


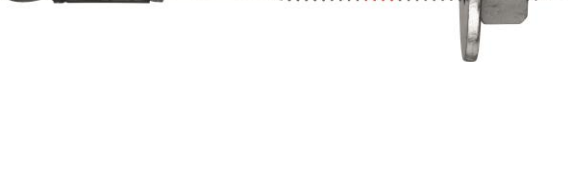

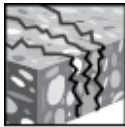





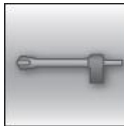





HST3 Metal expansion anchor

Anchor version	Benefits
 <p>HST3 Carbon steel</p>  <p>HST3-R Stainless steel</p>	<ul style="list-style-type: none"> - highest resistance for reduced member thickness, short spacing and edge distances - increased undercut percentage in combination with optimized coating - suitable for non-cracked and cracked concrete C 12/15 to C 80/95 - highly reliable and safe anchor for structural seismic design with ETA C1/C2 approval - flexibility with two embedment depths included in the ETA
 <p>HST3-BW Carbon steel</p>  <p>HST3-R-BW Stainless steel</p>	<ul style="list-style-type: none"> - minimum edge and spacing distances reduced by up to 25% compared to HST - design tension resistance increased by up to 66% compared to HST - product and length identification mark facilitates quality control and inspection

<p>Base material</p>  <p>Concrete (uncracked)</p>  <p>Concrete (cracked)</p>	<p>Load conditions</p>  <p>Static/quasi-static</p>  <p>Seismic ETA-C1/C2</p>  <p>Fire ETA</p>
<p>Installation conditions</p>  <p>Hammer drilled holes</p>  <p>Diamond drilled holes</p>  <p>Hollow drill-bit drilling</p>	<p>Other informations</p>  <p>European Technical Approval</p>  <p>CE conformity</p>  <p>PROFIS Anchor design Software</p>

Approvals / certificates

Description	Authority / Laboratory	No. / date of issue
European technical approval ^{a)}	DIBt, Berlin	ETA-98/0001 / 2015-11-06
Fire test report	DIBt, Berlin	ETA-98/0001 / 2015-11-06

a) All data for HST3 in concrete strength class C20/25 to C50/60 given in this section according to ETA-98/0001, issue 2015-11-06. Data for other concrete strength classes according to Hilti Technical Data assessment.

Basic loading data (for a single anchor)

Static and quasi-static resistance

All data in this section applies to:

- Correct setting (See setting instruction)
- No edge distance and spacing influence
- Steel failure
- Minimum base material thickness
- Concrete C 20/25, $f_{ck,cube} = 25 \text{ N/mm}^2$

For details see Simplified design method

Mean ultimate resistance

Anchor size		M8	M10		M12		M16		M20	M24
Eff. Anchorage depth h_{ef}	[mm]	47	40	60	50	70	65	85	101	125
Non-cracked concrete										
Tensile $N_{Ru,m}$										
HST3/HST3-BW	[kN]	15,9	17,0	26,6	23,7	33,2	35,1	52,5	68,1	79,7
HST3-R/HST3-R-BW	[kN]	15,9	17,0	26,6	23,7	33,2	35,1	52,5	68,1	79,7
Shear $V_{Ru,m}$										
HST3/HST3-BW	[kN]	14,5	23,0	24,8	35,7	37,2	57,2	58,1	88,1	98,7
HST3-R/HST3-R-BW	[kN]	16,5	26,9	26,6	32,7	38,5	51,0	66,8	102,1	120,8
Cracked concrete										
Tensile $N_{Ru,m}$										
HST3/HST3-BW	[kN]	10,0	12,1	15,9	16,9	26,6	25,0	37,5	48,5	53,1
HST3-R/HST3-R-BW	[kN]	10,0	12,1	15,9	16,9	26,6	25,0	37,5	48,5	53,1
Shear $V_{Ru,m}$										
HST3/HST3-BW	[kN]	14,5	23,0	24,8	35,7	37,2	57,2	58,1	88,1	98,7
HST3-R/HST3-R-BW	[kN]	16,5	26,9	26,6	32,7	38,5	51,0	66,8	102,1	120,8

Characteristic resistance

Anchor size		M8	M10		M12		M16		M20	M24
Eff. Anchorage depth h_{ef}	[mm]	47	40	60	50	70	65	85	101	125
Non-cracked concrete										
Tensile N_{Rk}										
HST3/HST3-BW	[kN]	12,0	12,8	20,0	17,9	25,0	26,5	39,6	51,3	60,0
HST3-R/HST3-R-BW	[kN]	12,0	12,8	20,0	17,9	25,0	26,5	39,6	51,3	60,0
Shear V_{Rk}										
HST3/HST3-BW	[kN]	13,8	21,9	23,6	34,0	35,4	54,5	55,3	83,9	94,0
HST3-R/HST3-R-BW	[kN]	15,7	25,6	25,3	31,1	36,7	48,6	63,6	97,2	115,0
Cracked concrete										
Tensile N_{Rk}										
HST3/HST3-BW	[kN]	7,5	9,1	12,0	12,7	20,0	18,9	28,2	36,5	40,0
HST3-R/HST3-R-BW	[kN]	7,5	9,1	12,0	12,7	20,0	18,9	28,2	36,5	40,0
Shear V_{Rk}										
HST3/HST3-BW	[kN]	13,8	21,9	23,6	34,0	35,4	54,5	55,3	83,9	94,0
HST3-R/HST3-R-BW	[kN]	15,7	24,3	25,3	31,1	36,7	48,6	63,6	97,2	115,0

Design resistance

Anchor size		M8	M10		M12		M16		M20	M24
Eff. Anchorage depth h_{ef}	[mm]	47	40	60	50	70	65	85	101	125
Non-cracked concrete										
Tensile N_{Rd}										
HST3/HST3-BW	[kN]	8,0	8,5	13,3	11,9	16,7	17,6	26,4	34,2	40,0
HST3-R/HST3-R-BW	[kN]	8,0	8,5	13,3	11,9	16,7	17,6	26,4	34,2	40,0
Shear V_{Rd}										
HST3/HST3-BW	[kN]	11,0	17,5	18,9	27,2	28,3	43,6	44,2	67,1	62,7
HST3-R/HST3-R-BW	[kN]	12,6	20,5	20,2	24,9	29,4	38,9	50,9	77,8	88,5
Cracked concrete										
Tensile N_{Rd}										
HST3/HST3-BW	[kN]	5,0	6,1	8,0	8,5	13,3	12,6	18,8	24,4	26,7
HST3-R/HST3-R-BW	[kN]	5,0	6,1	8,0	8,5	13,3	12,6	18,8	24,4	26,7
Shear V_{Rd}										
HST3/HST3-BW	[kN]	11,0	16,2	18,9	23,6	28,3	42,9	44,2	67,1	62,7
HST3-R/HST3-R-BW	[kN]	12,6	16,2	20,2	23,6	29,4	38,9	50,9	77,8	83,9

