2,0 > h / h_{ef} > 1,3$ | | | | |
| | | | **$2,26\ h_{ef}$** | for $h / h_{ef} \leq 1,3$ | | | | |
| Critical spacing for concrete cone failure | $s_{cr,N}$ | | $2\ c_{cr,N}$ | | | | | |
| Critical edge distance for concrete cone failure b) | $c_{cr,N}$ | | $1.5\ h_{ef}$ | | | | | |
| Torque moment c) | $T_{inst}$ | [Nm] | 10 | 20 | 40 | 80 | 150 | 200 |




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

a) h: base material thickness ($h \geq h_{min}$)

b) The critical edge distance for concrete cone failure depends on the embedment depth $h_{ef}$ and the design bond resistance. The simplified formula given in this table is on the save side.

c) This is the maximum recommended torque moment to avoid splitting failure during installation for anchors with minimum spacing and/or edge distance.

## Simplified design method

Simplified version of the design method according ETAG 001, TR 029. Design resistance according data given by Hilti.

- 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 distance. 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, TR 029. 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)

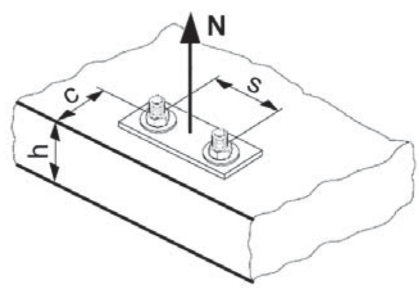
The values are valid for one anchor.

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




## Basic design tensile resistance

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

| | | | Hilti technical data | | | | | |
|---|---|---|---|---|---|---|---|---|
| Anchor size | | | M8 | M10 | M12 | M16 | M20 | M24 |
| $N_{Rd,s}$ | HAS 5.8 | [kN] | 11,1 | 17,6 | 25,4 | 48,1 | 74,8 | 106,8 |
| | HIT-V 5.8 | [kN] | 12,0 | 19,3 | 28,0 | 52,7 | 82,0 | 118,0 |
| | HIT-V 8.8 | [kN] | 19,3 | 30,7 | 44,7 | 84,0 | 130,7 | 188,0 |
| | HAS (-E)-R | [kN] | 12,4 | 19,8 | 28,6 | 54,1 | 84,1 | 120,2 |
| | HIT-V-R | [kN] | 13,9 | 21,9 | 31,6 | 58,8 | 92,0 | 132,1 |
| | HAS (-E)-HCR | [kN] | 17,7 | 28,2 | 40,6 | 76,9 | 119,6 | 106,8 |
| | HIT-V-HCR | [kN] | 19,3 | 30,7 | 44,7 | 84,0 | 130,7 | 117,6 |

### Design combined pull-out and concrete cone resistance
$N_{Rd,p} = N^0_{Rd,p} \cdot f_{B,p} \cdot f_{1,N} \cdot f_{2,N} \cdot f_{3,N} \cdot f_{h,p} \cdot f_{re,N}$

| | | | Hilti technical data | | | | | |
|---|---|---|---|---|---|---|---|---|
| Anchor size | | | M8 | M10 | M12 | M16 | M20 | M24 |
| Typical embedment depth $h_{ef,typ}$ [mm] | | | 80 | 90 | 110 | 125 | 170 | 210 |
| $N^0_{Rd,p}$ | Temperature range I | [kN] | 8,4 | 11,2 | 16,8 | 21,4 | 36,4 | 45,4 |

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

| | Hilti technical data | | | | | |
|---|---|---|---|---|---|---|
| **Anchor size** | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** |
| $N^0_{Rd,c}$ [kN] | 17,2 | 20,5 | 27,7 | 33,6 | 53,3 | 73,2 |

## Influencing factors

### Influence of concrete strength on combined pull-out and concrete cone resistance

| 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 |
|---|---|---|---|---|---|---|---|
| $f_{B,p} = (f_{ck,cube}/25N/mm^2)^{0,1}$ a) | 1 | 1,02 | 1,04 | 1,06 | 1,07 | 1,08 | 1,09 |

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

### Influence of embedment depth on combined pull-out and concrete cone resistance

$f_{h,p} = 1$

### Influence of concrete strength on concrete cone resistance

| 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 embedment depth on concrete cone resistance

$f_{h,N} = 1$

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

a) The 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 smaller than the critical 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 |
|---|---|---|---|---|---|---|---|---|---|---|
| $f_{3,N} = 0,5 \cdot (1 + s/s_{cr,N})$<br>$f_{3,sp} = 0,5 \cdot (1 + s/s_{cr,sp})$ | 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 reinforcement

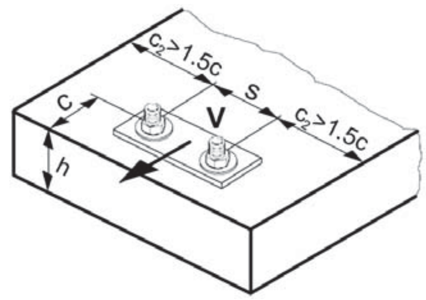
| $h_{ef}$ [mm] | 80 | 90 | ≥ 100 |
|---|---|---|---|
| $f_{re,N}$ = 0,5 + $h_{ef}$/200mm ≤ 1 | 0,9 a) | 0,95 a) | 1 |

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 · lower value of $N_{Rd,p}$ and $N_{Rd,c}$
- Concrete edge resistance: $V_{Rd,c} = V^0_{Rd,c} \cdot f_B \cdot f_ß \cdot f_h \cdot f_4 \cdot f_{hef} \cdot f_c$




### Basic design shear resistance

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

| | | | Hilti technical data | | | | | |
|---|---|---|---|---|---|---|---|---|
| Anchor size | | | M8 | M10 | M12 | M16 | M20 | M24 |
| $V_{Rd,s}$ | HAS 5.8 | [kN] | 6,6 | 10,6 | 15,2 | 28,8 | 44,9 | 64,1 |
| | HIT-V 5.8 | [kN] | 7,2 | 12,0 | 16,8 | 31,2 | 48,8 | 70,4 |
| | HIT-V 8.8 | [kN] | 12,0 | 18,4 | 27,2 | 50,4 | 78,4 | 112,8 |
| | HAS (-E)-R | [kN] | 7,5 | 11,9 | 17,1 | 32,4 | 50,5 | 72,1 |
| | HIT-V-R | [kN] | 8,3 | 12,8 | 19,2 | 35,3 | 55,1 | 79,5 |
| | HAS (-E)-HCR | [kN] | 10,6 | 16,9 | 24,4 | 46,1 | 71,8 | 64,1 |
| | HIT-V-HCR | [kN] | 12,0 | 18,4 | 27,2 | 50,4 | 78,4 | 70,9 |

### Design concrete pryout resistance $V_{Rd,cp}$ = lower value[a)] of k · $N_{Rd,p}$ and k · $N_{Rd,c}$

| k = 2 |
|---|

a) $N_{Rd,p}$: Design combined pull-out and concrete cone resistance
$N_{Rd,c}$: Design concrete cone resistance

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

| Anchor size | | M8 | M10 | M12 | M16 | M20 | M24 |
|---|---|---|---|---|---|---|---|
| Non-cracked concrete | | | | | | | |
| $V^0_{Rd,c}$ | [kN] | 5,9 | 8,6 | 11,6 | 18,7 | 27,0 | 36,6 |

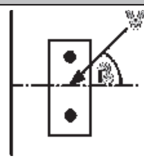
## Influencing factors

### 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° |
|---|---|---|---|---|---|---|---|---|---|---|
| $f_\beta = \sqrt{\frac{1}{(\cos\alpha_V)^2 + \left(\frac{\sin\alpha_V}{2,5}\right)^2}}$  | 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 | M8 | M10 | M12 | M16 | M20 | M24 |
|---|---|---|---|---|---|---|
| $f_{hef} = 0,05 \cdot (h_{ef} / d)^{1,68}$ | 2,39 | 2 | 2,07 | 1,58 | 1,82 | 1,91 |

### 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 $c_{min}$.

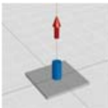
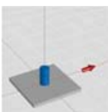
## Combined tension and shear loading

For combined tension and shear loading see section “Anchor Design”.

