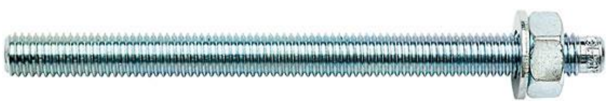
HILTI

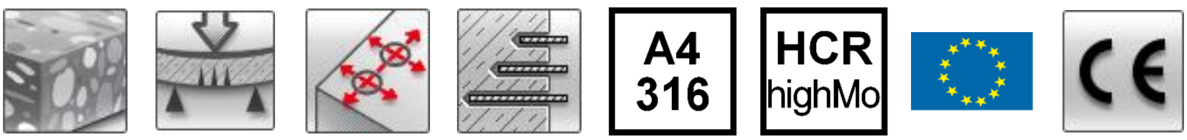
Anchor Fastening Technology Manual

Hilti HIT-HY 170 with HIT-V HIS-(R)N

03 / 2015

Hilti HIT-HY 170 with HIT-V

Injection mortar system	Benefits
 Hilti HIT-HY 170 500 ml foil pack (also available as 330 ml foil pack)  Static mixer  HIT-V rods HIT-V-F rods HIT-V-R rods HIT-V-HCR rods	- suitable for cracked and non-cracked concrete C20/25 to C50/60 - suitable for dry and water saturated concrete - small edge distance and anchor spacing possible - high corrosion resistant - in service temperature range up to 80°C short term/50°C long term - manual cleaning for drill hole sizes ≤ 18 mm and embedment depth h_{ef} ≤ 10d - embedment depth range M8: 60 to 96 mm M24: 96 to 288 mm



Concrete | Tensile zone | Small edge distance and spacing | Variable embedment depth | Corrosion resistance | High corrosion resistance | European Technical Approval | CE conformity

Approvals / certificates

Description	Authority / Laboratory	No. / date of issue
European Technical Approval [a)]	DIBt, Berlin Germany	ETA-14/0457 / 2015-03-10

a) All data given in this section according to ETA-14/0457, issued 2015-03-10.

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
- Temperate range I
  (min. base material temperature -40°C, max. long term/short term base material temperature: +24°C/40°C)
- Installation temperature range -5°C to +40°C

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
Typical embedment depth h_{ef} [mm]	80	90	110	125	170	210
Base material thickness h [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.

Anchor size			M8	M10	M12	M16	M20	M24
Non-cracked concrete								
Tensile $N_{Ru,m}$	HIT-V 5.8	[kN]	18,9	30,5	44,1	83,0	129,2	185,9
Shear $V_{Ru,m}$	HIT-V 5.8	[kN]	9,5	15,8	22,1	41,0	64,1	92,4
Cracked concrete								
Tensile $N_{Ru,m}$	HIT-V 5.8	[kN]	-	20,6	30,3	45,9	-	-
Shear $V_{Ru,m}$	HIT-V 5.8	[kN]	-	15,8	22,1	41,0	-	-

Anchor size			M8	M10	M12	M16	M20	M24
Non-cracked concrete								
Tensile N_{Rk}	HIT-V 5.8	[kN]	18	28,3	41,5	62,8	106,8	153,7
Shear V_{Rk}	HIT-V 5.8	[kN]	9,0	15,0	21,0	39,0	61,0	88,0
Cracked concrete								
Tensile N_{Rk}	HIT-V 5.8	[kN]	-	15,6	22,8	34,6	-	-
Shear V_{Rk}	HIT-V 5.8	[kN]	-	15,0	21,0	39,0	-	-

Anchor size			M8	M10	M12	M16	M20	M24
Non-cracked concrete								
Tensile N_{Rd}	HIT-V 5.8	[kN]	12,0	18,8	27,6	41,9	71,2	102,5
Shear V_{Rd}	HIT-V 5.8	[kN]	7,2	12,0	16,8	31,2	48,8	70,4
Cracked concrete								
Tensile N_{Rd}	HIT-V 5.8	[kN]	-	10,4	15,2	23,0	-	-
Shear V_{Rd}	HIT-V 5.8	[kN]	-	12,0	16,8	31,2	-	-

Anchor size			M8	M10	M12	M16	M20	M24
Non-cracked concrete								
Tensile N_{rec}	HIT-V 5.8	[kN]	8,6	13,5	19,7	29,9	50,9	73,2
Shear V_{rec}	HIT-V 5.8	[kN]	5,1	8,6	12,0	22,3	34,9	50,3
Cracked concrete								
Tensile N_{rec}	HIT-V 5.8	[kN]	-	7,4	10,9	16,5	-	-
Shear V_{rec}	HIT-V 5.8	[kN]	-	8,6	12,0	22,3	-	-

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

Service temperature range

Hilti HIT-HY 170 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	+24 °C	+40 °C
Temperature range II	-40 °C to +80 °C	+50 °C	+80 °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

Anchor size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Nominal tensile strength f_{uk}	HIT-V 5.8	[N/mm²]	500	500	500	500	500	500
	HIT-V 8.8	[N/mm²]	800	800	800	800	800	800
	HIT-V-R	[N/mm²]	700	700	700	700	700	700
	HIT-V-HCR	[N/mm²]	800	800	800	800	800	700
Yield strength f_{yk}	HIT-V 5.8	[N/mm²]	400	400	400	400	400	400
	HIT-V 8.8	[N/mm²]	640	640	640	640	640	640
	HIT-V-R	[N/mm²]	450	450	450	450	450	450
	HIT-V-HCR	[N/mm²]	640	640	640	640	640	400
Stressed cross-section A_s	HIT-V	[mm²]	36,6	58,0	84,3	157	245	353
Moment of resistance W	HIT-V	[mm³]	31,2	62,3	109	277	541	935

Material quality

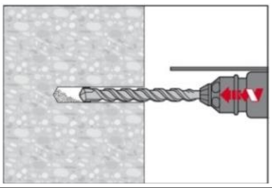
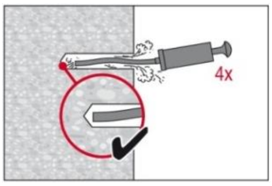
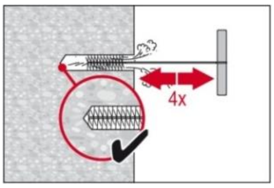
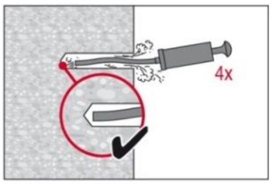
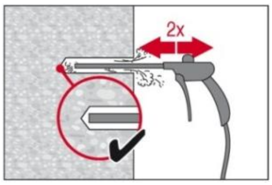
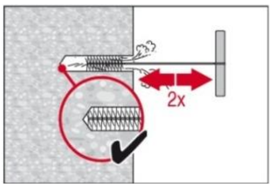
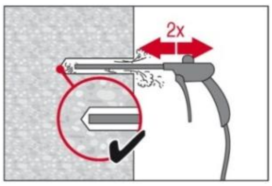
Part	Material
Threaded rod HIT-V(-F) 5.8	Strength class 5.8, A_5 > 8% ductile Steel galvanized ≥ 5 µm, (F) hot dipped galvanized ≥ 45 µm,
Threaded rod HIT-V(-F) 8.8	Strength class 8.8, A_5 > 8% ductile Steel galvanized ≥ 5 µm, (F) hot dipped galvanized ≥ 45 µm,
Threaded rod HIT-V-R	Stainless steel, A_5 > 8% ductile Strength class 70, 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362
Threaded rod HIT-V-HCR	High corrosion resistant steel, 1.4529; 1.4565 For ≤ M20: R_m = 800 N/mm², $R_{p\,0.2}$ = 640 N/mm², A_5 > 8% ductile For M24: R_m = 700 N/mm², $R_{p\,0.2}$ = 400 N/mm², A_5 > 8% ductile
Washer ISO 7089	Steel galvanized ≥ 5 µm, Hot dipped galvanized ≥ 45 µm
	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 of nut adapted to strength class of threaded rod Steel galvanized ≥ 5 µm, Hot dipped galvanized ≥ 45 µm
	Strength class of nut adapted to strength class of threaded rod Stainless steel 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362
	Strength class of nut adapted to strength class of threaded rod High corrosion resistant steel 1.4529; 1.4565

