Hilti HIT-RE 500-SD with HIT-V rod

Injection mortar system		Benefits
	Hilti HIT-RE 500-SD 330 ml foil pack (also available as 500 ml and 1400 ml foil pack)	- suitable for non-cracked and cracked concrete C 20/25 to C 50/60 - high loading capacity - suitable for dry and water saturated concrete - large diameter applications - high corrosion resistant - long working time at elevated temperatures - odourless epoxy - embedment depth range: from 40 … 160 mm for M8 to 120 … 600 mm for M30
	Static mixer	
	HIT-V rod	

Concrete · Tensile zone · Small edge distance and spacing · Variable embedment depth · Fire resistance · Shock · Seismic · Corrosion resistance · High corrosion resistance

European Technical Approval · CE conformity · PROFIS Anchor design software

Approvals / certificates

Description	Authority / Laboratory	No. / date of issue
European technical approval a)	DIBt, Berlin	ETA-07/0260 / 2009-01-12
ES report icl. seismic	ICC evaluation service	ESR 2322 / 2012-02-01
Shockproof fastenings in civil defence installations	Federal Office for Cicil Protection, Bern	BZS D 08-604 / 2009-10-21
Fire test report	MFPA, Leipzig	GS-III/B-07-070 / 2008-01-18
Assessment report (fire)	warringtonfire	WF 166402 / 2007-10-26 & suppl. WF 172920 / 2008-05-27

a) All data given in this section according ETA-07/0260, issue 2009-01-12.

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℃, max. long term/short term base material temperature: +24℃/40℃)
- Installation temperature range +5℃ to +40℃

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	M27	M30
Typical embedment depth [mm]	80	90	110	125	170	210	240	270
Base material thickness [mm]	110	120	140	165	220	270	300	340

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

			Data according ETA-07/0260, issue 2009-01-12							
Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
Non cracked concrete										
Tensile $N_{Ru,m}$	HIT-V 5.8	[kN]	*18,9*	*30,5*	*44,1*	*83,0*	*129,2*	*185,9*	*241,5*	*295,1*
Shear $V_{Ru,m}$	HIT-V 5.8	[kN]	*9,5*	*15,8*	*22,1*	*41,0*	*64,1*	*92,4*	*120,8*	*147,0*
Cracked concrete										
Tensile $N_{Ru,m}$	HIT-V 5.8	[kN]	*18,9*	*30,5*	*44,1*	65,2	110,8	146,1	196,0	226,2
Shear $V_{Ru,m}$	HIT-V 5.8	[kN]	*9,5*	*15,8*	*22,1*	*41,0*	*64,1*	*92,4*	*120,8*	*147,0*

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

			Data according ETA-07/0260, issue 2009-01-12							
Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
Non cracked concrete										
Tensile N_{Rk}	HIT-V 5.8	[kN]	*18,0*	*29,0*	*42,0*	70,6	111,9	153,7	187,8	224,0
Shear V_{Rk}	HIT-V 5.8	[kN]	*9,0*	*15,0*	*21,0*	*39,0*	*61,0*	*88,0*	*115,0*	*140,0*
Cracked concrete										
Tensile N_{Rk}	HIT-V 5.8	[kN]	*16,1*	*22,6*	*31,1*	44,0	74,8	109,6	132,3	152,7
Shear V_{Rk}	HIT-V 5.8	[kN]	*9,0*	*15,0*	*21,0*	*39,0*	*61,0*	*88,0*	*115,0*	*140,0*

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

			Data according ETA-07/0260, issue 2009-01-12							
Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
Non cracked concrete										
Tensile N_{Rd}	HIT-V 5.8	[kN]	12,0	19,3	28,0	33,6	53,3	73,2	89,4	106,7
Shear V_{Rd}	HIT-V 5.8	[kN]	7,2	12,0	16,8	31,2	48,8	70,4	92,0	112,0
Cracked concrete										
Tensile N_{Rd}	HIT-V 5.8	[kN]	8,9	12,6	17,3	20,9	35,6	52,2	63,0	72,7
Shear V_{Rd}	HIT-V 5.8	[kN]	7,2	12,0	16,8	31,2	48,8	70,4	92,0	112,0

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

			Data according ETA-07/0260, issue 2009-01-12							
Anchor size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Non cracked concrete										
Tensile N_{rec}	HIT-V 5.8	[kN]	8,6	13,8	20,0	24,0	38,1	52,3	63,9	76,2
Shear V_{rec}	HIT-V 5.8	[kN]	5,1	8,6	12,0	22,3	34,9	50,3	65,7	80,0
Cracked concrete										
Tensile N_{rec}	HIT-V 5.8	[kN]	6,4	9,0	12,3	15,0	25,4	37,3	45,0	51,9
Shear V_{rec}	HIT-V 5.8	[kN]	5,1	8,6	12,0	22,3	34,9	50,3	65,7	80,0

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-RE 500-SD 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 +58 °C	+35 °C	+58 °C
Temperature range III	-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

			Data according ETA-07/0260, issue 2009-01-12							
Anchor size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Nominal tensile strength f_{uk}	HIT-V 5.8	[N/mm²]	500	500	500	500	500	500	500	500
	HIT-V 8.8	[N/mm²]	800	800	800	800	800	800	800	800
	HIT-V-R	[N/mm²]	700	700	700	700	700	700	500	500
	HIT-V-HCR	[N/mm²]	800	800	800	800	800	700	700	700
Yield strength f_{yk}	HIT-V 5.8	[N/mm²]	400	400	400	400	400	400	400	400
	HIT-V 8.8	[N/mm²]	640	640	640	640	640	640	640	640
	HIT-V -R	[N/mm²]	450	450	450	450	450	450	210	210
	HIT-V -HCR	[N/mm²]	600	600	600	600	600	400	400	400
Stressed cross-section A_s	HIT-V	[mm²]	36,6	58,0	84,3	157	245	353	459	561
Moment of resistance W	HIT-V	[mm³]	31,2	62,3	109	277	541	935	1387	1874

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 grade A4, A_5 > 8% ductile strength class 70 for ≤ M24 and class 50 for M27 to M30, 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 strength ≤ M20: R_m = 800 N/mm², $R_{p\,0.2}$ = 640 N/mm², A_5 > 8% ductile M24 to M30: 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, steel galvanized ≥ 5 µm, hot dipped galvanized ≥ 45 µm
	Strength class 70, stainless steel grade A4, 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362
	Strength class 70, high corrosion resistant steel, 1.4529; 1.4565

Anchor dimensions

Anchor size		M8	M10	M12	M16	M20	M24	M27	M30
Anchor embedment depth	[mm]	80	90	110	125	170	210	240	270
Anchor rod HIT-V, HIT-V-R, HIT-V-HCR		Anchor rods HIT-V (-R / -HCR) are available in variable length							

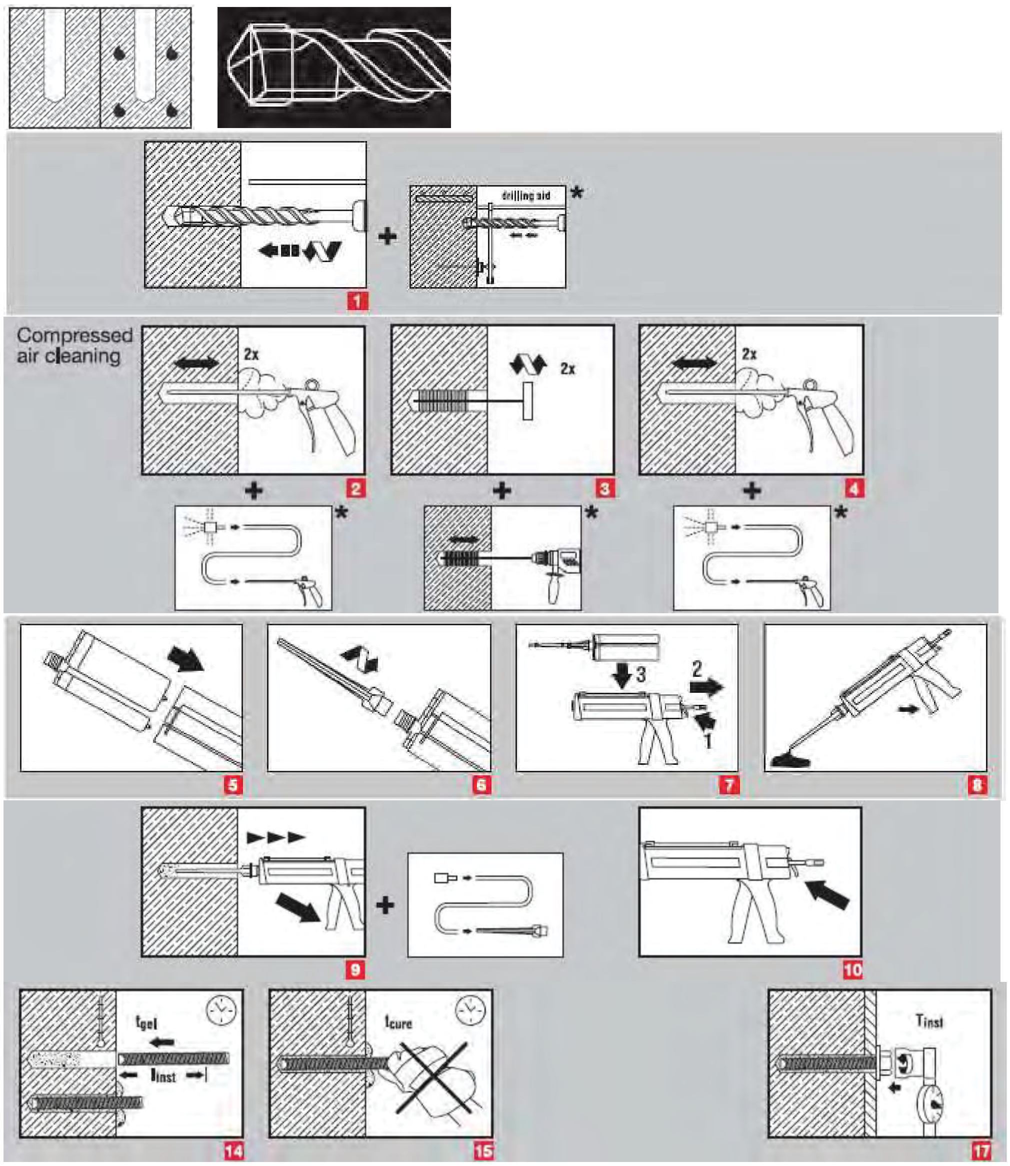
Setting

installation equipment

Anchor size	M8	M10	M12	M16	M20	M24	M27	M30
Rotary hammer	TE2 – TE16				TE40 – TE70			
Other tools	compressed air gun or blow out pump, set of cleaning brushes, dispenser							

