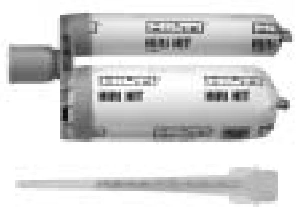
HIT-HY 150 injection mortar with HAS rod

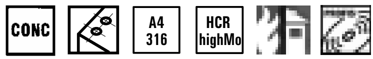
Features:	
	- base material: concrete
	- two-component hybrid mortar
	- rapid curing
	- no expansion forces in base material
	- high loading capacity
	- small edge distance and anchor spacing possible
	- clean and simple application
	- fastening through in-place parts
	- special lengths available on request
Material:	
HAS, HAS-E:	- grade 5.8 , ISO 898 T1, galvanised to min.5 µm
HAS-R / -ER:	- stainless steel; A4-70; 1.4401, 1.4404, 1.4571
HAS-HCR:	- stainless steel; 1.4529
Mortar:	- Foil pack: 330 ml, 500 ml - Jumbo cartridge: 1100ml
Dispenser:	- MD2000, BD2000, P3000 F, MD2500, P3500 F, P5000 HY, HIT P-8000 D



HIT-HY 150 foil pack, mixer

HAS, HAS-R and HAS-HCR rods

HAS-E and HAS-E-R rods



Concrete | Small edge distance / spacing | Corrosion resistance | High corrosion resistance | Fire resistance | Hilti Anchor programme

3

Basic loading data (for a single anchor): HIT-HY 150 with HAS, HAS-E

All data on this page applies to
- concrete: See table below.
- correct setting (See setting operations page 260)
- no edge distance and spacing influence
- *steel* failure

For detailed design method, see pages 261 – 265.

CONC non-cracked concrete

Mean ultimate resistance, $R_{u,m}$ [kN]: concrete ≅ C20/25

Anchor size	M8	M10	M12	M16	M20	M24
Tensile, $N_{Ru,m}$	*17.7*	*28.2*	*41.1*	*77.9*	*121.7*	*175.2*
Shear, $V_{Ru,m}$	*10.7*	*17.0*	*24.7*	*46.7*	*72.9*	*105.0*

Characteristic resistance, R_k [kN]: concrete ≅ C20/25

Anchor size	M8	M10	M12	M16	M20	M24
Tensile, N_{Rk}	*16.4*	*26.1*	*38.1*	*72.2*	*112.7*	*162.2*
Shear, V_{Rk}	*9.9*	*15.8*	*22.9*	*43.3*	*67.5*	*97.3*

Following values according to the

Concrete Capacity Method

Design resistance, R_d [kN]: concrete $f_{ck,cube}$ = 25 N/mm^2

Anchor size	M8	M10	M12	M16	M20	M24
Tensile, N_{Rd}	8.4	11.2	16.8	21.4	36.4	45.4
Shear, V_{Rd}	7.9	12.6	18.3	34.6	54.0	77.8

Recommended load, L_{rec} [kN]: concrete $f_{ck,cube}$ = 25 N/mm^2

Anchor size	M8	M10	M12	M16	M20	M24
Tensile, N_{Rec}	6.0	8.0	12.0	15.3	26.0	32.4
Shear, V_{Rec}	5.6	9.0	13.1	24.7	38.6	55.6

Basic loading data (for a single anchor): HIT-HY 150 with HAS-R, HAS-E-R, HAS-HCR

All data on this page applies to

- concrete: See table below.
- correct setting (See setting operations page 260)
- no edge distance and spacing influence
- *steel* failure

For detailed design method, see pages 261 – 265.