Setting

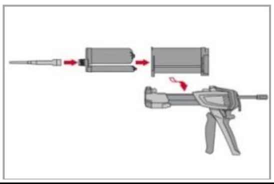
Installation equipment

Anchor size	M8	M10	M12	M16	M20	M24
Rotary hammer	TE 2 – TE 30				TE 40 – TE 70	
Other tools	compressed air gun or blow out pump, set of cleaning brushes, dispenser					

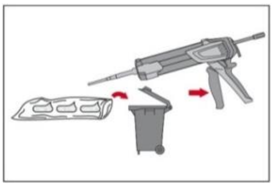
Setting instructions

Hole drilling	
Hammer drilling	
	Drill hole to the required embedment depth with a hammer drill set in rotation-hammer mode using an appropriately sized carbide drill bit.
Drill hole cleaning	Just before setting an anchor, the drill hole must be free of dust and debris. Inadequate hole cleaning = poor load values.
Manual Cleaning (MC)	**Non-cracked concrete only** for drill hole diameters $d_0 \leq 18$ mm and drill hole depths $h_0 \leq 10 \cdot d$
	The Hilti manual pump may be used for blowing out drill holes up to diameters $d_0 \leq 18$ mm and embedment depths up to $h_{ef} \leq 10 \cdot d$. Blow out at least 4 times from the back of the drill hole until return air stream is free of noticeable dust
	Brush 4 times with the specified brush by inserting the steel brush Hilti HIT-RB to the back of the hole (if needed with extension) in a twisting motion and removing it. The brush must produce natural resistance as it enters the drill hole (brush Ø ≥ drill hole Ø) - if not the brush is too small and must be replaced with the proper brush diameter.
	Blow out again with manual pump at least 4 times until return air stream is free of noticeable dust.
	Blow 2 times from the back of the hole (if needed with nozzle extension) over the hole length with oil-free compressed air (min. 6 bar at 6 m³/h) until return air stream is free of noticeable dust.
	Brush 2 times with the specified brush by inserting the steel brush Hilti HIT-RB to the back of the hole (if needed with extension) in a twisting motion and removing it. The brush must produce natural resistance as it enters the drill hole (brush Ø ≥ drill hole Ø) - if not the brush is too small and must be replaced with the proper brush diameter.
	Blow again with compressed air 2 times until return air stream is free of noticeable dust.

Injection preparation



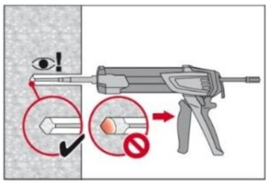
Tightly attach new Hilti mixing nozzle HIT-RE-M to foil pack manifold (snug fit). Do not modify the mixing nozzle.
Observe the instruction for use of the dispenser.
Check foil pack holder for proper function. Do not use damaged foil packs / holders.
Insert foil pack into foil pack holder and put holder into HIT-dispenser.



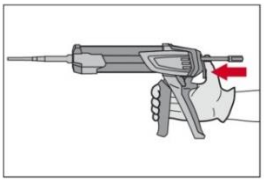
Discard initial adhesive. The foil pack opens automatically as dispensing is initiated. Depending on the size of the foil pack an initial amount of adhesive has to be discarded.
Discarded quantities are

2 strokes	for 330 ml foil pack,
3 strokes	for 500 ml foil pack

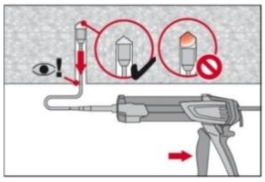
Inject adhesive from the back of the drill hole without forming air voids.



Inject the adhesive starting at the back of the hole, slowly withdrawing the mixer with each trigger pull.
Fill holes approximately 2/3 full, or as required to ensure that the annular gap between the anchor and the concrete is completely filled with adhesive along the embedment length.

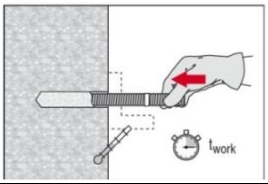


After injection is completed, depressurize the dispenser by pressing the release trigger. This will prevent further adhesive discharge from the mixer.

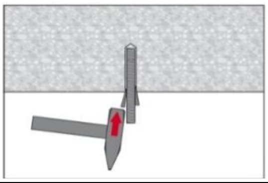


Overhead installation and/or installation with embedment depth h_{ef} > 250mm.
For overhead installation the injection is only possible with the aid of extensions and piston plugs. Assemble HIT-RE-M mixer, extension(s) and appropriately sized piston plug HIT-SZ. Insert piston plug to back of the hole and inject adhesive. During injection the piston plug will be naturally extruded out of the drill hole by the adhesive pressure

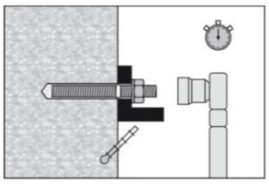
Setting the element



Before use, verify that the element is dry and free of oil and other contaminants.
Mark and set element to the required embedment depth until working time t_{work} has elapsed. The working time t_{work} is given in the next page.



For overhead installation use piston plugs and fix embedded parts with e.g. wedges (HIT-OHW).



Loading the anchor: After required curing time t_{cure} the anchor can be loaded.
The applied installation torque shall not exceed the values T_{max} given in the Setting details table.

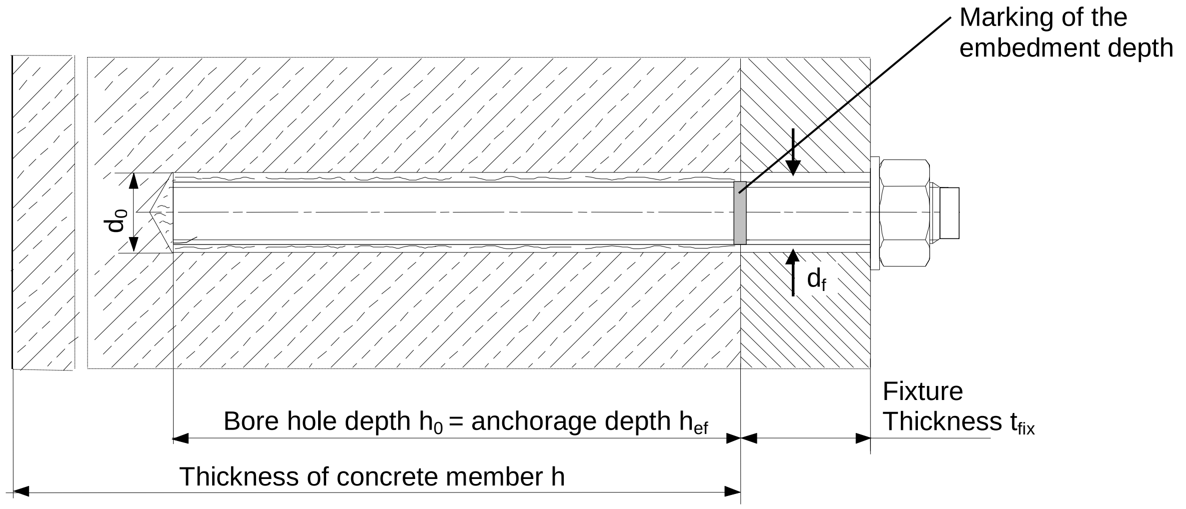
For detailed information on installation see instruction for use given with the package of the product.

