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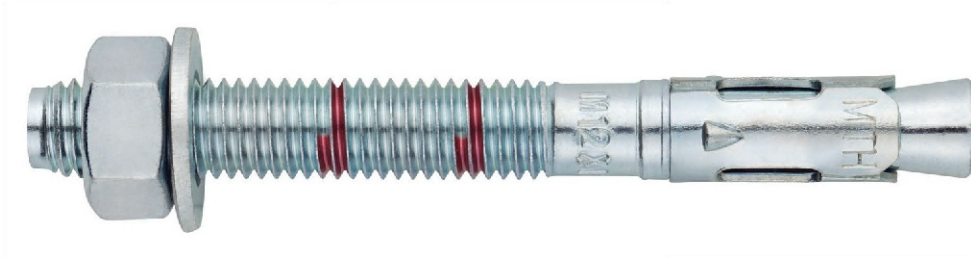


IWA

Indo Wedge Anchor

Through-bolt expansion anchor with controlled torque, for use in non cracked concrete

ETA Assessed Option 7. Zinc-plated shaft. Zinc-plated clip.



PRODUCT INFORMATION

DESCRIPTION

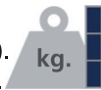
Metallic anchor, with male thread, expansion by controlled torque.

SIZES

M6x60 to M20x270.

DESIGN LOAD RANGE

From 5,3 to 34,3 kN (standard depth).
From 6,7 to 21,3 kN (reduced depth).



BASE MATERIAL

Concrete class from C20/25 to C50/60 non-cracked.



Stone



Concrete



Reinforced Concrete

ASSESSMENTS

- Option 7 (Non-cracked concrete).



ETA 16/0502

CHARACTERISTICS AND BENEFITS

- Easy installation.
- Use in non-cracked concrete.
- Use for medium-heavy duty loads.
- Pre-installation or through the drill-hole of the fixture.
- Variety of lengths and diameters: flexibility in assembly.
- For static and quasi-static loads.
- Two installation depths in M8, M10, M12, M16 and M20, allowing the use in thick anchor plates or in low thickness base materials.
- Available at

MATERIALS

Shaft: Cold-formed carbon steel, zinc-plated = 5 µm.

Washer: DIN 125 or DIN 9021, zinc-plated = 5 µm.

Nut: DIN 934, zinc-plated = 5 µm.

Clip: Cold-formed carbon steel, zinc-plated = 40 µm



APPLICATIONS

- Anchor Plates
- Structures
- Shelving
- Urban Fixments
- Protective Fence
- Catenaries
- Elevators
- Scaffolding Fix

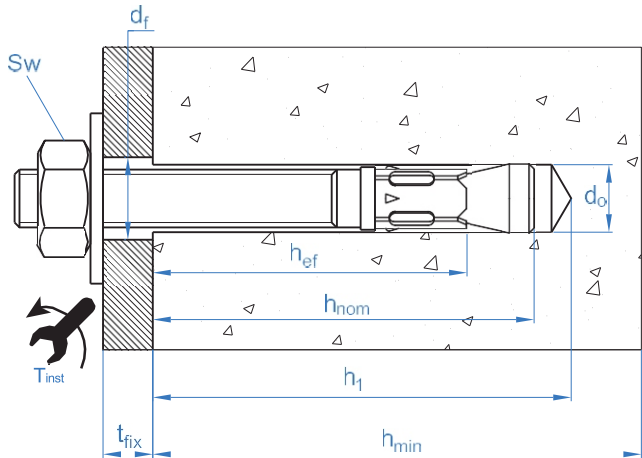


Anchor Fasteners - Indo Construction Fastening Systems

MECHANICAL PROPERTIES									
			M6	M8	M10	M12	M14	M16	M20
Cone area section									
A _s	(mm ²)	Cone area section	14,5	25,5	46,5	68,0	100,2	122,6	216,3
f _{u,s}	(N/mm ²)	Characteristic tension resistance	510	510	510	490	490	490	460
f _{y,s}	(N/mm ²)	Yield strength	440	440	440	410	410	410	375
Threaded area section									
A _s	(mm ²)	Cone area section	20,1	36,6	58,0	84,3	115,0	157,0	245,0
f _{u,s}	(N/mm ²)	Characteristic tension resistance	510	510	510	490	490	490	490
f _{y,s}	(N/mm ²)	Yield strength	440	440	440	410	410	410	410