CONC **non-cracked concrete**

Mean ultimate resistance, $R_{u,m}$ [kN]: concrete ≅ C20/25

Anchor size	M8	M10	M12	M16	M20	M24
Tensile, $N_{Ru,m}$	*24.8*	*39.6*	*57.8*	*109.1*	*170.3*	*244.4*
Shear, $V_{Ru,m}$	*14.8*	*23.8*	*34.5*	*65.4*	*102.1*	*146.9*

Characteristic resistance, R_k [kN]: concrete ≅ C20/25

Anchor size	M8	M10	M12	M16	M20	M24
Tensile, N_{Rk}	*23.0*	*36.7*	*53.5*	*101.0*	*157.6*	*226.3*
Shear, V_{Rk}	*13.7*	*22.0*	*32.0*	*60.5*	*94.5*	*136.0*

Following values according to the

Concrete Capacity Method

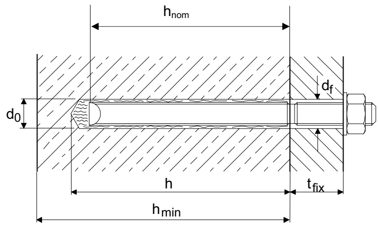
Design resistance, R_d [kN]: concrete $f_{ck,cube}$ = 25 N/mm^2

Anchor size	M8	M10	M12	M16	M20	M24
Tensile, N_{Rd}	8.4	11.2	16.8	21.4	36.4	45.4
Shear, V_{Rd}	8.8	14.1	20.5	38.8	60.6	87.2

Recommended load, L_{rec} [kN]: concrete $f_{ck,cube}$ = 25 N/mm^2

Anchor size	M8	M10	M12	M16	M20	M24
Tensile, N_{Rec}	6.0	8.0	12.0	15.3	26.0	32.4
Shear, V_{Rec}	6.3	10.1	14.6	27.7	43.3	62.3

Setting details



Anchor size		M8	M10	M12	M16	M20	M24
Anchor rod [1]	HAS /-E/-R/-E-R/-HCR	M8x80/14	M10x90/21	M12x110/28	M16x125/38	M20x170//48	M24x210/54
d_0 [mm]	Drill bit diameter	10	12	14	18	22	28
h [mm]	Hole depth	80	90	110	130	175	215
h_{nom} [mm]	Nominal anchorage depth	80	90	110	125	170	210
h_{min} [mm]	Min. base material thickness	110	120	140	170	220	270
t_{fix} [mm]	Max. fixture (fastenable) thickness	14	21	28	38	48	54
d_f [mm]	Clearance hole rec.	9	12	14	18	22	26
	Clearance hole max.	11	13	15	19	25	29
T_{inst} [Nm]	Tightening torque HAS/-E	15	30	50	100	160	240
	Tightening torque HAS-R/-E-R, HAS-HCR	12	25	40	90	135	200
Filling Volume[2] (guide)	ml	4	6	10	15	31	65
	Trigger pulls~	0.5	1	1.5	2	4	8
Drill bit	TE-CX-	10/22	12/22	14/22	-	-	-
	TE-T-	-	-	-	18/32	24/32	28/52

[1] The values for the maximum fixture thickness are only valid for the HAS anchor rods given in this table.
If other HAS rods are used, these values will change. (Example: HAS M12x110/128; t_{fix} = 128 mm)

[2] The hole must be filled about 50%.

Note: To ensure that optimal holding power is obtained, the first **two trigger pulls** of mortar after opening a **330 ml** foil pack of Hilti HIT-HY 150 must be thrown away, in case of using a **500 ml** foil pack the first **three trigger pulls** must be thrown away.
One trigger pull is approx. 8 ml mortar when using the MD 2000.

Temperature of the base material °C	Working time in which rod can be inserted and adjusted, t_{gel}	Curing time before anchor can be fully loaded, t_{cure}
-5	90 min.	6 hours
0	45 min.	3 hours
5	25 min.	1.5 hours
20	6 min.	50 min.
30	4 min.	40 min.
40	2 min.	30 min.

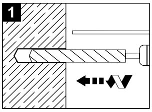
The foil pack temperature must be at least +5°C.