Working time and curing time

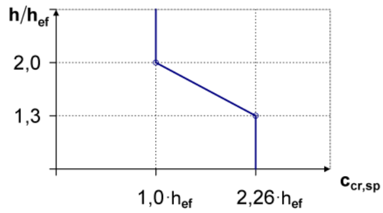
Temperature in the base material T			Maximum working time t_{work}	Maximum curing time t_{cure} a)
-5 °C	to	0 °C	10 min	12 h
> 0 °C	to	5 °C	10 min	5 h
> 5 °C	to	10 °C	8 min	2,5 h
> 10 °C	to	20 °C	5 min	1,5 h
> 20 °C	to	30 °C	3 min	45 min
> 30 °C	to	40 °C	2 min	30 min

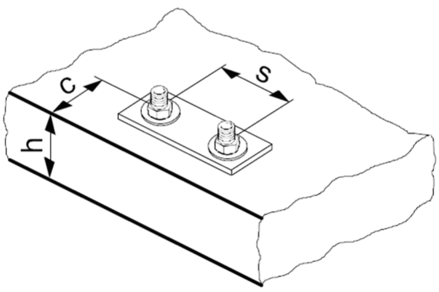
a) The curing time data are valid for dry base material only. In wet base material, curing times must be doubled.

Setting details



Setting details

Anchor size			M8	M10	M12	M16	M20	M24
Nominal diameter of drill bit	d_0	[mm]	10	12	14	18	22	28
Eff. embedment h_{ef} and drill hole depth range h_0 a) **for HIT-V**	$h_{ef,min}$	[mm]	60	60	70	80	90	96
	$h_{ef,max}$	[mm]	96	120	144	192	240	288
Minimum base material thickness	h_{min}	[mm]	h_{ef} + 30 mm ≥ 100 mm			$h_{ef} + 2\ d_0$		
Max. diameter of clearance hole in the fixture	d_f	[mm]	9	12	14	18	22	26
Max. torque moment	T_{max} b)	[Nm]	10	20	40	80	150	200
Minimum spacing	s_{min}	[mm]	40	50	60	80	100	120
Min. edge distance	c_{min}	[mm]	40	50	60	80	100	120
Critical spacing for splitting failure	$s_{cr,sp}$	[mm]	$2\ c_{cr,sp}$					
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	$s_{cr,N}$	[mm]	$2\ c_{cr,N}$					
Critical edge distance for concrete cone failure d)	$c_{cr,N}$	[mm]	$1{,}5\ h_{ef}$					



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

a) Embedment depth range: $h_{ef,min} \leq h_{ef} \leq h_{ef,max}$

b) Maximum recommended torque moment to avoid splitting failure during installation with minimum spacing and/or edge distance.

c) h: base material thickness ($h \geq h_{min}$), h_{ef}: embedment depth

d) 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.

- 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

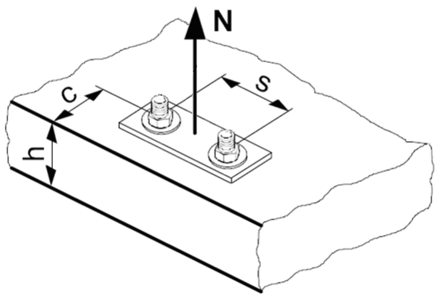
The design tensile resistance is the lower value of

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

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

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

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



Basic design tensile resistance

Design steel resistance $N_{Rd,s}$

Anchor size			M8	M10	M12	M16	M20	M24
$N_{Rd,s}$	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
	HIT-V-R	[kN]	13,9	21,9	31,6	58,8	92,0	132,1
	HIT-V-HCR	[kN]	19,3	30,7	44,7	84,0	130,7	117,6

Design combined pull-out and concrete cone resistance

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

Anchor size			M8	M10	M12	M16	M20	M24
Typical embedment depth $h_{ef} = h_{ef,typ}$		**[mm]**	**80**	**90**	**110**	**125**	**170**	**210**
Non-cracked concrete								
$N^0_{Rd,p}$	Temperature range I	[kN]	13,4	18,8	27,6	41,9	71,2	105,6
$N^0_{Rd,p}$	Temperature range II	[kN]	10,1	14,1	20,7	31,4	53,4	79,2
Cracked concrete								
$N^0_{Rd,p}$	Temperature range I	[kN]	-	10,4	15,2	23,0	-	-
$N^0_{Rd,p}$	Temperature range II	[kN]	-	7,5	11,1	16,8	-	-

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

Anchor size			M8	M10	M12	M16	M20	M24
$N^0_{Rd,c}$	Non-cracked concrete	[kN]	24,1	28,7	38,8	47,1	74,6	102,5
$N^0_{Rd,c}$	Cracked concrete	[kN]	-	20,5	27,7	33,5	-	-

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
$f_{B,p} = (f_{ck,cube}/25N/mm^2)^{0,15}$ a)	1,00	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

$$f_{h,p} = h_{ef}/h_{ef,typ}$$

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
$f_B = (f_{ck,cube}/25N/mm^2)^{0,5}$ 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)

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

a) The edge distance shall not be smaller than the minimum edge distance c_{min}. These influencing factors must be considered for every edge distance smaller than the critical edge distance.

Influence of anchor spacing a)

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

a) The anchor spacing shall not be smaller than the minimum anchor spacing s_{min}. This influencing factor must be considered for every anchor spacing.

Influence of embedment depth on concrete cone resistance

$$f_{h,N} = (h_{ef}/h_{ef,typ})^{1,5}$$

Influence of reinforcement

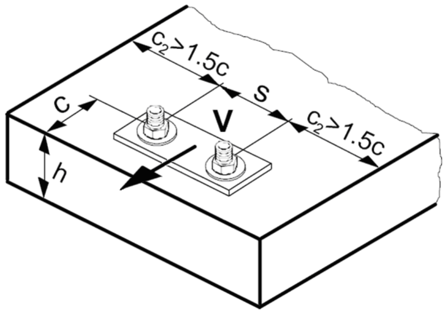
h_{ef} [mm]	40	50	60	70	80	90	≥ 100
$f_{re,N}$ = 0,5 + h_{ef}/200mm ≤ 1	0,7 a)	0,75 a)	0,8 a)	0,85 a)	0,9 a)	0,95 a)	1

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 $V_{Rd,s}$

Anchor size			M8	M10	M12	M16	M20	M24
$V_{Rd,s}$	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 concrete pryout resistance $V_{Rd,cp}$ = lower value a) of k · $N_{Rd,p}$ and k · $N_{Rd,c}$

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	M24
Non-cracked concrete							
$V^0_{Rd,c}$	[kN]	5,9	8,6	11,6	18,7	27	36,6
Cracked concrete							
$V^0_{Rd,c}$	[kN]	-	6,1	8,2	13,2	-	-

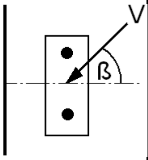
Influencing factors

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°
$f_\beta = \sqrt{\dfrac{1}{(\cos\alpha_V)^2 + \left(\dfrac{\sin\alpha_V}{2{,}5}\right)^2}}$		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

h_{ef}/d	4	4,5	5	6	7	8	9	10	11
$f_{hef} = 0{,}05 \cdot (h_{ef} / d)^{1,68}$	0,51	0,63	0,75	1,01	1,31	1,64	2,00	2,39	2,81
h_{ef}/d	12	13	14	15	16	17	18	19	20
$f_{hef} = 0{,}05 \cdot (h_{ef} / d)^{1,68}$	3,25	3,72	4,21	4,73	5,27	5,84	6,42	7,04	7,67

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

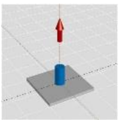
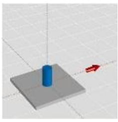
For combined tension and shear loading see section “Anchor Design”.

