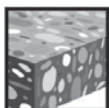


HSA-F Stud anchor

	Anchor version	Benefits
	HSA-F; Carbon steel, hot dipped galvanized, min 35 microns coating thickness DIN 125 washer	<ul style="list-style-type: none"> - Hot dipped galvanized material for increased corrosion resistance - Three embedment depths for maximal design flexibility - Suitable for pre- and through fastening



Concrete

Basic loading data (for a single anchor)

All data in this section applies to

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

For details see Simplified design method

Mean ultimate resistance

Anchor size			M6			M8			M10		
Effective anchorage depth	h_{ef}	[mm]	30	40	30	40	70	40	50	80	
Tensile	$N_{Ru,m}$	[kN]	8,0	9,5	11,0	17,0	17,3	17,0	21,2	26,6	
Shear	$V_{Ru,m}$	[kN]	6,8	6,8	11,0	11,1	11,1	19,8	19,8	19,8	

Anchor size			M12			M16			M20		
Effective anchorage depth	h_{ef}	[mm]	50	65	100	65	80	120	75	100	115
Tensile	$N_{Ru,m}$	[kN]	23,7	33,2	33,2	26,6	39,8	53,1	43,5	67,0	82,7
Shear	$V_{Ru,m}$	[kN]	31,0	31,0	31,0	53,6	53,6	53,6	87,1	90,1	90,1

Characteristic resistance

Anchor size			M6			M8			M10		
Effective anchorage depth	h_{ef}	[mm]	30	40		30	40	70	40	50	80
Tensile	N_{Rk}	[kN]	6,0	7,5		8,3	12,8	16,0	12,8	16,0	20,0
Shear	V_{Rk}	[kN]	6,5	6,5		8,3	10,6	10,6	18,9	18,9	18,9

Anchor size			M12			M16			M20		
Effective anchorage depth	h_{ef}	[mm]	50	65	100	65	80	120	75	100	115
Tensile	N_{Rk}	[kN]	17,9	25,0	25,0	20,0	30,0	40,0	32,8	50,5	62,3
Shear	V_{Rk}	[kN]	29,5	29,5	29,5	51,0	51,0	51,0	65,6	85,8	85,8

Design resistance

Anchor size			M6			M8			M10		
Effective anchorage depth	h_{ef}	[mm]	30	40		30	40	70	40	50	80
Tensile	N_{Rd}	[kN]	4,0	5,0		5,5	8,5	10,7	8,5	10,7	13,3
Shear	V_{Rd}	[kN]	5,2	5,2		5,5	8,5	8,5	15,1	15,1	15,1

Anchor size			M12			M16			M20		
Effective anchorage depth	h_{ef}	[mm]	50	65	100	65	80	120	75	100	115
Tensile	N_{Rd}	[kN]	11,9	16,7	16,7	13,3	20,0	26,7	21,9	33,7	41,5
Shear	V_{Rd}	[kN]	23,6	23,6	23,6	40,8	40,8	40,8	43,7	68,6	68,6

Recommended loads

Anchor size			M6			M8			M10		
Effective anchorage depth	h_{ef}	[mm]	30	40		30	40	70	40	50	80
Tensile	N_{rec}	[kN]	2,9	3,6		4,0	6,1	7,6	6,1	7,6	9,5
Shear	V_{rec}	[kN]	3,7	3,7		4,0	6,1	6,1	10,8	10,8	10,8

Anchor size			M12			M16			M20		
Effective anchorage depth	h_{ef}	[mm]	50	65	100	65	80	120	75	100	115
Tensile	N_{rec}	[kN]	8,5	11,9	11,9	9,5	14,3	19,0	15,6	24,0	29,7
Shear	V_{rec}	[kN]	16,9	16,9	16,9	29,1	29,1	29,1	31,2	49,0	49,0