Installation equipment

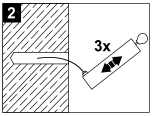
Rotary hammer (TE1, TE 2, TE5, TE 6, TE6A, TE15, TE15-C, TE18-M, TE 35, TE 55 or TE 76), a drill bit, the MD 2000 or BD 2000 (P3000 F, MD2500, P3500F, P5000 HY, HIT P-8000 D) dispenser, blow-out pump, a brush and a torque wrench.

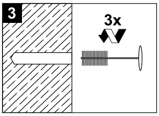
HIT-HY 150 injection mortar with HAS rod

Setting operations

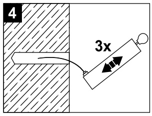


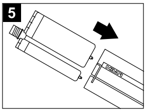
Drill hole.



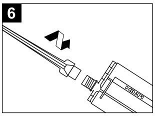


Clean hole.

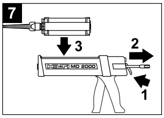




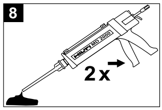
Insert foil pack into holder.



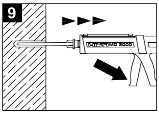
Screw in mixer.



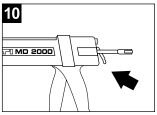
Put cartridge into dispenser.



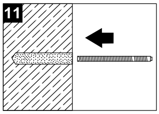
Throw away first two trigger pulls using a 330ml cartridge*



Inject mortar.

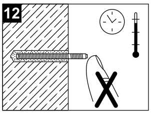


Release dispenser.



11	°F	°C	t_{gel}
	23	-5	90 min
	32	0	45 min
	41	5	25 min
	68	20	6 min
	86	30	4 min
	104	40	2 min

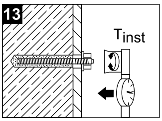
Insert rod before gel time.



Wait for curing.

12	°F	°C	t_{cure}
	23	-5	6 h
	32	0	3 h
	41	5	1.5 h
	68	20	50 min
	86	30	40 min
	104	40	30 min

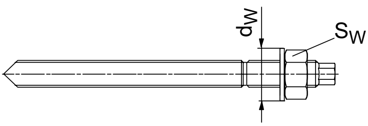
t_{cure} time



Apply tightening torque.

* Throw away first three trigger pulls using a 500 ml cartridge.

Anchor geometry and mechanical properties



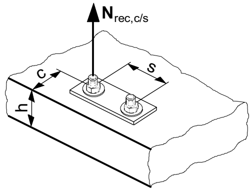
Anchor size			M8	M10	M12	M16	M20	M24
A_s [mm²]	Stressed cross-section		32.8	52.3	76.2	144	225	324
f_{uk} [N/mm²]	Nominal tensile strength	HAS (5.8), HAS-E (5.8) HAS-R, HAS-E-R, -HCR	500 700	500 700	500 700	500 700	500 700	500 700
f_{yk} [N/mm²]	Nominal yield strength	HAS (5.8), HAS-E (5.8) HAS-R, HAS-E-R, -HCR	400 450	400 450	400 450	400 450	400 450	400 450
W [mm³]	Moment of resistance		26.5	53.3	93.9	244	477	824
$M_{Rd,s}$ [Nm]	Design bending resistance [1)]	HAS (5.8), HAS-E (5.8) HAS-R, HAS-E-R, -HCR	12.7 14.3	25.6 28.7	45.1 50.6	117.1 131.4	228.8 256.7	395.3 443.5
S_w [mm]	Width across flats		13	17	19	24	30	36
d_w [mm]	Washer diameter		16	20	24	30	37	44

1) The design bending resistance of the anchor rod was calculated from $M_{Rd,s} = (1.2 \cdot W \cdot f_{uk})/\gamma_{Ms,b}$, where the partial safety factor for steel of grade 5.8 is $\gamma_{Ms,b} = 1.25$, for A4-70 and HCR $\gamma_{Ms,b} = 1.56$. Verification of the safety level is then $M_{Sk} \cdot \gamma_F \leq M_{Rd,s}$.

