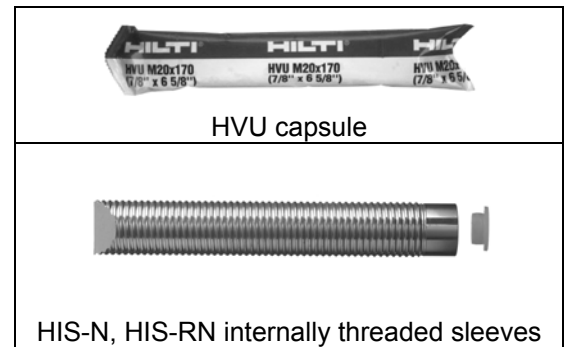


HVU adhesive with HIS-N / HIS-RN sleeve

Features:	
	- anchor fastenings flush with surface
	- foil capsule vs. glass
	- no expansion force in base material
	- high loading capacity
	- small edge distance and spacing
	- complete system consisting of robust foil capsule, internally threaded sleeve and setting tool
Material:	
HIS-N:	- carbon steel galvanised to 5 microns
HIS-RN	- stainless steel, A4-70: 1.4401
HVU capsule:	- urethane methacrylate resin, styrene free, hardener, quartz sand or corundum, foil tube



Concrete



Small edge distance/spacing



Fire resistance



Corrosion resistance



Hilti Anchor programme

Basic loading data (for a single anchor): HIS-N

All data on this page applies to

For detailed design method, see pages 212 – 217.

- concrete: See table below.
- correct setting (See setting operations page 211)
- no edge distance and spacing influence
- tensile values are for HIS-N (derived using grade 12.9 rods)
- *shear (steel failure)*: rod / bolt of steel grade 5.8



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

Anchor size	M8	M10	M12	M16	M20
Tensile, $N_{Ru,m}$	37.2	85.1	102.4	161.3	210.0
Shear, $V_{Ru,m}$	11.9	18.8	27.3	50.9	79.4

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

Anchor size	M8	M10	M12	M16	M20
Tensile, N_{Rk}	35.6	81.6	66.9	150.3	174.3
Shear, V_{Rk}	11.0	17.4	25.3	47.1	73.5

Following values according to the

Concrete Capacity Method

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

Anchor size	M8	M10	M12	M16	M20
Tensile, N_{Rd}	12.2	19.3	28.1	52.3	81.7
Shear, V_{Rd}	8.8	13.9	20.2	37.7	58.8

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

Anchor size	M8	M10	M12	M16	M20
Tensile, N_{Rec}	8.7	13.8	20.1	37.4	58.6
Shear, V_{Rec}	6.3	9.9	14.5	26.9	42.0

Basic loading data (for a single anchor): HIS-RN

All data on this section applies to

For detailed design method, see pages 212 – 217.

- concrete: See table below.
- correct setting (See setting operations page 211)
- no edge distance and spacing influence
- tensile values are for HIS-RN (derived using grade 12.9 rods)
- *shear (steel failure)*: rod / bolt of steel grade A4-70

CONC	non-cracked concrete
-------------	-----------------------------

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

Anchor size	M8	M10	M12	M16	M20
Tensile, $N_{R_{u,m}}$	40.5	85.1	102.4	161.3	173.1
Shear, $V_{R_{u,m}}$	16.6	26.3	38.2	71.2	111.1

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

Anchor size	M8	M10	M12	M16	M20
Tensile, N_{R_k}	37.5	81.6	66.9	150.3	160.3
Shear, V_{R_k}	15.4	24.4	35.4	65.9	102.9

Following values according to the

Concrete Capacity Method

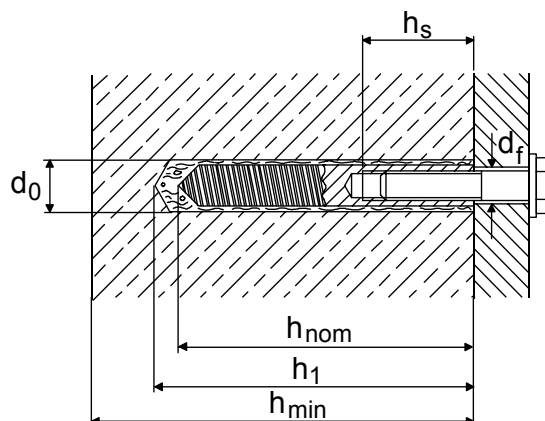
Design resistance, R_d [kN]: concrete, $f_{ck,cube} = 25 \text{ N/mm}^2$

