FIX Z

Stainless Steel (A4)

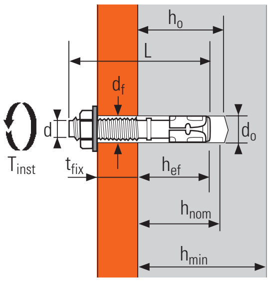
Torque controlled expansion anchor, made of stainless steel for use in cracked and non-cracked concrete

Performance	Material	Installation

Technical Data

ETA Option 1

n° 04/0010



Pre-assembled anchor

FIX Z A4	Letter marking	Minimum anchor depth: Min anchor depth (mm)	Minimum anchor depth: Max thick of fixture (mm)	Minimum anchor depth: Min drill depth (mm)	Minimum anchor depth: Min thick of base material (mm)	Maximum anchor depth: Max anchor depth (mm)	Maximum anchor depth: Max thick of fixture (mm)	Maximum anchor depth: Min drill depth (mm)	Maximum anchor depth: Min thick of base material (mm)	Ø Thread (mm)	Ø Drill bit (mm)	Total rod length (mm)	Max tighten torque (Nm)	Ramset power tool code	Drill bit type-size
		$h_{ef,min}$	t_{fix}	h_o	h_{min}	$h_{ef,max}$	t_{fix}	h_o	h_{min}	d	h_o	L	T_{inst}		
M8x55/5	-	35	5	52	100	48	-	65	100	8	8	55	20	DD527	R3 PLUS-8
M8x70/20	C		20				7					70			
M8x90/40	E		40				27					90			
M8x130/80	H		80				67					130			
M10x65/5	-	42	5	62	100	58	-	78	100	10	10	65	35	DD527	R3 PLUS-10
M10x75/15	C		15				-					75			
M10x95/35	E		35				20					95			
M10x120/60	G		60				45					120			
M12x80/5	-	50	5	75	100	70	-	95	140	12	12	80	50	DD527	R3 PLUS-12
M12x100/25	E		25				6					100			
M12x115/40	G		40				21					115			
M12x140/65	I		65				46					140			
M16x125/30	G	64	30	95	128	86	8	117	172	16	16	125	100	DD543	R3 PLUS-16
M16x150/55	I		55				33					150			
M16x170/75	K		75				53					170			

MATERIAL

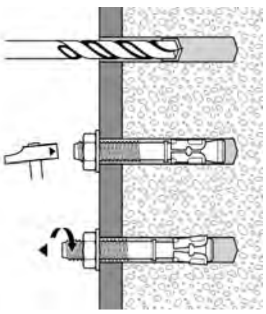
Bolt:
Stainless Steel A4

Sleeve:
Stainless Steel A4

Washer:
Stainless Steel A4

Hexagonal nut:
Stainless Steel A4-80

INSTALLATION



Anchor Mechanical Properties

THREADED PART	M8	M10	M12	M16
f_{uk} (N/mm2) Min. tensile strength	620	620	620	580
f_{yk} (N/mm2) Yield strength	420	420	420	330
A_s (mm2) Stressed cross-section	36.6	58.0	84.3	157.0
W_{el} (mm3) Elastic section modulus	31.2	62.3	109.2	277.5
$M^0_{Rk,s}$ (Nm) Characteristic bending moment	23	46	81	193
M (Nm) Recommended bending moment	9.4	18.8	33.1	78.8

MECHANICAL ANCHORS

Ultimate Loads ($N_{Ru,m}$, $V_{Ru,m}$) / Characteristic Loads (N_{Rk}, V_{Rk}) in kN - Non cracked concrete

TENSILE @ Concrete strength 30 N/mm2

Anchor size	M8	M10	M12	M16
Minimum anchorage depth				
h_{ef} (mm)	35	42	50	64
$N_{Ru,m}$ (kN)	13.8	14.6	22.1	36.4
N_{Rk} (kN)	8.8	10.9	15.0	26.5
Maximum anchorage depth				
h_{ef} (mm)	48	58	70	86
$N_{Ru,m}$ (kN)	24.2	25.3	28.9	59.0
N_{Rk} (kN)	18.9	21.1	27.6	48.5

SHEAR @ Concrete strength 30 N/mm2

Anchor size	M8	M10	M12	M16
$V_{Ru,m}$ (kN)	20.0	32.1	47.5	76.0
V_{Rk} (kN)	19.0	27.5	39.7	56.4