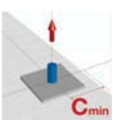
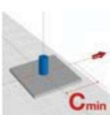
### Precalculated values

Recommended loads can be calculated by dividing the design resistance by an 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.

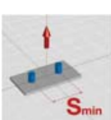
**Design resistance: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm²**

| | Hilti technical data | | | | | |
|---|---|---|---|---|---|---|
| **Anchor size** | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** |
| Embedment depth $h_{ef,typ}$ = [mm] | 80 | 90 | 110 | 125 | 170 | 210 |
| Base material thickness $h_{min}$= [mm] | 110 | 120 | 140 | 161 | 218 | 266 |
| **Tensile $N_{Rd}$: single anchor, no edge effects** | | | | | | |
|  HIT-V 5.8, HIT-V 8.8, HIT-V-R, HIT-V-HCR [kN] | 8,4 | 11,2 | 16,8 | 21,4 | 36,4 | 45,4 |
| **Shear $V_{Rd}$: single anchor, no edge effects, without lever arm** | | | | | | |
|  HIT-V 5.8 [kN] | 7,2 | 12,0 | 16,8 | 31,2 | 48,8 | 70,4 |
| HIT-V 8.8 [kN] | 12,0 | 18,4 | 27,2 | 50,4 | 78,4 | 112,8 |
| HIT-V-R [kN] | 8,3 | 12,8 | 19,2 | 35,3 | 55,1 | 79,5 |
| HIT-V-HCR [kN] | 12,0 | 18,4 | 27,2 | 50,4 | 78,4 | 70,9 |

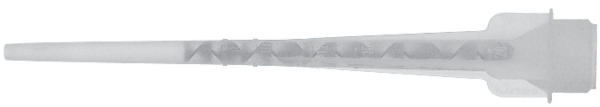
**Design resistance: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm²**

| | Hilti technical data | | | | | |
|---|---|---|---|---|---|---|
| **Anchor size** | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** |
| Embedment depth $h_{ef,typ}$ = [mm] | 80 | 90 | 110 | 125 | 170 | 210 |
| Base material thickness $h_{min}$= [mm] | 110 | 120 | 140 | 161 | 218 | 266 |
| Edge distance $c = c_{min}$= [mm] | 40 | 50 | 60 | 80 | 100 | 120 |
| **Tensile $N_{Rd}$: single anchor, min. edge distance ($c = c_{min}$)** | | | | | | |
|  HIT-V 5.8, HIT-V 8.8, HIT-V-R, HIT-V-HCR [kN] | 5,2 | 7,0 | 10,4 | 13,8 | 23,5 | 30,7 |
| **Shear $V_{Rd}$: single anchor, min. edge distance ($c = c_{min}$) , without lever arm** | | | | | | |
|  HIT-V 5.8, HIT-V 8.8, HIT-V-R, HIT-V-HCR [kN] | 3,7 | 5,3 | 7,3 | 11,5 | 17,2 | 23,6 |

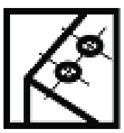
**Design resistance: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm²**
**(load values are valid for single anchor)**

| | Hilti technical data | | | | | |
|---|---|---|---|---|---|---|
| **Anchor size** | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** |
| Embedment depth $h_{ef,typ}$ = [mm] | 80 | 90 | 110 | 125 | 170 | 210 |
| Base material thickness $h_{min}$= [mm] | 110 | 120 | 140 | 161 | 218 | 266 |
| Spacing $s = s_{min}$= [mm] | 40 | 50 | 60 | 80 | 100 | 120 |
| **Tensile $N_{Rd}$: double anchor, no edge effects, min. spacing ($s = s_{min}$)** | | | | | | |
|  HIT-V 5.8, HIT-V 8.8, HIT-V-R, HIT-V-HCR [kN] | 5,9 | 7,8 | 11,5 | 14,8 | 24,9 | 31,9 |
| **Shear $V_{Rd}$: double anchor, no edge effects, min. spacing ($s = s_{min}$) , without lever arm** | | | | | | |
|  HIT-V 5.8 [kN] | 7,2 | 12,0 | 16,8 | 31,2 | 48,8 | 70,4 |
| HIT-V 8.8 [kN] | 12,0 | 18,4 | 27,2 | 36,4 | 61,0 | 75,7 |
| HIT-V-R [kN] | 8,3 | 12,8 | 19,2 | 35,3 | 55,1 | 75,7 |
| HIT-V-HCR [kN] | 12,0 | 18,4 | 27,2 | 36,4 | 61,0 | 70,9 |

# Hilti HIT-ICE with HIS-(R)N

<table>
<tr><th colspan="2">Injection mortar system</th><th>Benefits</th></tr>
<tr><td></td><td>Hilti<br>HIT-ICE<br>296 ml cartridge</td><td rowspan="3">- suitable for non-cracked concrete C 20/25 to C 50/60<br>- high loading capacity<br>- suitable for dry and water saturated concrete<br>- odourless resin<br>- low installation temperature (range -23 ℃ to +32 ℃)</td></tr>
<tr><td></td><td>Statik mixer</td></tr>
<tr><td></td><td>HIS-(R)N sleeve</td></tr>
</table>


Concrete


Small edge distance and spacing

Corrosion resistance


PROFIS Anchor design software

## Basic loading data (for a single anchor)

**All data in this section applies to**

For details see Simplified design method

- Correct setting (See setting instruction)
- No edge distance and spacing influence
- *Steel* failure
- Screw strength class 8.8
- Base material thickness, as specified in the table
- Embedment depth, as specified in the table
- One anchor material, as specified in the tables
- Concrete C 20/25, $f_{ck,cube}$ = 25 N/mm²
- Installation temperature range -18℃ to +32℃

### Embedment depth and base material thickness for the basic loading data. Mean ultimate resistance, characteristic resistance, design resistance, recommended loads.

| Anchor size | M8 | M10 | M12 | M16 | M20 |
|---|---|---|---|---|---|
| Embedment depth [mm] | 90 | 110 | 125 | 170 | 205 |
| Base material thickness [mm] | 120 | 150 | 170 | 230 | 270 |

### Mean ultimate resistance [a)]: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm², anchor HIS-N

| | | | Hilti technical data | | | | |
|---|---|---|---|---|---|---|---|
| Anchor size | | | M8 | M10 | M12 | M16 | M20 |
| Tensile $N_{Ru,m}$ | HIS-N | [kN] | *27,3* | 48,2 | 61,0 | 105,6 | *114,5* |
| Shear $V_{Ru,m}$ | HIS-N | [kN] | *13,7* | *24,2* | *41,0* | *62,0* | *57,8* |

## Characteristic resistance: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm², anchor HIS-N

| | | | Hilti technical data | | | | |
|---|---|---|---|---|---|---|---|
| **Anchor size** | | | **M8** | **M10** | **M12** | **M16** | **M20** |
| Tensile $N_{Rk}$ | HIS-N | [kN] | 24,2 | 36,1 | 45,8 | 79,2 | 94,7 |
| Shear $V_{Rk}$ | HIS-N | [kN] | *13,0* | *23,0* | *39,0* | *59,0* | *55,0* |

## Design resistance: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm², anchor HIS-N

| | | | Hilti technical data | | | | |
|---|---|---|---|---|---|---|---|
| **Anchor size** | | | **M8** | **M10** | **M12** | **M16** | **M20** |
| Tensile $N_{Rd}$ | HIS-N | [kN] | 11,5 | 17,2 | 21,8 | 37,7 | 45,1 |
| Shear $V_{Rd}$ | HIS-N | [kN] | 10,4 | 18,4 | 26,0 | 39,3 | 36,7 |

## Recommended loads [a)]: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm², anchor HIS-N

| | | | Hilti technical data | | | | |
|---|---|---|---|---|---|---|---|
| **Anchor size** | | | **M8** | **M10** | **M12** | **M16** | **M20** |
| Tensile $N_{rec}$ | HIS-N | [kN] | 8,2 | 12,3 | 15,6 | 26,9 | 32,2 |
| Shear $V_{rec}$ | HIS-N | [kN] | 7,4 | 13,1 | 18,6 | 28,1 | 26,2 |

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.