Materials

Mechanical properties

Anchor size		M6	M8	M10	M12	M16	M20
Nominal tensile strength $f_{uk,thread}$	[N/mm ²]	650	580	650	700	650	700
Yield strength $f_{yk,thread}$	[N/mm ²]	520	464	520	560	520	560
Stressed cross-section $A_{s,thread}$	[mm ²]	20,1	36,6	58,0	84,3	157,0	245,0
Moment of resistance W	[mm ³]	12,7	31,2	62,3	109,2	277,5	540,9
Char. bending resistance $M_{Rk,s}^0$	[Nm]	9,9	21,7	48,6	91,7	216,4	454,4

Material quality

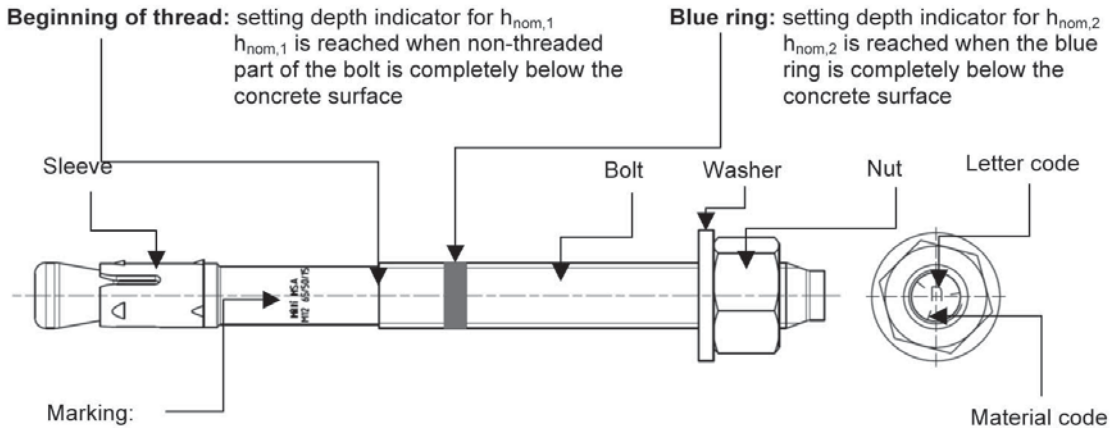
Type	Part	Material	Coating
HSA-F Carbon Steel	Sleeve	Stainless steel A2 1.4301	-
	Bolt	Carbon steel, Rupture elongation $A_5 > 8\%$	Hot dipped galvanized ($\geq 35 \mu\text{m}$)
	Washer	HSA :carbon steel	
	Hexagon nut	Steel, strength class 8	

Geometry washer

Anchor Size	M6	M8	M10	M12	M16	M20	
Inner diameter d_1							
HSA-F	d_1 [mm]	6,4	8,4	10,5	13,0	17,0	21
Outer diameter d_2							
HSA-F	d_2 [mm]	12,0	16,0	20,0	24,0	30,0	37,0
Thickness h							
HSA-F	h [mm]	1,6	1,6	2,0	2,5	3,0	3,0


Anchor dimensions and coding

Product marking and identification of anchor



e.g.
 Hilti HSA-F ... Brand and Anchor type
 M12 65/50/15 ... Anchor Size and the max. $t_{fix,1}/t_{fix,2}/t_{fix,3}$ for the corresponding $h_{nom,1}/h_{nom,2}/h_{nom,3}$

Material code for identification of different materials

Type	HSA-F (carbon steel, hot dipped galvanized)
Material Code	 Letter code without mark

Effective and nominal anchorage depth

Anchor size	M6			M8			M10		
Effective anchorage depth h_{ef} [mm]	30	40		30	40	70	40	50	80
Nominal anchorage depth h_{nom} [mm]	37	47		39	49	79	50	60	90

Anchor size	M12			M16			M20		
Effective anchorage depth h_{ef} [mm]	50	65	100	65	80	120	75	100	115
Nominal anchorage depth h_{nom} [mm]	64	79	114	77	92	132	90	115	130