INSTALLATION DATA										
SIZE				M6	M8	M10	M12	M14	M16	M20
Code				IWA06	IWA08	IWA10	IWA12	IWA14	IWA16	IWA20
Standard depth	d ₀	Nominal diameter of drill bit	[mm]	6	8	10	12	14	16	20
	T _{ins}	Installation torque moment	[Nm]	7	20	35	60	90	120	240
	d _i =	Diameter of clearance hole in the fixture	[mm]	7	9	12	14	16	18	22
	h ₁	Minimum drill hole depth	[mm]	55	65	75	85	100	110	135
	h _{nom}	Installation depth	[mm]	49,5	59,5	66,5	77	91	103,5	125
	h _{ef}	Effective embedment depth	[mm]	40	48	55	65	75	84	103
	h _{min}	Minimum base material thickness	[mm]	100	100	110	130	150	168	206
	t _{fix}	Maximum thickness of fixture*	[mm]	L-58	L-70	L-80	L-92	L-108	L-122	L-147
	s _{cr,N}	Critical spacing	[mm]	120	144	165	195	225	252	309
	c _{cr,N}	Critical edge distance	[mm]	60	72	83	98	113	126	155
	s _{cr,sp}	Critical distance (splitting)	[mm]	160	192	220	260	300	280	360
	c _{cr,sp}	Critical edge distance (splitting)	[mm]	80	96	110	130	150	140	180
Reduced depth	h ₁	Minimum drill hole depth	[mm]	-	50	60	70	-	90	107
	h _{nom}	Installation depth	[mm]	-	46,5	53,5	62	-	84,5	97
	h _{ef}	Effective embedment depth	[mm]	-	35	42	50	-	65	75
	h _{min}	Minimum base material thickness	[mm]	-	100	100	100	-	130	150
	t _{fix}	Maximum thickness of fixture*	[mm]	-	L-57	L-67	L-77	-	L-103	L-121
	s _{cr,N}	Critical spacing	[mm]	-	105	126	150	-	195	225
	c _{cr,N}	Critical edge distance	[mm]	-	53	63	75	-	98	113
	s _{cr,sp}	Critical distance (splitting)	[mm]	-	140	168	200	-	260	300
	c _{cr,sp}	Critical edge distance (splitting)	[mm]	-	70	84	100	-	130	150
	s _{min}	Minimum spacing	[mm]	35	40	50	70	80	90	135
	c _{min}	Minimum edge distance	[mm]	35	40	50	70	80	90	135
	SW	Installation wrench		10	13	17	19	22	24	30

*L= Total anchor length

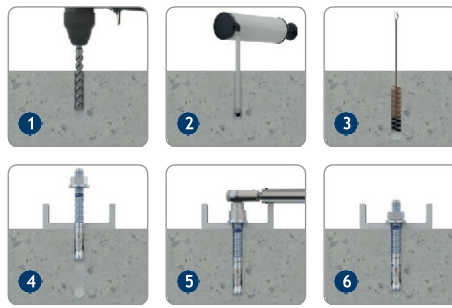


Anchor Fasteners - Indo Construction Fastening Systems

INSTALLATION PRODUCTS

Hammer drill
Concrete Drill bits
Blow pump
Cleaning Brush
Installation hammering tool
Torque wrench
Hexagonal socket

INSTALLATION



Resistances in C20/25 concrete for an isolated anchor, without effects of edge distance or spacing

Characteristic Resistance N_{rk} y V_{rk}

TENSION										SHEAR									
Size			M6	M8	M10	M12	M14	M16	M20	Size			M6	M8	M10	M12	M14	M16	M20
N _{Rk}	Standard depth	[kN]	7,4	13,0	19,0	25,8	32,0	37,9	51,4	V _{Rk}	Standard depth	[kN]	5,1	9,3	14,7	20,6	28,1	38,4	56,3
N _{Rk}	Reduced depth	[kN]	-	10,0	13,4	17,4	-	25,8	32,0	V _{Rk}	Reduced depth	[kN]	-	10,2	13,4	17,4	-	38,4	63,9

Design Resistance N_{rd} y V_{rd}

TENSION										SHEAR									
Size			M6	M8	M10	M12	M14	M16	M20	Size			M6	M8	M10	M12	M14	M16	M20
N _{rd}	Standard depth	[kN]	5,3	9,3	12,7	17,2	21,3	25,2	34,3	V _{Rd}	Standard depth	[kN]	4,1	7,4	11,8	16,5	22,5	30,7	45,0
N _{rd}	Reduced depth	[kN]	-	6,7	8,9	11,6	-	17,2	21,3	V _{Rd}	Reduced depth	[kN]	-	6,8	8,9	11,6	-	30,7	42,6

Maximum Loads Recommended N_{rec} y V_{rec}

TENSION									
Size			M6	M8	M10	M12	M14	M16	M20
N _{rec}	Standard depth	[kN]	3,8	6,6	9,0	12,3	15,2	18,0	24,5
N _{rec}	Reduced depth	[kN]	-	4,8	6,4	8,3	-	12,3	15,2

SHEAR									
Size			M6	M8	M10	M12	M14	M16	M20
V _{rec}	Standard depth	[kN]	2,9	5,3	8,4	11,8	16,1	21,9	32,2
V _{rec}	Reduced depth	[kN]	-	4,9	6,4	8,3	-	21,9	30,4

Simplified calculation method

European Technical Assessment

Simplified version of the calculation method according to Eurocode 2 EN 1992-4. Resistance is calculated according to the data shown in assessment

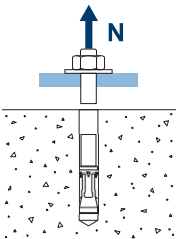
The calculation method is based on the following simplification:
Different loads do not act on individual anchors,
without eccentricity.