Precalculated values – design resistance values

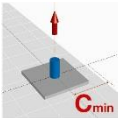
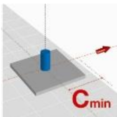
All data applies to:
- non-cracked concrete C 20/25 – $f_{ck,cube}$ =25 N/mm²
- temperature range I (see Service temperature range)
- minimum thickness of base material
- no effects of dense reinforcement

Recommended loads can be calculated by dividing the design resistance by an overall partial safety factor for action γ = 1,4. The partial safety factors for action depend on the type of loading and shall be taken from national regulations.

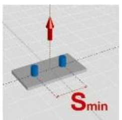
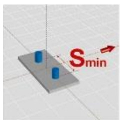
Design resistance: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm² - minimum embedment depth

Anchor size			M8	M10	M12	M16	M20	M24
Embedment depth $h_{ef} = h_{ef,min}$		[mm]	60	60	70	80	90	96
Base material thickness $h = h_{min}$		[mm]	100	100	100	116	134	152
	Tensile N_{Rd}: single anchor, no edge effects							
	Non-cracked concrete							
	HIT-V 5.8	[kN]	10,1	12,6	17,6	24,1	28,7	31,7
	HIT-V 8.8	[kN]						
	HIT-V-R	[kN]						
	HIT-V-HCR	[kN]						
	Cracked concrete							
	HIT-V 5.8	[kN]	-	6,9	9,7	14,7	-	-
	HIT-V 8.8	[kN]						
	HIT-V-R	[kN]						
	HIT-V-HCR	[kN]						
	Shear V_{Rd}: single anchor, no edge effects, without lever arm							
	Non-cracked concrete							
	HIT-V 5.8	[kN]	7,2	12,0	16,8	31,2	48,8	63,3
	HIT-V 8.8	[kN]	12,0	18,4	27,2	48,2	57,5	63,3
	HIT-V-R	[kN]	8,3	12,8	19,2	35,3	55,1	63,3
	HIT-V-HCR	[kN]	12,0	18,4	27,2	48,2	57,5	63,3
	Cracked concrete							
	HIT-V 5.8	[kN]	-	12,0	16,8	29,5	-	-
	HIT-V 8.8	[kN]	-	13,8	19,4	29,5	-	-
	HIT-V-R	[kN]	-	12,8	19,2	29,5	-	-
	HIT-V-HCR	[kN]	-	13,8	19,4	29,5	-	-

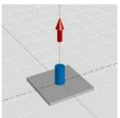
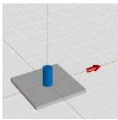
Design resistance: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm² - minimum embedment depth

Anchor size			M8	M10	M12	M16	M20	M24
Embedment depth	$h_{ef} = h_{ef,min}$	[mm]	60	60	70	80	90	96
Base material thickness	$h = h_{min}$	[mm]	100	100	100	116	134	152
Edge distance	$c = c_{min}$	[mm]	40	50	60	80	100	120
	Tensile N_{Rd}: single anchor, min. edge distance ($c = c_{min}$)							
	Non-cracked concrete							
	HIT-V 5.8	[kN]	6,1	8,5	11,6	15,4	19,8	24,8
	HIT-V 8.8	[kN]						
	HIT-V-R	[kN]						
	HIT-V-HCR	[kN]						
	Cracked concrete							
	HIT-V 5.8	[kN]	-	4,7	6,6	11,1	-	-
	HIT-V 8.8	[kN]						
	HIT-V-R	[kN]						
	HIT-V-HCR	[kN]						
	Shear V_{Rd}: single anchor, min. edge distance ($c = c_{min}$), without lever arm							
	Non-cracked concrete							
	HIT-V 5.8	[kN]	3,5	4,9	6,6	10,2	13,9	17,9
	HIT-V 8.8	[kN]						
	HIT-V-R	[kN]						
	HIT-V-HCR	[kN]						
	Cracked concrete							
	HIT-V 5.8	[kN]	-	3,5	4,7	7,2	-	-
	HIT-V 8.8	[kN]						
	HIT-V-R	[kN]						
	HIT-V-HCR	[kN]						

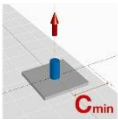
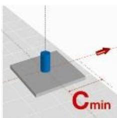
Design resistance: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm² - minimum embedment depth
(load values are valid for single anchor)

Anchor size			M8	M10	M12	M16	M20	M24
Embedment depth	$h_{ef} = h_{ef,min}$	[mm]	60	60	70	80	90	96
Base material thickness	$h = h_{min}$	[mm]	100	100	100	116	134	152
Spacing	$s = s_{min}$	[mm]	40	50	60	80	100	120
	Tensile N_{Rd}: double anchor, no edge effects, min. spacing ($s = s_{min}$)							
	Non-cracked concrete							
	HIT-V 5.8	[kN]	6,8	8,5	11,6	15,1	18,5	21,5
	HIT-V 8.8	[kN]						
	HIT-V-R	[kN]						
	HIT-V-HCR	[kN]						
	Cracked concrete							
	HIT-V 5.8	[kN]	-	4,9	6,7	10,2	-	-
	HIT-V 8.8	[kN]						
	HIT-V-R	[kN]						
	HIT-V-HCR	[kN]						
	Shear V_{Rd}: double anchor, no edge effects, min. spacing ($s = s_{min}$), without lever arm							
	Non-cracked concrete							
	HIT-V 5.8	[kN]	7,2	12,0	16,8	31,2	39,4	44,9
	HIT-V 8.8	[kN]	12,0	16,1	22,6	32,1	39,4	44,9
	HIT-V-R	[kN]	8,3	12,8	19,2	32,1	39,4	44,9
	HIT-V-HCR	[kN]	12,0	16,1	22,6	32,1	39,4	44,9
	Cracked concrete							
	HIT-V 5.8	[kN]	-	8,8	12,4	19,7	-	-
	HIT-V 8.8	[kN]						
	HIT-V-R	[kN]						
	HIT-V-HCR	[kN]						

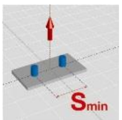
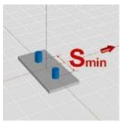
Design resistance: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm² - typical embedment depth