Anchor size	M8	M10	M12	M16	M20
Tensile, N_{R_d}	13.7	21.7	31.6	58.8	91.7
Shear, V_{R_d}	9.9	15.6	22.7	42.3	66.0

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

Anchor size	M8	M10	M12	M16	M20
Tensile, N_{Rec}	9.8	15.5	22.5	42.0	65.5
Shear, V_{Rec}	7.1	11.1	16.2	30.2	47.1

Setting details



HVU adhesive with HIS-N / HIS-RN sleeve

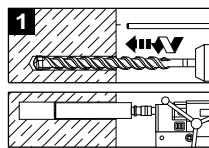
Anchor size			M8	M10	M12	M16	M20
Foil capsule	HVU...		M10x90	M12x110	M16x125	M20x170	M24x210
Sleeve	HIS-N ..., HIS-RN ...		M8x90	M10x110	M12x125	M16x170	M20x205
d_0 [mm]	Drill bit diameter		14	18	22	28	32
h_1 [mm]	Hole depth		90	110	125	170	205
h_{min} [mm]	Min. thickness of base material		120	150	170	230	280
h_s [mm]	Thread engagement length	min	8	10	12	16	20
		max	20	25	30	40	50
d_f [mm]	Rec. clearance hole		9	12	14	18	22
T_{inst} [Nm]	Tightening torque	HIS-N	15	28	50	85	170
		HIS-RN	12	23	40	70	130
Drill bit	TE-CX-		14/22	-	-	-	-
Drill bit	TE-T-		-	18/32	22/32	28/32	32/37

Temperature when setting:	Min. time to wait before removing SCREWED-ON setting tool, t_{rel}	Curing time before anchor can be fully loaded, t_{cure}
20°C and above	8 min.	20 min.
10°C to 20°C	20 min.	30 min.
0°C to 10°C	30 min.	1 hour
-5°C to 0°C	1 hour	5 hours

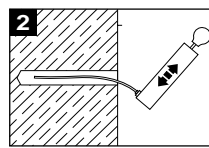
Installation equipment

Rotary hammer (TE5, TE6, TE6A, TE15, TE15-C, TE18-M, TE 55 or TE 76), a drill bit, a setting tool, a TE adapter (TE-C-HIS, TE-F-Y-HIS) with HIS-S - M8 - M20 and a blow-out pump.

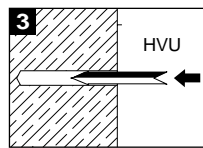
Setting operations



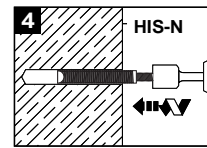
Drill hole.



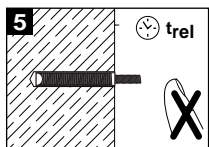
Blow out dust and fragments.



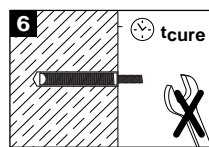
Insert HVU capsule.



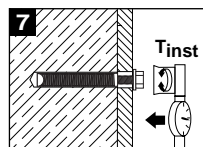
Drive in anchor.



Allow rel time to pass.



Wait for curing.

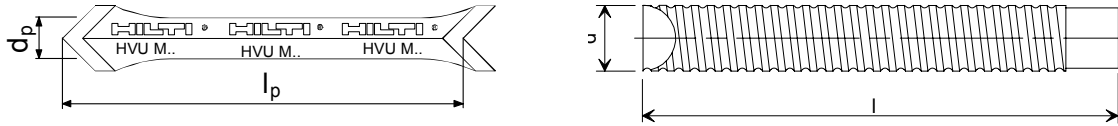


Apply tightening torque.