## Service temperature range

Hilti HIT-ICE injection mortar may be applied in the temperature ranges given below. An elevated base material temperature may lead to a reduction of the design bond resistance.

| Temperature range | Base material temperature | Maximum long term base material temperature | Maximum short term base material temperature |
|---|---|---|---|
| Temperature range I | -40 °C to +70 °C | +43 °C | +70 °C |

**Max short term base material temperature**
Short-term elevated base material temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

**Max long term base material temperature**
Long-term elevated base material temperatures are roughly constant over significant periods of time.

# Materials

## Mechanical properties of HIS-(R)N

| | | | Hilti technical data | | | | |
|---|---|---|---|---|---|---|---|
| **Anchor size** | | | **M8** | **M10** | **M12** | **M16** | **M20** |
| Nominal tensile strength $f_{uk}$ | HIS-N | [N/mm²] | 490 | 490 | 460 | 460 | 460 |
| | Screw 8.8 | [N/mm²] | 800 | 800 | 800 | 800 | 800 |
| | HIS-RN | [N/mm²] | 700 | 700 | 700 | 700 | 700 |
| | Screw A4-70 | [N/mm²] | 700 | 700 | 700 | 700 | 700 |
| Yield strength $f_{yk}$ | HIS-N | [N/mm²] | 410 | 410 | 375 | 375 | 375 |
| | Screw 8.8 | [N/mm²] | 640 | 640 | 640 | 640 | 640 |
| | HIS-RN | [N/mm²] | 350 | 350 | 350 | 350 | 350 |
| | Screw A4-70 | [N/mm²] | 450 | 450 | 450 | 450 | 450 |
| Stressed cross-section $A_s$ | HIS-(R)N | [mm²] | 51,5 | 108,0 | 169,1 | 256,1 | 237,6 |
| | Screw | [mm²] | 36,6 | 58 | 84,3 | 157 | 245 |
| Moment of resistance W | HIS-(R)N | [mm³] | 145 | 430 | 840 | 1595 | 1543 |
| | Screw | [mm³] | 31,2 | 62,3 | 109 | 277 | 541 |

## Material quality

| Part | Material |
|---|---|
| internally threaded sleeves [a)] HIS-N | C-steel 1.0718, steel galvanized ≥ 5µm |
| internally threaded sleeves [b)] HIS-RN | stainless steel 1.4401 and 1.4571 |

a) related fastening screw: strength class 8.8, A5 > 8% Ductile
steel galvanized ≥ 5µm

b) related fastening screw: strength class 70, A5 > 8% Ductile
stainless steel 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362

# Anchor dimensions

| **Anchor size** | | **M8** | **M10** | **M12** | **M16** | **M20** |
|---|---|---|---|---|---|---|
| Internal sleeve HIS-(R)N | | M8x90 | M10x110 | M12x125 | M16x170 | M20x205 |
| Anchor embedment depth | [mm] | 90 | 110 | 125 | 170 | 205 |

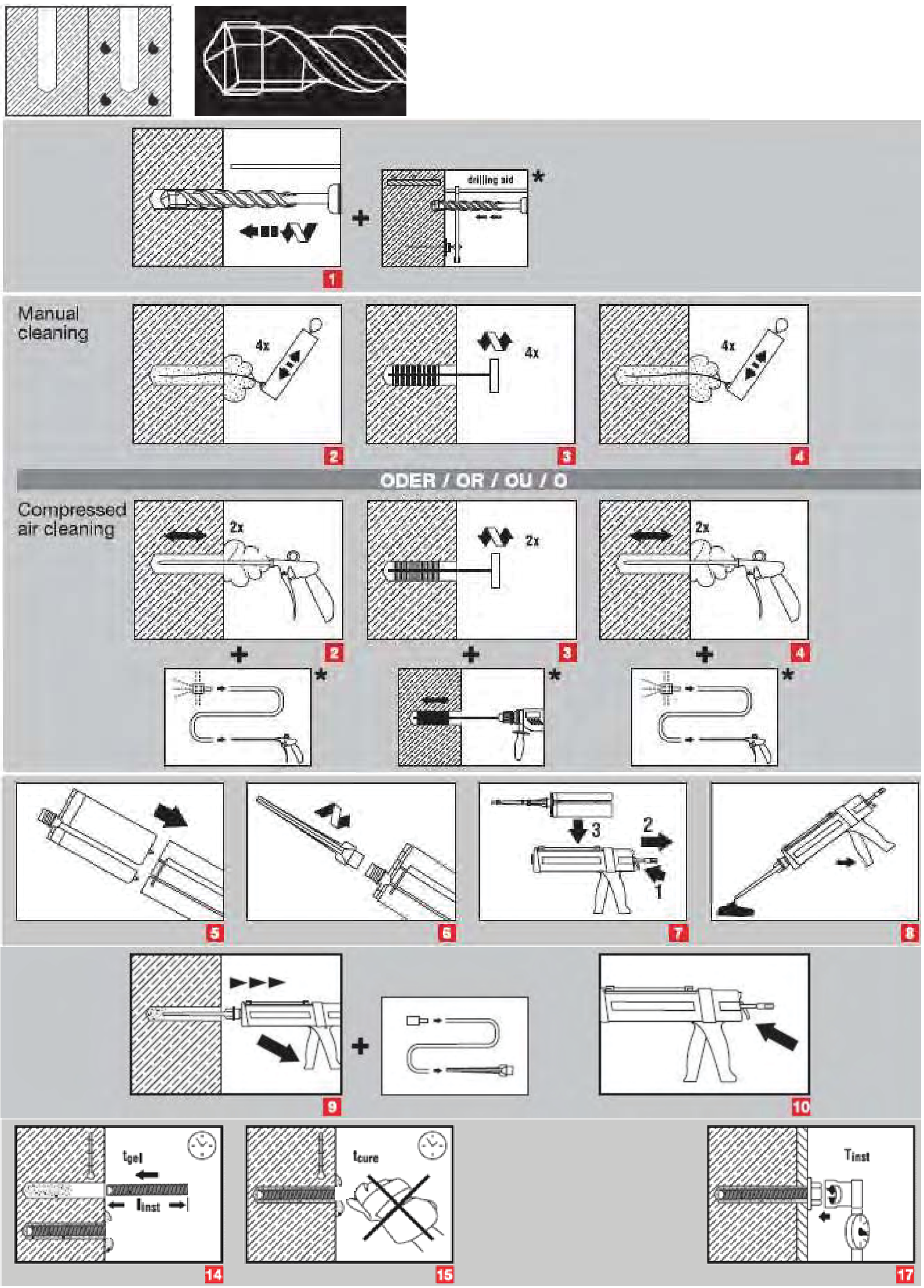
# Setting

## installation equipment

| **Anchor size** | **M8** | **M10** | **M12** | **M16** | **M20** |
|---|---|---|---|---|---|
| Rotary hammer | TE 2 – TE 16 | | TE 40 – TE 50 | | |
| Other tools | compressed air gun or blow out pump, set of cleaning brushes, dispenser | | | | |

## Setting instruction

**Dry and water-saturated concrete, hammer drilling**




a)

**a) Note: Manual cleaning for HIS-(R)N M8 and HIS-(R)N M10 only!**

Brush bore hole with required steel brush HIT-RB

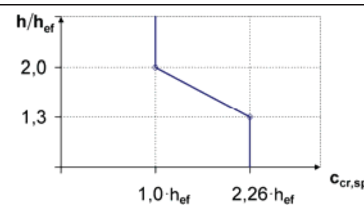
For detailed information on installation see instruction for use given with the package of the product.