Anchor size			M8	M10	M12	M16	M20	M24
Embedment depth	$h_{ef} = h_{ef,typ}$	[mm]	80	90	110	125	170	210
Base material thickness	$h = h_{min}$	[mm]	110	120	140	161	214	266
	Tensile N_{Rd}: single anchor, no edge effects							
	Non-cracked concrete							
	HIT-V 5.8	[kN]	12,0	18,8	27,6	41,9	71,2	102,5
	HIT-V 8.8	[kN]	13,4	18,8	27,6	41,9	71,2	102,5
	HIT-V-R	[kN]	13,4	18,8	27,6	41,9	71,2	102,5
	HIT-V-HCR	[kN]	13,4	18,8	27,6	41,9	71,2	102,5
	Cracked concrete							
	HIT-V 5.8	[kN]	-	10,4	15,2	23,0	-	-
	HIT-V 8.8	[kN]						
	HIT-V-R	[kN]						
	HIT-V-HCR	[kN]						
	Shear V_{Rd}: single anchor, no edge effects, without lever arm							
	Non-cracked concrete							
	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
	Cracked concrete							
	HIT-V 5.8	[kN]	-	12,0	16,8	31,2	-	-
	HIT-V 8.8	[kN]	-	18,4	27,2	46,1	-	-
	HIT-V-R	[kN]	-	12,8	19,2	35,3	-	-
	HIT-V-HCR	[kN]	-	18,4	27,2	46,1	-	-

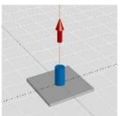
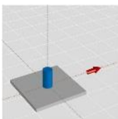
Design resistance: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm² - typical embedment depth

Anchor size			M8	M10	M12	M16	M20	M24
Embedment depth	$h_{ef} = h_{ef,typ}$	[mm]	80	90	110	125	170	210
Base material thickness	$h = h_{min}$	[mm]	110	120	140	161	214	266
Edge distance	$c = c_{min}$	[mm]	40	50	60	80	100	120
	Tensile N_{Rd}: single anchor, min. edge distance ($c = c_{min}$)							
	Non-cracked concrete							
	HIT-V 5.8	[kN]	8,0	11,2	16,4	23,7	36,6	49,8
	HIT-V 8.8	[kN]						
	HIT-V-R	[kN]						
	HIT-V-HCR	[kN]						
	Cracked concrete							
	HIT-V 5.8	[kN]	-	6,2	9,0	13,7	-	-
	HIT-V 8.8	[kN]						
	HIT-V-R	[kN]						
	HIT-V-HCR	[kN]						
	Non-cracked concrete							
	HIT-V 5.8	[kN]	3,7	5,3	7,3	11,5	17,2	23,6
	HIT-V 8.8	[kN]						
	HIT-V-R	[kN]						
	HIT-V-HCR	[kN]						
	Cracked concrete							
	HIT-V 5.8	[kN]	-	3,8	5,2	8,1	-	-
	HIT-V 8.8	[kN]						
	HIT-V-R	[kN]						
	HIT-V-HCR	[kN]						

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

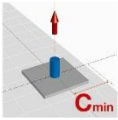
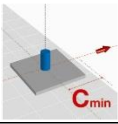
Anchor size		M8	M10	M12	M16	M20	M24
Embedment depth	$h_{ef} = h_{ef,typ}$ [mm]	80	90	110	125	170	210
Base material thickness	$h = h_{min}$ [mm]	110	120	140	161	214	266
Spacing	$s = s_{min}$ [mm]	40	50	60	80	100	120
	Tensile N_{Rd}: double anchor, no edge effects, min. spacing ($s = s_{min}$)						
	Non-cracked concrete						
	HIT-V 5.8 [kN]	9,2	12,6	18,3	26,3	42,2	57,7
	HIT-V 8.8 [kN]						
	HIT-V-R [kN]						
	HIT-V-HCR [kN]						
	Cracked concrete						
	HIT-V 5.8 [kN]	-	7,2	10,5	15,4	-	-
	HIT-V 8.8 [kN]						
	HIT-V-R [kN]						
	HIT-V-HCR [kN]						
	Shear V_{Rd}: double anchor, no edge effects, min. spacing ($s = s_{min}$), without lever arm						
	Non-cracked concrete						
	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
	Cracked concrete						
	HIT-V 5.8 [kN]	-	12,0	16,8	28,0	-	-
	HIT-V 8.8 [kN]	-	12,3	18,0	28,0	-	-
	HIT-V-R [kN]	-	12,3	18,0	28,0	-	-
	HIT-V-HCR [kN]	-	12,3	18,0	28,0	-	-

Design resistance: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm² - embedment depth = 12 d [a)]

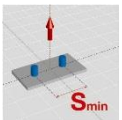
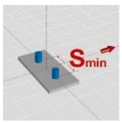
Anchor size		M8	M10	M12	M16	M20	M24
Embedment depth	h_{ef} = 12 d [a)] [mm]	96	120	144	192	240	288
Base material thickness	$h = h_{min}$ [mm]	126	150	174	228	284	344
	Tensile N_{Rd}: single anchor, no edge effects						
	Non-cracked concrete						
	HIT-V 5.8 [kN]	12,0	19,3	28,0	52,7	82,0	118,0
	HIT-V 8.8 [kN]	16,1	25,1	36,2	64,3	100,5	144,8
	HIT-V-R [kN]	13,9	21,9	31,6	58,8	92,0	132,1
	HIT-V-HCR [kN]	16,1	25,1	36,2	64,3	100,5	117,6
	Cracked concrete						
	HIT-V 5.8 [kN]	-	13,8	19,9	35,4	-	-
	HIT-V 8.8 [kN]						
	HIT-V-R [kN]						
	HIT-V-HCR [kN]						
	Shear V_{Rd}: single anchor, no edge effects, without lever arm						
	Non-cracked concrete						
	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
	Cracked concrete						
	HIT-V 5.8 [kN]	-	12,0	16,8	31,2	-	-
	HIT-V 8.8 [kN]	-	18,4	27,2	50,4	-	-
	HIT-V-R [kN]	-	12,8	19,2	35,3	-	-
	HIT-V-HCR [kN]	-	18,4	27,2	50,4	-	-

a) d = element diameter

Design resistance: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm² - embedment depth = 12 d [a)]

Anchor size		M8	M10	M12	M16	M20	M24
Embedment depth h_{ef} = 12 d [a)]	[mm]	96	120	144	192	240	288
Base material thickness h = h_{min}	[mm]	126	150	174	228	284	344
Edge distance c = c_{min}	[mm]	40	50	60	80	100	120
Tensile N_{Rd}: single anchor, min. edge distance (c = c_{min})							
Non-cracked concrete							
HIT-V 5.8 HIT-V 8.8 HIT-V-R HIT-V-HCR	[kN] [kN] [kN] [kN]	9,6	14,9	21,5	38,3	56,0	73,6
Cracked concrete							
 HIT-V 5.8 HIT-V 8.8 HIT-V-R HIT-V-HCR	[kN] [kN] [kN] [kN]	-	8,2	11,8	21,0	-	-
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] [kN] [kN] [kN]	3,9	5,7	7,8	12,9	18,9	25,9
Cracked concrete							
 HIT-V 5.8 HIT-V 8.8 HIT-V-R HIT-V-HCR	[kN] [kN] [kN] [kN]	-	4,0	5,5	9,1	-	-

Design resistance: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm² - embedment depth = 12 d [a)]
(load values are valid for single anchor)