°C	t_{rel}	t_{cure}
-5° ... 0°	60'	5 h
0° ... 10°	30'	60'
10° ... 20°	20'	30'
20° ... 40°	8'	20'

HVU adhesive with HIS-N / HIS-RN sleeve

Anchor geometry and mechanical properties



Anchor size			M8	M10	M12	M16	M20
Capsule		HVU ...	M10x90	M12x110	M16x125	M20x170	M24x210
l_p [mm]	Capsule length		110	127	140	170	200
d_p [mm]	Capsule diameter		10,7	13,1	17,1	22	25,7
Element		HIS-N ..., HIS-RN ...	M8x90	M10x110	M12x125	M16x170	M20x210
l [mm]	Sleeve length		90	110	125	170	210
d [mm]	Sleeve outside diameter		12,5	16,5	20,5	25,4	27,6
A_s [mm ²]	Stressed cross-section	Sleeve	53,6	110	170	255	229
		Bolt	36,6	58,0	84,3	157	245
f_{uk} [N/mm ²]	Nominal tensile strength	HIS-N	510	510	460	460	460
		HIS-RN	700	700	700	700	700
f_{yk} [N/mm ²]	Yield strength	HIS-N	410	410	375	375	375
		HIS-RN	350	350	350	350	350
W [mm ³]	Moment of resistance of bolt		31,2	62,3	109	277	375
$M_{Rd,s}$ [Nm]	Design bending resistance of bolt ¹⁾	5.8	12,7	25,6	45,1	117,1	228,8
		8.8	20,4	41,0	75,1	187,4	366,1
		A2/A4	14,3	28,7	50,6	131,4	256,7

¹⁾ The design bending resistance of the bolt is calculated from $M_{Rd,s} = (1,2 \cdot W \cdot f_{uk}) / \gamma_{ms,b}$, where the partial safety factor, $\gamma_{ms,b}$, for grade 5.8 and 8.8 bolts is 1.25 and 1.56 for A4-70 and A2-70. The final safety check 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.)

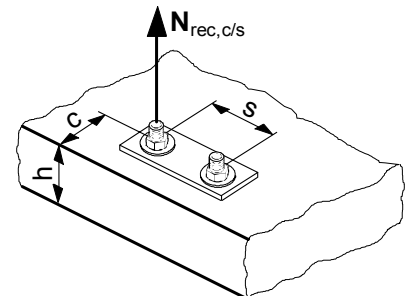
Caution: In view of the high loads transferable with the HVU, it must be verified by the user that the load acting on the concrete structure, including the loads introduced by the anchor fastening, do not cause failure, e.g. cracking, of the concrete structure.

TENSION

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

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

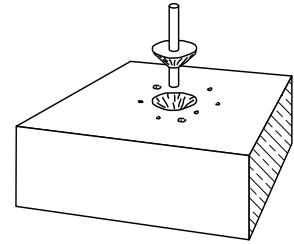
$N_{Rd,s}$: steel resistance of the bolt or sleeve



HVU adhesive with HIS-N / HIS-RN sleeve

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

$$N_{Rd,c} = N_{Rd,c}^0 \cdot f_{B,N} \cdot f_{A,N} \cdot f_{R,N}$$



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

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

Anchor size	M8	M10	M12	M16	M20
$N_{Rd,c}^0$ [kN]	22.6	35.4	46.9	85.1	120.1
h_{nom} [mm] Nominal anchorage depth	90	110	125	170	205

1) The design tensile resistance is calculated from the characteristic tensile resistance, $N_{Rk,c}^0$, by $N_{Rd,c}^0 = N_{Rk,c}^0 / \gamma_{Mc,N}$, where the partial safety factor, $\gamma_{Mc,N}$, is 1.8.

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

Concrete strength designation (ENV 206)	compressive cylinder strength, $f_{ck,cyl}$ [N/mm ²]	compressive cube strength, $f_{ck,cube}$ [N/mm ²]	$f_{B,N}$
C16/20	16	20	0.95
C20/25	20	25	1
C25/30	25	30	1.04
C30/37	30	37	1.10
C35/45	35	45	1.16
C40/50	40	50	1.20
C45/55	45	55	1.24
C50/60	50	60	1.28

Concrete cylinder: height 30cm, 15cm diameter	Concrete cube: side length 15cm
Concrete test specimen geometry	