Recommended loads

Anchor size		M8	M10		M12		M16		M20	M24
Eff. Anchorage depth h_{ef}	[mm]	47	40	60	50	70	65	85	101	125
Non-cracked concrete										
Tensile N_{rec}^a										
HST3/HST3-BW	[kN]	5,7	6,1	9,5	8,5	11,9	12,6	18,8	24,4	28,6
HST3-R/HST3-R-BW	[kN]	5,7	6,1	9,5	8,5	11,9	12,6	18,8	24,4	28,6
Shear V_{rec}^a										
HST3/HST3-BW	[kN]	7,9	12,5	13,5	19,4	20,2	31,1	31,6	47,9	44,8
HST3-R/HST3-R-BW	[kN]	9,0	14,6	14,5	17,8	21,0	27,8	36,3	55,5	63,2
Cracked concrete										
Tensile N_{rec}^a										
HST3/HST3-BW	[kN]	3,6	4,3	5,7	6,1	9,5	9,0	13,4	17,4	19,0
HST3-R/HST3-R-BW	[kN]	3,6	4,3	5,7	6,1	9,5	9,0	13,4	17,4	19,0
Shear V_{rec}^a										
HST3/HST3-BW	[kN]	7,9	11,6	13,5	16,8	20,2	30,6	31,6	47,9	44,8
HST3-R/HST3-R-BW	[kN]	9,0	11,6	14,5	16,8	21,0	27,8	36,3	55,5	59,9

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

Seismic resistance

All data in this section applies to:

- Correct setting (See setting instruction)
- No edge distance and spacing influence
- Steel failure

- Minimum base material thickness

- Concrete C 20/25, $f_{ck,cube} = 25 \text{ N/mm}^2$

- $\alpha_{gap} = 1,0$ (no hole clearance between anchor and fixture); in case of connections with hole clearance, $\alpha_{gap} = 0,5$ has to be used

For details see Simplified design method

Characteristic resistance

Anchor size		M8	M10	M12	M16	M20
Eff. Anchorage depth h_{ef}	[mm]	47	60	70	85	101
Seismic performance category C1						
Tensile $N_{Rk,seis}$						
HST3/HST3-BW	[kN]	7,5	12	17,9	24,0	31,1
HST3-R/HST3-R-BW	[kN]	7,5	12	17,9	24,0	31,1
Shear $V_{Rk,seis}$						
HST3/HST3-BW	[kN]	12,5	21,4	32,2	48,7	77,6
HST3-R/HST3-R-BW	[kN]	15,0	22,8	36,6	60,4	56,7
Seismic performance category C2						
Tensile $N_{Rk,seis}$						
HST3/HST3-BW	[kN]	3,0	10,4	17,9	24,0	31,1
HST3-R/HST3-R-BW	[kN]	3,4	10,4	17,9	24,0	31,1
Shear $V_{Rk,seis}$						
HST3/HST3-BW	[kN]	9,5	16,1	26,1	42,4	66,9
HST3-R/HST3-R-BW	[kN]	8,1	15,7	22,4	42,6	49,5

Design resistance

Anchor size		M8	M10	M12	M16	M20
Eff. Anchorage depth h_{ef}	[mm]	47	60	70	85	101
Seismic performance category C1						
Tensile $N_{Rd,seis}$						
HST3/HST3-BW	[kN]	5,0	8,0	11,9	16,0	20,7
HST3-R/HST3-R-BW	[kN]	5,0	8,0	11,9	16,0	20,7
Shear $V_{Rd,seis}$						
HST3/HST3-BW	[kN]	10,0	17,1	25,8	39,0	62,1
HST3-R/HST3-R-BW	[kN]	12,0	18,2	29,3	48,3	45,4
Seismic performance category C2						
Tensile $N_{Rd,seis}$						
HST3/HST3-BW	[kN]	2,0	6,9	11,9	16,0	20,7
HST3-R/HST3-R-BW	[kN]	2,3	6,9	11,9	16,0	20,7
Shear $V_{Rd,seis}$						
HST3/HST3-BW	[kN]	7,6	12,9	20,9	33,9	53,5
HST3-R/HST3-R-BW	[kN]	6,5	12,6	17,9	34,1	39,6

Fire resistance

All data in this section applies to:

- Correct setting (See setting instruction)
- No edge distance and spacing influence
- Steel failure
- Minimum base material thickness
- Concrete C 20/25, $f_{ck,cube} = 25 \text{ N/mm}^2$
- Hilti Technical Data for concrete strength class C55/67 to C80/95: for a structural element that fulfills the requirements according to DIN EN 1992-1-2 the fire resistances of C20/25 could be assumed.
- partial safety factor for resistance under fire exposure $\gamma_{M,fi}=1,0$ (in absence of other national regulations)

Characteristic resistance

Anchor size		M8	M10		M12		M16		M20	M24
Eff. Anchorage depth h_{ef}	[mm]	47	40	60	50	70	65	85	101	125
Fire Exposure R30										
Tensile $N_{Rk,fi}$										
HST3/HST3-BW	[kN]	0,9	1,5	2,4	2,3	5,0	4,4	7,1	9,1	12,6
HST3-R/HST3-R-BW	[kN]	1,9	1,8	3,0	3,2	5,0	4,7	7,1	9,1	12,6
Shear $V_{Rk,fi}$										
HST3/HST3-BW	[kN]	0,9	1,5	2,4	2,3	5,2	4,4	9,7	15,2	21,9
HST3-R/HST3-R-BW	[kN]	4,9	4,7	11,8	8,9	17,1	16,9	31,9	37,0	62,8
Fire Exposure R120										
Tensile $N_{Rk,fi}$										
HST3/HST3-BW	[kN]	0,6	0,8	0,9	0,8	1,3	1,5	2,4	3,8	5,4
HST3-R/HST3-R-BW	[kN]	1,5	1,5	2,4	2,5	4,0	3,8	5,6	7,3	10,1
Shear $V_{Rk,fi}$										
HST3/HST3-BW	[kN]	0,6	0,8	0,9	0,8	1,5	1,5	2,4	3,8	5,4
HST3-R/HST3-R-BW	[kN]	1,7	2,0	3,3	3,3	4,8	6,2	9,0	14,1	20,3

Design resistance

Anchor size		M8	M10		M12		M16		M20	M24
Eff. Anchorage depth h_{ef}	[mm]	47	40	60	50	70	65	85	101	125
Fire Exposure R30										
Tensile $N_{Rd,fi}$										
HST3/HST3-BW	[kN]	0,9	1,5	2,4	2,3	5,0	4,4	7,1	9,1	12,6
HST3-R/HST3-R-BW	[kN]	1,9	1,8	3,0	3,2	5,0	4,7	7,1	9,1	12,6
Shear $V_{Rd,fi}$										
HST3/HST3-BW	[kN]	0,9	1,5	2,4	2,3	5,2	4,4	9,7	15,2	21,9
HST3-R/HST3-R-BW	[kN]	4,9	4,7	11,8	8,9	17,1	16,9	31,9	37,0	62,8
Fire Exposure R120										
Tensile $N_{Rd,fi}$										
HST3/HST3-BW	[kN]	0,6	0,8	0,9	0,8	1,3	1,5	2,4	3,8	5,4
HST3-R/HST3-R-BW	[kN]	1,5	1,5	2,4	2,5	4,0	3,8	5,6	7,3	10,1
Shear $V_{Rd,fi}$										
HST3/HST3-BW	[kN]	0,6	0,8	0,9	0,8	1,5	1,5	2,4	3,8	5,4
HST3-R/HST3-R-BW	[kN]	1,7	2,0	3,3	3,3	4,8	6,2	9,0	14,1	20,3