Detailed design method - Hilti CC

(The Hilti CC method is a simplified Version of ETAG Annex C.)

Caution: In view of the high loads transferable with the HIT-HY 150, it must be verified by the user that the load acting on the concrete structure, including the loads introduced by the anchor fastening, do not cause failure, e.g. cracking, of the concrete structure.



TENSION

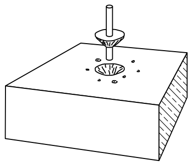
The design tensile resistance of a single anchor is the lower of:

$N_{Rd,c}$: concrete cone/pull-out resistance

$N_{Rd,s}$: steel resistance

$N_{Rd,c}$: Concrete cone/pull-out resistance

$$N_{Rd,c} = N^{o}_{Rd,c} \cdot f_T \cdot f_{B,N} \cdot f_{A,N} \cdot f_{R,N}$$



$N^{0}_{Rd,c}$: Concrete cone/pull-out design resistance

- Concrete compressive strength, $f_{ck,cube(150)} = 25\ N/mm^2$

Anchor size	M8	M10	M12	M16	M20	M24
$N^{o}_{Rd,c}$ [kN]	8.4	11.2	16.8	21.4	36.4	45.4
h_{nom} [mm] Nominal anchorage depth	80	90	110	125	170	210

1) The design tensile resistance is calculated from the characteristic tensile resistance $N^{o}_{Rk,c}$ by $N^{o}_{Rd,c} = N^{o}_{Rk,c}/\gamma_{Mc,N}$, where the partial safety factor $\gamma_{Mc,N}$ is equal to 1.8.

f_T: Influence of anchorage depth

$$f_T = \frac{h_{act}}{h_{nom}}$$

Limits to actual anchorage depth h_{act}: $h_{nom} \le h_{act} \le 2.0\ h_{nom}$

$f_{B,N}$: Influence of concrete strength

Concrete strength designation (ENV 206)	Cylinder compressive strength, $f_{ck,cyl}$ [N/mm²]	**Cube compressive strength, $f_{ck,cube}$ [N/mm²]**	$f_{B,N}$
C20/25	20	**25**	**1**
C25/30	25	**30**	**1.05**
C30/37	30	**37**	**1.12**
C35/45	35	**45**	**1.20**
C40/50	40	**50**	**1.25**
C45/55	45	**55**	**1.30**
C50/60	50	**60**	**1.35**
	Concrete cylinder: height 30cm, 15cm diameter	Concrete cube: side length 15cm	
	Concrete test specimen geometry		

$$f_{B,N} = 1 + \left(\frac{f_{ck,cube} - 25}{100} \right)$$

Limits: 25 N/mm² $\le f_{ck,cube(150)} \le$ 60 N/mm²

$f_{A,N}$: Influence of anchor spacing

Anchor spacing, s [mm]	Anchor size					
	M8	M10	M12	M16	M20	M24
40	0.63					
45	0.64	0.63				
50	0.66	0.64				
55	0.67	0.65	0.63			
60	0.69	0.67	0.64			
65	0.70	0.68	0.65	0.63		
70	0.72	0.69	0.66	0.64		
80	0.75	0.72	0.68	0.66		
90	0.78	0.75	0.70	0.68	0.63	
100	0.81	0.78	0.73	0.70	0.65	
120	0.88	0.83	0.77	0.74	0.68	0.64
140	0.94	0.89	0.82	0.78	0.71	0.67
160	1.00	0.94	0.86	0.82	0.74	0.69
180		1.00	0.91	0.86	0.76	0.71
200			0.95	0.90	0.79	0.74
220			1.00	0.94	0.82	0.76
250				1.00	0.87	0.80
280					0.91	0.83
310					0.96	0.87
340					1.00	0.90
390						0.96
420						1.00