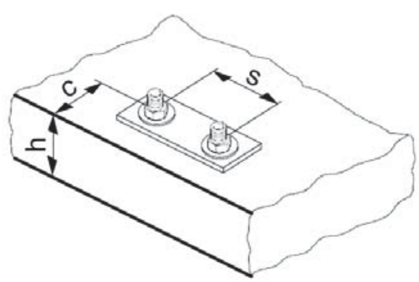
## Curing time for general conditions

| Hilti technical data | | |
|---|---|---|
| Temperature of the base material | Curing time before anchor can be fully loaded $t_{cure}$ | Working time in which anchor can be inserted and adjusted $t_{gel}$ |
| 32 °C | 35 min | 1 min |
| 21 °C | 45 min | 2,5 min |
| 16 °C | 1 h | 5 min |
| 4 °C | 1 ½ h | 15 min |
| - 7 °C | 6 h | 1 h |
| - 18 °C | 24 h | 1,5 h |
| - 23 °C | 36 h | 1,5 h |

## Setting details

| | | | Hilti technical data | | | | |
|---|---|---|---|---|---|---|---|
| **Anchor size** | | | **M8** | **M10** | **M12** | **M16** | **M20** |
| Nominal diameter of drill bit | $d_0$ | [mm] | 14 | 18 | 22 | 28 | 32 |
| Diameter of element | d | [mm] | 12,5 | 16,5 | 20,5 | 25,4 | 27,6 |
| Effective anchorage and drill hole depth | $h_{ef}$ | [mm] | 90 | 110 | 125 | 170 | 205 |
| Minimum base material thickness a) | $h_{min}$ | [mm] | 120 | 150 | 170 | 230 | 270 |
| Diameter of clearance hole in the fixture | $d_f$ | [mm] | 9 | 12 | 14 | 18 | 22 |
| Thread engagement length; min - max | $h_s$ | [mm] | 8-20 | 10-25 | 12-30 | 16-40 | 20-50 |
| Minimum spacing | $s_{min}$ | [mm] | 40 | 45 | 55 | 65 | 90 |
| Minimum edge distance | $c_{min}$ | [mm] | 40 | 45 | 55 | 65 | 90 |
| Critical spacing for splitting failure | $s_{cr,sp}$ | | $2\ c_{cr,sp}$ | | | | |
| Critical edge distance for splitting failure a) | $c_{cr,sp}$ | [mm] | **$1{,}0 \cdot h_{ef}$** | for $h / h_{ef} \geq 2{,}0$ | | | |
| | | | **$4{,}6\ h_{ef} - 1{,}8\ h$** | for $2{,}0 > h / h_{ef} > 1{,}3$ | | | |
| | | | **$2{,}26\ h_{ef}$** | for $h / h_{ef} \leq 1{,}3$ | | | |
| Critical spacing for concrete cone failure | $s_{cr,N}$ | | $2\ c_{cr,N}$ | | | | |
| Critical edge distance for concrete cone failure | $c_{cr,N}$ | b) | $1.5\ h_{ef}$ | | | | |
| Torque moment c) | $T_{inst}$ | [Nm] | 10 | 20 | 40 | 80 | 150 |




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

a) h: base material thickness ($h \geq h_{min}$)

b) The critical edge distance for concrete cone failure depends on the embedment depth $h_{ef}$ and the design bond resistance. The simplified formula given in this table is on the save side.

c) This is the maximum recommended torque moment to avoid splitting failure during installation for anchors with minimum spacing and/or edge distance.

## Simplified design method

Simplified version of the design method according ETAG 001, TR 029. Design resistance according data given by Hilti.

- 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 distance. 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, TR 029. 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

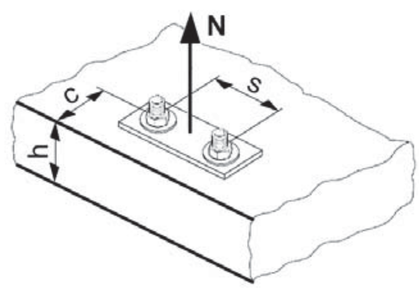
### The design tensile resistance is the lower value of

- Steel resistance: $N_{Rd,s}$
- Combined pull-out and concrete cone resistance:

$$N_{Rd,p} = N^0_{Rd,p} \cdot f_{B,p} \cdot f_{1,N} \cdot f_{2,N} \cdot f_{3,N} \cdot f_{h,p} \cdot f_{re,N}$$

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

$$N_{Rd,sp} = N^0_{Rd,c} \cdot f_B \cdot f_{1,sp} \cdot f_{2,sp} \cdot f_{3,sp} \cdot f_{h,N} \cdot f_{re,N}$$




### Basic design tensile resistance

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

| | | | Hilti technical data | | | | |
|---|---|---|---|---|---|---|---|
| Anchor size | | | M8 | M10 | M12 | M16 | M20 |
| $N_{Rd,s}$ | HIS-N | [kN] | 17,4 | 30,7 | 44,7 | 80,3 | 74,1 |
| | HIS-RN | [kN] | 13,9 | 21,9 | 31,6 | 58,8 | 69,2 |

#### Design combined pull-out and concrete cone resistance

$$N_{Rd,p} = N^0_{Rd,p} \cdot f_{B,p} \cdot f_{1,N} \cdot f_{2,N} \cdot f_{3,N} \cdot f_{h,p} \cdot f_{re,N}$$

| | | | Hilti technical data | | | | |
|---|---|---|---|---|---|---|---|
| Anchor size | | | M8 | M10 | M12 | M16 | M20 |
| Embedment depth $h_{ef}$ [mm] | | | 90 | 110 | 125 | 170 | 205 |
| $N^0_{Rd,p}$ | Temperature range I | [kN] | 11,5 | 17,2 | 21,8 | 37,7 | 45,1 |

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

| | Hilti technical data | | | | |
|---|---|---|---|---|---|
| **Anchor size** | **M8** | **M10** | **M12** | **M16** | **M20** |
| $N^0_{Rd,c}$ [kN] | 20,5 | 27,7 | 33,6 | 53,3 | 70,6 |

## Influencing factors

### Influence of concrete strength on combined pull-out and concrete cone resistance

| 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 |
|---|---|---|---|---|---|---|---|
| $f_{B,p}$ = $(f_{ck,cube}/25N/mm^2)^{0,1}$ a) | 1 | 1,02 | 1,04 | 1,06 | 1,07 | 1,08 | 1,09 |