Materials and dimensions

Mechanical properties

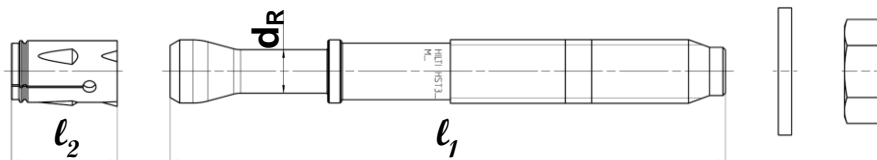
Anchor size			M8	M10	M12	M16	M20	M24
Nominal tensile strength $f_{uk,thread}$	HST3/HST3-BW	[N/mm ²]	800	800	800	720	700	530
	HST3-R/HST3-R-BW	[N/mm ²]	720	710	710	650	650	650
Yield strength $f_{yk,thread}$	HST3/HST3-BW	[N/mm ²]	640	640	640	576	560	450
	HST3-R/HST3-R-BW	[N/mm ²]	576	568	568	520	520	500
Stressed cross-section A_s		[mm ²]	36,6	58,0	84,3	157	245	353
Moment of resistance W		[mm ³]	31,2	62,3	109	277	541	935
Char. bending resistance $M^0_{Rk,s}$	HST3/HST3-BW	[Nm]	30	60	105	240	457	595
	HST3-R/HST3-R-BW	[Nm]	27	53	93	216	425	730

Material quality

Part	Material	
Bolt	HST3/HST3-BW	Carbon steel, galvanized to min. 5 μ m
	HST3-R/HST3-R-BW	Stainless steel

Anchor dimensions

Anchor size			M8	M10	M12	M16	M20	M24
Minimum thickness of fixture	$t_{fix,min}$	[mm]	2	2	2	2	2	2
Maximum thickness of fixture	$t_{fix,max}$	[mm]	195	220	270	370	310	330
Shaft diameter at the cone	d_R	[mm]	5,60	6,94	8,22	11,00	14,62	17,40
Minimum length of the anchor	$l_{1,min}$	[mm]	75	90	115	140	170	200
Maximum length of the anchor	$l_{1,max}$	[mm]	260	280	350	475	450	500
Length of expansion sleeve	l_2	[mm]	13,6	16,0	20,0	25,0	28,3	36,0



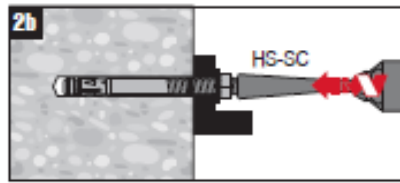
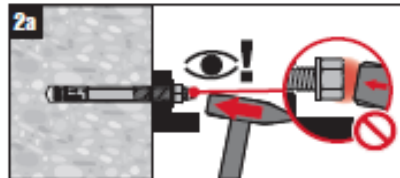
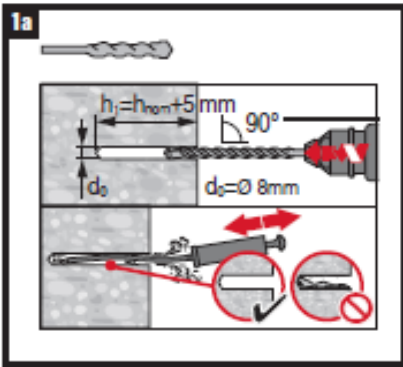
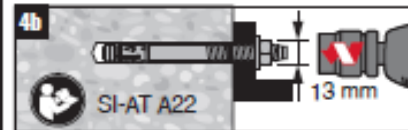
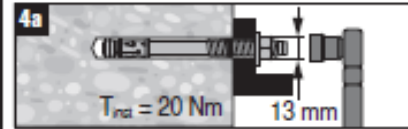
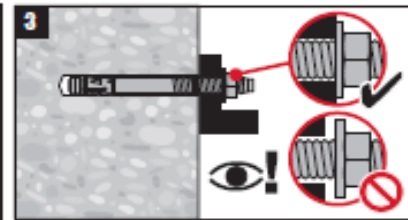
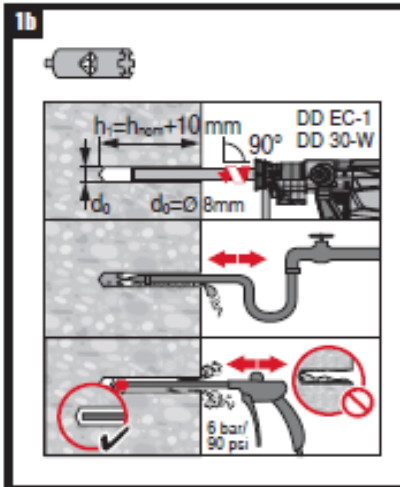
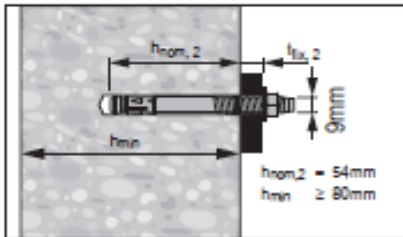
Setting instructions

Installation equipment

Anchor size	M8	M10	M12	M16	M20	M24
Rotary hammer	TE2(-A) – TE30(-A)				TE40 – TE70	
Diamond coring tool	DD-30W, DD-EC1					
Setting tool	Setting tool HS-SC				-	
Hollow drill bit	-		TE-CD, TE-YD			
Other tools	hammer, torque wrench, blow out pump					

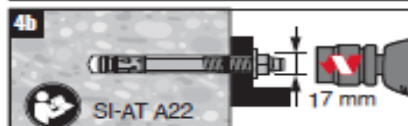
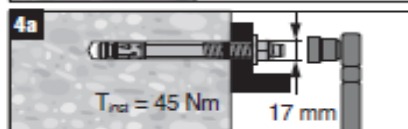
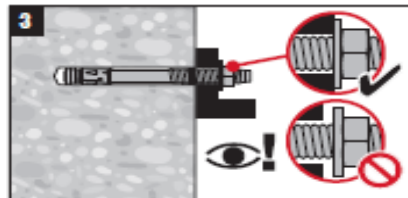
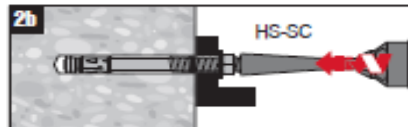
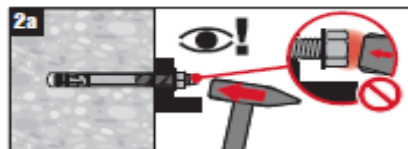
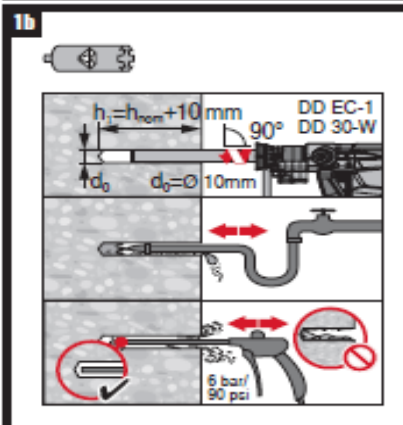
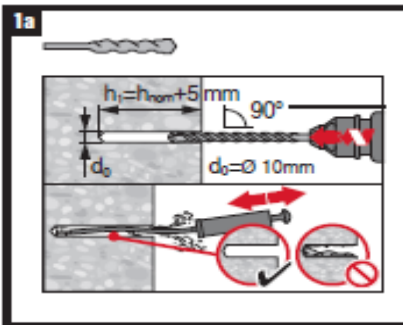
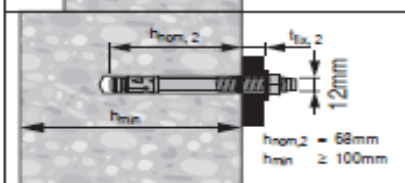
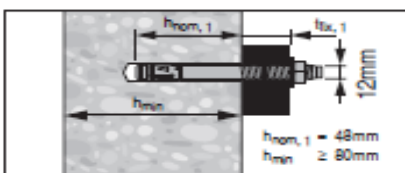
Setting instruction for M8