Design Loads (N_{Rd}, V_{Rd}) for one anchor without edge or spacing influence in kN - Non cracked concrete

$$N_{Rd} = \frac{N_{Rk}}{\gamma_{Mc,N}} \qquad V_{Rd} = \frac{V_{Rk}}{\gamma_{Ms,V}}$$

TENSILE @ Concrete strength 30 N/mm2

Anchor size	M8	M10	M12	M16
Minimum anchorage depth				
h_{ef} (mm)	35	42	50	64
N_{Rd} (kN)	5.9	7.3	10.0	17.7
Maximum anchorage depth				
h_{ef} (mm)	48	58	70	86
N_{Rd} (kN)	12.6	14.1	18.4	32.3

$\gamma_{Mc,N} = 1.5$

SHEAR @ Concrete strength 30 N/mm2

Anchor size	M8	M10	M12	M16
V_{Rd} (kN)	12.7	18.3	26.5	31.4

$\gamma_{Ms,V} = 1.5$ for M8 to M12

$\gamma_{Ms,V} = 1.8$ for M16

Recommended Loads (N_{rec}, V_{rec}) for one anchor without edge or spacing influence in kN - Non cracked concrete

$$N_{rec} = \frac{N_{Rk}}{\gamma_{Mc,N} \cdot \gamma_F} \qquad V_{rec} = \frac{V_{Rk}}{\gamma_{Ms,V} \cdot \gamma_F}$$

TENSILE @ Concrete strength 30 N/mm2

Anchor size	M8	M10	M12	M16
Minimum anchorage depth				
h_{ef} (mm)	35	42	50	64
N_{rec} (kN)	4.2	5.2	7.1	12.6
Maximum anchorage depth				
h_{ef} (mm)	48	58	70	86
N_{rec} (kN)	9.0	10.1	13.1	23.1

$\gamma_F = 1.4$

$\gamma_{Mc,N} = 1.5$

SHEAR @ Concrete strength 30 N/mm2

Anchor size	M8	M10	M12	M16
V_{rec} (kN)	9.1	13.1	18.9	22.4

$\gamma_F = 1.4$

$\gamma_{Ms,V} = 1.5$ for M8 to M12

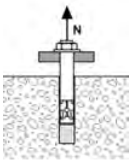
$\gamma_{Ms,V} = 1.8$ for M16

FIX Z

Stainless Steel (A4)

CC-Method - Non cracked concrete

TENSILE in kN

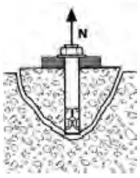


Pull-out resistance
Concrete strength 30 N/mm²

$N_{Rd,p} = N^0_{Rd,p} \cdot f_B \cdot f_T$

$N^0_{Rd,p}$	Design pull-out resistance			
Anchor size	**M8**	**M10**	**M12**	**M16**
Minimum anchorage depth				
h_{ef} (mm)	35	42	50	64
$N^0_{Rd,p}$ (kN)	6.6	6.6	8.8	14.6
Maximum anchorage depth				
h_{ef} (mm)	48	58	70	86
$N^0_{Rd,p}$ (kN)	8.8	11.8	11.8	22.0

$\gamma_{Mc,N} = 1.8$

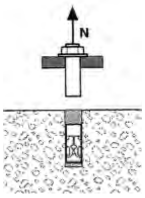


Concrete cone resistance
Concrete strength 30 N/mm²

$N_{Rd,c} = N^0_{Rd,c} \cdot f_B \cdot f_T \cdot \Psi_s \cdot \Psi_{c,N}$

$N^0_{Rd,p}$	Design cone resistance			
Anchor size	**M8**	**M10**	**M12**	**M16**
Minimum anchorage depth				
h_{ef} (mm)	35	42	50	64
$N^0_{Rd,c}$ (kN)	7.7	10.0	13.1	18.9
Maximum anchorage depth				
h_{ef} (mm)	48	58	70	86
$N^0_{Rd,c}$ (kN)	12.3	16.3	21.7	29.5

$\gamma_{Mc,N} = 1.5$

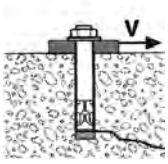


Steel resistance

$N_{Rd,s}$	Steel design tensile resistance			
Anchor size	**M8**	**M10**	**M12**	**M16**
$N_{Rd,s}$ (kN)	8.5	14.4	20.0	29.7