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

### Influence of embedment depth on combined pull-out and concrete cone resistance

$$f_{h,p} = 1$$

### Influence of concrete strength on concrete cone resistance

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

a) The 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 smaller than the critical 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 |
|---|---|---|---|---|---|---|---|---|---|---|
| $f_{3,N} = 0,5 \cdot (1 + s/s_{cr,N})$<br>$f_{3,sp} = 0,5 \cdot (1 + s/s_{cr,sp})$ | 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 embedment depth on concrete cone resistance

$$f_{h,N} = 1$$

### Influence of reinforcement

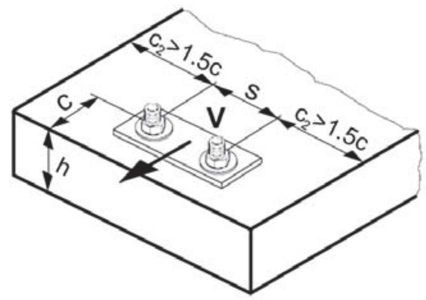
| $h_{ef}$ [mm] | 80 | 90 | ≥ 100 |
|---|---|---|---|
| $f_{re,N} = 0.5 + h_{ef}/200mm \leq 1$ | 0.9 a) | 0.95 a) | 1 |

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 · lower value of $N_{Rd,p}$ and $N_{Rd,c}$
- Concrete edge resistance: $V_{Rd,c} = V^0_{Rd,c} \cdot f_B \cdot f_ß \cdot f_h \cdot f_4 \cdot f_{hef} \cdot f_c$




## Basic design shear resistance

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

| | | | Hilti technical data | | | | |
|---|---|---|---|---|---|---|---|
| Anchor size | | | M8 | M10 | M12 | M16 | M20 |
| $V_{Rd,s}$ | HIS-N | [kN] | 10,4 | 18,4 | 26,0 | 39,3 | 36,7 |
| | HIS-RN | [kN] | 8,3 | 12,8 | 19,2 | 35,3 | 41,5 |

### Design concrete pryout resistance $V_{Rd,cp}$ = lower value a) of k · $N_{Rd,p}$ and k · $N_{Rd,c}$

| |
|---|
| **k = 1 for $h_{ef}$ < 60 mm** |
| **k = 2 for $h_{ef}$ ≥ 60 mm** |

a) $N_{Rd,p}$: Design combined pull-out and concrete cone resistance
$N_{Rd,c}$: Design concrete cone resistance

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

| Anchor size | M8 | M10 | M12 | M16 | M20 |
|---|---|---|---|---|---|
| Non-cracked concrete | | | | | |
| $V^0_{Rd,c}$ [kN] | 12,4 | 19,6 | 28,2 | 40,2 | 46,2 |

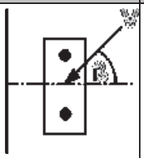
## Influencing factors

### 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 | M8 | M10 | M12 | M16 | M20 |
|---|---|---|---|---|---|
| $f_{hef}$ = | 1,38 | 1,21 | 1,04 | 1,22 | 1,45 |

## 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 $c_{min}$.

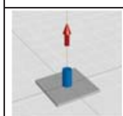
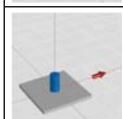
## Combined tension and shear loading

For combined tension and shear loading see section “Anchor Design”.

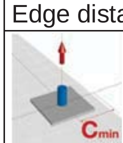
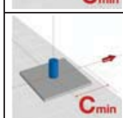
## Precalculated values

Recommended loads can be calculated by dividing the design resistance by an 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.

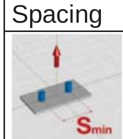
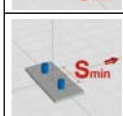
**Design resistance: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm²**

| | | Hilti technical data | | | | |
|---|---|---|---|---|---|---|
| **Anchor size** | | **M8** | **M10** | **M12** | **M16** | **M20** |
| Embedment depth | $h_{ef}$ = [mm] | 90 | 110 | 125 | 170 | 205 |
| Base material thickness | $h_{min}$= [mm] | 120 | 150 | 170 | 230 | 270 |
|  | **Tensile $N_{Rd}$: single anchor, no edge effects** | | | | | |
| HIS-(R)N | [kN] | 11,5 | 17,2 | 21,8 | 37,7 | 45,1 |
|  | **Shear $V_{Rd}$: single anchor, no edge effects, without lever arm** | | | | | |
| HIS-N | [kN] | 10,4 | 18,4 | 26,0 | 39,3 | 36,7 |
| HIS-RN | [kN] | 8,3 | 12,8 | 19,2 | 35,3 | 41,5 |

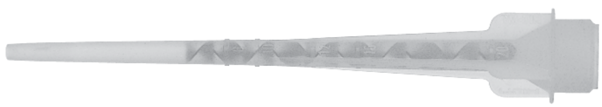
**Design resistance: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm²**

| | | Hilti technical data | | | | |
|---|---|---|---|---|---|---|
| **Anchor size** | | **M8** | **M10** | **M12** | **M16** | **M20** |
| Embedment depth | $h_{ef}$ = [mm] | 90 | 110 | 125 | 170 | 205 |
| Base material thickness | $h_{min}$= [mm] | 120 | 150 | 170 | 230 | 270 |
| Edge distance | $c = c_{min}$= [mm] | 40 | 45 | 55 | 65 | 90 |
|   | **Tensile $N_{Rd}$: single anchor, min. edge distance ($c = c_{min}$)** | | | | | |
| HIS-(R)N | [kN] | 6,1 | 8,8 | 11,3 | 19,1 | 25,5 |
|   | **Shear $V_{Rd}$: single anchor, min. edge distance ($c = c_{min}$) , without lever arm** | | | | | |
| HIS-(R)N | [kN] | 4,2 | 5,5 | 7,6 | 10,8 | 17,2 |

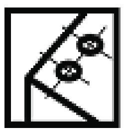
**Design resistance: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm²**
**(load values are valid for single anchor)**

| | | Hilti technical data | | | | |
|---|---|---|---|---|---|---|
| **Anchor size** | | **M8** | **M10** | **M12** | **M16** | **M20** |
| Embedment depth | $h_{ef}$ = [mm] | 90 | 110 | 125 | 170 | 205 |
| Base material thickness | $h_{min}$= [mm] | 120 | 150 | 170 | 230 | 270 |
| Spacing | $s = s_{min}$= [mm] | 40 | 45 | 55 | 65 | 90 |
|   | **Tensile $N_{Rd}$: double anchor, no edge effects, min. spacing ($s = s_{min}$)** | | | | | |
| HIS-(R)N | [kN] | 7,7 | 11,2 | 14,1 | 23,8 | 29,9 |
|   | **Shear $V_{Rd}$: double anchor, no edge effects, min. spacing ($s = s_{min}$) , without lever arm** | | | | | |
| HIS-N | [kN] | 10,4 | 18,4 | 26,0 | 39,3 | 36,7 |
| HIS-RN | [kN] | 8,3 | 12,8 | 19,2 | 35,3 | 41,5 |

# Hilti HIT-ICE with rebar

| Injection mortar system | | Benefits |
|---|---|---|
|  | Hilti<br>HIT-ICE<br>296 ml cartridge | - suitable for non-cracked concrete C 20/25 to C 50/60<br>- high loading capacity<br>- suitable for dry and water saturated concrete<br>- high corrosion resistant<br>- odourless resin<br>- low installation temperature (range -23 ℃ – 32 ℃) |
|  | Statik mixer | |
|  | rebar BSt 500 S | |

Concrete



Small edge distance and spacing

PROFIS Anchor design software

## Basic loading data (for a single anchor)

**All data in this section applies to**

For details see Simplified design method

- Correct setting (See setting instruction)
- No edge distance and spacing influence
- *Steel* failure
- Base material thickness, as specified in the table
- One typical embedment depth, as specified in the table
- One anchor material, as specified in the tables
- Concrete C 20/25, $f_{ck,cube}$ = 25 N/mm²
- Installation temperature range -18℃ to +32℃

### Embedment depth [a)] and base material thickness for the basic loading data. Mean ultimate resistance, characteristic resistance, design resistance, recommended loads.

| | Hilti technical data | | | | | | |
|---|---|---|---|---|---|---|---|
| **Anchor size** | **Ø8** | **Ø10** | **Ø12** | **Ø14** | **Ø16** | **Ø20** | **Ø25** |
| Typical embedment depth [mm] | 80 | 90 | 110 | 125 | 125 | 170 | 210 |
| Base material thickness [mm] | 110 | 120 | 145 | 165 | 165 | 220 | 275 |

a) The allowed range of embedment depth is shown in the setting details. The corresponding load values can be calculated according to the simplified design method.