Setting instruction

Dry and water-saturated concrete, hammer drilling



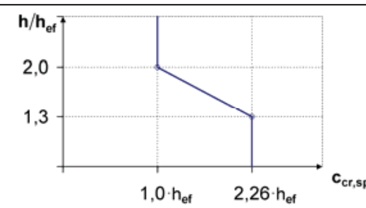
Brush bore hole with required steel brush HIT-RB

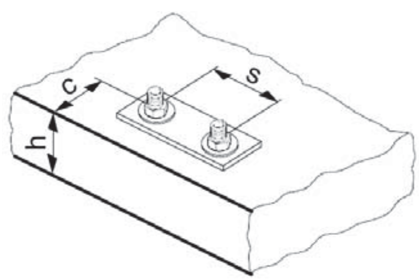
For detailed information on installation see instruction for use given with the package of the product.

Curing time for general conditions

Data according ETA-07/0260, issue 2009-01-12		
Temperature of the base material	**Working time in which anchor can be inserted and adjusted t_{gel}**	**Curing time before anchor can be fully loaded t_{cure}**
40 °C	12 min	4 h
30 °C to 39 °C	12 min	8 h
20 °C to 29 °C	20 min	12 h
15 °C to 19 °C	30 min	24 h
10 °C to 14 °C	90 min	48 h
5 °C to 9 °C	120 min	72 h

Setting details

			Data according ETA-07/0260, issue 2009-01-12							
Anchor size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Nominal diameter of drill bit	d_0	[mm]	10	12	14	18	24	28	30	35
Effective anchorage and drill hole depth range [a)]	$h_{ef,min}$	[mm]	40	40	48	64	80	96	108	120
	$h_{ef,max}$	[mm]	160	200	240	320	400	480	540	600
Minimum base material thickness	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	30	33
Minimum spacing	s_{min}	[mm]	40	50	60	80	100	120	135	150
Minimum edge distance	c_{min}	[mm]	40	50	60	80	100	120	135	150
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 $h / h_{ef} \geq 2{,}0$			 			
			$4{,}6\ h_{ef} - 1{,}8\ h$	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)]	$c_{cr,N}$		$1{,}5\ h_{ef}$							
Torque moment [d)]	T_{max}	[Nm]	10	20	40	80	150	200	270	300



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

a) $h_{ef,min} \leq h_{ef} \leq h_{ef,max}$ (h_{ef}: embedment depth)

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

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.

d) 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 in ETA-07/0260, issue 2009-01-12.

- 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)

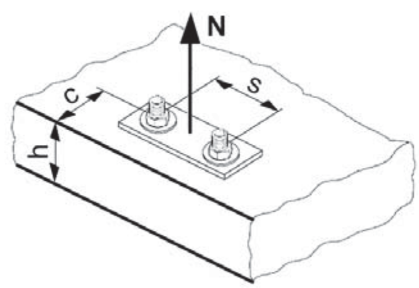
The values are valid for one anchor.

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 $N_{Rd,s}$

			Data according ETA-07/0260, issue 2009-01-12							
Anchor size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
$N_{Rd,s}$	HIT-V 5.8	[kN]	12,0	19,3	28,0	52,7	82,0	118,0	153,3	187,3
	HIT-V 8.8	[kN]	19,3	30,7	44,7	84,0	130,7	188,0	244,7	299,3
	HIT-V-R	[kN]	13,9	21,9	31,6	58,8	92,0	132,1	80,4	98,3
	HIT-V-HCR	[kN]	19,3	30,7	44,7	84,0	130,7	117,6	152,9	187,1

Design combined pull-out and concrete cone resistance

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

	Data according ETA-07/0260, issue 2009-01-12							
Anchor size	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Typical embedment depth $h_{ef,typ}$ [mm]	**80**	**90**	**110**	**125**	**170**	**210**	**240**	**270**
Non cracked concrete								
$N^0_{Rd,p}$ Temperature range I [kN]	17,9	25,1	36,9	44,9	76,3	105,6	135,7	157,5
$N^0_{Rd,p}$ Temperature range II [kN]	14,5	20,4	29,9	35,9	61,0	82,9	106,6	133,3
$N^0_{Rd,p}$ Temperature range III [kN]	8,9	12,6	18,4	22,4	35,6	52,8	63,0	78,8
Cracked concrete								
$N^0_{Rd,p}$ Temperature range I [kN]	8,9	12,6	17,3	20,9	35,6	52,8	63,0	72,7
$N^0_{Rd,p}$ Temperature range II [kN]	7,3	9,4	13,8	18,0	28,0	41,5	48,5	60,6
$N^0_{Rd,p}$ Temperature range III [kN]	4,5	5,5	8,1	10,5	15,3	22,6	29,1	36,4

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

	Data according ETA-07/0260, issue 2009-01-12							
Anchor size	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
$N^0_{Rd,c}$ Non cracked concrete [kN]	20,1	24,0	32,4	33,6	53,3	73,2	89,4	106,7
$N^0_{Rd,c}$ Cracked concrete [kN]	14,3	17,1	23,1	24,0	38,0	52,2	63,7	76,1

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

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

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

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
$f_B = (f_{ck,cube}/25N/mm^2)^{1/2}$ 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)

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

$s/s_{cr,N}$ $s/s_{cr,sp}$	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9	1
$f_{3,N} = 0{,}5 \cdot (1 + s/s_{cr,N})$ $f_{3,sp} = 0{,}5 \cdot (1 + s/s_{cr,sp})$	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

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

Influence of reinforcement

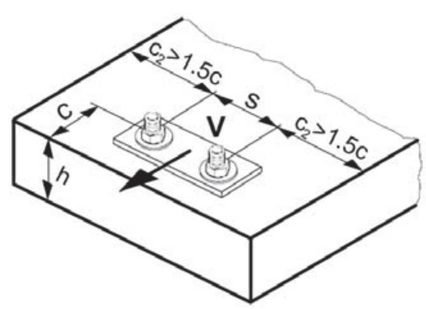
h_{ef} [mm]	40	50	60	70	80	90	≥ 100
$f_{re,N} = 0{,}5 + h_{ef}/200mm \leq 1$	0,7 a)	0,75 a)	0,8 a)	0,85 a)	0,9 a)	0,95 a)	1

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 $f_{re} = 1$ may be applied.

Shear loading

The design shear resistance is the lower value of

- Steel resistance: $V_{Rd,s}$
- Concrete pryout resistance: $V_{Rd,cp} = k \cdot$ 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 $V_{Rd,s}$

			Data according ETA-07/0260, issue 2009-01-12							
Anchor size			M8	M10	M12	M16	M20	M24	M27	M30
$V_{Rd,s}$	HIT-V 5.8	[kN]	7,2	12,0	16,8	31,2	48,8	70,4	92,0	112,0
	HIT-V 8.8	[kN]	12,0	18,4	27,2	50,4	78,4	112,8	147,2	179,2
	HIT-V-R	[kN]	8,3	12,8	19,2	35,3	55,1	79,5	48,3	58,8
	HIT-V-HCR	[kN]	12,0	18,4	27,2	50,4	78,4	70,9	92,0	112,0

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

k = 1 for h_{ef} < 60 mm
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	M20	M24	M27	M30
Non-cracked concrete									
$V^0_{Rd,c}$	[kN]	5,9	8,6	11,6	18,7	27,0	36,6	44,5	53,0
Cracked concrete									
$V^0_{Rd,c}$	[kN]	4,2	6,1	8,2	13,2	19,2	25,9	31,5	37,5

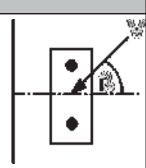
Influencing factors

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

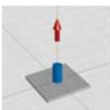
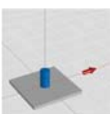
Combined tension and shear loading

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

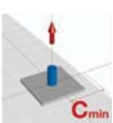
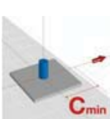
Precalculated values

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.