	HST3	HST3-R	HST3/-R BW	t _{fix,1}	t _{fix,2}
M8x75 -/10	✓	✓	✓	-	10
M8x95 -/30	✓	✓	-	-	30
M8x115 -/50	✓	✓	-	-	50



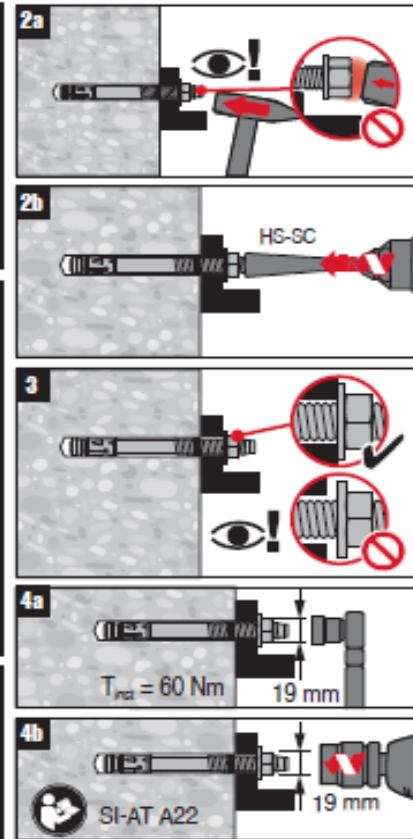
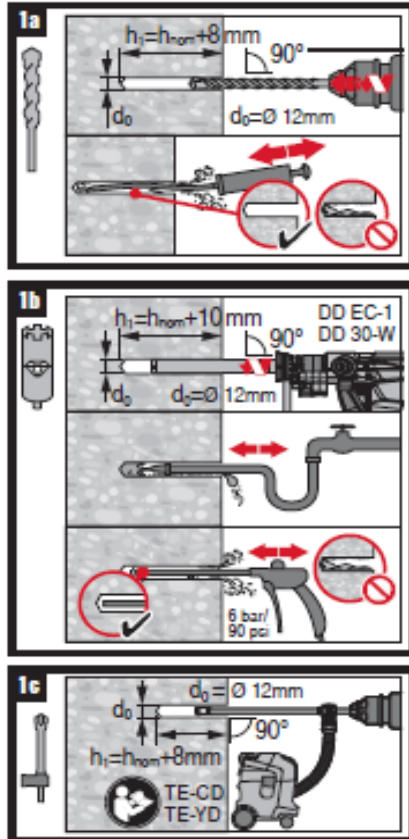
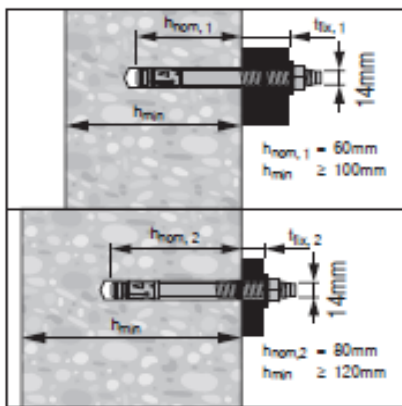
Setting instruction for M10

	HST3	HST3-R	HST3/-R BW	t _{fix,1}	t _{fix,2}
M10x70 10/-	✓	✓	-	10	-
M10x80 20/-	✓	✓	-	20	-
M10x90 30/10	✓	✓	-	30	10
M10x100 40/20	✓	✓	✓	40	20
M10x110 50/30	✓	✓	-	50	30
M10x130 70/50	✓	✓	-	70	50
M10x160 100/80	✓	✓	-	100	80
M10x200 140/120	✓	-	-	140	120



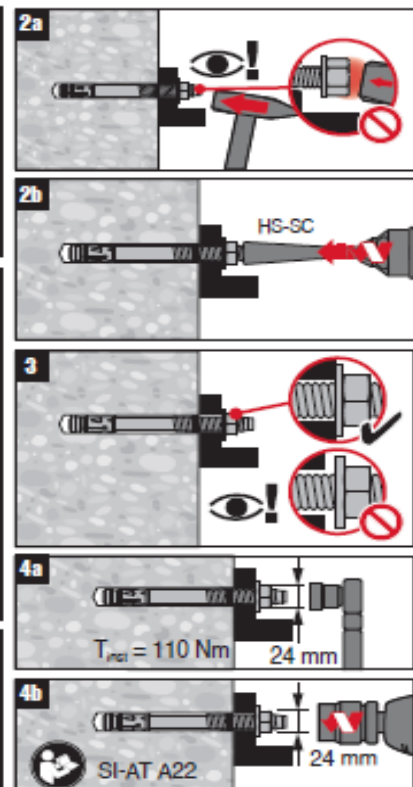
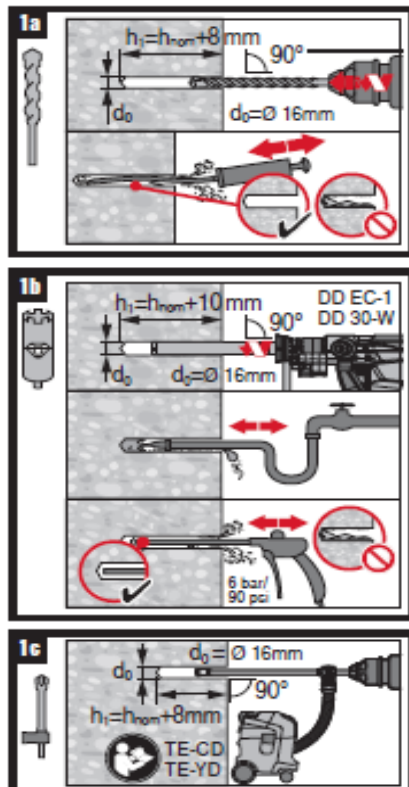
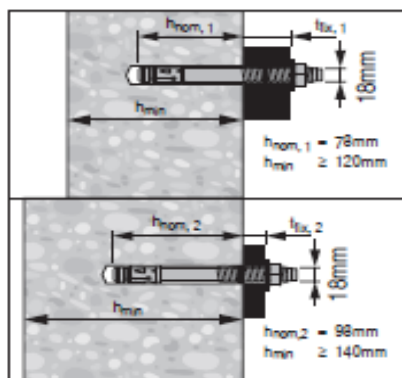
Setting instruction for M12

	HST3	HST3-R	HST3-R BW	$h_{fix,1}$	$h_{fix,2}$
M12x85 10/-	✓	✓	-	10	-
M12x95 20/-	✓	✓	-	20	-
M12x105 30/10	✓	✓	-	30	10
M12x115 40/20	✓	✓	✓	40	20
M12x125 50/30	✓	✓	-	50	30
M12x145 70/50	✓	✓	-	70	50
M12x165 90/70	✓	✓	-	90	70
M12x185 110/90	✓	✓	-	110	90
M12x215 140/120	✓	✓	-	140	120
M12x235 160/140	✓	-	-	160	140
M12x255 180/160	✓	-	-	180	160
M12x295 220/200	✓	-	-	220	200
M12x345 270/250	✓	-	-	270	250