### Mean ultimate resistance: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm², anchor rebar BSt 500S

| | | | Hilti technical data | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Anchor size** | | | **Ø8** | **Ø10** | **Ø12** | **Ø14** | **Ø16** | **Ø20** | **Ø25** |
| Tensile $N_{Ru,m}$ | BSt 500 S | [kN] | 20,2 | 28,3 | 40,0 | 51,8 | 63,6 | 84,6 | 105,8 |
| Shear $V_{Ru,m}$ | BSt 500 S | [kN] | 14,7 | 23,1 | 32,6 | 44,1 | 57,8 | 90,3 | 141,8 |

## Characteristic resistance: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm², anchor rebar BSt 500 S

| | | | Hilti technical data | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Anchor size** | | | **Ø8** | **Ø10** | **Ø12** | **Ø14** | **Ø16** | **Ø20** | **Ø25** |
| Tensile $N_{Rk}$ | BSt 500 S | [kN] | 15,1 | 21,2 | 30,0 | 38,9 | 47,7 | 63,4 | 79,4 |
| Shear $V_{Rk}$ | BSt 500 S | [kN] | *14,0* | *22,0* | *31,0* | *42,0* | *55,0* | *86,0* | *135,0* |

## Design resistance: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm², anchor rebar BSt 500 S

| | | | Hilti technical data | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Anchor size** | | | **Ø8** | **Ø10** | **Ø12** | **Ø14** | **Ø16** | **Ø20** | **Ø25** |
| Tensile $N_{Rd}$ | BSt 500 S | [kN] | 7,2 | 10,1 | 14,3 | 18,5 | 22,7 | 30,2 | 37,8 |
| Shear $V_{Rd}$ | BSt 500 S | [kN] | 9,3 | 14,7 | 20,7 | 28,0 | 36,7 | 57,3 | 90,0 |

## Recommended loads a): concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm², anchor rebar BSt 500 S

| | | | Hilti technical data | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Anchor size** | | | **Ø8** | **Ø10** | **Ø12** | **Ø14** | **Ø16** | **Ø20** | **Ø25** |
| Tensile $N_{rec}$ | BSt 500 S | [kN] | 5,1 | 7,2 | 10,2 | 13,2 | 16,2 | 21,6 | 27,0 |
| Shear $V_{rec}$ | BSt 500 S | [kN] | 6,7 | 10,5 | 14,8 | 20,0 | 26,2 | 41,0 | 64,3 |

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.

## Service temperature range

Hilti HIT-ICE injection mortar may be applied in the temperature ranges given below. An elevated base material temperature may lead to a reduction of the design bond resistance.

| Temperature range | Base material temperature | Maximum long term base material temperature | Maximum short term base material temperature |
|---|---|---|---|
| Temperature range I | -40 °C to +40 °C | +43 °C | +70 °C |

**Max short term base material temperature**
Short-term elevated base material temperatures are those that occur over brief intervals, e.g. as a result of diurnal cycling.

**Max long term base material temperature**
Long-term elevated base material temperatures are roughly constant over significant periods of time.

# Materials

## Mechanical properties of rebar BSt 500S

| | | | Hilti technical data | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Anchor size** | | | **Ø8** | **Ø10** | **Ø12** | **Ø14** | **Ø16** | **Ø20** | **Ø25** |
| Nominal tensile strength $f_{uk}$ | BSt 500 S | [N/mm²] | 550 | 550 | 550 | 550 | 550 | 550 | 550 |
| Yield strength $f_{yk}$ | | [N/mm²] | 500 | 500 | 500 | 500 | 500 | 500 | 500 |
| Stressed cross-section $A_s$ | BSt 500 S | [mm²] | 50,3 | 78,5 | 113,1 | 153,9 | 201,1 | 314,2 | 490,9 |
| Moment of resistance W | BSt 500 S | [mm³] | 50,3 | 98,2 | 169,6 | 269,4 | 402,1 | 785,4 | 1534 |

## Material quality

| Part | Material |
|---|---|
| rebar BSt 500 S | Geometry and mechanical properties according to DIN 488-2:1986 or E DIN 488-2:2006 |

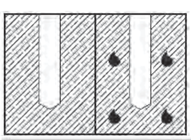
# Setting

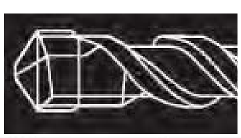
## installation equipment

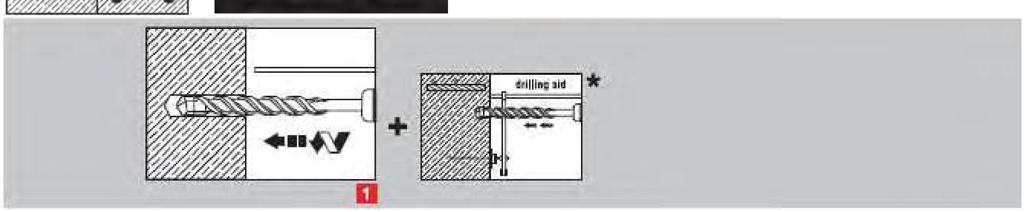
| Anchor size | Ø8 | Ø10 | Ø12 | Ø14 | Ø16 | Ø20 | Ø25 |
|---|---|---|---|---|---|---|---|
| Rotary hammer | TE 2 – TE 16 | | | | | TE 40 – TE 70 | |
| Other tools | compressed air gun or blow out pump, set of cleaning brushes, dispenser | | | | | | |