Letter code for anchor length and maximum thickness of the fixture t_{fix}

Type	HSA-F					
Size	M6	M8	M10	M12	M16	M20
h_{nom} [mm]	37 / 47 / -	39 / 49 / 79	50 / 60 / 90	64 / 79 / 114	77 / 92 / 132	90 / 115 / 130
Letter t_{fix}	$t_{\text{fix},1}/t_{\text{fix},2}/t_{\text{fix},3}$	$t_{\text{fix},1}/t_{\text{fix},2}/t_{\text{fix},3}$	$t_{\text{fix},1}/t_{\text{fix},2}/t_{\text{fix},3}$	$t_{\text{fix},1}/t_{\text{fix},2}/t_{\text{fix},3}$	$t_{\text{fix},1}/t_{\text{fix},2}/t_{\text{fix},3}$	$t_{\text{fix},1}/t_{\text{fix},2}/t_{\text{fix},3}$
z	5/-/-	5/-/-	5/-/-	5/-/-	5/-/-	
y						10/-/-
w	20/10/-	20/10/-	20/10/-	20/5/-		
t		35/25/-	35/25/-	35/20/-		
s					40/25/-	
q			50/40/10			
p		55/45/15				55/30/15
n				65/50/15		
k		80/70/40				
j					85/70/30	
a				145/130/95		

Setting
Installation equipment

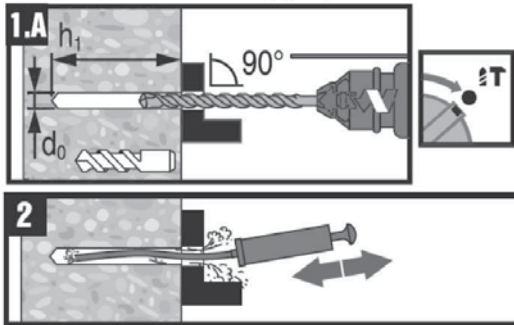
Anchor size	M6	M8	M10	M12	M16	M20
Rotary hammer	TE2 – TE16					TE40 – TE70
Other tools	hammer, torque wrench, blow out pump					

Setting instruction

Drill and clean borehole

Standard drilling method

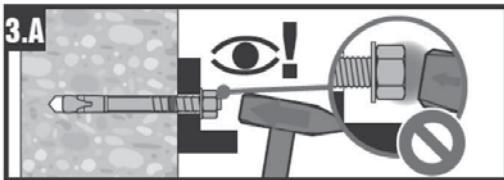
M6 – M20: Hammer drilling (HD)



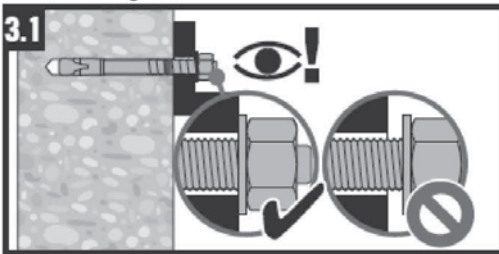
Install anchor with hammer or machine setting tool