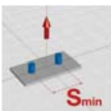
Design resistance: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm², Temperature range I

		Data according ETA-07/0260, issue 2009-01-12							
Anchor size		**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Embedment depth $h_{ef,1}$ =	[mm]	48	60	72	96	120	144	162	180
Base material thickness h_{min}=	[mm]	100	100	102	132	168	200	222	250
Tensile N_{Rd}: single anchor, no edge effects									
Non cracked concrete									
HIT-V 5.8 HIT-V 8.8 HIT-V-R HIT-V-HCR	[kN]	9,3	13,0	17,1	22,6	31,6	41,6	49,6	58,1
Cracked concrete									
 HIT-V 5.8 HIT-V 8.8 HIT-V-R HIT-V-HCR	[kN]	5,4	8,4	11,3	16,1	22,5	29,6	35,3	41,4
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	92,0	112,0
HIT-V 8.8	[kN]	11,2	18,4	27,2	50,4	78,4	112,8	138,8	162,6
HIT-V-R	[kN]	8,3	12,8	19,2	35,3	55,1	79,5	48,3	58,8
HIT-V-HCR	[kN]	11,2	18,4	27,2	50,4	78,4	70,9	92,0	112,0
Cracked concrete									
 HIT-V 5.8	[kN]	6,4	12,0	16,8	31,2	48,8	70,4	92,0	112,0
HIT-V 8.8	[kN]	6,4	18,4	27,1	45,0	63,1	82,9	99,0	115,9
HIT-V-R	[kN]	6,4	12,8	19,2	35,3	55,1	79,5	48,3	58,8
HIT-V-HCR	[kN]	6,4	18,4	27,1	45,0	63,1	70,9	92,0	112,0

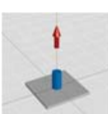
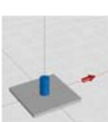
Design resistance: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm², Temperature range I

		Data according ETA-07/0260, issue 2009-01-12							
Anchor size		**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Embedment depth $h_{ef,1}$ =	[mm]	48	60	72	96	120	144	162	180
Base material thickness h_{min}=	[mm]	100	100	102	132	168	200	222	250
Edge distance $c = c_{min}$=	[mm]	40	50	60	80	100	120	135	150
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]	6,3	8,5	9,9	12,9	18,2	23,8	28,2	33,2
Cracked concrete									
 HIT-V 5.8 HIT-V 8.8 HIT-V-R HIT-V-HCR	[kN]	3,6	5,6	7,1	9,2	12,9	16,9	20,1	23,7
Shear V_{Rd}: single anchor, min. edge distance ($c = c_{min}$) , without lever arm									
Non cracked concrete									
HIT-V 5.8 HIT-V 8.8 HIT-V-R HIT-V-HCR	[kN]	3,4	4,9	6,7	10,8	15,7	21,4	26,0	31,1
Cracked concrete									
 HIT-V 5.8 HIT-V 8.8 HIT-V-R HIT-V-HCR	[kN]	2,4	3,5	4,7	7,6	11,1	15,1	18,4	22,0

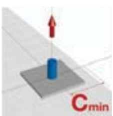
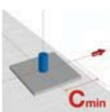
Design resistance: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm², Temperature range I
(load values are valid for single anchor)

		Data according ETA-07/0260, issue 2009-01-12							
Anchor size		**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Embedment depth $h_{ef,1}$ =	[mm]	48	60	72	96	120	144	162	180
Base material thickness h_{min}=	[mm]	100	100	102	132	168	200	222	250
Spacing s = s_{min}=	[mm]	40	50	60	80	100	120	135	150
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]	6,0	8,2	10,3	13,5	19,0	24,9	29,6	34,8
Cracked concrete									
 HIT-V 5.8 HIT-V 8.8 HIT-V-R HIT-V-HCR	[kN]	3,6	5,5	7,4	9,6	13,5	17,8	21,1	24,8
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	88,7	103,9
HIT-V 8.8	[kN]	7,2	18,4	26,3	40,5	56,5	74,3	88,7	103,9
HIT-V-R	[kN]	7,2	12,8	19,2	35,3	55,1	74,3	48,3	58,8
HIT-V-HCR	[kN]	7,2	18,4	26,3	40,5	56,5	70,9	88,7	103,9
Cracked concrete									
 HIT-V 5.8	[kN]	4,1	12,0	16,8	28,8	40,3	53,0	63,2	74,1
HIT-V 8.8	[kN]	4,1	12,8	17,3	28,8	40,3	53,0	63,2	74,1
HIT-V-R	[kN]	4,1	12,8	17,3	28,8	40,3	53,0	48,3	58,8
HIT-V-HCR	[kN]	4,1	12,8	17,3	28,8	40,3	53,0	63,2	74,1

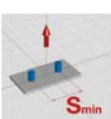
Design resistance: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm², Temperature range I

		Data according ETA-07/0260, issue 2009-01-12							
Anchor size		**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Embedment depth $h_{ef,typ}$ =	[mm]	80	90	110	125	170	210	240	270
Base material thickness h_{min}=	[mm]	110	120	140	161	218	266	300	340
Tensile N_{Rd}: single anchor, no edge effects									
Non cracked concrete									
HIT-V 5.8	[kN]	12,0	19,3	28,0	33,6	53,3	73,2	89,4	106,7
HIT-V 8.8	[kN]	17,9	24,0	32,4	33,6	53,3	73,2	89,4	106,7
HIT-V-R	[kN]	13,9	21,9	31,6	33,6	53,3	73,2	80,4	98,3
HIT-V-HCR	[kN]	17,9	24,0	32,4	33,6	53,3	73,2	89,4	106,7
Cracked concrete									
 HIT-V 5.8 HIT-V 8.8 HIT-V-R HIT-V-HCR	[kN]	8,9	12,6	17,3	20,9	35,6	52,2	63,0	72,7
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	92,0	112,0
HIT-V 8.8	[kN]	12,0	18,4	27,2	50,4	78,4	112,8	147,2	179,2
HIT-V-R	[kN]	8,3	12,8	19,2	35,3	55,1	79,5	48,3	58,8
HIT-V-HCR	[kN]	12,0	18,4	27,2	50,4	78,4	70,9	92,0	112,0
Cracked concrete									
 HIT-V 5.8	[kN]	7,2	12,0	16,8	31,2	48,8	70,4	92,0	112,0
HIT-V 8.8	[kN]	12,0	18,4	27,2	50,4	78,4	112,8	147,2	179,2
HIT-V-R	[kN]	8,3	12,8	19,2	35,3	55,1	79,5	48,3	58,8
HIT-V-HCR	[kN]	12,0	18,4	27,2	41,9	71,2	70,9	92,0	112,0

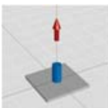
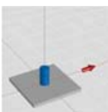
Design resistance: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm², Temperature range I

		Data according ETA-07/0260, issue 2009-01-12							
Anchor size		**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Embedment depth $h_{ef,typ}$ =	[mm]	80	90	110	125	170	210	240	270
Base material thickness h_{min} =	[mm]	110	120	140	161	218	266	300	340
Edge distance $c = c_{min}$=	[mm]	40	50	60	80	100	120	135	150
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]	9,6	11,6	15,5	16,9	26,1	35,6	43,3	51,4
Cracked concrete									
 HIT-V 5.8 HIT-V 8.8 HIT-V-R HIT-V-HCR	[kN]	4,8	7,0	9,5	12,1	18,6	25,4	30,8	36,7
Shear V_{Rd}: single anchor, min. edge distance ($c = c_{min}$) , without lever arm									
Non cracked concrete									
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	29,0	34,8
Cracked concrete									
 HIT-V 5.8 HIT-V 8.8 HIT-V-R HIT-V-HCR	[kN]	2,6	3,8	5,2	8,1	12,2	16,7	20,5	24,7

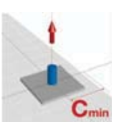
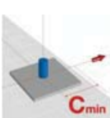
Design resistance: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm², Temperature range I
(load values are valid for single anchor)

		Data according ETA-07/0260, issue 2009-01-12							
Anchor size		**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Embedment depth $h_{ef,typ}$ =	[mm]	80	90	110	125	170	210	240	270
Base material thickness h_{min}=	[mm]	110	120	140	161	218	266	300	340
Spacing $s = s_{min}$=	[mm]	40	50	60	80	100	120	135	150
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]	10,9	13,5	18,1	19,2	30,1	41,2	50,3	59,9
Cracked concrete									
 HIT-V 5.8 HIT-V 8.8 HIT-V-R HIT-V-HCR	[kN]	5,9	8,1	11,1	13,2	21,5	29,4	35,8	42,7
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	92,0	112,0
HIT-V 8.8	[kN]	12,0	18,4	27,2	50,4	78,4	112,8	147,2	177,0
HIT-V-R	[kN]	8,3	12,8	19,2	35,3	55,1	79,5	48,3	58,8
HIT-V-HCR	[kN]	12,0	18,4	27,2	50,4	78,4	70,9	92,0	112,0
Cracked concrete									
HIT-V 5.8	[kN]	7,2	12,0	16,8	31,2	48,8	70,4	92,0	112,0
 HIT-V 8.8	[kN]	12,0	17,9	24,5	35,6	59,6	86,9	104,8	120,6
HIT-V-R	[kN]	8,3	12,8	19,2	35,3	55,1	79,5	48,3	58,8
HIT-V-HCR	[kN]	12,0	17,9	24,5	35,6	59,6	70,9	92,0	112,0

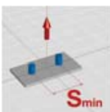
Design resistance: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm², Temperature range I

			Data according ETA-07/0260, issue 2009-01-12						
Anchor size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Embedment depth	$h_{ef,2}$ =	[mm]	96	120	144	192	240	288	324	360
Base material thickness	h_{min}=	[mm]	126	150	174	228	288	344	384	430
	**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	117,5	140,2	164,3
	HIT-V 8.8	[kN]	19,3	30,7	44,7	64,0	89,4	117,5	140,2	164,3
	HIT-V-R	[kN]	13,9	21,9	31,6	58,8	89,4	117,5	80,4	98,3
	HIT-V-HCR	[kN]	19,3	30,7	44,7	64,0	89,4	117,5	140,2	164,3
	Cracked concrete									
	HIT-V 5.8	[kN]	10,7	16,8	22,6	32,2	50,3	72,4	85,1	96,9
	HIT-V 8.8	[kN]	10,7	16,8	22,6	32,2	50,3	72,4	85,1	96,9
	HIT-V-R	[kN]	10,7	16,8	22,6	32,2	50,3	72,4	80,4	96,9
	HIT-V-HCR	[kN]	10,7	16,8	22,6	32,2	50,3	72,4	85,1	96,9
	**Shear V_{Rd}: single anchor, no edge effects, without lever arm**									
	Non cracked and cracked concrete									
	HIT-V 5.8	[kN]	7,2	12,0	16,8	31,2	48,8	70,4	92,0	112,0
	HIT-V 8.8	[kN]	12,0	18,4	27,2	50,4	78,4	112,8	147,2	179,2
	HIT-V-R	[kN]	8,3	12,8	19,2	35,3	55,1	79,5	48,3	58,8
	HIT-V-HCR	[kN]	12,0	18,4	27,2	50,4	78,4	70,9	92,0	112,0