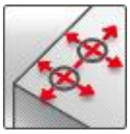
Anchor size		M8	M10	M12	M16	M20	M24
Embedment depth h_{ef} = 12 d [a)]	[mm]	96	120	144	192	240	288
Base material thickness h = h_{min}	[mm]	126	150	174	228	284	344
Spacing s=s_{min}	[mm]	40	50	60	80	100	120
Tensile N_{Rd}: double anchor, no edge effects, min. spacing (s = s_{min})							
Non-cracked concrete							
HIT-V 5.8 HIT-V 8.8 HIT-V-R HIT-V-HCR	[kN] [kN] [kN] [kN]	11,2	17,2	24,5	42,5	64,9	89,9
Cracked concrete							
 HIT-V 5.8 HIT-V 8.8 HIT-V-R HIT-V-HCR	[kN] [kN] [kN] [kN]	-	9,7	13,9	24,3	-	-
Shear V_{Rd}: double anchor, no edge effects, min. spacing (s = s_{min}) , without lever arm							
Non-cracked concrete							
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
Cracked concrete							
 HIT-V 5.8	[kN]	-	12,0	16,8	31,2	-	-
HIT-V 8.8	[kN]	-	15,7	22,7	40,3	-	-
HIT-V-R	[kN]	-	12,8	19,2	35,3	-	-
HIT-V-HCR	[kN]	-	15,7	22,7	40,3	-	-

a) d = element diameter

Hilti HIT-HY 170 with HIS-(R)N

Injection mortar system		Benefits
	Hilti HIT-HY 170 500 ml foil pack (also available as 330 ml foil pack)	- suitable for non-cracked concrete C 20/25 to C 50/60 - suitable for dry and water saturated concrete - small edge distance and anchor spacing possible - corrosion resistant - in service temperature range up to 80°C short term/50°C long term - manual cleaning for drill hole sizes ≤ 18 mm
	Static mixer	
	Internal threaded sleeve HIS-N HIS-RN	

Concrete



Small edge distance and spacing

Corrosion resistance

European Technical Approval

CE conformity

Approvals / certificates

Description	Authority / Laboratory	No. / date of issue
European Technical Approval [a)]	DIBt, Berlin Germany	ETA-14/0457 / 2015-03-10

a) All data given in this section according to ETA-14/0457, issued 2015-03-10.

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
- <u>One</u> anchor material, as specified in the tables
- Concrete C 20/25, $f_{ck,cube}$ = 25 N/mm²
- Temperate range I
  (min. base material temperature -40°C, max. long term/short term base material temperature: +24°C/40°C)
- Installation temperature range -5°C to +40°C

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

Anchor size			M8x90	M10x110	M12x125	M16x170
Embedment depth	h_{ef}	[mm]	90	110	125	170
Base material thickness	h	[mm]	120	150	170	230

Mean ultimate resistance: non-cracked concrete C 20/25 , anchor HIS-N

Anchor size			M8x90	M10x110	M12x125	M16x170
Tensile $N_{Ru,m}$	HIS-N	[kN]	26,3	48,3	70,4	131,3
Shear $V_{Ru,m}$	HIS-N	[kN]	13,7	24,2	35,7	66,2

Characteristic resistance: non-cracked concrete C 20/25 , anchor HIS-N

Anchor size			M8x90	M10x110	M12x125	M16x170
Tensile N_{Rk}	HIS-N	[kN]	25,0	46,0	67,0	111,9
Shear V_{Rk}	HIS-N	[kN]	13,0	23,0	34,0	63,0

Design resistance: non-cracked concrete C 20/25 , anchor HIS-N

Anchor size			M8x90	M10x110	M12x125	M16x170
Tensile N_{Rd}	HIS-N	[kN]	16,7	30,7	44,7	74,6
Shear V_{Rd}	HIS-N	[kN]	10,4	18,4	27,2	50,4

Recommended loads [a)]: non-cracked concrete C 20/25 , anchor HIS-N

Anchor size			M8x90	M10x110	M12x125	M16x170
Tensile N_{rec}	HIS-N	[kN]	11,9	21,9	31,9	53,3
Shear V_{rec}	HIS-N	[kN]	7,4	13,1	19,4	36,0

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

Service temperature range

Hilti HIT-HY 170 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	+24 °C	+40 °C
Temperature range II	-40 °C to +80 °C	+50 °C	+80 °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

Anchor size			M8x90	M10x110	M12x125	M16x170
Nominal tensile strength f_{uk}	HIS-N	[N/mm²]	490	490	490	490
	Screw 8.8	[N/mm²]	800	800	800	800
	HIS-RN	[N/mm²]	700	700	700	700
	Screw A4-70	[N/mm²]	700	700	700	700
Yield strength f_{yk}	HIS-N	[N/mm²]	390	390	390	390
	Screw 8.8	[N/mm²]	640	640	640	640
	HIS-RN	[N/mm²]	350	350	350	350
	Screw A4-70	[N/mm²]	450	450	450	450
Stressed cross-section A_s	HIS-(R)N	[mm²]	51,5	108,0	169,1	256,1
	Screw	[mm²]	36,6	58	84,3	157
Moment of resistance W	HIS-(R)N	[mm³]	145	430	840	1595
	Screw	[mm³]	31,2	62,3	109	277

Material quality

Part	Material
Internal threaded sleeve [a)] HIS-N	Steel galvanized ≥ 5µm
Internal threaded sleeve [a)] 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 Internal threaded sleeve HIS-N / HIS-RN			M8x90	M10x110	M12x125	M16x170
Embedment depth	h_{ef}	[mm]	90	110	125	170

Setting

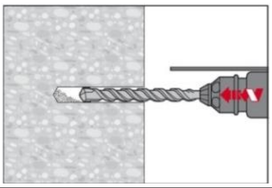
installation equipment

Anchor size	M8x90	M10x110	M12x125	M16x170
Rotary hammer	TE 2 – TE 30		TE 40 – TE 70	
Other tools	compressed air gun or blow out pump, set of cleaning brushes, dispenser			

Setting instructions

Hole drilling

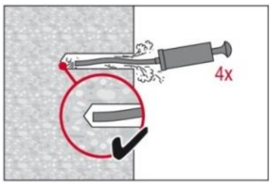
Hammer drilling



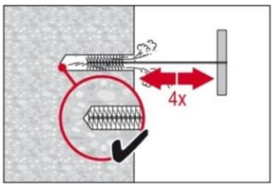
Drill hole to the required embedment depth with a hammer drill set in rotation-hammer mode using an appropriately sized carbide drill bit.

Drill hole cleaning Just before setting an anchor, the drill hole must be free of dust and debris. Inadequate hole cleaning = poor load values.

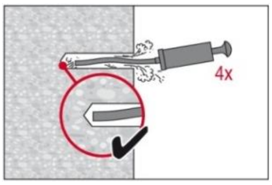
Manual Cleaning (MC) **Non-cracked concrete only**
for drill hole diameters $d_0 \leq 18$ mm and drill hole depths $h_0 \leq 10 \cdot d$



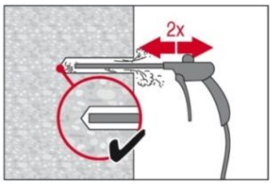
The Hilti manual pump may be used for blowing out drill holes up to diameters $d_0 \leq 18$ mm and embedment depths up to $h_{ef} \leq 10 \cdot d$.
Blow out at least 4 times from the back of the drill hole until return air stream is free of noticeable dust



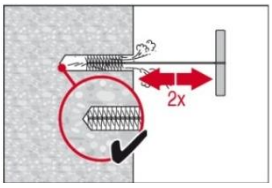
Brush 4 times with the specified brush by inserting the steel brush Hilti HIT-RB to the back of the hole (if needed with extension) in a twisting motion and removing it.
The brush must produce natural resistance as it enters the drill hole (brush Ø ≥ drill hole Ø) - if not the brush is too small and must be replaced with the proper brush diameter.