Standard setting method

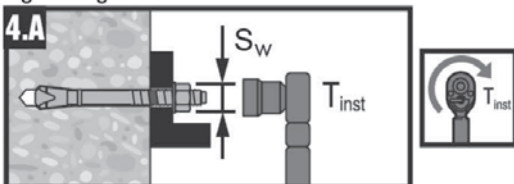
M6 – M20: Hammer setting



Check setting

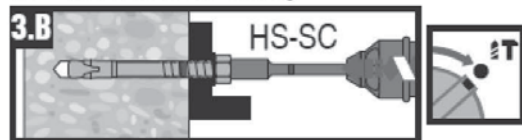


Tightening the anchor



Alternative setting method

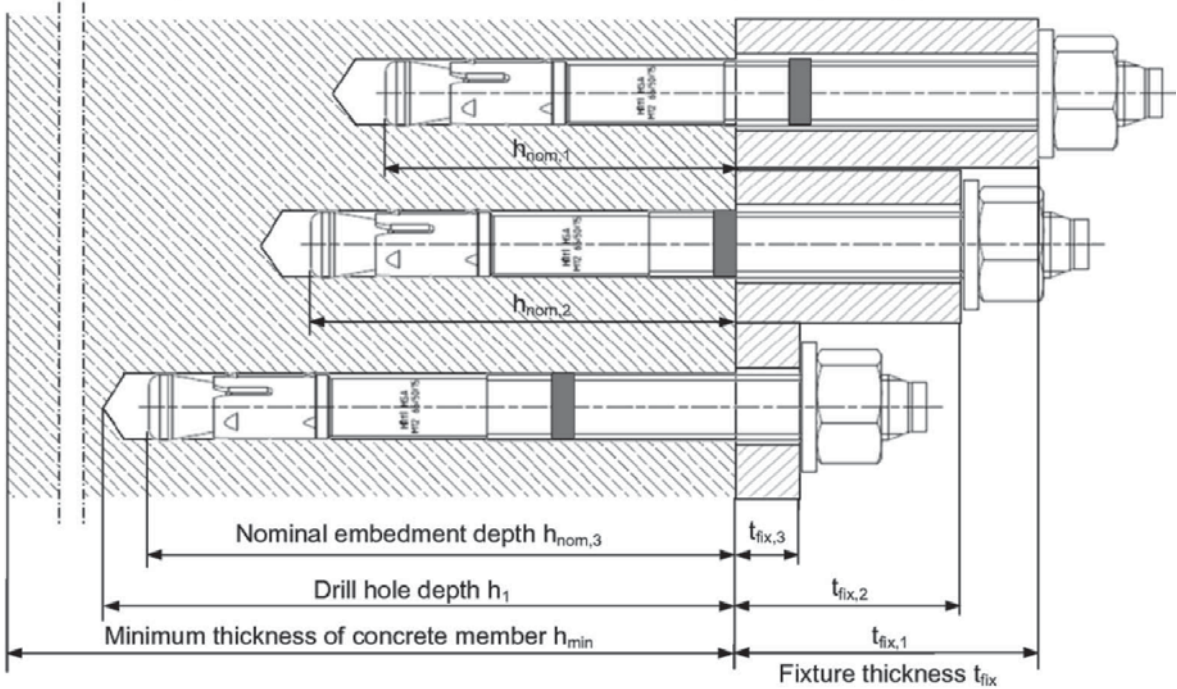
M8 – M16: Machine setting



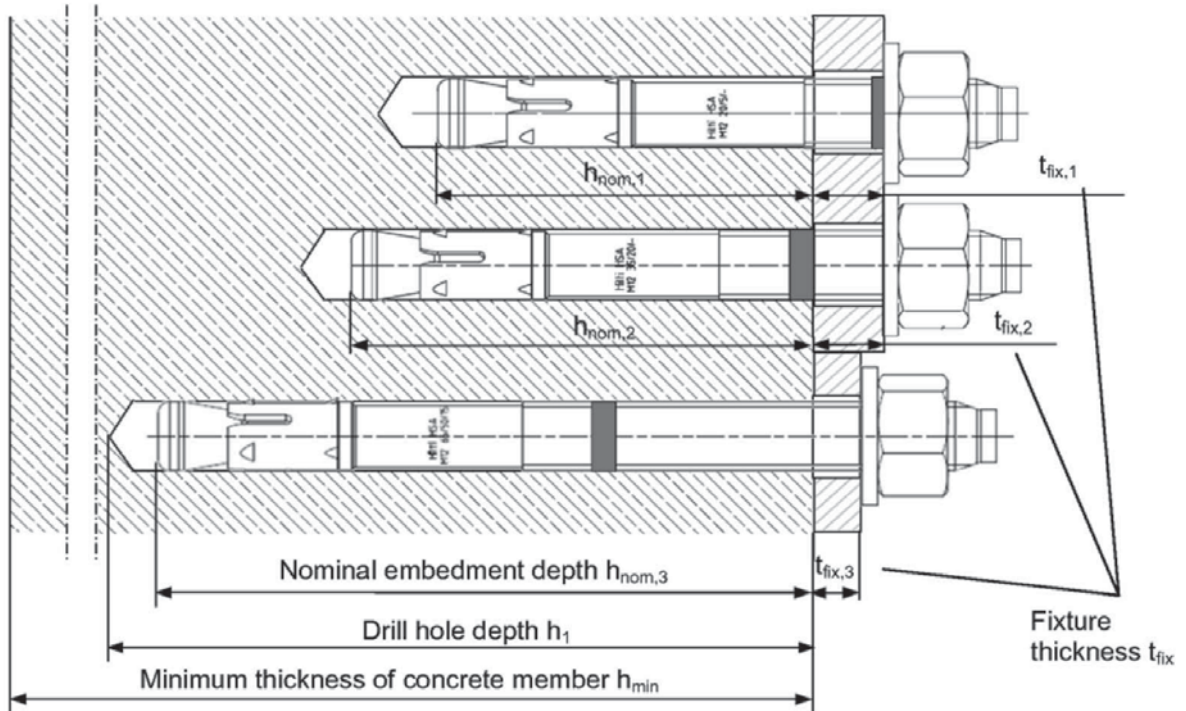
For detailed information on installation see instruction for use given with the package of the product.