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

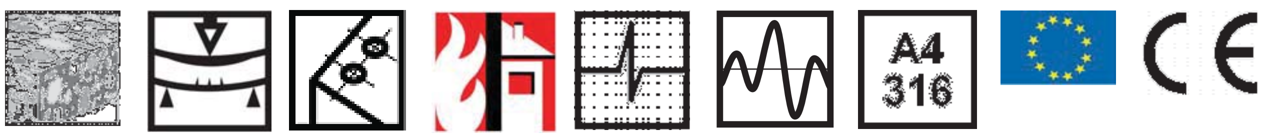
			Data according ETA-07/0260, issue 2009-01-12						
Anchor size			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Embedment depth	$h_{ef,2}$ =	[mm]	96	120	144	192	240	288	324	360
Base material thickness	h_{min} =	[mm]	126	150	174	228	288	344	384	430
Edge distance	$c = c_{min}$=	[mm]	40	50	60	80	100	120	135	150
	**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]	11,6	16,5	21,7	28,6	40,0	52,6	62,7	73,5
	Cracked concrete									
	HIT-V 5.8 HIT-V 8.8 HIT-V-R HIT-V-HCR	[kN]	5,8	9,0	12,2	17,5	27,4	37,5	44,7	52,4
	**Shear V_{Rd}: single anchor, min. edge distance ($c = c_{min}$) , without lever arm**									
	Non cracked concrete									
	HIT-V 5.8 HIT-V 8.8 HIT-V-R HIT-V-HCR	[kN]	3,9	5,7	7,8	12,9	18,9	25,9	31,8	38,1
	Cracked concrete									
	HIT-V 5.8 HIT-V 8.8 HIT-V-R HIT-V-HCR	[kN]	2,8	4,0	5,5	9,1	13,4	18,4	22,5	27,0

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

	Data according ETA-07/0260, issue 2009-01-12							
Anchor size	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Embedment depth $h_{ef,2}$ = [mm]	96	120	144	192	240	288	324	360
Base material thickness h_{min}= [mm]	126	150	174	228	288	344	384	430
Spacing $s = s_{min}$= [mm]	40	50	60	80	100	120	135	150
Tensile N_{Rd}: double anchor, no edge effects, min. spacing ($s = s_{min}$)								
Non cracked concrete								
HIT-V 5.8 [kN]	12,0	19,3	26,5	34,9	48,8	64,2	76,6	89,7
HIT-V 8.8 [kN]	13,4	20,1	26,5	34,9	48,8	64,2	76,6	89,7
HIT-V-R [kN]	13,4	20,1	26,5	34,9	48,8	64,2	76,6	89,7
HIT-V-HCR [kN]	13,4	20,1	26,5	34,9	48,8	64,2	76,6	89,7
Cracked concrete								
 HIT-V 5.8 HIT-V 8.8 HIT-V-R HIT-V-HCR [kN]	7,2	11,0	14,8	20,8	31,7	44,9	52,9	61,1
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	92,0	112,0
HIT-V 8.8 [kN]	12,0	18,4	27,2	50,4	78,4	112,8	147,2	179,2
HIT-V-R [kN]	8,3	12,8	19,2	35,3	55,1	79,5	48,3	58,8
HIT-V-HCR [kN]	12,0	18,4	27,2	50,4	78,4	70,9	92,0	112,0
Cracked concrete								
 HIT-V 5.8 [kN]	7,2	12,0	16,8	31,2	48,8	70,4	92,0	112,0
HIT-V 8.8 [kN]	12,0	18,4	27,2	50,4	78,4	112,8	135,6	154,6
HIT-V-R [kN]	8,3	12,8	19,2	35,3	55,1	79,5	48,3	58,8
HIT-V-HCR [kN]	12,0	18,4	27,2	50,4	78,4	70,9	92,0	112,0

Hilti HIT-RE 500-SD with HIS-(R)N

Injection mortar system		Benefits
	Hilti HIT-RE 500-SD 330 ml foil pack (also available as 500 ml and 1400 ml foil pack) Statik mixer HIS-(R)N sleeve	- suitable for cracked and non-cracked concrete C 20/25 to C 50/60 - high loading capacity - suitable for dry and water saturated concrete - long working time at elevated temperatures - odourless epoxy



Concrete | Tensile zone | Small edge distance and spacing | Fire resistance | Shock | Seismic | Corrosion resistance | European Technical Approval | CE conformity

PROFIS Anchor design software

Approvals / certificates

Description	Authority / Laboratory	No. / date of issue
European technical approval [a)]	DIBt, Berlin	ETA-07/0260 / 2009-01-12
ES report icl. seismic	ICC evaluation service	ESR 2322 / 2012-02-01
Shockproof fastenings in civil defence installations	Federal Office for Cicil Protection, Bern	BZS D 08-604 / 2009-10-21
Fire test report	MFPA, Leipzig	GS-III/B-07-070 / 2008-01-18
Assessment report (fire)	warringtonfire	WF 166402 / 2007-10-26 & suppl. WF 172920 / 2008-05-27

a) All data given in this section according ETA-07/0260, issue 2009-01-12.

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

			Data according ETA-07/0260, issue 2009-01-12				
Anchor size			**M8**	**M10**	**M12**	**M16**	**M20**
Non cracked concrete							
Tensile $N_{Ru,m}$	HIS-N	[kN]	*26,3*	*48,3*	*70,4*	*123,9*	*114,5*
Shear $V_{Ru,m}$	HIS-N	[kN]	*13,7*	*24,2*	*41,0*	*62,0*	*57,8*
Cracked concrete							
Tensile $N_{Ru,m}$	HIS-N	[kN]	*26,3*	*48,3*	67,1	106,4	*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

			Data according ETA-07/0260, issue 2009-01-12				
Anchor size			**M8**	**M10**	**M12**	**M16**	**M20**
Non cracked concrete							
Tensile N_{Rk}	HIS-N	[kN]	*25,0*	*46,0*	*67,0*	111,9	*109,0*
Shear V_{Rk}	HIS-N	[kN]	*13,0*	*23,0*	*39,0*	*59,0*	*55,0*
Cracked concrete							
Tensile N_{Rk}	HIS-N	[kN]	25,0	40,0	50,3	79,8	105,7
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

			Data according ETA-07/0260, issue 2009-01-12				
Anchor size			**M8**	**M10**	**M12**	**M16**	**M20**
Non cracked concrete							
Tensile N_{Rd}	HIS-N	[kN]	16,8	27,7	33,6	53,3	70,6
Shear V_{Rd}	HIS-N	[kN]	10,4	18,4	26,0	39,3	36,7
Cracked concrete							
Tensile N_{Rd}	HIS-N	[kN]	13,9	19,0	24,0	38,0	50,3
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

			Data according ETA-07/0260, issue 2009-01-12				
Anchor size			**M8**	**M10**	**M12**	**M16**	**M20**
Non cracked concrete							
Tensile N_{rec}	HIS-N	[kN]	12,0	19,8	24,0	38,1	50,4
Shear V_{rec}	HIS-N	[kN]	7,4	13,1	18,6	28,1	26,2
Cracked concrete							
Tensile N_{rec}	HIS-N	[kN]	9,9	13,6	17,1	27,1	35,9
Shear V_{rec}	HIS-N	[kN]	7,4	13,1	18,6	28,1	26,2

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-RE 500-SD 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 +58 °C	+35 °C	+58 °C
Temperature range III	-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

			Data according ETA-07/0260, issue 2009-01-12				
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

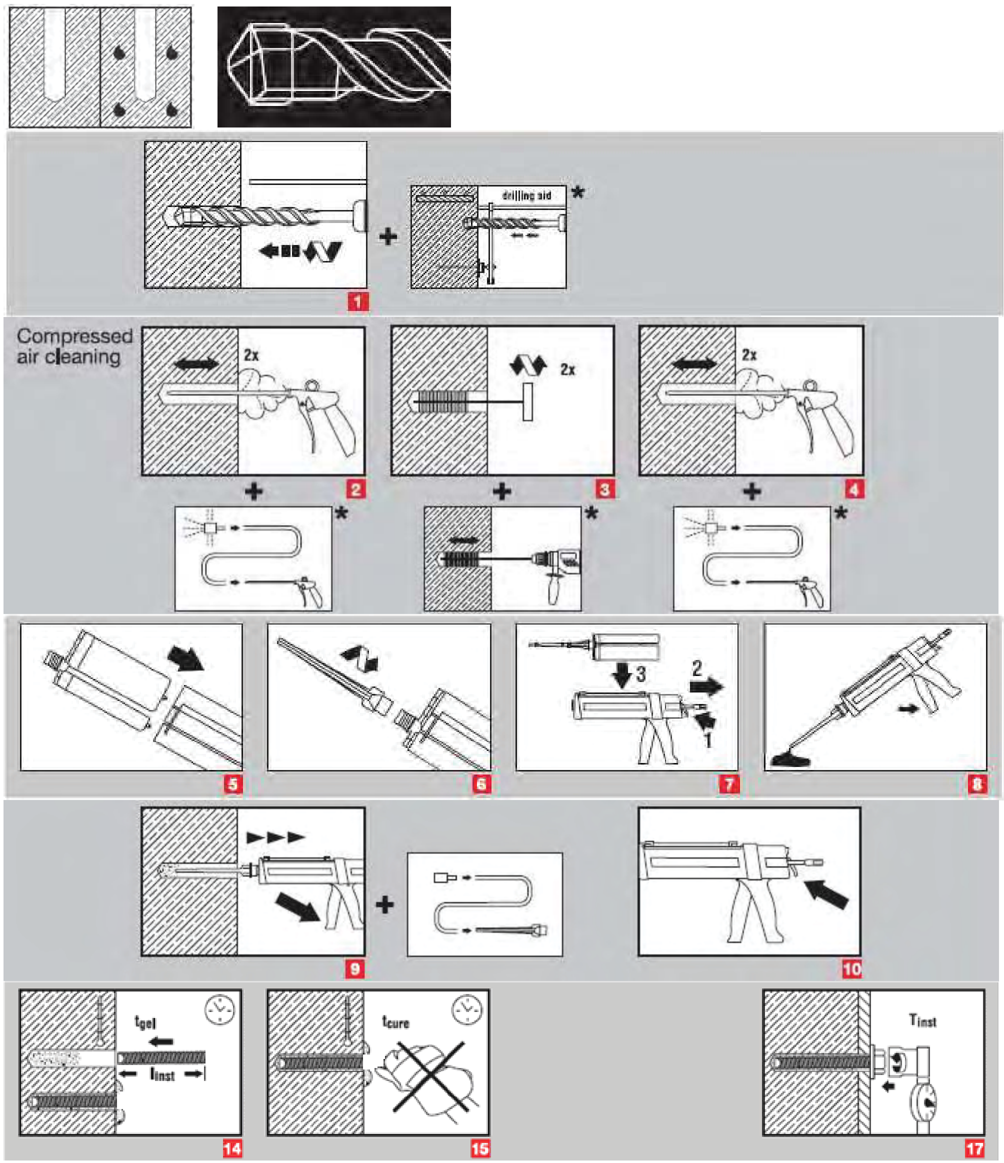
Setting

installation equipment

Anchor size	M8	M10	M12	M16	M20
Rotary hammer	TE 2 – TE 16		TE 40 – TE 70		
Other tools	compressed air gun or blow out pump, set of cleaning brushes, dispenser				