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

for $f_{ck,cube(150)} = 20 \text{ N/mm}^2$

$$f_{B,N} = 1 + \frac{\left(\frac{f_{ck,cube} - 25}{125} \right)}{125}$$

Limits: $25 \text{ N/mm}^2 \leq f_{ck,cube(150)} \leq 60 \text{ N/mm}^2$

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

Spacing, s [mm]	Anchor size				
	M8	M10	M12	M16	M20
45	0.63				
50	0.64				
55	0.65	0.63			
60	0.67	0.64			
65	0.68	0.65	0.63		
70	0.69	0.66	0.64		
80	0.72	0.68	0.66		
90	0.75	0.70	0.68	0.63	
100	0.78	0.73	0.70	0.65	
110	0.81	0.75	0.72	0.66	0.63
120	0.83	0.77	0.74	0.68	0.65
140	0.89	0.82	0.78	0.71	0.67
160	0.94	0.86	0.82	0.74	0.70
180	1.00	0.91	0.86	0.76	0.72
200		0.95	0.90	0.79	0.74
220		1.00	0.94	0.82	0.77
250			1.00	0.87	0.80
280				0.91	0.84
310				0.96	0.88
340				1.00	0.91
390					0.98
410					1.00

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

Limits: $s_{min} \leq s \leq s_{cr,N}$

$$s_{min} = 0.5h_{nom}$$

$$s_{cr,N} = 2.0h_{nom}$$

HVU adhesive with HIS-N / HIS-RN sleeve

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

Edge distance, c [mm]	Anchor size				
	M8	M10	M12	M16	M20
45	0.64				
50	0.68				
55	0.72	0.64			
60	0.76	0.67			
65	0.80	0.71	0.65		
70	0.84	0.74	0.68		
80	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	0.67
120			0.97	0.79	0.70
140			1.00	0.87	0.77
160				0.96	0.84
180				1.00	0.91
210					1.00

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

Limits: $c_{min} \leq c \leq c_{cr,N}$

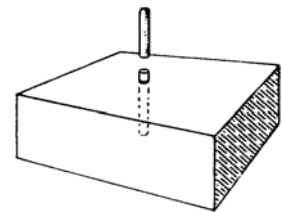
$c_{min} = 0,5 h_{nom}$

$c_{cr,N} = 1,0 h_{nom}$

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
$N_{Rd,s}^{sleeve}$ [kN] Sleeve	HIS-N	18,2	37,4	52,1	78,2	70,2
	HIS-RN	15,6	32,1	49,6	74,4	66,8
$N_{Rd,s}^{bolt}$ [kN] Bolt	grade 5.8	12,2	19,3	28,1	52,3	81,7
	grade 8.8	19,5	30,9	44,9	84,0	130,7
	grade A4-70	13,7	21,7	31,6	58,8	91,7



¹⁾ The design tensile resistance is calculated from the characteristic tensile resistance, $N_{Rk,s}$, by $N_{Rd,s} = A_s \cdot f_{uk} / \gamma_{Ms,N}$, where the partial safety factor, $\gamma_{Ms,N}$, for the sleeve / bolts of grades 5.8 and 8.8 is 1.5 or 1.87 for grade A4-70 and 2.4 for the sleeve.

N_{Rd} : System design tensile resistance

$$N_{Rd} = \text{lower of } N_{Rd,c}, N_{Rd,s}^{sleeve} \text{ or } N_{Rd,s}^{bolt}$$

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

HVU adhesive with HIS-N / HIS-RN sleeve

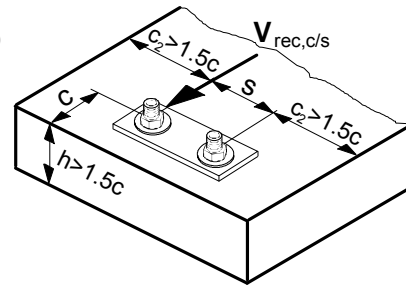
Detailed design method – Hilti CC

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

SHEAR

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

- $V_{Rd,c}$: concrete edge resistance
- $V_{Rd,s}$: steel resistance of the bolt

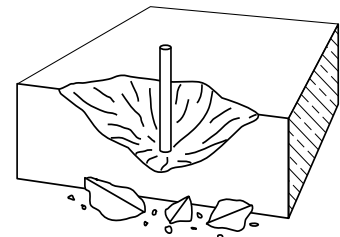


Note: If the conditions for h and c_2 are not met, consult your Hilti technical advisory service.

$V_{Rd,c}$: 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 $f_{\beta,V}$.