$$f_{A,N} = 0.5 + \frac{s}{4h_{nom}}$$

Limits: $s_{min} \leq s \leq s_{cr,N}$
s_{min}=0.5h_{nom}
$s_{cr,N}$=2.0 h_{nom}

$f_{R,N}$: Influence of edge distance

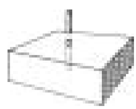
Edge distance, c [mm]	Anchor size					
	M8	M10	M12	M16	M20	M24
40	0.64					
45	0.69	0.64				
50	0.73	0.68				
55	0.78	0.72	0.64			
60	0.82	0.76	0.67			
65	0.87	0.80	0.71	0.65		
70	0.91	0.84	0.74	0.68		
80	1.00	0.92	0.80	0.74		
90		1.00	0.87	0.80	0.66	
100			0.93	0.86	0.70	
110			1.00	0.91	0.75	0.66
120				0.97	0.79	0.69
140				1.00	0.87	0.76
160					0.96	0.83
180					1.00	0.90
210						1.00

$$f_{R,N} = 0.28 + 0.72\frac{c}{h_{nom}}$$

Limits: $c_{min} \leq c \leq c_{cr,N}$
c_{min}= 0.5 h_{nom}
$c_{cr,N}$= 1.0 h_{nom}

Note: If more than 3 edges are smaller than $c_{cr,N}$, consult your Hilti technical advisory service.

$N_{Rd,s}$ [1)] : Steel design tensile resistance



Anchor size	M8	M10	M12	M16	M20	M24
HAS grade 5.8 [2)] [kN]	10,9	17,4	25,4	48,1	75,1	108,1
HAS grade 8.8 [2)] [kN]	*17,5*	*27,9*	*40,7*	*78,9*	*120,1*	*172,9*
HAS-R,HAS-HCR[2)] [kN]	12,3	19,6	28,6	54,0	84,3	121,0

1) The design tensile resistance is calculated from the characteristic tensile resistance, $N_{Rk,s}$, using $N_{Rd,s}= A_s \cdot f_{uk}/\gamma_{Ms,N}$, where the partial safety factor, $\gamma_{Ms,N}$, for grade 5.8 and 8.8 is 1.5; 1.87 for grades A4-70 and HCR of the M8 to M24 sizes

2) Data given in *italics* applies to non-standard rods.

N_{Rd} : System design tensile resistance

N_{Rd} = lower of $N_{Rd,c}$ and $N_{Rd,s}$

Combined loading: Only if tensile load and shear load applied (See page 31 and section 4 "Examples").

Detailed design method – Hilti CC

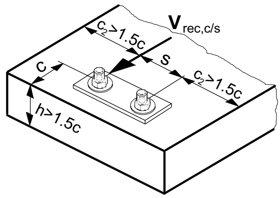
(The Hilti CC method is a simplified Version of ETAG Annex C.)

SHEAR

The design shear resistance of a single anchor is the lower value of

$V_{Rd,c}$: concrete edge resistance

$V_{Rd,s}$: steel resistance

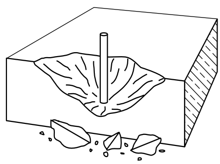


Note: If the conditions for h and c_2 are not met, consult your Hilti technical advisory service.

$V_{Rd,c}$: Concrete edge design resistance

The lowest concrete edge resistance must be calculated. All near edges must be checked (not only the edge in the direction of shear). The direction of shear is accounted for by the factor $f_{\beta,V}$.

$$V_{Rd,c} = V^0_{Rd,c} \cdot f_{BV} \cdot f_{AR,V} \cdot f_{\beta,V}$$



$V^0_{Rd,c}$: Concrete edge design resistance

- concrete compressive strength, $f_{ck,cube(150)}$ = 25 N/mm^2
- at minimum edge distance c_{min}

Anchor size	M8	M10	M12	M16	M20	M24
$V^0_{Rd,c}$ [1] [kN]	2.6	3.4	5.0	6.7	12.4	18.5
c_{min} [mm] Min. edge distance	40	45	55	65	85	105

1) The design shear resistance is calculated from the characteristic shear resistance $V^o_{Rk,s}$ by $V^o_{Rd,c} = V^o_{Rk,s}/\gamma_{Ms,V}$, where the partial safety factor, $\gamma_{Ms,V}$, is 1.5.