Setting instruction

Dry and water-saturated concrete, hammer drilling



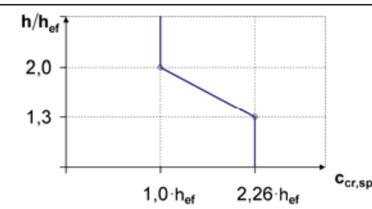
Brush bore hole with required steel brush HIT-RB

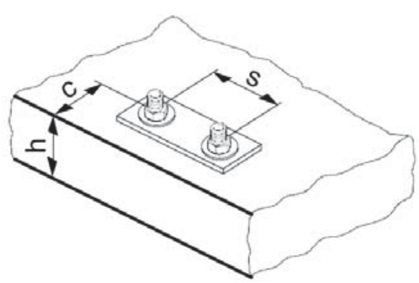
For detailed information on installation see instruction for use given with the package of the product.

Curing time for general conditions

Data according ETA-07/0260, issue 2009-01-12		
Temperature of the base material	**Working time in which anchor can be inserted and adjusted t_{gel}**	**Curing time before anchor can be fully loaded t_{cure}**
40 °C	12 min	4 h
30 °C to 39 °C	12 min	8 h
20 °C to 29 °C	20 min	12 h
15 °C to 19 °C	30 min	24 h
10 °C to 14 °C	90 min	48 h
5 °C to 9 °C	120 min	72 h

Setting details

			Data according ETA-07/0260, issue 2009-01-12				
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	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 [b]	$c_{cr,N}$		$1{,}5\ h_{ef}$				
Torque moment [c]	T_{max}	[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 in ETA-07/0260, issue 2009-01-12.

- 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:

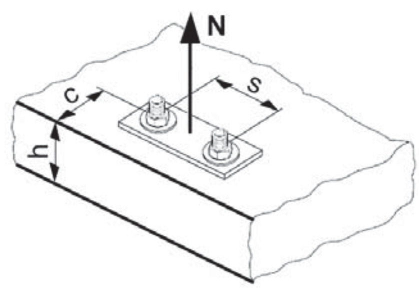
- No different loads are acting on individual anchors (no eccentricity)

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 $N_{Rd,s}$

			Data according ETA-07/0260, issue 2009-01-12				
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

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

	Data according ETA-07/0260, issue 2009-01-12				
Anchor size	**M8**	**M10**	**M12**	**M16**	**M20**
Embedment depth h_{ef} [mm]	**90**	**110**	**125**	**170**	**205**
Non cracked concrete					
$N^0_{Rd,p}$ Temperature range I [kN]	22,2	28,6	45,2	81,0	95,2
$N^0_{Rd,p}$ Temperature range II [kN]	19,4	23,8	35,7	66,7	81,0
$N^0_{Rd,p}$ Temperature range III [kN]	11,1	14,3	19,0	35,7	45,2
Cracked concrete					
$N^0_{Rd,p}$ Temperature range I [kN]	13,9	19,0	28,6	45,2	54,8
$N^0_{Rd,p}$ Temperature range II [kN]	11,1	16,7	19,0	35,7	45,2
$N^0_{Rd,p}$ Temperature range III [kN]	6,7	9,5	11,9	19,0	23,8

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

	Data according ETA-07/0260, issue 2009-01-12				
Anchor size	**M8**	**M10**	**M12**	**M16**	**M20**
$N^0_{Rd,c}$ Non cracked concrete [kN]	24,0	27,7	33,6	53,3	70,6
$N^0_{Rd,c}$ Cracked concrete [kN]	17,1	19,8	24,0	38,0	50,3

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

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)

$c/c_{cr,N}$ $c/c_{cr,sp}$	**0,1**	**0,2**	**0,3**	**0,4**	**0,5**	**0,6**	**0,7**	**0,8**	**0,9**	**1**
$f_{1,N} = 0{,}7 + 0{,}3 \cdot c/c_{cr,N}$ $f_{1,sp} = 0{,}7 + 0{,}3 \cdot c/c_{cr,sp}$	0,73	0,76	0,79	0,82	0,85	0,88	0,91	0,94	0,97	1
$f_{2,N} = 0{,}5 \cdot (1 + c/c_{cr,N})$ $f_{2,sp} = 0{,}5 \cdot (1 + c/c_{cr,sp})$	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)

$s/s_{cr,N}$ $s/s_{cr,sp}$	**0,1**	**0,2**	**0,3**	**0,4**	**0,5**	**0,6**	**0,7**	**0,8**	**0,9**	**1**
$f_{3,N} = 0{,}5 \cdot (1 + s/s_{cr,N})$ $f_{3,sp} = 0{,}5 \cdot (1 + s/s_{cr,sp})$	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

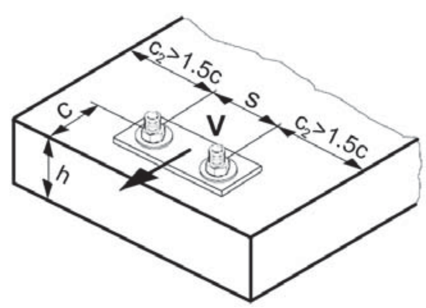
h_{ef} [mm]	80	90	≥ 100
$f_{re,N} = 0{,}5 + h_{ef}/200mm \le 1$	0,9 a)	0,95 a)	1

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 $f_{re} = 1$ may be applied.

Shear loading

The design shear resistance is the lower value of

- Steel resistance: $V_{Rd,s}$
- Concrete pryout resistance: $V_{Rd,cp} = k \cdot$ 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 $V_{Rd,s}$

			Data according ETA-07/0260, issue 2009-01-12				
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 $k \cdot N_{Rd,p}$ and $k \cdot N_{Rd,c}$

k = 1 for h_{ef} < 60 mm
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	M20
Non-cracked concrete					
$V^0_{Rd,c}$ [kN]	12,4	19,6	28,2	40,2	46,2
Cracked concrete					
$V^0_{Rd,c}$ [kN]	8,8	13,9	20,0	28,5	32,7

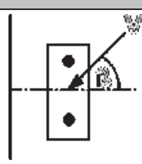
Influencing factors

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
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}.

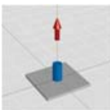
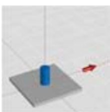
Combined tension and shear loading

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

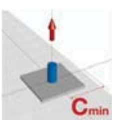
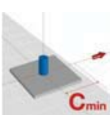
Precalculated values

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

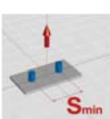
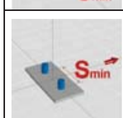
Design resistance: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm², Temperature range I

		Data according ETA-07/0260, issue 2009-01-12				
	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**					
	Non cracked concrete					
	HIS-N [kN]	17,4	27,7	33,6	53,3	70,6
	HIS-RN [kN]	13,9	21,9	31,6	53,3	69,2
	Cracked concrete					
	HIS-(R)N [kN]	13,9	19,0	24,0	38,0	50,3
	**Shear V_{Rd}: single anchor, no edge effects, without lever arm**					
	Non cracked and cracked concrete					
	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, Temperature range I

		Data according ETA-07/0260, issue 2009-01-12				
	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 ($c = c_{min}$)**					
	Non cracked concrete					
	HIS-(R)N [kN]	11,0	12,4	15,4	23,5	32,0
	Cracked concrete					
	HIS-(R)N [kN]	7,1	8,9	11,0	16,8	22,8
	**Shear V_{Rd}: single anchor, min. edge distance ($c = c_{min}$) , without lever arm**					
	Non cracked concrete					
	HIS-(R)N [kN]	4,2	5,5	7,6	10,8	17,2
	Cracked concrete					
	HIS-(R)N [kN]	3,0	3,9	5,4	7,7	12,2

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

		Data according ETA-07/0260, issue 2009-01-12				
	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 ($s = s_{min}$)**					
	Non cracked concrete					
	HIS-(R)N [kN]	13,1	15,2	18,5	29,0	38,8
	Cracked concrete					
	HIS-(R)N [kN]	8,5	10,8	13,2	20,6	27,6
	**Shear V_{Rd}: double anchor, no edge effects, min. spacing ($s = s_{min}$) , without lever arm**					
	Non cracked and cracked concrete					
	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-RE 500-SD with rebar

Injection mortar system		Benefits
	Hilti HIT-RE 500-SD 330 ml foil pack (also available as 500 ml and 1400 ml foil pack)	- suitable for non-cracked and cracked concrete C 20/25 to C 50/60 - high loading capacity - suitable for dry and water saturated concrete - large diameter applications - high corrosion resistant
	Statik mixer	- long working time at elevated temperatures - odourless epoxy
	rebar BSt 500 S	- embedment depth range: from 60 … 160 mm for Ø8 to 128 … 640 mm for Ø32

Concrete	Tensile zone	Small edge distance and spacing	Variable embedment depth	Fire resistance	Seismic	European Technical Approval	CE conformity	PROFIS Anchor design software

Approvals / certificates

Description	Authority / Laboratory	No. / date of issue
European technical approval [a)]	DIBt, Berlin	ETA-07/0260 / 2009-01-12
ES report icl. seismic	ICC evaluation service	ESR 2322 / 2012-02-01
Fire test report	MFPA, Leipzig	GS-III/B-07-070 / 2008-01-18
Assessment report (fire)	warringtonfire	WF 166402 / 2007-10-26 & suppl. WF 172920 / 2008-05-27

a) All data given in this section according ETA-07/0260, issue 2009-01-12.