- Influence of concrete strength.
- Influence of edge distance.
- Influence of spacing between anchors.
- Influence of reinforcements.
- Influence of base material thickness.
- Influence of load application angle.
- Valid for a group of two anchors.

TENSION LOADS

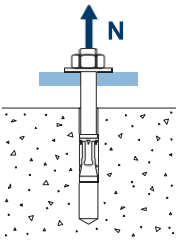
- Steel design resistance: $N_{Rd,s}$
- Pull-out design resistance: $N_{Rd,p} = N_{Rd,p}^o \cdot \psi_c$
- Concrete cone design resistance: $N_{Rd,c} = N_{Rd,c}^o \cdot \psi_b \cdot \psi_{s,N} \cdot \psi_{c,N} \cdot \psi_{re,N}$
- Concrete splitting design resistance: $N_{Rd,sp} = N_{Rd,c}^o \cdot \psi_b \cdot \psi_{s,sp} \cdot \psi_{c,sp} \cdot \psi_{re,N} \cdot \psi_{h,sp}$

Steel Design resistance									
$N_{Rd,s}$									
Size			M6	M8	M10	M12	M14	M16	M20
N_{Rd}^o	Standard depth	[kN]	5,3	9,3	16,9	23,8	35,1	42,9	71,1



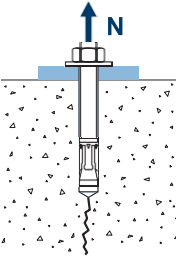
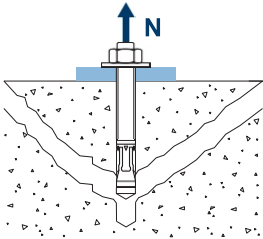
Pull-out design resistance									
$N_{Rd,p} = N_{Rd,p}^o \cdot \psi_c$									
Size			M6	M8	M10	M12	M14	M16	M20
$N_{Rd,p}^o$	Standard depth	[kN]	-*	-*	12,6	-*	-*	-*	-*
$N_{Rd,p}^o$	Reduced depth	[kN]	-	6,6	-*	-*	-	-*	-*

*Pull-out failure is not decisive.



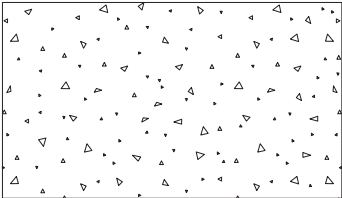
Concrete cone design resistance									
$N_{Rd,c} = N_{Rd,c}^o \cdot \psi_b \cdot \psi_{s,N} \cdot \psi_{c,N} \cdot \psi_{re,N}$									
Concrete splitting design resistance*									
$N_{Rd,sp} = N_{Rd,c}^o \cdot \psi_b \cdot \psi_{s,sp} \cdot \psi_{c,sp} \cdot \psi_{re,N} \cdot \psi_{h,sp}$									
Size			M6	M8	M10	M12	M14	M16	M20
N^o	Standard depth	[kN]	8,3	10,9	13,4	17,2	21,3	25,2	34,3
N^o	Reduced depth	[kN]	-	6,8	8,9	11,6	-	17,2	21,3

*Concrete splitting design resistance must only be considered for non-cracked concrete.

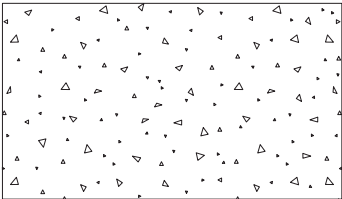


Coefficients of influence

Influence of concrete strength resistance in pul - out failure Ψ_c								
		M6	M8	M10	M12	M14	M16	M20
Ψ_c	C 20/25	1,00						
	C 30/37				1,22			
	C 40/50	1,41						
	C 50/60				1,58			