HIT-HY 150 injection mortar with HAS rod

f_{BV}: Influence of concrete strength

Concrete strength designation (ENV 206)	Cylinder compressive strength, $f_{ck,cyl}$ [N/mm²]	**Cube compressive strength, $f_{ck,cube}$ [N/mm²]**	f_{BV}
C20/25	20	**25**	**1**
C25/30	25	**30**	**1.1**
C30/37	30	**37**	**1.22**
C35/45	35	**45**	**1.34**
C40/50	40	**50**	**1.41**
C45/55	45	**55**	**1.48**
C50/60	50	**60**	**1.55**
	Concrete cylinder: height 30cm, 15cm diameter	Concrete cube: side length 15cm	
	Concrete test specimen geometry		

$$f_{BV} = \sqrt{\frac{f_{ck,cube}}{25}}$$

Limits:
$2\ N/mm^2 \leq f_{ck,cube(150)} \leq 60\ N/mm^2$

$f_{AR,V}$: Influence of spacing and edge distance

$f_{AR,V}$	c/c_{min} → 1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6	3.8	4.0
Single anchor with edge influence,	1.00	1.31	1.66	2.02	2.41	2.83	3.26	3.72	4.19	4.69	5.20	5.72	6.27	6.83	7.41	8.00
s/c_{min} ↓ 1.0	0.67	0.84	1.03	1.22	1.43	1.65	1.88	2.12	2.36	2.62	2.89	3.16	3.44	3.73	4.03	4.33
1.5	0.75	0.93	1.12	1.33	1.54	1.77	2.00	2.25	2.50	2.76	3.03	3.31	3.60	3.89	4.19	4.50
2.0	0.83	1.02	1.22	1.43	1.65	1.89	2.13	2.38	2.63	2.90	3.18	3.46	3.75	4.05	4.35	4.67
2.5	0.92	1.11	1.32	1.54	1.77	2.00	2.25	2.50	2.77	3.04	3.32	3.61	3.90	4.21	4.52	4.83
3.0	1.00	1.20	1.42	1.64	1.88	2.12	2.37	2.63	2.90	3.18	3.46	3.76	4.06	4.36	4.68	5.00
3.5		1.30	1.52	1.75	1.99	2.24	2.50	2.76	3.04	3.32	3.61	3.91	4.21	4.52	4.84	5.17
4.0			1.62	1.86	2.10	2.36	2.62	2.89	3.17	3.46	3.75	4.05	4.36	4.68	5.00	5.33
4.5				1.96	2.21	2.47	2.74	3.02	3.31	3.60	3.90	4.20	4.52	4.84	5.17	5.50
5.0					2.33	2.59	2.87	3.15	3.44	3.74	4.04	4.35	4.67	5.00	5.33	5.67
5.5						2.71	2.99	3.28	3.57	3.88	4.19	4.50	4.82	5.15	5.49	5.83
6.0						2.83	3.11	3.41	3.71	4.02	4.33	4.65	4.98	5.31	5.65	6.00
6.5							3.24	3.54	3.84	4.16	4.47	4.80	5.13	5.47	5.82	6.17
7.0								3.67	3.98	4.29	4.62	4.95	5.29	5.63	5.98	6.33
7.5									4.11	4.43	4.76	5.10	5.44	5.79	6.14	6.50
8.0										4.57	4.91	5.25	5.59	5.95	6.30	6.67
8.5											5.05	5.40	5.75	6.10	6.47	6.83
9.0											5.20	5.55	5.90	6.26	6.63	7.00
9.5												5.69	6.05	6.42	6.79	7.17
10.0													6.21	6.58	6.95	7.33
10.5														6.74	7.12	7.50
11.0															7.28	7.67
11.5																7.83
12.0																8.00