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> typical embedment depth, 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℃, max. long ter m/short term base material temperature: +24℃/40℃)
- Installation temperature range +5℃ to +40℃

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

	Data according ETA-07/0260, issue 2009-01-12								
Anchor size	**Ø8**	**Ø10**	**Ø12**	**Ø14**	**Ø16**	**Ø20**	**Ø25**	**Ø28**	**Ø32**
Typical embedment depth [mm]	80	90	110	125	125	170	210	270	300
Base material thickness [mm]	110	120	145	165	165	220	275	340	380

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

			Data according ETA-07/0260, issue 2009-01-12								
Anchor size			**Ø8**	**Ø10**	**Ø12**	**Ø14**	**Ø16**	**Ø20**	**Ø25**	**Ø28**	**Ø32**
Non cracked concrete											
Tensile $N_{Ru,m}$	BSt 500 S	[kN]	*29,4*	*45,2*	*65,1*	*89,3*	94,1	149,2	204,9	298,7	349,9
Shear $V_{Ru,m}$	BSt 500 S	[kN]	*14,7*	*23,1*	*32,6*	*44,1*	*57,8*	*90,3*	*141,8*	*177,5*	*232,1*
Cracked concrete											
Tensile $N_{Ru,m}$	BSt 500 S	[kN]	23,8	33,5	46,1	57,0	65,2	110,8	146,1	228,7	268,1
Shear $V_{Ru,m}$	BSt 500 S	[kN]	*14,7*	*23,1*	*32,6*	*44,1*	*57,8*	*90,3*	*141,8*	*177,5*	*232,1*

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

			Data according ETA-07/0260, issue 2009-01-12								
Anchor size			**Ø8**	**Ø10**	**Ø12**	**Ø14**	**Ø16**	**Ø20**	**Ø25**	**Ø28**	**Ø32**
Non cracked concrete											
Tensile N_{Rk}	BSt 500 S	[kN]	*28,0*	42,4	58,3	70,6	70,6	111,9	153,7	224,0	262,4
Shear V_{Rk}	BSt 500 S	[kN]	*14,0*	*22,0*	*31,0*	*42,0*	*55,0*	*86,0*	*135,0*	*169,0*	*221,0*
Cracked concrete											
Tensile N_{Rk}	BSt 500 S	[kN]	16,1	22,6	31,1	38,5	44,0	74,8	109,6	154,4	181,0
Shear V_{Rk}	BSt 500 S	[kN]	*14,0*	*22,0*	*31,0*	*42,0*	*55,0*	*86,0*	*135,0*	*169,0*	*221,0*

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

			Data according ETA-07/0260, issue 2009-01-12								
Anchor size			**Ø8**	**Ø10**	**Ø12**	**Ø14**	**Ø16**	**Ø20**	**Ø25**	**Ø28**	**Ø32**
Non cracked concrete											
Tensile N_{Rd}	BSt 500 S	[kN]	16,8	23,6	32,4	39,2	33,6	53,3	73,2	106,7	125,0
Shear V_{Rd}	BSt 500 S	[kN]	9,3	14,7	20,7	28,0	36,7	57,3	90,0	112,7	147,3
Cracked concrete											
Tensile N_{Rd}	BSt 500 S	[kN]	8,9	12,6	17,3	21,4	20,9	35,6	52,2	73,5	86,2
Shear V_{Rd}	BSt 500 S	[kN]	9,3	14,7	20,7	28,0	36,7	57,3	90,0	112,7	147,3

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

			Data according ETA-07/0260, issue 2009-01-12								
Anchor size			**Ø8**	**Ø10**	**Ø12**	**Ø14**	**Ø16**	**Ø20**	**Ø25**	**Ø28**	**Ø32**
Non cracked concrete											
Tensile N_{rec}	BSt 500 S	[kN]	12,0	16,8	23,1	28,0	24,0	38,1	52,3	76,2	89,3
Shear V_{rec}	BSt 500 S	[kN]	6,7	10,5	14,8	20,0	26,2	41,0	64,3	80,5	105,2
Cracked concrete											
Tensile N_{rec}	BSt 500 S	[kN]	6,4	9,0	12,3	15,3	15,0	25,4	37,3	52,5	61,5
Shear V_{rec}	BSt 500 S	[kN]	6,7	10,5	14,8	20,0	26,2	41,0	64,3	80,5	105,2

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-RE 500-SD 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 +58 °C	+35 °C	+58 °C
Temperature range III	-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 rebar BSt 500S

			Data according ETA-07/0260, issue 2009-01-12								
Anchor size			**Ø8**	**Ø10**	**Ø12**	**Ø14**	**Ø16**	**Ø20**	**Ø25**	**Ø28**	**Ø32**
Nominal tensile strength f_{uk}	BSt 500 S	[N/mm²]	550	550	550	550	550	550	550	550	550
Yield strength f_{yk}	BSt 500 S	[N/mm²]	500	500	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	615,8	804,2
Moment of resistance W	BSt 500 S	[mm³]	50,3	98,2	169,6	269,4	402,1	785,4	1534	2155	3217

Material quality

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

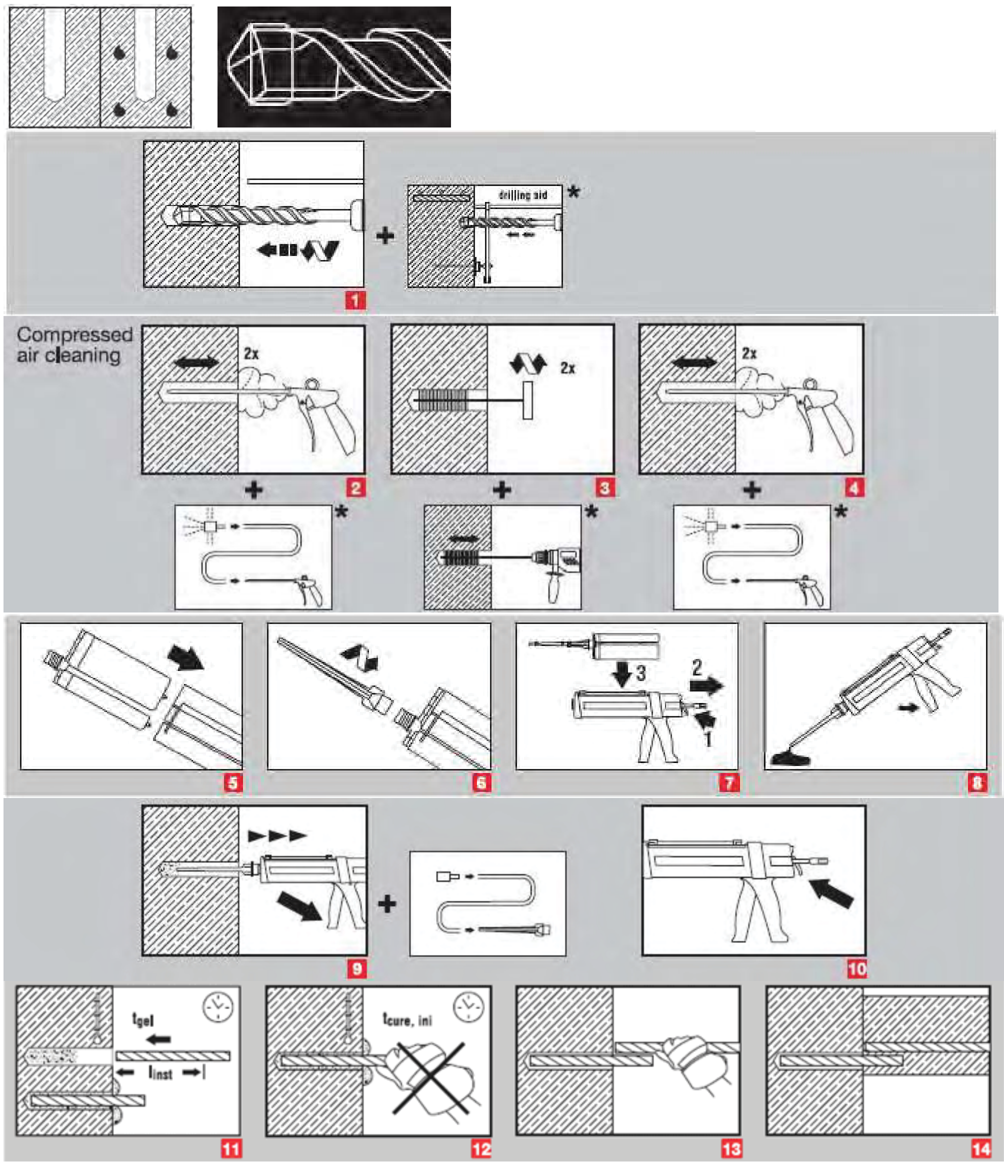
Setting

installation equipment

Anchor size	Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø28	Ø32
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



Brush bore hole with required steel brush HIT-RB

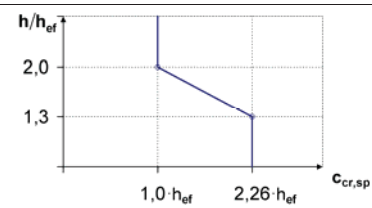
For detailed information on installation see instruction for use given with the package of the product.