$\gamma_{Ms,N} = 1.8$ for M8 to M12
$\gamma_{Ms,N} = 2.1$ for M16

SHEAR in kN

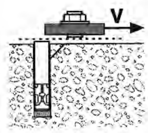


Concrete edge resistance
Concrete strength 30 N/mm²

$V_{Rd,c} = V^0_{Rd,c} \cdot f_B \cdot f_{\beta,V} \cdot \Psi_{s\text{-}c,V}$

$V^0_{Rd,c}$	Design concrete edge resistance at a minimum edge distance (c_{min})			
Anchor size	**M8**	**M10**	**M12**	**M16**
Minimum anchorage depth				
h_{ef} (mm)	35	42	50	64
c_{min}	60	65	100	100
s_{min}	60	75	170	150
$V^0_{Rd,c}$ (kN)	3.6	4.5	9.6	11.1
Maximum anchorage depth				
h_{ef} (mm)	48	58	70	86
c_{min}	60	65	90	105
s_{min}	50	55	75	90
$V^0_{Rd,c}$ (kN)	4.1	4.8	9.0	13.0

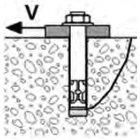
$\gamma_{Mc,V} = 1.5$



Steel resistance

$V_{Rd,s}$	Steel resistance shear resistance			
Anchor size	**M8**	**M10**	**M12**	**M16**
$V_{Rd,s}$ (kN)	7.5	12.0	17.4	25.3

$\gamma_{Ms,V} = 1.5$ for M8 to M12
$\gamma_{Ms,V} = 1.8$ for M16



Concrete pry-out failure

$V_{Rd,cp} = V^0_{Rd,cp} \cdot f_B \cdot \Psi_s \cdot \Psi_{c,N}$

$V^0_{Rd,cp}$	Design pry-out resistance			
Anchor size	**M8**	**M10**	**M12**	**M16**
Minimum anchorage depth				
h_{ef} (mm)	35	42	50	64
$V^0_{Rd,cp}$ (kN)	7.7	10.0	13.1	37.8
Maximum anchorage depth				
h_{ef} (mm)	48	58	70	86
$V^0_{Rd,cp}$ (kN)	12.3	16.3	43.3	59.0

$\gamma_{Mc,V} = 1.5$

$N_{Rd} = \min(N_{Rd,p}\,;\,N_{Rd,c}\,;\,N_{Rd,s})$
$\beta N = N_{Sd} / N_{Rd} \leq 1$

$V_{Rd} = \min(V_{Rd,c}\,;\,V_{Rd,s}\,;\,V_{Rd,cp})$
$\beta V = V_{Sd} / V_{Rd} \leq 1$

$\beta N + \beta V \leq 1.2$

f_B INFLUENCE OF CONCRETE

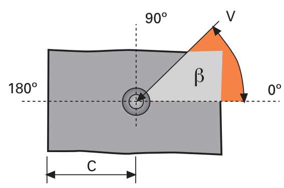
Concrete Grade	f_B	Concrete Grade	f_B
C16/20	0.81	C35/45	1.21
C20/25	0.90	C40/50	1.28
C25/30	1.00	C45/55	1.34
C30/37	1.10	C50/60	1.40

f_T INFLUENCE OF EMBEDMENT DEPTH

$f_T = \left(\frac{h_{act}}{h_{ef}}\right)^{1.5}$ where: $h_{ef,min} \leq h_{act} \leq 2h_{ef,max}$

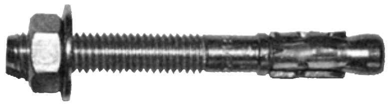
$f_{\beta,V}$ INFLUENCE OF SHEAR LOADING DIRECTION

Angle β [°]	$f_{\beta,V}$
0~50	1.0
60	1.1
70	1.2
80	1.5
90~180	2.0



FIX Z

Stainless Steel (A4)



Ultimate Loads ($N_{Ru,m}$, $V_{Ru,m}$) / Characteristic Loads (N_{Rk}, V_{Rk}) in kN - Cracked concrete

TENSILE @ Concrete strength 30 N/mm²

Anchor size	M8	M10	M12	M16
Minimum anchorage depth				
h_{ef} (mm)	35	42	50	64
$N_{Ru,m}$ (kN)	13.8	14.4	20.5	32.6
N_{Rk} (kN)	8.3	10.0	15.6	27.3
Maximum anchorage depth				
h_{ef} (mm)	48	58	70	86
$N_{Ru,m}$ (kN)	17.5	22.3	32.1	59.6
N_{Rk} (kN)	16.2	20.7	29.7	54.5