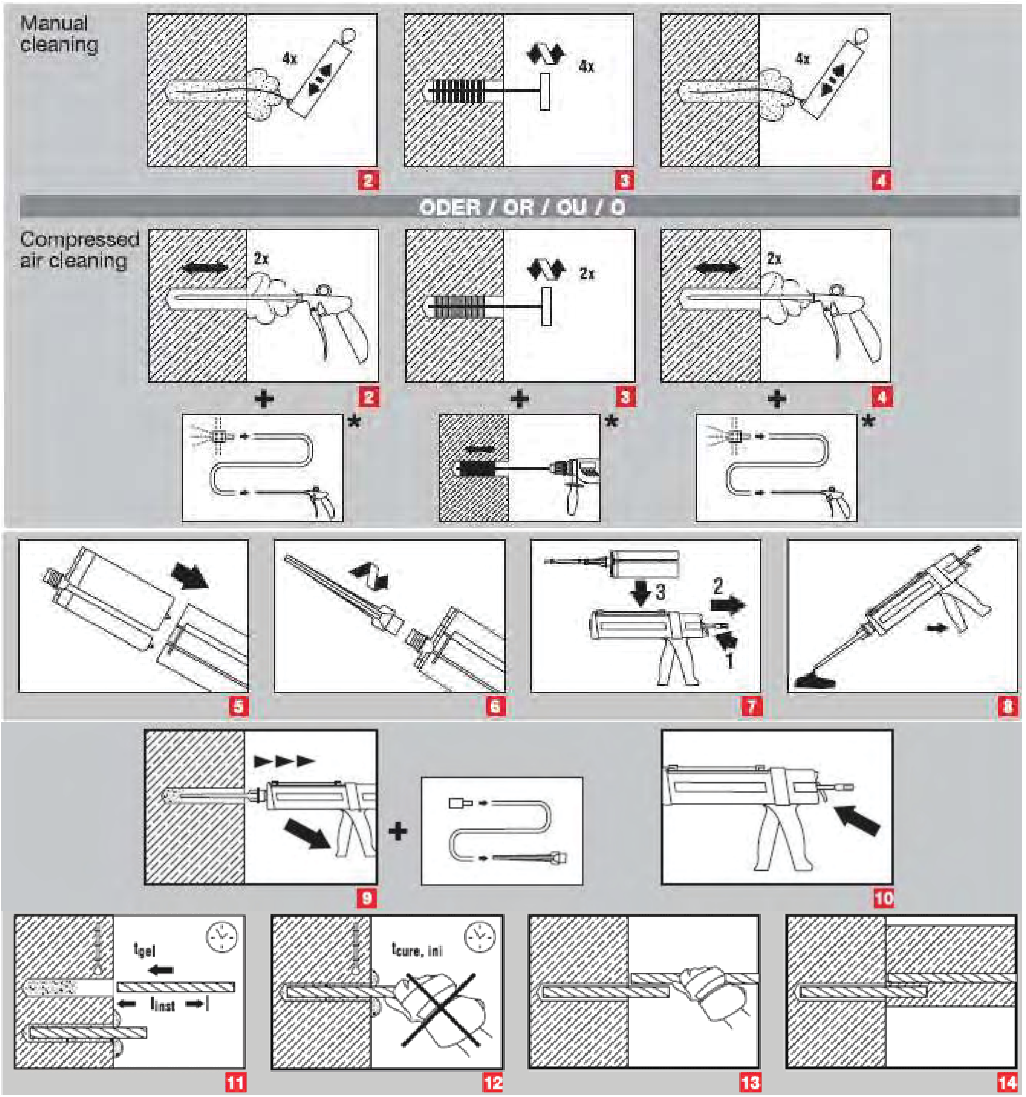
## Setting instruction

**Dry and water-saturated concrete, hammer drilling**









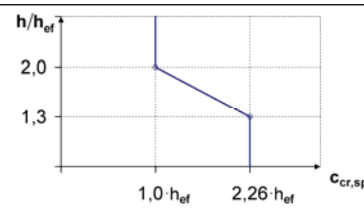

a)

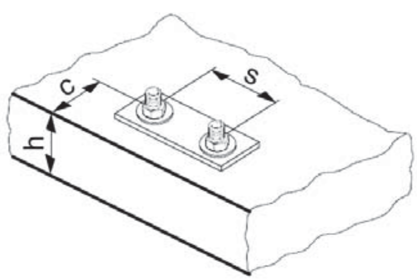
**a) Note: Manual cleaning for element sizes d ≤ 16mm and embedment depth $h_{ef}$ ≤ 10 d only!**
Brush bore hole with required steel brush HIT-RB
For detailed information on installation see instruction for use given with the package of the product.

## Curing time for general conditions

| Hilti technical data | | |
|---|---|---|
| **Temperature of the base material** | **Curing time before anchor can be fully loaded $t_{cure}$** | **Working time in which anchor can be inserted and adjusted $t_{gel}$** |
| 32 °C | 35 min | 1 min |
| 21 °C | 45 min | 2,5 min |
| 16 °C | 1 h | 5 min |
| 4 °C | 1 ½ h | 15 min |
| - 7 °C | 6 h | 1 h |
| - 18 °C | 24 h | 1,5 h |
| - 23 °C | 36 h | 1,5 h |

## Setting details

| | | | Hilti technical data | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Anchor size** | | | **Ø8** | **Ø10** | **Ø12** | **Ø14** | **Ø16** | **Ø20** | **Ø25** |
| Nominal diameter of drill bit | $d_0$ | [mm] | 12 | 14 | 16 | 18 | 20 | 25 | 32 |
| Effective anchorage and drill hole depth | $h_{ef}$ | [mm] | 80 | 90 | 110 | 125 | 125 | 170 | 210 |
| Minimum base material thickness [a] | $h_{min}$ | [mm] | $h_{ef}$ + 30 mm<br>≥ 100 mm | | $h_{ef} + 2\ d_0$ | | | | |
| Minimum spacing | $s_{min}$ | [mm] | 40 | 50 | 60 | 70 | 80 | 100 | 125 |
| Minimum edge distance | $c_{min}$ | [mm] | 40 | 50 | 60 | 70 | 80 | 100 | 125 |
| Critical spacing for splitting failure | $s_{cr,sp}$ | | $2\ c_{cr,sp}$ | | | | | | |
| Critical edge distance for splitting failure [b] | $c_{cr,sp}$ | [mm] | **$1{,}0 \cdot h_{ef}$** for $h / h_{ef} \geq 2{,}0$<br>**$4{,}6\ h_{ef} - 1{,}8\ h$** for $2{,}0 > h / h_{ef} > 1{,}3$<br>**$2{,}26\ h_{ef}$** for $h / h_{ef} \leq 1{,}3$ | | | |  | | |
| Critical spacing for concrete cone failure | $s_{cr,N}$ | | $2\ c_{cr,N}$ | | | | | | |
| Critical edge distance for concrete cone failure [c] | $c_{cr,N}$ | | $1.5\ h_{ef}$ | | | | | | |




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

a) h: base material thickness ($h \geq h_{min}$)

b) The critical edge distance for concrete cone failure depends on the embedment depth $h_{ef}$ and the design bond resistance. The simplified formula given in this table is on the save side.

## Simplified design method

Simplified version of the design method according ETAG 001, TR 029. Design resistance according data given by Hilti.

- 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 distance. 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, TR 029. 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)

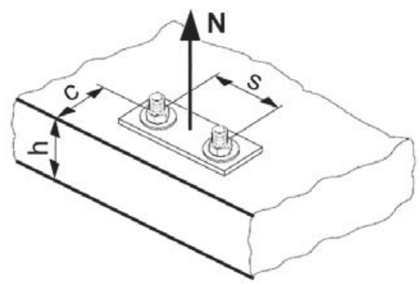
The values are valid for one anchor.

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




### Basic design tensile resistance

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

| | Hilti technical data | | | | | | |
|---|---|---|---|---|---|---|---|
| **Anchor size** | **Ø8** | **Ø10** | **Ø12** | **Ø14** | **Ø16** | **Ø20** | **Ø25** |
| $N_{Rd,s}$ BSt 500 S [kN] | 20,0 | 30,7 | 44,3 | 60,7 | 79,3 | 123,6 | 192,9 |

#### Design combined pull-out and concrete cone resistance
#### $N_{Rd,p} = N^0_{Rd,p} \cdot f_{B,p} \cdot f_{1,N} \cdot f_{2,N} \cdot f_{3,N} \cdot f_{h,p} \cdot f_{re,N}$

| | Hilti technical data | | | | | | |
|---|---|---|---|---|---|---|---|
| **Anchor size** | **Ø8** | **Ø10** | **Ø12** | **Ø14** | **Ø16** | **Ø20** | **Ø25** |
| **Typical embedment depth $h_{ef,typ}$ [mm]** | **80** | **90** | **110** | **125** | **125** | **170** | **210** |
| $N^0_{Rd,p}$ Temperature range I [kN] | 7,2 | 10,1 | 14,3 | 18,5 | 22,7 | 30,2 | 37,8 |

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

| | Hilti technical data | | | | | | |
|---|---|---|---|---|---|---|---|
| **Anchor size** | **Ø8** | **Ø10** | **Ø12** | **Ø14** | **Ø16** | **Ø20** | **Ø25** |
| $N^0_{Rd,c}$ [kN] | 17,2 | 20,5 | 27,7 | 33,6 | 33,6 | 53,3 | 73,2 |

### Influencing factors

#### Influence of concrete strength on combined pull-out and concrete cone resistance

| **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** |
|---|---|---|---|---|---|---|---|
| $f_{B,p} = (f_{ck,cube}/25N/mm^2)^{0,1}$ [a] | 1 | 1,02 | 1,04 | 1,06 | 1,07 | 1,08 | 1,09 |