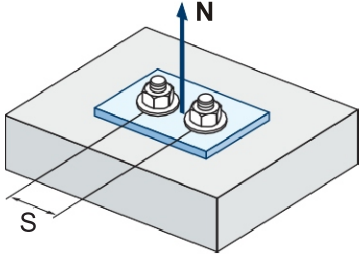


Influence of concrete strength in concret cone and splitting failure Ψ_b								
		M6	M8	M10	M12	M14	M16	M20
Ψ_b	C 20/25	1,00						
	C 30/37				1,22			
	C 40/50	1,41						
	C 50/60				1,58			



$$\Psi_b \sqrt{\frac{f_{ck,cube}}{25}} \geq 1$$

Anchor Fasteners - Indo Construction Fastening Systems



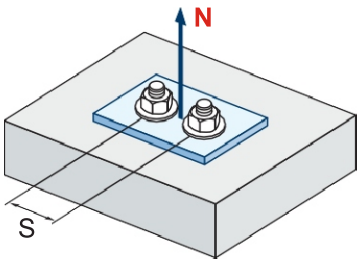
$$\Psi_{s,N} = 0,5 + \frac{s}{2 \cdot s_{cr,N}} \leq 1$$

Influence of spacing (concrete cone) $\Psi_{s,N}$									
s [mm]	IWA Standard depth								
	M6	M8	M10	M12	M14	M16	M20		
35	0,65	Invalid Value							
40	0,67							0,64	
50	0,71							0,67	0,65
55	0,73							0,69	0,67
60	0,75							0,71	0,68
65	0,77	0,73	0,70						
70	0,79	0,74	0,71					0,68	
80	0,83	0,78	0,74					0,71	
85	0,85	0,80	0,76					0,72	0,69
90	0,88	0,81	0,77					0,73	0,70
100	0,92	0,85	0,80	0,76	0,72	0,70			
105	0,94	0,86	0,82	0,77	0,73	0,71			
110	0,96	0,88	0,83	0,78	0,74	0,72			
120	1,00	0,92	0,86	0,81	0,77	0,74			
125		0,93	0,88	0,82	0,78	0,75			
126		0,94	0,88	0,82	0,78	0,75			
128		0,94	0,89	0,83	0,78	0,75			
130		0,95	0,89	0,83	0,79	0,76			
135		0,97	0,91	0,85	0,80	0,77		0,72	
144		1,00	0,94	0,87	0,82	0,79		0,73	
150			0,95	0,88	0,83	0,80	0,74		
165			1,00	0,92	0,87	0,83	0,77		
170			0,94	0,88	0,84	0,78			
180			0,96	0,90	0,86	0,79			
195			1,00	0,93	0,89	0,82			
200					0,94	0,90	0,82		
210					0,97	0,92	0,84		
220					0,99	0,94	0,86		
225					1,00	0,95	0,86		
252						1,00	0,91		
255	Value without reduction = 1						0,91		
260							0,92		
300							0,99		
309							1,00		

s [mm]	IWA Reduced depth						
	M6	M8	M10	M12	M14	M16	M20
40		0,69					
50		0,74	0,70				
55		0,76	0,72				
60		0,79	0,74				
65		0,81	0,76				
70		0,83	0,78	0,73			
80		0,88	0,82	0,77			
85		0,90	0,84	0,78			
90		0,93	0,86	0,80		0,73	
100			0,90	0,83		0,76	
105			0,92	0,85		0,77	
110			0,94	0,87		0,78	
120			0,98	0,90		0,81	
125			1,00	0,92		0,82	
126			1,00	0,92		0,82	
128				0,93		0,83	
130				0,93		0,83	
135						0,85	0,80
144				0,98		0,87	0,82
150						0,88	0,83
165						0,92	0,87
170						0,94	0,88
180						0,96	0,90
195						1,00	0,93
200							0,94
210							0,97
220							0,99
225							1,00