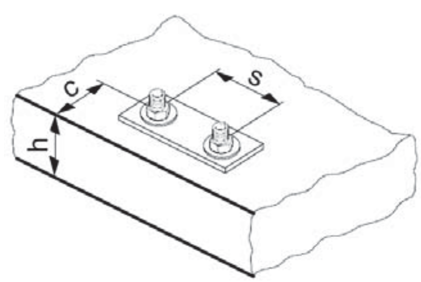
Curing time for general conditions

Data according ETA-07/0260, issue 2009-01-12		
Temperature of the base material	**Working time in which anchor can be inserted and adjusted t_{gel}**	**Curing time before anchor can be fully loaded t_{cure}**
40 °C	12 min	4 h
30 °C to 39 °C	12 min	8 h
20 °C to 29 °C	20 min	12 h
15 °C to 19 °C	30 min	24 h
10 °C to 14 °C	90 min	48 h
5 °C to 9 °C	120 min	72 h

Setting details

			Data according ETA-07/0260, issue 2009-01-12								
Anchor size			**Ø8**	**Ø10**	**Ø12**	**Ø14**	**Ø16**	**Ø20**	**Ø25**	**Ø28**	**Ø32**
Nominal diameter of drill bit	d_0	[mm]	12	14	16	18	20	25	32	35	40
Effective anchorage and drill hole depth range a)	$h_{ef,min}$	[mm]	60	60	70	75	80	90	100	112	128
	$h_{ef,max}$	[mm]	160	200	240	280	320	400	500	560	640
Minimum base material thickness	h_{min}	[mm]	h_{ef} + 30 mm ≥ 100 mm		$h_{ef} + 2\ d_0$						
Minimum spacing	s_{min}	[mm]	40	50	60	70	80	100	125	140	160
Minimum edge distance	c_{min}	[mm]	40	50	60	70	80	100	125	140	160
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 $h / h_{ef} \geq 2{,}0$						
			$4{,}6\ h_{ef}$ - $1{,}8\ h$		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)	$c_{cr,N}$		$1{,}5\ h_{ef}$								





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

a) $h_{ef,min} \leq h_{ef} \leq h_{ef,max}$ (h_{ef}: embedment depth)

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

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. Design resistance according data given in ETA-07/0260, issue 2009-01-12.

- 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)

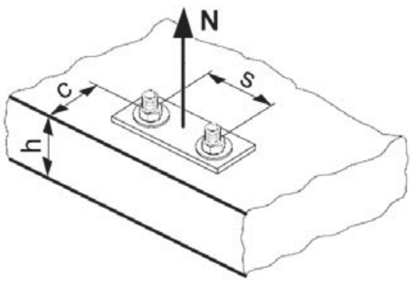
The values are valid for one anchor.

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 $N_{Rd,s}$

	Data according ETA-07/0260, issue 2009-01-12								
Anchor size	**Ø8**	**Ø10**	**Ø12**	**Ø14**	**Ø16**	**Ø20**	**Ø25**	**Ø28**	**Ø32**
$N_{Rd,s}$ BSt 500 S [kN]	20,0	30,7	44,3	60,7	79,3	123,6	192,9	242,1	315,7

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

	Data according ETA-07/0260, issue 2009-01-12								
Anchor size	**Ø8**	**Ø10**	**Ø12**	**Ø14**	**Ø16**	**Ø20**	**Ø25**	**Ø28**	**Ø32**
Typical embedment depth $h_{ef,typ}$ [mm]	**80**	**90**	**110**	**125**	**125**	**170**	**210**	**270**	**300**
Non cracked concrete									
$N^0_{Rd,p}$ Temperature range I [kN]	16,8	23,6	34,6	42,8	41,9	71,2	102,1	147,0	186,7
$N^0_{Rd,p}$ Temperature range II [kN]	13,4	18,8	27,6	36,7	32,9	56,0	86,4	113,1	143,6
$N^0_{Rd,p}$ Temperature range III [kN]	7,8	11,0	16,1	21,4	20,9	33,1	51,1	67,9	86,2
Cracked concrete									
$N^0_{Rd,p}$ Temperature range I [kN]	8,9	12,6	17,3	21,4	20,9	35,6	55,0	73,5	86,2
$N^0_{Rd,p}$ Temperature range II [kN]	7,3	10,2	13,8	18,3	18,0	28,0	43,2	56,5	71,8
$N^0_{Rd,p}$ Temperature range III [kN]	4,5	5,5	8,1	10,7	10,5	15,3	23,6	33,9	43,1

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

	Data according ETA-07/0260, issue 2009-01-12								
Anchor size	**Ø8**	**Ø10**	**Ø12**	**Ø14**	**Ø16**	**Ø20**	**Ø25**	**Ø28**	**Ø32**
$N^0_{Rd,c}$ Non cracked concrete [kN]	20,1	24,0	32,4	39,2	33,6	53,3	73,2	106,7	125,0
$N^0_{Rd,c}$ Cracked concrete [kN]	14,3	17,1	23,1	28,0	24,0	38,0	52,2	76,1	89,1

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

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

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

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
$f_B = (f_{ck,cube}/25N/mm^2)^{1/2}$ 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)]

$c/c_{cr,N}$ $c/c_{cr,sp}$	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9	1
$f_{1,N} = 0,7 + 0,3 \cdot c/c_{cr,N}$ $f_{1,sp} = 0,7 + 0,3 \cdot c/c_{cr,sp}$	0,73	0,76	0,79	0,82	0,85	0,88	0,91	0,94	0,97	1
$f_{2,N} = 0,5 \cdot (1 + c/c_{cr,N})$ $f_{2,sp} = 0,5 \cdot (1 + c/c_{cr,sp})$	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)]

$s/s_{cr,N}$ $s/s_{cr,sp}$	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9	1
$f_{3,N} = 0,5 \cdot (1 + s/s_{cr,N})$ $f_{3,sp} = 0,5 \cdot (1 + s/s_{cr,sp})$	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

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

Influence of reinforcement

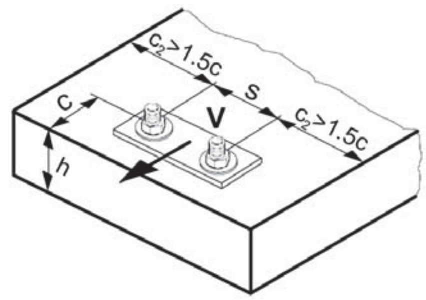
h_{ef} [mm]	40	50	60	70	80	90	≥ 100
$f_{re,N}$ = 0,5 + h_{ef}/200mm ≤ 1	0,7 [a)]	0,75 [a)]	0,8 [a)]	0,85 [a)]	0,9 [a)]	0,95 [a)]	1

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} = 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 $V_{Rd,s}$

	Data according ETA-07/0260, issue 2009-01-12								
Anchor size	Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø28	Ø32
$V_{Rd,s}$ BSt 500 S [kN]	9,3	14,7	20,7	28,0	36,7	57,3	90,0	112,7	147,3

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

	Data according ETA-07/0260, issue 2009-01-12								
Anchor size	Ø8	Ø10	Ø12	Ø14	Ø16	Ø20	Ø25	Ø28	Ø32
Non-cracked concrete									
$V^0_{Rd,c}$ [kN]	5,9	8,6	11,6	15,0	18,7	27,0	39,2	47,3	59,0
Cracked concrete									
$V^0_{Rd,c}$ [kN]	4,2	6,1	8,2	10,6	13,2	19,2	27,7	33,5	41,8

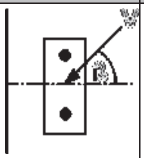
Influencing factors

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

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}.

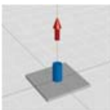
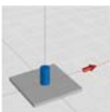
Combined tension and shear loading

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

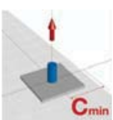
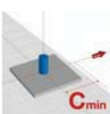
Precalculated values

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.

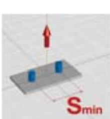
Design resistance: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm², Temperature range I

	Data according ETA-07/0260, issue 2009-01-12								
Anchor size	**Ø8**	**Ø10**	**Ø12**	**Ø14**	**Ø16**	**Ø20**	**Ø25**	**Ø28**	**Ø32**
Embedment depth $h_{ef,1}$ = [mm]	60	60	72	84	96	120	150	168	192
Base material thickness h_{min}= [mm]	100	100	104	120	136	170	214	238	272
 **Tensile N_{Rd}: single anchor, no edge effects**									
Non cracked concrete									
BSt 500 S [kN]	12,6	13,0	17,1	21,6	22,6	31,6	44,2	52,4	64,0
Cracked concrete									
BSt 500 S [kN]	6,7	8,4	11,3	14,4	16,1	22,5	31,5	37,3	45,6
 **Shear V_{Rd}: single anchor, no edge effects, without lever arm**									
Non cracked concrete									
BSt 500 S [kN]	9,3	14,7	20,7	28,0	36,7	57,3	90,0	112,7	147,3
Cracked concrete									
BSt 500 S [kN]	9,3	14,7	20,7	28,0	36,7	57,3	88,2	104,5	127,7

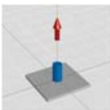
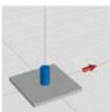
Design resistance: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm², Temperature range I

	Data according ETA-07/0260, issue 2009-01-12								
Anchor size	**Ø8**	**Ø10**	**Ø12**	**Ø14**	**Ø16**	**Ø20**	**Ø25**	**Ø28**	**Ø32**
Embedment depth $h_{ef,1}$ = [mm]	60	60	72	84	96	120	150	168	192
Base material thickness h_{min}= [mm]	100	100	104	120	136	170	214	238	272
Edge distance $c = c_{min}$= [mm]	40	50	60	70	80	100	125	140	160
 **Tensile N_{Rd}: single anchor, min. edge distance ($c = c_{min}$)**									
Non cracked concrete									
BSt 500 S [kN]	7,6	8,5	10,0	12,5	13,1	18,3	25,6	30,3	37,0
Cracked concrete									
BSt 500 S [kN]	4,0	5,6	7,6	9,7	10,8	15,2	21,2	25,2	30,7
 **Shear V_{Rd}: single anchor, min. edge distance ($c = c_{min}$) , without lever arm**									
Non cracked concrete									
BSt 500 S [kN]	3,5	4,9	6,7	8,6	10,8	15,7	22,9	27,7	34,6
Cracked concrete									
BSt 500 S [kN]	2,5	3,5	4,7	6,1	7,6	11,1	16,2	19,6	24,5