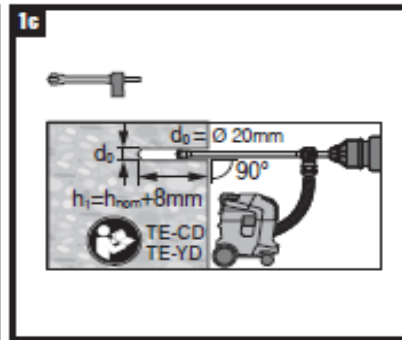
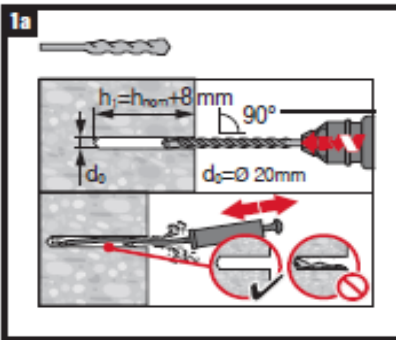
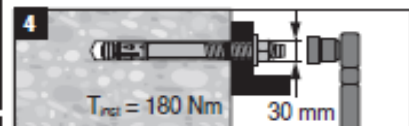
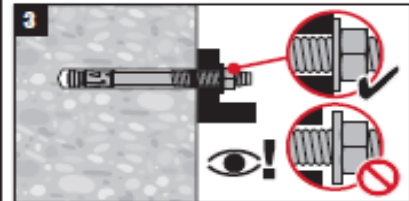
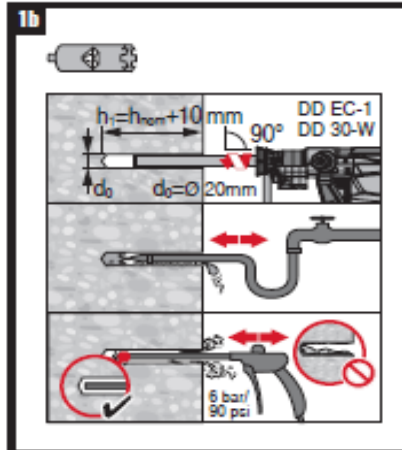
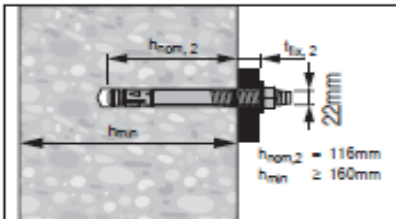
Setting instruction for M16

	HST3	HST3-R	HST3-R BW	$h_{fix,1}$	$h_{fix,2}$
M16x115 15/-	✓	✓	-	15	-
M16x135 35/15	✓	✓	-	35	15
M16x145 45/25	✓	✓	✓	45	25
M16x170 70/50	✓	✓	-	70	50
M16x220 120/100	✓	✓	-	120	100
M16x260 160/140	✓	✓	-	160	140
M16x300 200/180	✓	✓	-	200	180
M16x360 260/240	✓	-	-	260	240
M16x420 320/300	✓	-	-	320	300
M16x470 370/350	✓	-	-	370	350



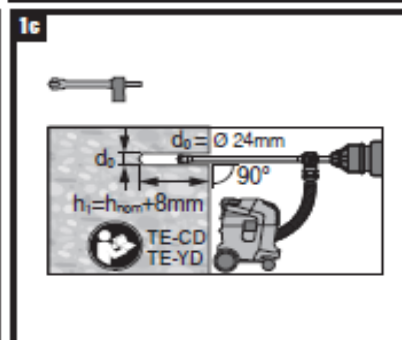
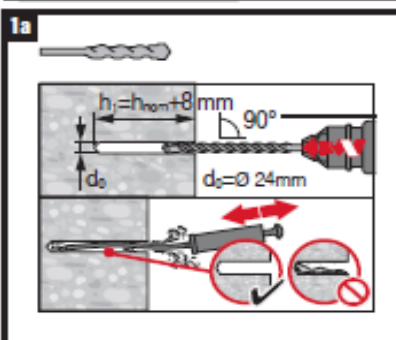
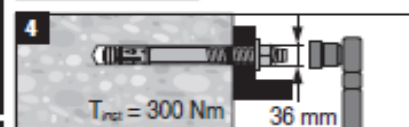
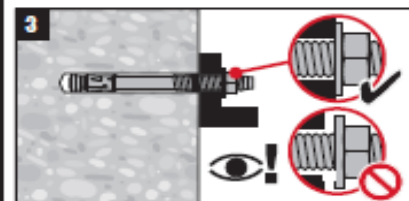
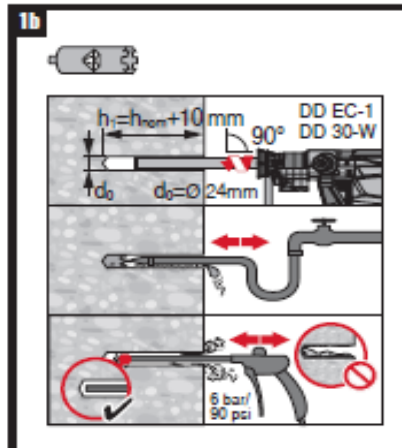
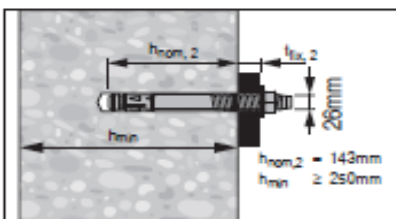
Setting instruction for M20

	HST3	HST3-R	$f_{ex,1}$	$f_{ex,2}$
M20x170 -/30	✓	✓	-	30
M20x200 -/60	✓	✓	-	60
M20x260 -/120	✓	✓	-	120



Setting instruction for M24

	HST3	HST3-R	$f_{ex,1}$	$f_{ex,2}$
M24x200 -/30	✓	✓	-	30
M24x230 -/60	✓	✓	-	60



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

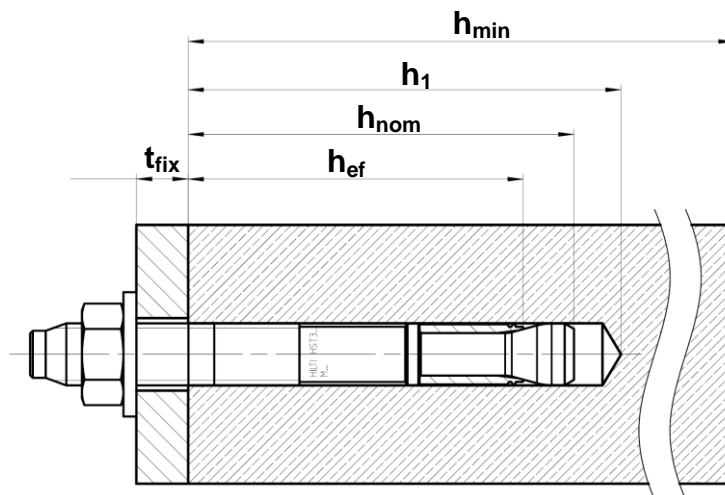
Setting details

Anchor size			M8	M10	M12	M16	M20	M24
Nominal diameter of drill bit	d_o	[mm]	8	10	12	16	20	24
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	8,45	10,45	12,5	16,5	20,55	24,55
Nominal anchorage depth	$h_{nom,1}$	[mm]	-	48	60	78	-	-
	$h_{nom,2}$	[mm]	54	68	80	98	116	143
Effective anchorage depth	$h_{ef,1}^{a)}$	[mm]	-	40	50	65	-	-
	$h_{ef,2}^{b)}$	[mm]	47	60	70	85	101	125
Depth of drill hole (hammer drilled holes)	$h_{1,1h}$	[mm]	-	53	68	86	-	-
	$h_{1,2h}$	[mm]	59	73	88	106	124	151
Depth of drill hole (diamond drilled holes)	$h_{1,1d}$	[mm]	-	58	70	88	-	-
	$h_{1,2d}$	[mm]	64	78	90	108	-	-
Diameter of clearance hole in the fixture	$d_f \leq$	[mm]	9	12	14	18	22	26
Torque moment	T_{inst}	[Nm]	20	45	60	110	180	300
Width across	S_w	[mm]	13	17	19	24	30	36

a) Only for C20/25 to C50/60

b) For C12/15 to C80/95, for concrete strength class C12/15, C16/20 and C55/67 to C80/95 Hilti Technical Data only.