**These results are for a two-anchor fastening.
For fastenings with more than two anchors, use the general formulae for n anchors.**

$f_{AR,V}$: Influence of edge distance and spacing

Formula for **single**-anchor fastening influenced only by edge

$$f_{AR,V} = \frac{c}{c_{min}} \cdot \sqrt{\frac{c}{c_{min}}}$$

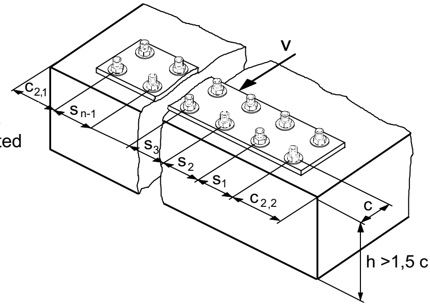
Formula for **two**-anchor fastening (edge plus 1 spacing) only valid for s < 3c

$$f_{AR,V} = \frac{3 \cdot c + s}{6 \cdot c_{min}} \cdot \sqrt{\frac{c}{c_{min}}}$$

General formula for **n** anchors (edge plus n-1 spacing) only valid where s_1 and s_{n-1} are each < 3c and c_2 > 1.5c

$$f_{AR,V} = \frac{3 \cdot c + s_1 + s_2 + \ldots + s_{n-1}}{3 \cdot n \cdot c_{min}} \cdot \sqrt{\frac{c}{c_{min}}}$$

results tabulated below



Note: It is assumed that only the row of anchors closest to the free concrete edge carries the centric shear load

$f_{\beta,V}$: Influence of loading direction

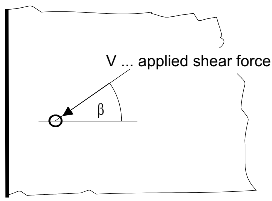
Angle, ß [°]	$f_{\beta,V}$
0 to 55	**1**
60	**1.1**
70	**1.2**
80	**1.5**
90 to 180	**2**

Formulae:

$f_{\beta,V} = 1$ for 0° ≤ ß ≤ 55°

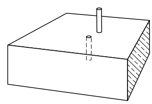
$f_{\beta,V} = \dfrac{1}{\cos ß + 0{,}5 \sin ß}$ for 55° < ß ≤ 90°

$f_{\beta,V} = 2$ for 90° < ß ≤ 180°



$V_{Rd,s}$[1)] : Steel design shear resistance

Anchor size		M8	M10	M12	M16	M20	M24
HAS grade 5.8 [2)]	[kN]	7,9	12,6	18,3	34,6	54,0	77,8
HAS grade 8.8 [2)]	[kN]	*12,6*	*20,1*	*29,3*	*55,3*	*86,4*	*124,4*
HAS-R, HAS-HCR[2)]	[kN]	8.8	14.1	20.5	38.8	60.6	87.2



1) The design shear resistance is calculated using $V_{Rd,s}$= (0,6 A_s f_{uk})/$\gamma_{Ms,V}$. The values for the stressed cross-section, A_s , and the nominal tensile strength of steel, f_{uk}, are given in the table "Anchor mechanical properties and geometry". The partial safety factor, $\gamma_{Ms,V}$, is 1.25 for grades 5.8 and 8.8; 1.56 for grade sA4-70 and HCR in the sizes M8 to M24

2) Data given in *italics* applies to non-standard rods.

V_{Rd} : System design shear resistance

V_{Rd} = lower of $V_{Rd,c}$ and $V_{Rd,s}$

Combined loading: Only if tensile load and shear load applied (See page 31 and section 4 "Examples").

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