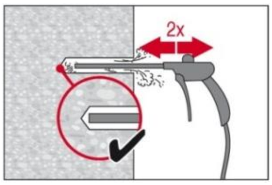
Blow out again with manual pump at least 4 times until return air stream is free of noticeable dust.



Blow 2 times from the back of the hole (if needed with nozzle extension) over the hole length with oil-free compressed air (min. 6 bar at 6 m³/h) until return air stream is free of noticeable dust.

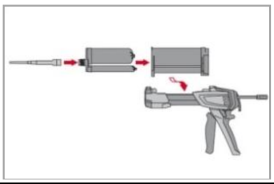


Brush 2 times with the specified brush by inserting the steel brush Hilti HIT-RB to the back of the hole (if needed with extension) in a twisting motion and removing it.
The brush must produce natural resistance as it enters the drill hole (brush Ø ≥ drill hole Ø) - if not the brush is too small and must be replaced with the proper brush diameter.

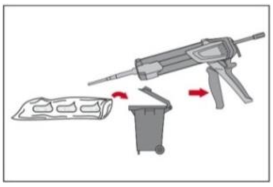


Blow again with compressed air 2 times until return air stream is free of noticeable dust.

Injection preparation



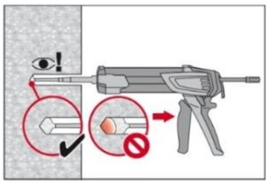
Tightly attach new Hilti mixing nozzle HIT-RE-M to foil pack manifold (snug fit). Do not modify the mixing nozzle.
Observe the instruction for use of the dispenser.
Check foil pack holder for proper function. Do not use damaged foil packs / holders.
Insert foil pack into foil pack holder and put holder into HIT-dispenser.



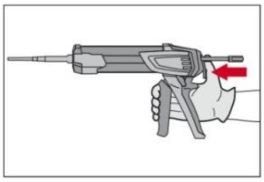
Discard initial adhesive. The foil pack opens automatically as dispensing is initiated.
Depending on the size of the foil pack an initial amount of adhesive has to be discarded.
Discarded quantities are

2 strokes	for 330 ml foil pack,
3 strokes	for 500 ml foil pack

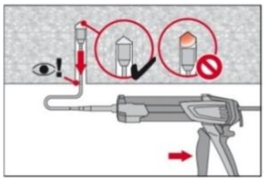
Inject adhesive from the back of the drill hole without forming air voids.



Inject the adhesive starting at the back of the hole, slowly withdrawing the mixer with each trigger pull.
Fill holes approximately 2/3 full, or as required to ensure that the annular gap between the anchor and the concrete is completely filled with adhesive along the embedment length.

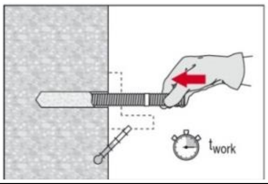


After injection is completed, depressurize the dispenser by pressing the release trigger. This will prevent further adhesive discharge from the mixer.

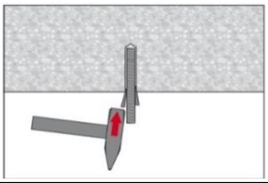


Overhead installation and/or installation with embedment depth h_{ef} > 250mm.
For overhead installation the injection is only possible with the aid of extensions and piston plugs. Assemble HIT-RE-M mixer, extension(s) and appropriately sized piston plug HIT-SZ. Insert piston plug to back of the hole and inject adhesive. During injection the piston plug will be naturally extruded out of the drill hole by the adhesive pressure

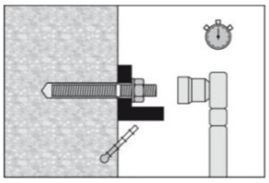
Setting the element



Before use, verify that the element is dry and free of oil and other contaminants.
Mark and set element to the required embedment depth until working time t_{work} has elapsed. The working time t_{work} is given in the next table.



For overhead installation use piston plugs and fix embedded parts with e.g. wedges (HIT-OHW).



Loading the anchor: After required curing time t_{cure} the anchor can be loaded.
The applied installation torque shall not exceed the values T_{max} given in the Setting details table.

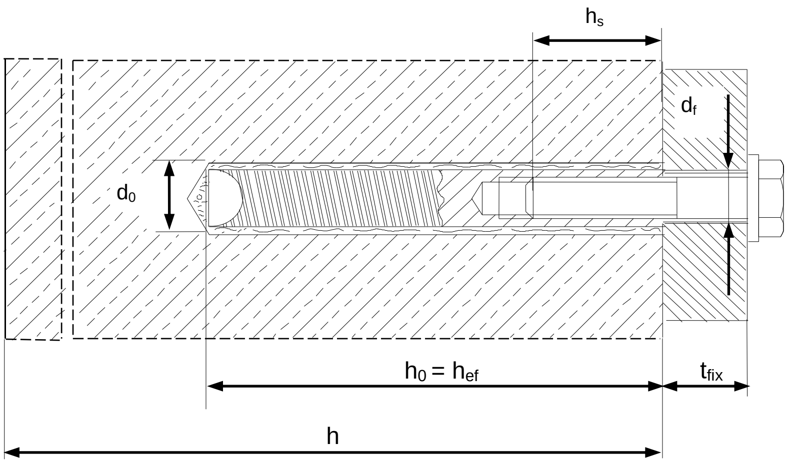
For detailed information on installation see instruction for use given with the package of the product.

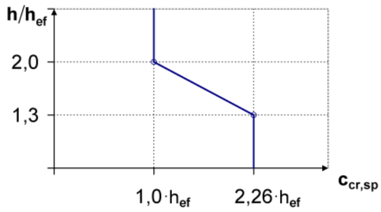
Working time and curing time

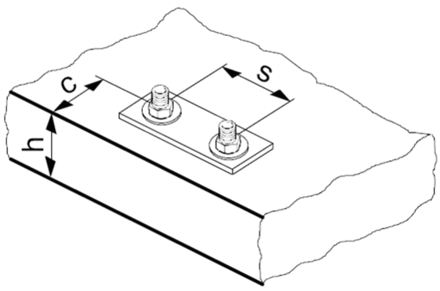
Temperature in the base material T			Maximum working time t_{work}	Maximum curing time t_{cure} a)
-5 °C	to	0 °C	10 min	12 h
> 0 °C	to	5 °C	10 min	5 h
> 5 °C	to	10 °C	8 min	2,5 h
> 10 °C	to	20 °C	5 min	1,5 h
> 20 °C	to	30 °C	3 min	45 min
> 30 °C	to	40 °C	2 min	30 min

a) The curing time data are valid for dry base material only. In wet base material, curing times must be doubled.