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



Setting parameters for M8 and M10

Anchor Size			M8			M10			
Concrete class			C20/25 to C50/60 ^{a)} C55/67 to C80/95 ^{b)}		C12/15 ^{b)} C16/20 ^{b)}	C20/25 to C50/60 ^{a)}	C20/25 to C50/60 ^{a)} C55/67 to C80/95 ^{b)}		C12/15 ^{b)} C16/20 ^{b)}
Effective anchorage depth	h_{ef}	[mm]	47		47	40	60		60
Minimum base material thickness	h_{min}	[mm]	80	100	100	80	100	120	120
Minimum spacing in <i>non-cracked</i> concrete	s_{min}	[mm]	35	35	35	50	40	40	70
	for $c \geq$	[mm]	55	50	65	95	100	60	90
Minimum spacing in <i>cracked</i> concrete	s_{min}	[mm]	35	35	35	40	40	40	45
	for $c \geq$	[mm]	50	50	55	90	100	55	85
Minimum edge distance in <i>non-cracked</i> concrete	c_{min}	[mm]	40	40	50	50	60	50	80
	for $s \geq$	[mm]	60	50	80	190	90	90	120
Minimum edge distance in <i>cracked</i> concrete	c_{min}	[mm]	40	40	40	45	60	45	70
	for $s \geq$	[mm]	50	50	75	180	90	80	120
Critical spacing for splitting failure and concrete cone failure	$s_{cr,sp}$	[mm]	141	141	188	168	180	180	240
	$s_{cr,N}$	[mm]	141		141	120	180		180
Critical edge distance for splitting failure and concrete cone failure	$c_{cr,sp}$	[mm]	71	71	94	84	90	90	120
	$c_{cr,N}$	[mm]	71		71	60	90		90

a) For concrete classes C20/25 to C50/60 data covered by ETA-98/0001 issue 2015-11-06.

b) Data covered by Hilti Technical Data.

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

Setting parameters for M12 and M16

Anchor size			M12				M16			
Concrete class			C20/25 to C50/60 ^{a)}	C20/25 to C50/60 ^{a)} C55/67 to C80/95 ^{b)}		C12/15 ^{b)} C16/20 ^{b)}	C20/25 to C50/60 ^{a)}	C20/25 to C50/60 ^{a)} C55/67 to C80/95 ^{b)}		C12/15 ^{b)} C16/20 ^{b)}
Effective anchorage depth	h_{ef}	[mm]	50	70		70	65	85		85
Minimum base material thickness	h_{min}	[mm]	100	120	140	140	120	140	160	160
Minimum spacing in <i>non-cracked</i> concrete	s_{min}	[mm]	55	50	60	110	75	80	65	90
	for $c \geq$	[mm]	110	100	70	140	140	130	95	145
Minimum spacing in <i>cracked</i> concrete	s_{min}	[mm]	50	50	50	80	65	80	65	70
	for $c \geq$	[mm]	105	90	70	120	130	130	95	125
Minimum edge distance in <i>non-cracked</i> concrete	c_{min}	[mm]	60	60	55	90	65	65	65	110
	for $s \geq$	[mm]	210	120	110	190	240	180	150	170
Minimum edge distance in <i>cracked</i> concrete	c_{min}	[mm]	55	60	55	80	65	65	65	90
	for $s \geq$	[mm]	210	120	110	170	240	180	150	165
Critical spacing for splitting failure and concrete cone failure	$s_{cr,sp}$	[mm]	180	210		280	208	255		340
	$s_{cr,N}$	[mm]	150			210	195			255
Critical edge distance for splitting failure and concrete cone failure	$c_{cr,sp}$	[mm]	90	105		140	104	128		170
	$c_{cr,N}$	[mm]	75			105	98			128

a) For concrete classes from C20/25 to C50/60 data covered by ETA-98/0001 issue 2015-11-06.

b) Data covered by Hilti Technical Data.

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

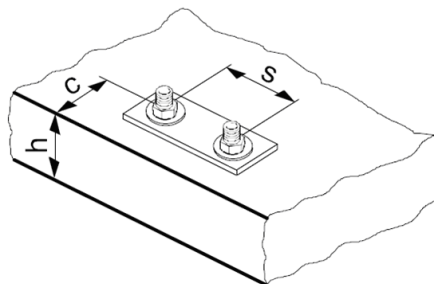
Setting parameters for M20 and M24

Anchor size			M20		M24			
Concrete class			C20/25 to C50/60 ^{a)}		C12/15 ^{b)} C16/20 ^{b)}	C20/25 to C50/60 ^{a)}		
			C55/67 to C80/95 ^{b)}			C55/67 to C80/95 ^{b)}		
Effective anchorage depth	h_{ef}	[mm]	101		101	125	125	
Minimum base material thickness	h_{min}	[mm]	160	200	200	250	250	
Minimum spacing in <i>non-cracked</i> concrete	HST3/HST3-BW	s_{min}	[mm]	120	90	90	125	180
		for $c \geq$	[mm]	180	130	165	255	375
	HST3-R/ HST3-R-BW	s_{min}	[mm]	120	90	90	125	180
		for $c \geq$	[mm]	180	130	165	205	375
Minimum spacing in <i>cracked</i> concrete	HST3/HST3-BW	s_{min}	[mm]	120	90	90	125	140
		for $c \geq$	[mm]	180	130	140	180	325
	HST3-R/ HST3-R-BW	s_{min}	[mm]	120	90	90	125	140
		for $c \geq$	[mm]	180	130	140	130	325
Minimum edge distance in <i>non-cracked</i> concrete	HST3/HST3-BW	c_{min}	[mm]	120	80	120	170	260
		for $s \geq$	[mm]	180	180	270	295	400
	HST3-R/ HST3-R-BW	c_{min}	[mm]	120	80	120	150	260
		for $s \geq$	[mm]	180	180	270	235	400
Minimum edge distance in <i>cracked</i> concrete	HST3/HST3-BW	c_{min}	[mm]	120	80	100	125	230
		for $s \geq$	[mm]	180	180	240	240	295
	HST3-R/ HST3-R-BW	c_{min}	[mm]	120	80	100	125	230
		for $s \geq$	[mm]	180	180	240	140	295
Critical spacing for splitting failure and concrete cone failure	$s_{cr,sp}$	[mm]	384		404	375	500	
	$s_{cr,N}$	[mm]	303		303	375	375	
Critical edge distance for splitting failure and concrete cone failure	$c_{cr,sp}$	[mm]	192		202	188	250	
	$c_{cr,N}$	[mm]	152		152	188	188	

a) For concrete classes from C20/25 to C50/60 data covered by ETA-98/0001 issue 2015-11-06.

b) Data covered by Hilti Technical Data.

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



Simplified design method

Simplified version of the design method according to ETAG 001, Annex C respectively CEN TS 1992-4-4.

Design resistance according to the data given in ETA-98/0001, issue 2015-11-06 for concrete classes C20/25 to C50/60. In case of concrete classes C12/15, C16/20 and C55/67 to C80/95 the concrete cone failure mode can also be assumed according to CEN TS 1992-4-4 based on the Expert Report.