Anchor Fasteners - Indo Construction Fastening Systems

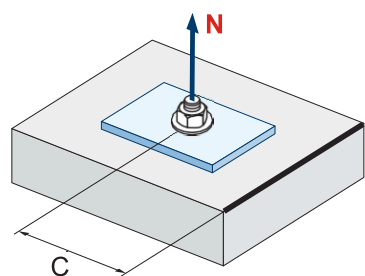
Influence of spacing (concrete splitting) $\Psi_{s,sp}$									
s [mm]	IWA Standard depth								
	M6	M8	M10	M12	M14	M16	M20		
35	0,61	0,60	Invalid Value						
40	0,63	0,63							
50	0,66	0,64						0,63	
55	0,67	0,66						0,64	
60	0,69	0,67						0,65	
65	0,70	0,68	0,66	0,63	Invalid Value				
70	0,72	0,71	0,68	0,65				0,63	
80	0,75	0,72	0,69	0,66				0,64	
85	0,77	0,73	0,70	0,67				0,65	0,66
90	0,78	0,76	0,73	0,69				0,67	0,68
100	0,81	0,79	0,75	0,71	0,68	0,70	Invalid Value		
110	0,84	0,83	0,78	0,74	0,71	0,72			
125	0,89	0,83	0,79	0,75	0,71	0,73			
128	0,90	0,85	0,81	0,76	0,73	0,74			
135	0,92	0,86	0,82	0,77	0,73	0,75		0,69	
140	0,94	0,89	0,84	0,79	0,75	0,77	0,69		
150	0,97	0,92	0,86	0,81	0,77	0,79	0,71		
160	1,00	0,93	0,88	0,82	0,78	0,79	0,72		
165	Value without reduction = 1	0,94	0,88	0,82	0,78	0,80	0,73		
168		0,97	0,91	0,85	0,80	0,82	0,73		
180		1,00	0,94	0,87	0,82	0,84	0,75		
192			0,95	0,88	0,83	0,86	0,77		
200			0,98	0,90	0,85	0,88	0,78		
210			1,00	0,92	0,87	0,89	0,79		
220				1,00	0,93	0,96	0,81		
260						0,97	1,00	0,86	
280						0,98		0,89	
288						1,00		0,90	
300	Value without reduction = 1						0,92		
336							0,97		
350							0,99		
360							1,00		



$$\Psi_{s,sp} = 0,5 + \frac{s}{2 \cdot s_{cr,sp}} \leq 1$$

s [mm]	IWA Reduced depth							
	M6	M8	M10	M12	M14	M16	M20	
40	Value without reduction = 1	0,64		Invalid Value				
50		0,68	0,65					
55		0,70	0,66					
60		0,71	0,68					
65		0,73	0,69					
70		0,75	0,71	0,68				
80		0,79	0,74	0,70				
85		0,80	0,75	0,71				
90		0,82	0,77	0,73		0,67		
100		0,86	0,80	0,75		0,69		
110		0,89	0,83	0,78		0,71		
125		0,95	0,87	0,81		0,74		
128		0,96	0,88	0,82		0,75		
135		0,98	0,90	0,84		0,76	0,73	
140		1,00	0,92	0,85		0,77	0,73	
150			0,95	0,88		0,79	0,75	
160			0,98	0,90		0,81	0,77	
165			0,99	0,91		0,82	0,78	
168			1,00	0,92		0,82	0,78	
180				0,95		0,85	0,80	
192					0,98		0,87	0,82
200					1,00		0,88	0,83
210						0,90	0,85	
220						0,92	0,87	
260						1,00	0,93	
280							0,97	
288							0,98	
300							1,00	

Anchor Fasteners - Indo Construction Fastening Systems



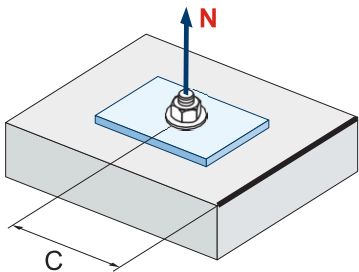
$$\psi_{c,sp} = 0,35 + \frac{0,5 \cdot c}{c_{r,sp}} + \frac{0,15 \cdot c^2}{c_{r,sp}^2} \leq 1$$

Influence of concrete edge distance (splitting) c,sp							
c [mm]	IWA Standard depth						
	M6	M8	M10	M12	M14	M16	M20
35							
40	0,64	0,58					
50	0,72	0,65	0,61				
60	0,81	0,72	0,67				
65	0,86	0,76	0,70				
70	0,90	0,79	0,73	0,66			
75	0,95	0,83	0,76	0,69			
80	1,00	0,87	0,79	0,71	0,66		
83		0,89	0,81	0,73	0,67		
84		0,90	0,82	0,74	0,68		
85		0,91	0,83	0,74	0,68		
90		0,95	0,86	0,77	0,70	0,73	
96		1,00	0,90	0,80	0,73	0,76	
100			0,93	0,82	0,75	0,78	
105			0,96	0,85	0,77	0,81	
110			1,00	0,88	0,80	0,84	
125				0,97	0,87	0,92	
128				0,99	0,89	0,93	
130				1,00	0,90	0,94	
135					0,92	0,97	0,81
140					0,95	1,00	0,83
144					0,97		0,85
150					1,00		0,87
168							0,95
175							0,98
180							1,00

c [mm]	IWA Standard depth						
	M6	M8	M10	M12	M14	M16	M20
40		0,68					
50		0,78	0,70				
60		0,89	0,78				
65		0,94	0,83				
70		1,00	0,87	0,77			
75			0,92	0,81			
80			0,96	0,85			
83			0,99	0,87			
84			1,00	0,88			
85				0,88			
90				0,92		0,77	
96				0,97		0,80	
100				1,00		0,82	
105						0,85	
110						0,88	
125						0,97	
128						0,99	
130						1,00	
135							0,92
144							0,97
150							1,00