Setting details

One anchor length for different fixture thickness t_{fix} and the corresponding setting positions



Different anchor length for different setting positions and the corresponding fixture thickness t_{fix}



Setting details

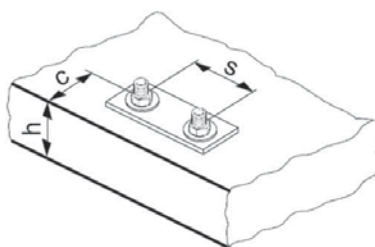
Anchor size		M6		M8			M10		
Nominal anchorage depth	h_{nom} [mm]	37	47	39	49	79	50	60	90
Minimum base material thickness	h_{min} [mm]	100	100	100	100	120	100	120	160
Minimum spacing	s_{min} [mm]	35	35	85	85	85	100	100	100
Minimum edge distance	c_{min} [mm]	35	35	75	75	60	60	60	55
Nominal diameter of drill bit	d_o [mm]	6		8			10		
Cutting diameter of drill bit	$d_{cut} \leq$ [mm]	6,4		8,45			10,45		
Depth of drill hole	$h_1 \geq$ [mm]	42	52	44	54	84	55	65	95
Diameter of clearance hole in the fixture	$d_f \leq$ [mm]	7		9			12		
Torque moment	T_{inst} [Nm]	5		15			25		
Width across	SW [mm]	10		13			17		

Anchor size		M12			M16			M20		
Nominal anchorage depth	h_{nom} [mm]	64	79	114	77	92	132	90	115	130
Minimum base material thickness	h_{min} [mm]	100	140	180	140	160	180	160	220	220
Minimum spacing	s_{min} [mm]	100	100	100	190	190	190	200	200	200
Minimum edge distance	c_{min} [mm]	175	140	90	170	140	120	185	165	165
Nominal diameter of drill bit	d_o [mm]	12			16			20		
Cutting diameter of drill bit	$d_{cut} \leq$ [mm]	12,5			16,5			20,55		
Depth of drill hole	$h_1 \geq$ [mm]	72	87	122	85	100	140	98	123	138
Diameter of clearance hole in the fixture	$d_f \leq$ [mm]	14			18			22		
Torque moment	T_{inst} [Nm]	50			80			200		
Width across	SW [mm]	19			24			30		