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

The design method is based on the following simplification:

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

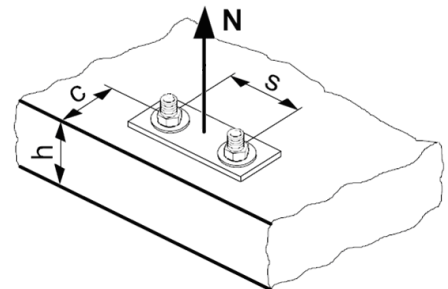
The values are valid for one anchor.

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

Tension loading

The design tensile resistance is the lower value of

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



Basic design tensile resistance

Design steel resistance $N_{Rd,s}$

Anchor size		M8	M10	M12	M16	M20	M24
$N_{Rd,s}$	HST3/HST3-BW [kN]	14,1	23,2	32,2	54,3	88,7	90,1
	HST3-R/HST3-R-BW [kN]	12,6	20,5	30,4	49,6	82,7	100,0

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

Anchor size		M8	M10	M12	M16	M20	M24
Non cracked concrete							
$N_{Rd,p}^0$	HST3/HST3-BW [kN]	8,0	13,3	16,7	-	-	40,0
	HST3-R/HST3-R-BW [kN]	8,0	13,3	16,7	-	-	40,0
Cracked concrete							
$N_{Rd,p}^0$	HST3/HST3-BW [kN]	5,0	8,0	13,3	-	-	26,7
	HST3-R/HST3-R-BW [kN]	5,0	8,0	13,3	-	-	26,7

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

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

Anchor size		M8	M10		M12		M16		M20	M24	
Effective anchorage depth	h_{ef}	47	40	60	50	70	65	85	101	125	
Non cracked concrete											
$N_{Rd,c}^0$	HST3/HST3-BW	[kN]	10,8	8,5	15,6	11,9	19,7	17,6	26,4	34,2	47,1
	HST3-R/HST3-R-BW	[kN]	10,8	8,5	15,6	11,9	19,7	17,6	26,4	34,2	47,1
Cracked concrete											
$N_{Rd,c}^0$	HST3/HST3-BW	[kN]	7,7	6,1	11,2	8,5	14,1	12,6	18,8	24,4	33,5
	HST3-R/HST3-R-BW	[kN]	7,7	6,1	11,2	8,5	14,1	12,6	18,8	24,4	33,5

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

Influencing factors

Influence of concrete strength

Concrete strength designation (ENV 206)	Hilti data ^{b)}		Data according to ETA-98/0001							Hilti Data ^{b)}			
	C 12/15	C 16/20	C 20/25	C 25/30	C 30/37	C 35/45	C 40/50	C 45/55	C 50/60	C 55/67	C 60/75	C 70/85	C 80/95
$f_{B,c} = (f_{ck,cube}/25N/mm^2)^{1/2}$ ^{a)}	0,77	0,89	1,00	1,10	1,22	1,34	1,41	1,48	1,55	1,64	1,73	1,84	1,95
For HST3 M8, M10, M12 and M16													
$f_{B,p}$	0,68	0,85	1,00	1,10	1,22	1,34	1,41	1,48	1,55	1,55	1,55	1,55	1,55
For HST3 M20 and M24													
$f_{B,p}$	0,68	0,85	1,00	1,10	1,22	1,34	1,41	1,48	1,55	1,60	1,66	1,72	1,78

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

b) Valid only for standard embedment depth

Influence of edge distance ^{a)}

$c/c_{cr,N}$	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9	1
$c/c_{cr,sp}$										
$f_{1,N} = 0,7 + 0,3 \cdot c/c_{cr,N} \leq 1$	0,73	0,76	0,79	0,82	0,85	0,88	0,91	0,94	0,97	1,00
$f_{1,sp} = 0,7 + 0,3 \cdot c/c_{cr,sp} \leq 1$										
$f_{2,N} = 0,5 \cdot (1 + c/c_{cr,N}) \leq 1$	0,55	0,60	0,65	0,70	0,75	0,80	0,85	0,90	0,95	1,00
$f_{2,sp} = 0,5 \cdot (1 + c/c_{cr,sp}) \leq 1$										

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

Influence of anchor spacing ^{a)}

$s/s_{cr,N}$	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9	1
$s/s_{cr,sp}$										
$f_{3,N} = 0,5 \cdot (1 + s/s_{cr,N}) \leq 1$	0,55	0,60	0,65	0,70	0,75	0,80	0,85	0,90	0,95	1,00
$f_{3,sp} = 0,5 \cdot (1 + s/s_{cr,sp}) \leq 1$										

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

Influence of base material thickness

h/h_{ef}	2,0	2,2	2,4	2,6	2,8	3,0	3,2	3,4	3,6	$\geq 3,68$
$f_{h,sp} = [h/(2 \cdot h_{ef})]^{2/3}$	1,00	1,07	1,13	1,19	1,25	1,31	1,37	1,42	1,48	1,50

Influence of reinforcement

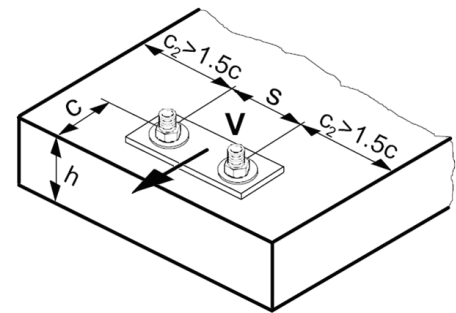
Anchor size	M8	M10	M12	M16	M20	M24
$f_{re,N} = 0,5 + h_{ef}/200\text{mm} \leq 1$	0,74 ^{a)}	0,70 ^{a)}	0,80 ^{a)}	0,75 ^{a)}	0,85 ^{a)}	0,83 ^{a)}

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

Shear loading

The design shear resistance is the lower value of

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



Basic design shear resistance

Design steel resistance $V_{Rd,s}$

Anchor size	M8	M10	M12	M16	M20	M24
Effective anchorage depth h_{ef}	47	40	60	50	70	65
$V_{Rd,s}$	HST3/HST3-BW [kN]	11,0	17,5	18,9	27,2	28,3
	HST3-R/HST3-R-BW [kN]	12,6	20,5	20,2	24,9	29,4

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

Anchor size	M8	M10	M12	M16	M20	M24
k-factor for C20/25 to C80/95	2,6	2,7	2,8	3,4	3,2	2,5
k-factor for C12/15	1	2	2	2	2	2

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

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

Anchor size	M8	M10	M12	M16	M20	M24
Effective anchorage depth h_{ef}	47	40	60	50	70	65
Non-cracked concrete						
$V_{Rd,c}^0$	HST3/HST3-BW [kN]	5,9	8,5	8,6	11,6	11,7
	HST3-R/HST3-R-BW [kN]					
Cracked concrete						
$V_{Rd,c}^0$	HST3/HST3-BW [kN]	4,2	6,0	6,1	8,2	8,3
	HST3-R/HST3-R-BW [kN]					

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

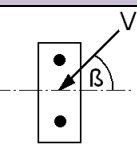
Influencing factors

Concrete strength designation (ENV 206)	Hilti data ^{b)}		Data according to ETA-98/0001							Hilti Data ^{b)}			
	C 12/15	C 16/20	C 20/25	C 25/30	C 30/37	C 35/45	C 40/50	C 45/55	C 50/60	C 55/67	C 60/75	C 70/85	C 80/95
$f_{B,c} = (f_{ck,cube}/25N/mm^2)^{1/2}$ a)	0,77	0,89	1,00	1,10	1,22	1,34	1,41	1,48	1,55	1,64	1,73	1,84	1,95