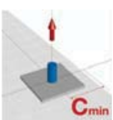
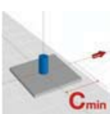
Design resistance: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm², Temperature range I
(load values are valid for single anchor)

	Data according ETA-07/0260, issue 2009-01-12								
Anchor size	**Ø8**	**Ø10**	**Ø12**	**Ø14**	**Ø16**	**Ø20**	**Ø25**	**Ø28**	**Ø32**
Embedment depth $h_{ef,1}$ = [mm]	60	60	72	84	96	120	150	168	192
Base material thickness h_{min}= [mm]	100	100	104	120	136	170	214	238	272
Spacing $s = s_{min}$= [mm]	40	50	60	70	80	100	125	140	160
 **Tensile N_{Rd}: double anchor, no edge effects, min. spacing ($s = s_{min}$)**									
Non cracked concrete									
BSt 500 S [kN]	7,8	8,2	10,4	13,0	13,6	19,0	26,6	31,5	38,5
Cracked concrete									
BSt 500 S [kN]	4,4	5,5	7,4	9,3	9,7	13,6	19,0	22,5	27,4
 **Shear V_{Rd}: double anchor, no edge effects, min. spacing ($s = s_{min}$) , without lever arm**									
Non cracked concrete									
BSt 500 S [kN]	9,3	14,7	20,7	28,0	36,7	56,5	79,0	93,7	114,4
Cracked concrete									
BSt 500 S [kN]	9,3	12,8	17,3	22,0	28,8	40,3	56,3	66,8	81,6

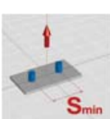
Design resistance: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm², Temperature range I

		Data according ETA-07/0260, issue 2009-01-12								
Anchor size		**Ø8**	**Ø10**	**Ø12**	**Ø14**	**Ø16**	**Ø20**	**Ø25**	**Ø28**	**Ø32**
Embedment depth $h_{ef,typ}$ =	[mm]	80	90	110	125	125	170	210	270	300
Base material thickness h_{min}=	[mm]	110	120	142	161	165	220	274	340	380
	**Tensile N_{Rd}: single anchor, no edge effects**									
	Non cracked concrete									
	BSt 500 S [kN]	16,8	23,6	32,4	39,2	33,6	53,3	73,2	106,7	125,0
	Cracked concrete									
	BSt 500 S [kN]	8,9	12,6	17,3	21,4	20,9	35,6	52,2	73,5	86,2
	**Shear V_{Rd}: single anchor, no edge effects, without lever arm**									
	Non cracked concrete									
	BSt 500 S [kN]	9,3	14,7	20,7	28,0	36,7	57,3	90,0	112,7	147,3
	cracked concrete									
	BSt 500 S [kN]	9,3	14,7	20,7	28,0	36,7	57,3	90,0	112,7	147,3

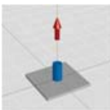
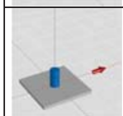
Design resistance: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm², Temperature range I

		Data according ETA-07/0260, issue 2009-01-12								
Anchor size		**Ø8**	**Ø10**	**Ø12**	**Ø14**	**Ø16**	**Ø20**	**Ø25**	**Ø28**	**Ø32**
Embedment depth $h_{ef,typ}$ =	[mm]	80	90	110	125	125	170	210	270	300
Base material thickness h_{min}=	[mm]	110	120	142	161	165	220	274	340	380
Edge distance $c = c_{min}$=	[mm]	40	50	60	70	80	100	125	140	160
	**Tensile N_{Rd}: single anchor, min. edge distance ($c = c_{min}$)**									
	Non cracked concrete									
	BSt 500 S [kN]	9,1	11,6	15,5	18,9	17,0	26,1	36,1	50,4	59,5
	Cracked concrete									
	BSt 500 S [kN]	4,3	6,0	8,4	10,5	10,3	17,4	25,7	35,9	42,4
	**Shear V_{Rd}: single anchor, min. edge distance ($c = c_{min}$) , without lever arm**									
	Non cracked concrete									
	BSt 500 S [kN]	3,7	5,3	7,3	9,5	11,5	17,2	25,0	31,6	39,3
	Cracked concrete									
	BSt 500 S [kN]	2,6	3,8	5,2	6,7	8,1	12,2	17,7	22,4	27,9

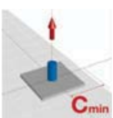
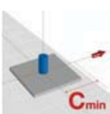
Design resistance: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm², Temperature range I
(load values are valid for single anchor)

		Data according ETA-07/0260, issue 2009-01-12								
Anchor size		**Ø8**	**Ø10**	**Ø12**	**Ø14**	**Ø16**	**Ø20**	**Ø25**	**Ø28**	**Ø32**
Embedment depth $h_{ef,typ}$ =	[mm]	80	90	110	125	125	170	210	270	300
Base material thickness h_{min}=	[mm]	110	120	142	161	165	220	274	340	380
Spacing $s = s_{min}$=	[mm]	40	50	60	70	80	100	125	140	160
	**Tensile N_{Rd}: double anchor, no edge effects, min. spacing ($s = s_{min}$)**									
	Non cracked concrete									
	BSt 500 S [kN]	10,4	13,5	18,1	22,0	19,2	30,1	41,4	59,5	69,8
	Cracked concrete									
	BSt 500 S [kN]	5,9	8,1	11,1	13,7	13,2	21,5	29,5	42,4	49,8
	**Shear V_{Rd}: double anchor, no edge effects, min. spacing ($s = s_{min}$) , without lever arm**									
	Non cracked concrete									
	BSt 500 S [kN]	9,3	14,7	20,7	28,0	36,7	57,3	90,0	112,7	147,3
	Cracked concrete									
	BSt 500 S [kN]	9,3	14,7	20,7	28,0	35,6	57,3	87,5	112,7	142,1

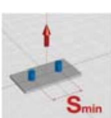
Design resistance: concrete C 20/25 – $f_{ck,cube}$ = 25 N/mm², Temperature range I

		Data according ETA-07/0260, issue 2009-01-12								
Anchor size		**Ø8**	**Ø10**	**Ø12**	**Ø14**	**Ø16**	**Ø20**	**Ø25**	**Ø28**	**Ø32**
Embedment depth	$h_{ef,2}$ = [mm]	96	120	144	168	192	240	300	336	384
Base material thickness	h_{min}= [mm]	126	150	176	204	232	290	364	406	464
	**Tensile N_{Rd}: single anchor, no edge effects**									
	Non cracked concrete									
BSt 500 S	[kN]	20,0	30,7	44,3	57,5	64,0	89,4	125,0	148,1	181,0
	Cracked concrete									
BSt 500 S	[kN]	10,7	16,8	22,6	28,7	32,2	50,3	78,5	91,5	110,3
	**Shear V_{Rd}: single anchor, no edge effects, without lever arm**									
	Non cracked and cracked concrete									
BSt 500 S	[kN]	9,3	14,7	20,7	28,0	36,7	57,3	90,0	112,7	147,3

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

		Data according ETA-07/0260, issue 2009-01-12								
Anchor size		**Ø8**	**Ø10**	**Ø12**	**Ø14**	**Ø16**	**Ø20**	**Ø25**	**Ø28**	**Ø32**
Embedment depth	$h_{ef,2}$ = [mm]	96	120	144	168	192	240	300	336	384
Base material thickness	h_{min}= [mm]	126	150	176	204	232	290	364	406	464
Edge distance	$c = c_{min}$= [mm]	40	50	60	70	80	100	125	140	160
	**Tensile N_{Rd}: single anchor, min. edge distance ($c = c_{min}$)**									
	Non cracked concrete									
BSt 500 S	[kN]	11,0	16,5	21,7	27,3	28,6	40,0	55,9	66,2	80,9
	Cracked concrete									
BSt 500 S	[kN]	5,8	9,1	12,3	15,9	17,8	27,8	44,1	51,4	61,9
	**Shear V_{Rd}: single anchor, min. edge distance ($c = c_{min}$) , without lever arm**									
	Non cracked and cracked concrete									
BSt 500 S	[kN]	3,9	5,7	7,8	10,2	12,9	18,9	27,8	33,9	42,6
	Cracked concrete									
BSt 500 S	[kN]	2,8	4,0	5,5	7,2	9,1	13,4	19,7	24,0	30,2

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

		Data according ETA-07/0260, issue 2009-01-12								
Anchor size		**Ø8**	**Ø10**	**Ø12**	**Ø14**	**Ø16**	**Ø20**	**Ø25**	**Ø28**	**Ø32**
Embedment depth	$h_{ef,2}$ = [mm]	96	120	144	168	192	240	300	336	384
Base material thickness	h_{min}= [mm]	126	150	176	204	232	290	364	406	464
Spacing	$s = s_{min}$= [mm]	40	50	60	70	80	100	125	140	160
	**Tensile N_{Rd}: double anchor, no edge effects, min. spacing ($s = s_{min}$)**									
	Non cracked concrete									
BSt 500 S	[kN]	12,8	19,4	26,5	33,4	34,9	48,8	68,2	80,9	98,8
	Cracked concrete									
BSt 500 S	[kN]	7,2	11,0	14,8	18,9	20,9	31,9	48,6	56,9	68,9
	**Shear V_{Rd}: double anchor, no edge effects, min. spacing ($s = s_{min}$) , without lever arm**									
	Non cracked concrete									
BSt 500 S	[kN]	9,3	14,7	20,7	28,0	36,7	57,3	90,0	112,7	147,3
	Cracked concrete									
BSt 500 S	[kN]	9,3	14,7	20,7	28,0	36,7	57,3	90,0	112,7	147,3