Anchor Fasteners - Indo Construction Fastening Systems

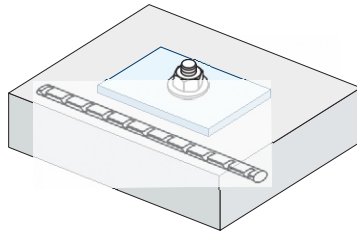
Influence of concrete edge distance (concrete cone) $\psi_{c,N}$							
c [mm]	IWA Standard depth						
	M6	M8	M10	M12	M14	M16	M20
35	0,69						
40	0,75	0,69					
50	0,87	0,77	0,71				
53	0,91	0,80	0,73				
60	1,00	0,87	0,79				
63		0,90	0,82				
65		0,92	0,83				
70		0,98	0,88	0,78			
72		1,00	0,90	0,80			
75			0,92	0,82			
80			0,97	0,86	0,78		
83			1,00	0,88	0,80		
85				0,90	0,81		
90				0,94	0,84	0,78	
98				1,00	0,90	0,83	
100					0,91	0,84	
105					0,94	0,87	
110					0,98	0,90	
113					1,00	0,92	
125						0,99	
126						1,00	
128							
135							0,90
150							0,97
155							1,00



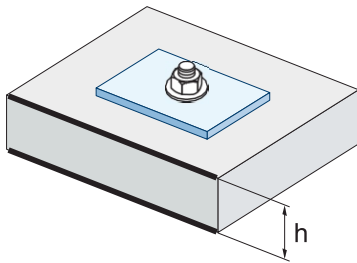
$$\psi_{c,N} = 0,35 + \frac{0,5 \cdot c}{C_{cr,N}} + \frac{0,15 \cdot c^2}{C_{cr,N}^2} \leq 1$$

c [mm]	IWA Standard depth						
	M6	M8	M10	M12	M14	M16	M20
40		0,81					
50		0,96	0,84				
53		1,00	0,88				
60			0,96				
63			1,00				
65							
70				0,95			
72				0,97			
75				1,00			
80							
83							
85							
90						0,94	
98						1,00	
100							
105							
110							
113							
125							
126							
128							
135							1,00

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$$\Psi_{re,N} = 0,5 + \frac{h_{ef}}{200} \leq 1$$



Influence of reinforcements $\Psi_{re,N}$							
$\Psi_{re,N}$	IWA Standard depth						
	M6	M8	M10	M12	M14	M16	M20
	0,70	0,74	0,77	0,82	0,87	0,92	1,00
	Reduced depth						
$\Psi_{re,N}$	M6	M8	M10	M12	M14	M16	M20
	-	0,67	0,71	0,75	-	0,83	0,88

*This factor only applies for a high density of reinforcements. If in the area of the anchor there are reinforcements with a distancing of = 150 mm (any diameter) or with a diameter = 10 mm and a distancing of = 100 mm, a $\Psi_{re,N} = 1$ factor may be applied

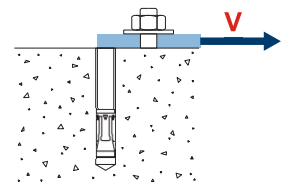
Influence of base material thickness											
$\Psi_{h,sp}$	IWA										
	h/h _{ef}	2,00	2,20	2,40	2,60	2,80	3,00	3,20	3,40	3,60	=3,68
	$\Psi_{h,sp}$	1,00	1,07	1,13	1,19	1,25	1,31	1,37	1,42	1,48	1,50

$$\Psi_{h,sp} = \left(\frac{h}{2 \cdot h_{ef}} \right)^{2/3} \leq 1,5$$

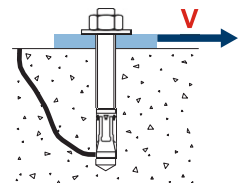
SHEAR LOADS

- Steel design resistance without lever arm : $V_{Rd,s}$
- Pry-out design resistance: $V_{Rd,cp} = k \cdot N_{Rd,c}^o$
- Concrete edge design resistance: $V_{Rd,c} = V_{Rd,c}^o \cdot \Psi_b \cdot \Psi_{se,V} \cdot \Psi_{c,V} \cdot \Psi_{re,V} \cdot \Psi_{\alpha,V} \cdot \Psi_{h,V}$

Steel design resistance									
$V_{Rd,s}$									
Size			M6	M8	M10	M12	M14	M16	M20
$V_{Rd,s}$	Standard depth	[kN]	4,1	7,4	11,8	16,5	22,5	30,7	45,0
$V_{Rd,s}$	Reduced depth	[kN]		7,4	11,8	16,5		30,7	45,0