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

## Influence of embedment depth on combined pull-out and concrete cone resistance

| $f_{h,p}$ = 1 |
|---|

## Influence of concrete strength on concrete cone resistance

| 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 embedment depth on concrete cone resistance

| $f_{h,N}$ = 1 |
|---|

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

a) The 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 smaller than the critical 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 |
|---|---|---|---|---|---|---|---|---|---|---|
| $f_{3,N} = 0,5 \cdot (1 + s/s_{cr,N})$<br>$f_{3,sp} = 0,5 \cdot (1 + s/s_{cr,sp})$ | 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 reinforcement

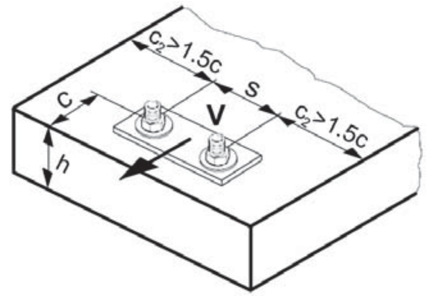
| $h_{ef}$ [mm] | 80 | 90 | ≥ 100 |
|---|---|---|---|
| $f_{re,N} = 0.5 + h_{ef}/200mm \leq 1$ | 0,9 a) | 0,95 a) | 1 |

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 · lower value of $N_{Rd,p}$ and $N_{Rd,c}$
- Concrete edge resistance: $V_{Rd,c} = V^0_{Rd,c} \cdot f_B \cdot f_ß \cdot f_h \cdot f_4 \cdot f_{hef} \cdot f_c$




## Basic design shear resistance

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

| | Hilti technical data | | | | | | |
|---|---|---|---|---|---|---|---|
| **Anchor size** | **Ø8** | **Ø10** | **Ø12** | **Ø14** | **Ø16** | **Ø20** | **Ø25** |
| $V_{Rd,s}$ BSt 500 S [kN] | 9,3 | 14,7 | 20,7 | 28,0 | 36,7 | 57,3 | 90,0 |

### Design concrete pryout resistance $V_{Rd,cp}$ = lower value a) of k · $N_{Rd,p}$ and k · $N_{Rd,c}$

| |
|---|
| **k = 2** |

a) $N_{Rd,p}$: Design combined pull-out and concrete cone resistance
$N_{Rd,c}$: Design concrete cone resistance

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

| **Anchor size** | **Ø8** | **Ø10** | **Ø12** | **Ø14** | **Ø16** | **Ø20** | **Ø25** |
|---|---|---|---|---|---|---|---|
| Non-cracked concrete | | | | | | | |
| $V^0_{Rd,c}$ [kN] | 5,9 | 8,6 | 11,6 | 15,0 | 18,7 | 27,0 | 39,2 |

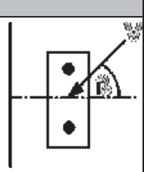
## Influencing factors

### 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°** |
|---|---|---|---|---|---|---|---|---|---|---|
| $f_\beta = \sqrt{\frac{1}{(\cos\alpha_V)^2 + \left(\frac{\sin\alpha_V}{2,5}\right)^2}}$  | 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** |
|---|---|---|---|---|---|---|---|---|---|---|
| $f_h = \{h/(1,5 \cdot c)\}^{1/2} \le 1$ | 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 | Ø8 | Ø10 | Ø12 | Ø14 | Ø16 | Ø20 | Ø25 |
|---|---|---|---|---|---|---|---|
| $f_{hef} = 0,05 \cdot (h_{ef} / d)^{1,68}$ | 2,39 | 2,00 | 2,07 | 1,98 | 1,58 | 1,82 | 1,79 |

### 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 $c_{min}$.

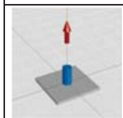
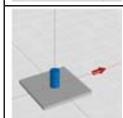
## Combined tension and shear loading

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

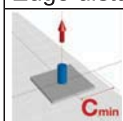
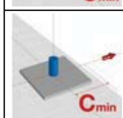
## Precalculated values

Recommended loads can be calculated by dividing the design resistance by an 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.

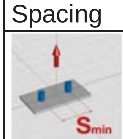
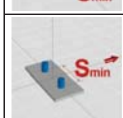
**Design resistance: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm²**

| | Hilti technical data | | | | | | |
|---|---|---|---|---|---|---|---|
| **Anchor size** | **Ø8** | **Ø10** | **Ø12** | **Ø14** | **Ø16** | **Ø20** | **Ø25** |
| Embedment depth $h_{ef,typ}$ = [mm] | 80 | 90 | 110 | 125 | 125 | 170 | 210 |
| Base material thickness $h_{min}$= [mm] | 110 | 120 | 142 | 161 | 165 | 220 | 274 |
|  **Tensile $N_{Rd}$: single anchor, no edge effects** | | | | | | | |
| BSt 500 S [kN] | 7,2 | 10,1 | 14,3 | 18,5 | 22,7 | 30,2 | 37,8 |
|  **Shear $V_{Rd}$: single anchor, no edge effects, without lever arm** | | | | | | | |
| BSt 500 S [kN] | 9,3 | 14,7 | 20,7 | 28,0 | 36,7 | 57,3 | 90,0 |

**Design resistance: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm²**

| | Hilti technical data | | | | | | |
|---|---|---|---|---|---|---|---|
| **Anchor size** | **Ø8** | **Ø10** | **Ø12** | **Ø14** | **Ø16** | **Ø20** | **Ø25** |
| Embedment depth $h_{ef,typ}$ = [mm] | 80 | 90 | 110 | 125 | 125 | 170 | 210 |
| Base material thickness $h_{min}$= [mm] | 110 | 120 | 142 | 161 | 165 | 220 | 274 |
| Edge distance c = $c_{min}$= [mm] | 40 | 50 | 60 | 70 | 80 | 100 | 125 |
|  **Tensile $N_{Rd}$: single anchor, min. edge distance (c = $c_{min}$)** | | | | | | | |
| BSt 500 S [kN] | 4,6 | 6,4 | 9,2 | 12,0 | 14,4 | 20,5 | 27,2 |
|  **Shear $V_{Rd}$: single anchor, min. edge distance (c = $c_{min}$) , without lever arm** | | | | | | | |
| BSt 500 S [kN] | 3,7 | 5,3 | 7,3 | 9,5 | 11,5 | 17,2 | 25,0 |

**Design resistance: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm²**
**(load values are valid for single anchor)**

| | Hilti technical data | | | | | | |
|---|---|---|---|---|---|---|---|
| **Anchor size** | **Ø8** | **Ø10** | **Ø12** | **Ø14** | **Ø16** | **Ø20** | **Ø25** |
| Embedment depth $h_{ef,typ}$ = [mm] | 80 | 90 | 110 | 125 | 125 | 170 | 210 |
| Base material thickness $h_{min}$= [mm] | 110 | 120 | 142 | 161 | 165 | 220 | 274 |
| Spacing s = $s_{min}$= [mm] | 40 | 50 | 60 | 70 | 80 | 100 | 125 |
|  **Tensile $N_{Rd}$: double anchor, no edge effects, min. spacing (s = $s_{min}$)** | | | | | | | |
| BSt 500 S [kN] | 5,2 | 7,2 | 10,1 | 13,0 | 15,5 | 21,5 | 27,6 |
|  **Shear $V_{Rd}$: double anchor, no edge effects, min. spacing (s = $s_{min}$) , without lever arm** | | | | | | | |
| BSt 500 S [kN] | 9,3 | 14,7 | 20,7 | 28,0 | 36,7 | 50,6 | 63,4 |