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

b) Valid only for standard embedment depth

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

Angle β	0°	10°	20°	30°	40°	50°	60°	70°	80°	≥ 90°
$f_{\beta} = \sqrt{\frac{1}{(\cos \alpha_v)^2 + \left(\frac{\sin \alpha_v}{2,5}\right)^2}}$ 	1,00	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:

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

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

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

Influence of embedment depth

Anchor size	M8	M10		M12		M16		M20	M24
$f_{\text{hef}} = 0,05 \cdot (h_{\text{ef}} / d)^{1,68}$	0,98	0,51	1,01	0,55	0,97	0,53	0,83	0,76	0,80

Influence of edge distance ^{a)}

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

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

Combined tension and shear loading

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

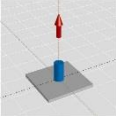
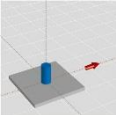
Precalculated values

Design resistance calculated according ETAG 001, Annex C and data given in ETA-98/0001, issue 2015-11-06.

All data applies to concrete C 20/25 – $f_{ck,cube} = 25 \text{ N/mm}^2$.

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

Design resistance for a single anchor, without edge effects

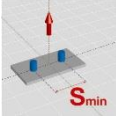
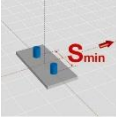
Anchor size			M8	M10		M12		M16		M20	M24
Effective anchorage depth	h_{ef}	[mm]	47	40	60	50	70	65	85	101	125
Minimum base material thickness	h_{min}	[mm]	80	80	120	100	140	120	160	200	250
	Tensile N_{Rd}										
	Non-cracked concrete										
	HST3/HST3-BW	[kN]	8,0	8,5	13,3	11,9	16,7	17,6	26,4	34,2	40,0
	HST3-R/HST3-R-BW	[kN]	8,0	8,5	13,3	11,9	16,7	17,6	26,4	34,2	40,0
	Cracked concrete										
	HST3/HST3-BW	[kN]	5,0	6,1	8,0	8,5	13,3	12,6	18,8	24,4	26,7
HST3-R/HST3-R-BW	[kN]	5,0	6,1	8,0	8,5	13,3	12,6	18,8	24,4	26,7	
	Shear V_{Rd}, without lever arm										
	Non-cracked concrete										
	HST3/HST3-BW	[kN]	11,0	17,5	18,9	27,2	28,3	43,6	44,2	67,1	62,7
	HST3-R/HST3-R-BW	[kN]	12,6	20,5	20,2	24,9	29,4	38,9	50,9	77,8	88,5
	Cracked concrete										
	HST3/HST3-BW	[kN]	11,0	16,2	18,9	23,6	28,3	42,9	44,2	67,1	62,7
HST3-R/HST3-R-BW	[kN]	12,6	16,2	20,2	23,6	29,4	38,9	50,9	77,8	83,9	

Design resistance for a single anchor, with min. edge distance ($c = c_{min}$)

Anchor size		M8	M10		M12			M16			M20	M24			
Effective anchorage depth	h_{ef} [mm]	47	40	60	50	70	65	85	101	125					
Minimum base material thickness	h_{min} [mm]	80	80	100	120	100	120	140	120	140	160	160	200	250	
Min. edge distance in Non-cracked concrete	c_{min} [mm]	40	50	60	50	60	60	55	65	65	65	120	80	170 ^{a)} 150 ^{b)}	
Min. edge distance in cracked concrete	c_{min} [mm]	40	45	60	45	55	60	55	65	65	65	120	80	125	
	Tensile N_{Rd}														
	Non-cracked concrete														
	HST3/HST3-BW	[kN]	7,4	6,0	11,7	10,5	8,9	13,5	12,9	12,7	17,0	17,0	24,6	20,0	40,0
	HST3-R/HST3-R-BW	[kN]	7,4	6,0	11,7	10,5	8,9	13,5	12,9	12,7	17,0	17,0	17,0	24,7	39,8
	Cracked concrete														
	HST3/HST3-BW	[kN]	3,9	2,8	6,7	5,7	5,1	8,2	7,8	7,8	11,2	11,2	20,5	16,0	25,2
HST3-R/HST3-R-BW	[kN]	3,9	2,8	6,7	5,7	5,1	8,2	7,8	7,8	11,2	11,2	20,5	16,0	25,2	
	Shear V_{Rd}, without lever arm														
	Non-cracked concrete														
	HST3/HST3-BW	[kN]	3,4	4,5	6,2	4,9	6,2	6,6	5,9	6,6	8,1	8,1	19,1	11,4	32,6
	HST3-R/HST3-R-BW	[kN]	3,4	4,5	6,2	4,9	6,2	6,6	5,9	6,6	8,1	8,1	19,1	11,4	27,5
	Cracked concrete														
	HST3/HST3-BW	[kN]	2,4	2,8	4,4	3,0	3,9	4,7	4,2	5,4	5,7	5,7	13,5	8,1	15,4
HST3-R/HST3-R-BW	[kN]	2,4	2,8	4,4	3,0	3,9	4,7	4,2	5,4	5,7	5,7	13,5	8,1	15,4	

- a) For HST3/HST3-BW
- b) For HST3-R/HST3-R-BW

Design resistance for double anchor, without edge effects, with min. spacing ($s = s_{min}$)

Anchor size			M8	M10		M12			M16		M20		M24		
Effective anchorage depth	h_{ef}	[mm]	47	40	60		50	70		65	85		101	125	
Minimum base material thickness	h_{min}	[mm]	80	80	100	120	100	120	140	120	140	160	160	200	250
Min. spacing in Non-cracked concrete	s_{min}	[mm]	35	50	40	40	55	50	60	75	80	65	120	90	125
Min. spacing in cracked Concrete	s_{min}	[mm]	35	40	40	40	50	50	50	65	80	65	120	90	125
	Tensile N_{Rd}														
	Non-cracked concrete														
	HST3/HST3-BW	[kN]	6,8	5,5	9,6	9,6	7,8	12,2	12,7	12,0	17,3	16,6	22,4	21,1	31,4
	HST3-R/HST3-R-BW	[kN]	6,8	5,5	9,6	9,6	7,8	12,2	12,7	12,0	17,3	16,6	22,4	21,1	31,4
	Cracked concrete														
	HST3/HST3-BW	[kN]	3,5	2,8	5,5	5,5	4,2	7,4	7,4	6,9	11,4	10,9	17,0	15,8	22,4
HST3-R/HST3-R-BW	[kN]	3,5	2,8	5,5	5,5	4,2	7,4	7,4	6,9	11,4	10,9	17,0	15,8	22,4	
	Shear V_{Rd}, without lever arm														
	Non-cracked concrete														
	HST3/HST3-BW	[kN]	11,0	16,1	25,5	18,9	22,6	33,9	28,3	41,7	59,1	44,2	76,3	67,1	62,7
	HST3-R/HST3-R-BW	[kN]	12,6	16,1	20,2	20,2	22,6	29,4	29,4	38,9	50,9	50,9	76,3	70,9	78,4
	Cracked concrete														
	HST3/HST3-BW	[kN]	9,3	7,6	14,6	14,6	11,8	20,6	20,6	23,6	39,0	37,2	54,4	50,6	55,9
HST3-R/HST3-R-BW	[kN]	9,3	7,6	14,6	14,6	11,8	20,6	20,6	23,6	39,0	37,2	54,4	50,6	55,9	