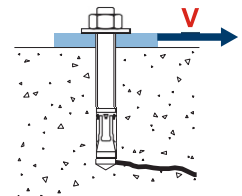


Pry-out design resistance*									
$V_{Rd,cp} = k \cdot N^o_{Rd,c}$									
Size			M6	M8	M10	M12	M14	M16	M20
	k (Standard depth)	[kN]	1	1	1	2	2	2	2
	k (Reduced depth)	[kN]	-	1	1	2	-	2	2



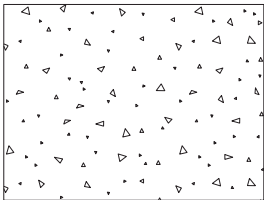
* $N_{Rd,c}^o$ Concrete cone design resistance for tension loads

Concrete edge resistance									
$V_{Rd,c} = V_{Rd,c}^o \cdot \psi_b \cdot \psi_{se,V} \cdot \psi_{c,V} \cdot \psi_{re,V} \cdot \psi_{\alpha,V} \cdot \psi_{h,V}$									
Size			M6	M8	M10	M12	M14	M16	M20
$V_{Rd,c}^o$	Standard depth	[kN]	4,6	6,2	7,7	10,2	12,9	15,6	21,8
$V_{Rd,c}^o$	Reduced depth	[kN]	-	3,6	4,9	6,5	-	10,1	12,8



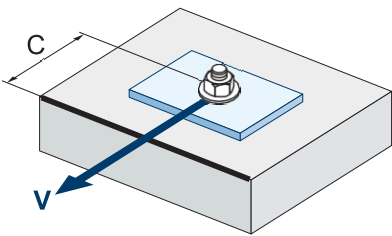
Coefficients of influence

Influence of concrete strength in concrete edge failure Ψ_b								
		M6	M8	M10	M12	M14	M16	M20
Ψ_b	C 20/25	1,00						
	C 30/37				1,22			
	C 40/50	1,41						
	C 50/60				1,55			

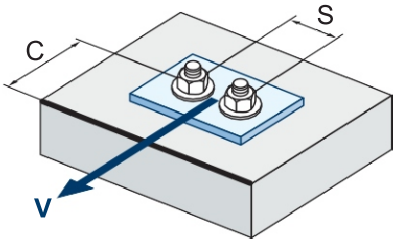


$\Psi \sqrt{\frac{f_{ck,cube}}{25}} \geq 1$

Influence of edge distance and spacing $\Psi_{se,V}$ FOR ONE ANCHOR ONLY																	
c/h _{ef}	0,50	0,75	1,00	1,25	1,50	1,75	2,00	2,25	2,50	2,75	3,00	3,25	3,50	3,75	4,00	4,50	5,00
Isolated	0,35	0,65	1,00	1,40	1,84	2,32	2,83	3,38	3,95	4,56	5,20	5,86	6,55	7,26	8,00	9,55	11,18
FOR TWO ANCHORS																	
c/h _{ef}	0,50	0,75	1,00	1,25	1,50	1,75	2,00	2,25	2,50	2,75	3,00	3,25	3,50	3,75	4,00	4,50	5,00
1,0	0,24	0,43	0,67	0,93	1,22	1,54	1,89	2,25	2,64	3,04	3,46	3,91	4,37	4,84	5,33	6,36	7,45
1,5	0,27	0,49	0,75	1,05	1,38	1,74	2,12	2,53	2,96	3,42	3,90	4,39	4,91	5,45	6,00	7,16	8,39
2,0	0,29	0,54	0,83	1,16	1,53	1,93	2,36	2,81	3,29	3,80	4,33	4,88	5,46	6,05	6,67	7,95	9,32
2,5	0,32	0,60	0,92	1,28	1,68	2,12	2,59	3,09	3,62	4,18	4,76	5,37	6,00	6,66	7,33	8,75	10,25
=3,0	0,35	0,65	1,00	1,40	1,84	2,32	2,83	3,38	3,95	4,56	5,20	5,86	6,55	7,26	8,00	9,55	11,18

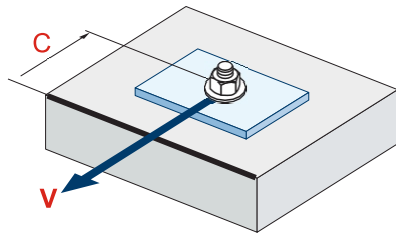


$\Psi_{se,V} = \left(\frac{C}{h_{ef}}\right)^{1,5}$



$\Psi_{se,V} = \left(\frac{C}{h_{ef}}\right)^{1,5} \cdot \left(1 + \frac{S}{3 \cdot C}\right) \cdot 0,5 = \left(\frac{C}{h_{ef}}\right)^{1,5}$