Setting details



Anchor size			M8x90	M10x110	M12x125	M16x170
Nominal diameter of drill bit	d_0	[mm]	14	18	22	28
Diameter of element	d	[mm]	12,5	16,5	20,5	25,4
Effective anchorage and drill hole depth	h_{ef}	[mm]	90	110	125	170
Minimum base material thickness	h_{min}	[mm]	120	150	170	230
Diameter of clearance hole in the fixture	d_f	[mm]	9	12	14	18
Thread engagement length; min - max	h_s	[mm]	8-20	10-25	12-30	16-40
Torque moment a)	T_{max}	[Nm]	10	20	40	80
Minimum spacing	s_{min}	[mm]	60	75	90	115
Minimum edge distance	c_{min}	[mm]	40	45	55	65
Critical spacing for splitting failure	$s_{cr,sp}$	[mm]	$2\ c_{cr,sp}$			
Critical edge distance for splitting failure b)	$c_{cr,sp}$	[mm]	**$1{,}0 \cdot h_{ef}$** for $h / h_{ef} \geq 2{,}0$ **$4{,}6\ h_{ef} - 1{,}8\ h$** 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	$s_{cr,N}$	[mm]	$2\ c_{cr,N}$			
Critical edge distance for concrete cone failure c)	$c_{cr,N}$	[mm]	$1{,}5\ h_{ef}$			



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

a) Maximum recommended torque moment to avoid splitting failure during installation with minimum spacing and/or edge distance.

b) h: base material thickness ($h \geq h_{min}$), h_{ef}: embedment depth

c) 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.

- 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)

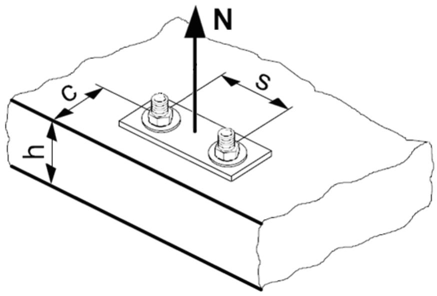
The values are valid for one anchor.

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 $N_{Rd,s}$

Anchor size			M8x90	M10x110	M12x125	M16x170
$N_{Rd,s}$	HIS-N	[kN]	16,7	30,7	44,7	83,3
	HIS-RN	[kN]	13,9	21,9	31,6	58,8

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

Anchor size			M8x90	M10x110	M12x125	M16x170
Embedment depth	h_{ef}	[mm]	**90**	**110**	**125**	**170**
$N^0_{Rd,p}$	Temperature range I	[kN]	23,6	38,0	53,7	90,4
$N^0_{Rd,p}$	Temperature range II	[kN]	17,7	28,5	40,3	67,8

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

Anchor size		M8	M10	M12	M16
$N^0_{Rd,c}$	[kN]	28,7	38,8	47,1	74,6

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
$f_{B,p} = (f_{ck,cube}/25N/mm^2)^{0,15}$ a)	1,00	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
$f_B = (f_{ck,cube}/25N/mm^2)^{0,5}$ 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)

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

a) The edge distance shall not be smaller than the minimum edge distance c_{min}. These influencing factors must be considered for every edge distance smaller than the critical edge distance.

Influence of anchor spacing a)

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

a) The anchor spacing shall not be smaller than the minimum anchor spacing s_{min}. 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

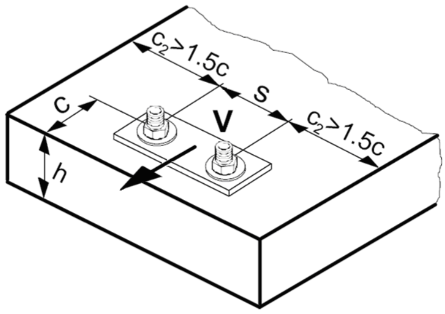
h_{ef} [mm]	40	50	60	70	80	90	≥ 100
$f_{re,N} = 0,5 + h_{ef}/200mm \leq 1$	0,7 a)	0,75 a)	0,8 a)	0,85 a)	0,9 a)	0,95 a)	1

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 $V_{Rd,s}$

Anchor size			M8x90	M10x110	M12x125	M16x170
$V_{Rd,s}$	HIS-N	[kN]	10,4	18,4	27,2	50,4
	HIS-RN	[kN]	8,3	12,8	19,2	35,3

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

k = 2 for $h_{ef} \geq 60$ 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
Non-cracked concrete					
$V^0_{Rd,c}$	[kN]	12,4	19,6	28,2	40,2

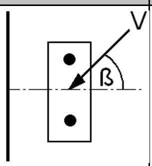
Influencing factors

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
$f_h = \{h/(1,5 \cdot c)\}^{1/2} \leq 1$	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
f_{hef} =	1,38	1,21	1,04	1,22

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

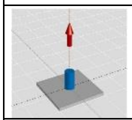
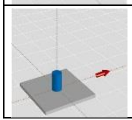
For combined tension and shear loading see section “Anchor Design”.

Precalculated values – design resistance values

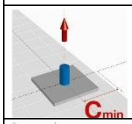
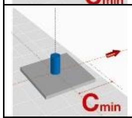
All data applies to:
- non-cracked concrete C 20/25 – $f_{ck,cube}$ =25 N/mm²
- temperature range I (see Service temperature range)
- minimum thickness of base material
- no effects of dense reinforcement

Recommended loads can be calculated by dividing the design resistance by an overall partial safety factor for action γ = 1,4. The partial safety factors for action depend on the type of loading and shall be taken from national regulations.

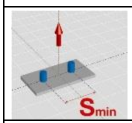
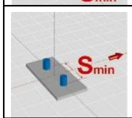
Design resistance: non-cracked- concrete C 20/25

Anchor size		M8x90	M10x110	M12x125	M16x170
Embedment depth	h_{ef} [mm]	90	110	125	170
Base material thickness	$h = h_{min}$ [mm]	120	150	170	230
	**Tensile N_{Rd}: single anchor, no edge effects**				
	HIS-N [kN]	16,7	30,7	44,7	74,6
	HIS-RN [kN]	13,9	21,9	31,6	58,8
	**Shear V_{Rd}: single anchor, no edge effects, without lever arm**				
	HIS-N [kN]	10,4	18,4	27,2	50,4
	HIS-RN [kN]	8,3	12,8	19,2	35,3

Design resistance: non-cracked- concrete C 20/25

Anchor size		M8x90	M10x110	M12x125	M16x170
Embedment depth	h_{ef} [mm]	90	110	125	170
Base material thickness	$h = h_{min}$ [mm]	120	150	170	230
Edge distance	$c = c_{min}$ [mm]	40	45	55	65
	**Tensile N_{Rd}: single single anchor, min. edge distance ($c = c_{min}$)**				
	HIS-N [kN]	12,0	17,5	21,6	33,1
	HIS-RN [kN]				
	**Shear V_{Rd}: single anchor, min. edge distance ($c = c_{min}$), without lever arm**				
	HIS-N [kN]	4,2	5,5	7,6	10,8
	HIS-RN [kN]				

Design resistance: non-cracked- concrete C 20/25

Anchor size		M8x90	M10x110	M12x125	M16x170
Embedment depth	h_{ef} [mm]	90	110	125	170
Base material thickness	$h = h_{min}$ [mm]	120	150	170	230
Spacing	$s = s_{min}$ [mm]	60	75	90	115
	**Tensile N_{Rd}: double anchor, no edge effects, min. spacing ($s = s_{min}$)**				
	HIS-N [kN]	15,2	22,5	27,5	43,1
	HIS-RN [kN]	13,9	21,9	27,5	43,1
	**Shear V_{Rd}: double anchor, no edge effects, min. spacing ($s = s_{min}$), without lever arm**				
	HIS-N [kN]	10,4	18,4	27,2	50,4
	HIS-RN [kN]	8,3	12,8	19,2	35,3