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



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

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

Anchor size	M8	M10	M12	M16	M20
$V_{Rd,c}^0$ ¹⁾ [kN]	3.6	5.4	7.6	12.8	19.2
c_{min} [mm] Min. edge distance	45	55	65	85	105

¹⁾ The design shear resistance is calculated from the characteristic shear resistance, $V_{Rk,c}^0$, by $V_{Rd,c}^0 = V_{Rk,c}^0 / \gamma_{Mc,V}$, where the partial safety factor, $\gamma_{Mc,V}$, is 1.5.

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

Concrete strength designation (ENV 206)	Cylinder compressive strength, $f_{ck,cyl}$ [N/mm ²]	Cube compressive strength, $f_{ck,cube}$ [N/mm ²]	$f_{B,V}$
C16/20	16	20	0.89
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			

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

Limits:
 $20 \text{ N/mm}^2 \leq f_{ck,cube(150)} \leq 60 \text{ N/mm}^2$

HVU adhesive with HIS-N / HIS-RN sleeve

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

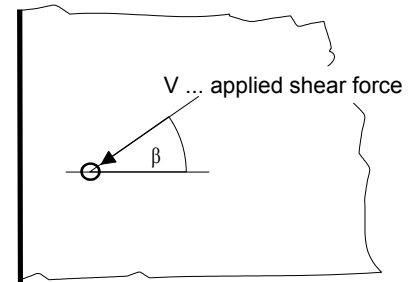
Angle, β [°]	$f_{\beta,V}$
0 to 55	1
60	1.1
70	1.2
80	1.5
90 to 180	2

Formulae:

$$f_{\beta,V} = 1 \quad \text{for } 0^\circ \leq \beta \leq 55^\circ$$

$$f_{\beta,V} = \frac{1}{\cos\beta + 0,5\sin\beta} \quad \text{for } 55^\circ < \beta \leq 90^\circ$$

$$f_{\beta,V} = 2 \quad \text{for } 90^\circ < \beta \leq 180^\circ$$



$f_{AR,V}$: Formulae for edge distance and spacing influence

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

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

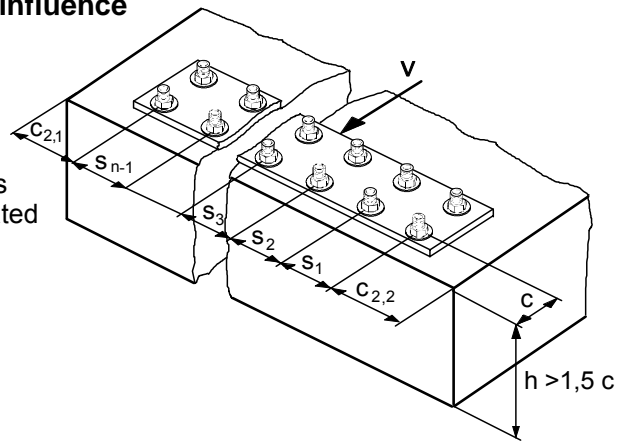
Formula for **two**-anchor fastening anchors (edge plus 1 spacing) only valid for $s < 3c$

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

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

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

results tabulated below



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

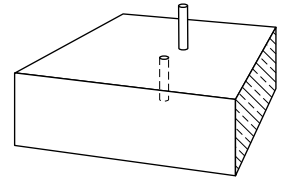
$f_{AR,V}$: Influence of edge distance and spacing

$f_{AR,V}$	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 at the top of the page.

HVU adhesive with HIS-N / HIS-RN sleeve

$V_{Rd,s}$: Steel design shear resistance



Anchor size			M8	M10	M12	M16	M20
$V_{Rd,s}^{1)}$ [kN]	Bolt	steel grade 5.8	8.8	13.9	20.2	37.7	58.8
		steel grade 8.8	14.1	22.3	32.4	60.3	94.1
		A4-70	9.9	15.6	22.7	42.3	66.0

¹⁾ The design shear resistance is calculated from $V_{Rd,s} = (0,6 A_s f_{uk}) / \gamma_{Ms,V}$. The values for the stressed cross-section, A_s , of the bolt and the nominal tensile steel strength, f_{uk} , are taken from the bolt standard ISO 898. The partial safety factor, $\gamma_{Ms,V}$, for grades 5.8 and 8.8 is 1.25 and 1.56 for grade A4-70.

V_{Rd} : System design shear resistance

$$V_{Rd} = \text{lower of } V_{Rd,c} \text{ and } V_{Rd,s}^{\text{bolt}}$$

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