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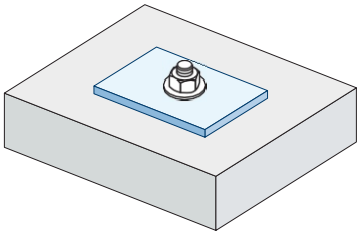


$$\Psi_{c,V} = \left(\frac{d}{c} \right)^{0,20}$$

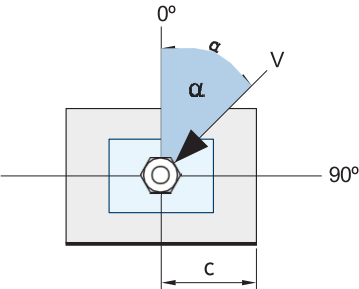
Influence of concrete edge distance $\Psi_{c,V}$							
c [mm]	IWA						
	M6	M10	M10	M12	M14	M16	M20
35	0,70						
40	0,68	0,70					
45	0,67	0,71					
50	0,65	0,69					
55	0,64	0,68	0,71				
60	0,63	0,67	0,70				
70	0,61	0,65	0,68	0,70			
80	0,60	0,63	0,66	0,68	0,71		
85	0,59	0,62	0,65	0,68	0,70		
90	0,58	0,62	0,64	0,67	0,69	0,71	
100	0,57	0,60	0,63	0,65	0,67	0,69	
105	0,56	0,60	0,62	0,65	0,67	0,69	
110	0,56	0,56	0,62	0,64	0,66	0,68	
120	0,55	0,58	0,61	0,63	0,65	0,67	
125	0,54	0,58	0,60	0,63	0,65	0,66	
128	0,54	0,57	0,60	0,62	0,64	0,66	
130	0,54	0,57	0,60	0,62	0,64	0,66	
135	0,54	0,57	0,59	0,62	0,64	0,65	
140	0,53	0,56	0,59	0,61	0,63	0,65	
150	0,53	0,56	0,58	0,60	0,62	0,64	
160	0,52	0,55	0,57	0,60	0,61	0,63	
170	0,51	0,54	0,57	0,59	0,61	0,62	0,65
175	0,51	0,54	0,56	0,59	0,60	0,62	0,65
180	0,51	0,54	0,56	0,58	0,60	0,62	0,64
190	0,50	0,53	0,55	0,58	0,59	0,61	0,64
200	0,50	0,53	0,55	0,57	0,59	0,60	0,63
210	0,49	0,52	0,54	0,56	0,58	0,60	0,62
220	0,49	0,52	0,54	0,56	0,58	0,59	0,62
230	0,48	0,51	0,53	0,55	0,57	0,59	0,61
240	0,48	0,51	0,53	0,55	0,57	0,58	0,61
250	0,47	0,50	0,53	0,54	0,56	0,58	0,60
260	0,47	0,50	0,52	0,54	0,56	0,57	0,60
270	0,47	0,49	0,52	0,54	0,55	0,57	0,59
280	0,46	0,49	0,51	0,53	0,55	0,56	0,59
290	0,46	0,49	0,51	0,53	0,55	0,56	0,59
300	0,46	0,48	0,51	0,53	0,54	0,56	0,58

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Influence of reinforcements $\psi_{re,V}$			
	Without perimetral reinforcements	Perimetral reinforcements = Ø12mm	Perimetral reinforcements with brackets = 100mm
Non-cracked concrete	1	1	1

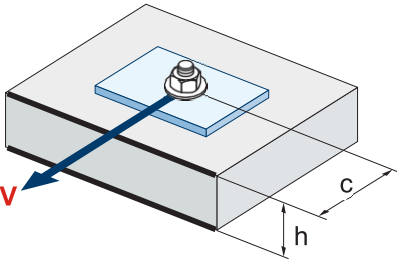


Influence of load application angle $\psi_{\alpha,V}$										
Angle, $\alpha(^{\circ})$	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°
$\psi_{\alpha,V}$	1,00	1,01	1,05	1,13	1,24	1,40	1,64	1,97	2,32	2,50



$$\psi_{\alpha,V} = \sqrt{\frac{1}{(\cos \alpha_v)^2 + \left(\frac{\sin \alpha}{2,5_v}\right)^2}} \geq 1$$

Influence of base material thickness $\psi_{h,V}$										
IWA										
h/c	0,15	0,30	0,45	0,60	0,75	0,90	1,05	1,20	1,35	=1,5
$\psi_{h,V}$	0,32	0,45	0,55	0,63	0,71	0,77	0,84	0,89	0,95	1,00



$$\psi_{h,V} = \left(\frac{h}{c}\right)^{0,5} \geq 1,0$$

CHANNEL PARTNER

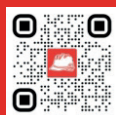
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