Design parameters

Anchor size		M6		M8			M10		
Nominal anchorage depth	h_{nom} [mm]	37	47	39	49	79	50	60	90
Effective anchorage depth	h_{ef} [mm]	30	40	30	40	70	40	50	80
Critical spacing for splitting failure	$s_{cr,sp}$ [mm]	126	150	162	226	250	238	262	362
Critical edge distance for splitting failure	$c_{cr,sp}$ [mm]	63	75	81	113	125	119	131	181
Critical spacing for concrete cone failure	$s_{cr,N}$ [mm]	90	120	90	120	210	120	150	240
Critical edge distance for concrete cone failure	$c_{cr,N}$ [mm]	45	60	45	60	105	60	75	120

Anchor size		M12			M16			M20		
Nominal anchorage depth	h_{nom} [mm]	64	79	114	77	92	132	90	115	130
Effective anchorage depth	h_{ef} [mm]	50	65	100	65	80	120	75	100	115
Critical spacing for splitting failure	$s_{cr,sp}$ [mm]	250	312	388	288	350	476	326	462	500
Critical edge distance for splitting failure	$c_{cr,sp}$ [mm]	125	156	194	144	175	238	163	231	250
Critical spacing for concrete cone failure	$s_{cr,N}$ [mm]	150	195	300	195	240	360	225	300	345
Critical edge distance for concrete cone failure	$c_{cr,N}$ [mm]	75	97,5	150	97,5	120	180	112,5	150	172,5



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 ETAG 001, Annex C. Design resistance according Hilti technical data.

- Influence of concrete strength
- Influence of edge distance
- Influence of spacing
- Valid for a group of two anchors. (The method may also be applied for anchor groups with more than two anchors or more than one edge. The influencing factors must then be considered for each edge distance and spacing. The calculated design loads are then conservative: 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)

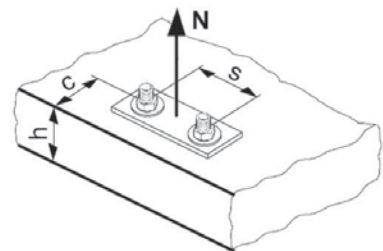
The values are valid for one anchor.

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: $N_{Rd,p} = N_{Rd,p}^0$
- Concrete cone resistance: $N_{Rd,c} = N_{Rd,c}^0 \cdot f_B \cdot f_{1,N} \cdot f_{2,N} \cdot f_{3,N} \cdot f_{re,N}$
- Concrete splitting resistance: $N_{Rd,sp} = N_{Rd,c}^0 \cdot f_B \cdot f_{1,sp} \cdot f_{2,sp} \cdot f_{3,sp} \cdot f_{h,sp} \cdot f_{re,N}$



Basic design tensile resistance

Design steel resistance $N_{Rd,s}$

Anchor size		M6	M8	M10	M12	M16	M20
$N_{Rd,s}$	HSA-F [kN]	6,4	11,8	20,0	29,6	59,0	88,5

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

Anchor size		M6		M8			M10		
Effective anchorage depth	h_{ef} [mm]	30	40	30	40	70	40	50	80
$N_{Rd,p}^0$	HSA-F [kN]	4,0	5,0	No pull-out			10,7	No pull-out	13,3

Anchor size		M12			M16			M20		
Effective anchorage depth	h_{ef} [mm]	50	65	100	65	80	120	75	100	115
$N_{Rd,p}^0$	HSA-F [kN]	No pull-out	16,7	16,7	13,3	20,0	26,7	No pull-out		

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

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

Anchor size			M6		M8			M10		
Effective anchorage depth	h_{ef}	[mm]	30	40	30	40	70	40	50	80
$N_{Rd,p}^0$	HSA-F	[kN]	5,5	8,5	5,5	8,5	19,7	8,5	11,9	24,1

Anchor size			M12			M16			M20		
Effective anchorage depth	h_{ef}	[mm]	50	65	100	65	80	120	75	100	115
$N_{Rd,p}^0$	HSA-F	[kN]	11,9	17,6	33,7	17,6	24,1	44,3	21,9	33,7	41,5

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
Pull-out, concrete cone and splitting resistance							
$f_B = (f_{ck,cube}/25\text{N/mm}^2)^{1/2}$ a)	1	1,1	1,22	1,34	1,41	1,48	1,55

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

Influence of edge distance ^{a)}

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

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

Influence of anchor spacing ^{a)}

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

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

Influence of base material thickness

h/h_{min}	1,0	1,1	1,2	1,3	1,4	1,5	1,6	1,7	1,8	$\geq 1,84$
$f_{h,sp} = [h/(h_{min})]^{2/3}$	1	1,07	1,13	1,19	1,25	1,31	1,37	1,42	1,48	1,5

Influence of reinforcement ^{a)}

Anchor size	M6			M8			M10		
Effective anchorage depth h_{ef} [mm]	30	40		30	40	70	40	50	80
$f_{re,N} = 0,5 + h_{ef}/200\text{mm} \leq 1$	0,65	0,7		0,65	0,7	0,85	0,7	0,75	0,9

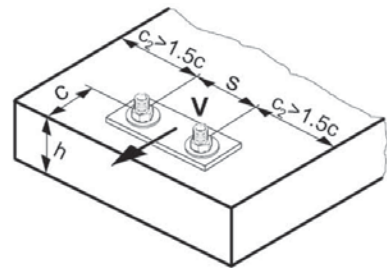
Anchor size	M12			M16			M20		
Effective anchorage depth h_{ef} [mm]	50	65	100	65	80	120	75	100	115
$f_{re,N} = 0,5 + h_{ef}/200\text{mm} \leq 1$	0,75	0,83	1	0,83	0,9	1	0,88	1	1

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

Shear loading

The design shear resistance is the lower value of

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



Basic design shear resistance

Design steel resistance $V_{Rd,s}$

Anchor size	M6	M8	M10	M12	M16	M20
$V_{Rd,s}$ HSA-F [kN]	5,2	8,5	15,1	23,6	40,8	68,6

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

Anchor size	M6			M8			M10		
Effective anchorage depth h_{ef} [mm]	30	40		30	40	70	40	50	80
k	1	1		1	1,5	2	2,4	2,4	2,4

Anchor size	M12			M16			M20		
Effective anchorage depth h_{ef} [mm]	50	65	100	65	80	120	75	100	115
k	2	2	2	2,9	2,9	2,9	2	3,5	3,5

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

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

Anchor size	M6			M8			M10		
Effective anchorage depth h_{ef} [mm]	30	40		30	40	70	40	50	80
$V_{Rd,c}^0$ [kN]	3,6	3,6		5,8	5,9	6,0	8,5	8,5	8,6

Anchor size	M12			M16			M20		
Effective anchorage depth h_{ef} [mm]	50	65	100	65	80	120	75	100	115
$V_{Rd,c}^0$ [kN]	11,6	11,6	11,7	18,7	18,8	18,9	27,2	27,3	27,4

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

Influencing factors

Influence of concrete strength

Concrete strength designation (ENV 206)	C 20/25	C 25/30	C 30/37	C 35/45	C 40/50	C 45/55	C 50/60
$f_B = (f_{ck,cube}/25N/mm^2)^{1/2}$ a)	1	1,1	1,22	1,34	1,41	1,48	1,55

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

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

Angle β	0°	10°	20°	30°	40°	50°	60°	70°	80°	≥ 90°
$f_{\beta} = \frac{1}{\sqrt{(\cos \alpha_r)^2 + \left(\frac{\sin \alpha_r}{2,5}\right)^2}}$	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	M6		M8			M10		
Effective anchorage depth h_{ef} [mm]	30	40	30	40	70	40	50	80
$f_{hef} = 0,05 \cdot (h_{ef} / d)^{1,68}$	0,75	1,21	0,46	0,75	1,91	0,51	0,75	1,64

Anchor size	M12			M16			M20		
Effective anchorage depth h_{ef} [mm]	50	65	100	65	80	120	75	100	115
$f_{hef} = 0,05 \cdot (h_{ef} / d)^{1,68}$	0,55	0,85	1,76	0,53	0,75	1,48	0,46	0,75	0,94

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".