SHEAR @ Concrete strength 30 N/mm²

Anchor size	M8	M10	M12	M16
$V_{Ru,m}$ (kN)	20.0	32.1	47.5	76.0
V_{Rk} (kN)	19.0	27.5	39.7	56.4

Design Loads (N_{Rd}, V_{Rd}) for one anchor without edge or spacing influence in kN - Cracked concrete

$$N_{Rd} = \frac{N_{Rk}}{\gamma_{Mc,N}}$$

$$V_{Rd} = \frac{V_{Rk}}{\gamma_{Ms,V}}$$

TENSILE @ Concrete strength 30 N/mm²

Anchor size	M8	M10	M12	M16
Minimum anchorage depth				
h_{ef} (mm)	35	42	50	64
N_{Rd} (kN)	5.5	6.7	10.4	18.2
Maximum anchorage depth				
h_{ef} (mm)	48	58	70	86
N_{Rd} (kN)	10.8	13.8	19.8	36.3

$\gamma_{Mc,N} = 1.5$

SHEAR @ Concrete strength 30 N/mm²

Anchor size	M8	M10	M12	M16
V_{Rd} (kN)	12.7	18.3	26.5	31.4

$\gamma_{Ms,V} = 1.5$ for M8 to M12

$\gamma_{Ms,V} = 1.8$ for M16

Recommended Loads (N_{rec}, V_{rec}) for one anchor without edge or spacing influence in kN - Cracked concrete

$$N_{rec} = \frac{N_{Rk}}{\gamma_{Mc,N} \cdot \gamma_F}$$

$$V_{rec} = \frac{V_{Rk}}{\gamma_{Ms,V} \cdot \gamma_F}$$

TENSILE @ Concrete strength 30 N/mm²

Anchor size	M8	M10	M12	M16
Minimum anchorage depth				
h_{ef} (mm)	35	42	50	64
N_{rec} (kN)	3.9	4.8	7.4	13.0
Maximum anchorage depth				
h_{ef} (mm)	48	58	70	86
N_{rec} (kN)	7.7	9.8	14.1	25.9

$\gamma_F = 1.4$

$\gamma_{Mc,N} = 1.5$

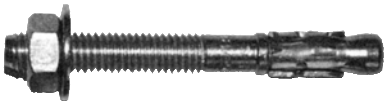
SHEAR @ Concrete strength 30 N/mm²

Anchor size	M8	M10	M12	M16
V_{rec} (kN)	9.1	13.1	18.9	22.4

$\gamma_F = 1.4$

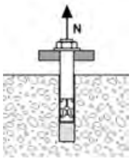
$\gamma_{Ms,V} = 1.5$ for M8 to M12

$\gamma_{Ms,V} = 1.8$ for M16



CC-Method - Cracked concrete

TENSILE in kN

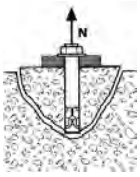


Pull-out resistance
Concrete strength 30 N/mm²

$N_{Rd,p} = N^0_{Rd,p} \cdot f_B \cdot f_T$

$N^0_{Rd,p}$ Design pull-out resistance				
Anchor size	**M8**	**M10**	**M12**	**M16**
Minimum anchorage depth				
h_{ef} (mm)	35	42	50	64
$N^0_{Rd,p}$ (kN)	2.2	4.4	5.5	8.8
Maximum anchorage depth				
h_{ef} (mm)	48	58	70	86
$N^0_{Rd,p}$ (kN)	3.0	5.5	6.6	11.8

$\gamma_{Mc,N} = 1.8$

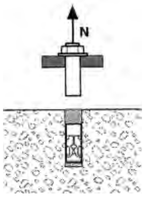


Concrete cone resistance
Concrete strength 30 N/mm²

$N_{Rd,c} = N^0_{Rd,c} \cdot f_B \cdot f_T \cdot \Psi_s \cdot \Psi_{c,N}$

$N^0_{Rd,p}$ Design cone resistance				
Anchor size	**M8**	**M10**	**M12**	**M16**
Minimum anchorage depth				
h_{ef} (mm)	35	42	50	64
$N^0_{Rd,c}$ (kN)	5.5	7.2	9.4	13.5
Maximum anchorage depth				
h_{ef} (mm)	48	58	70	86
$N^0_{Rd,c}$ (kN)	8.8	11.7	15.5	21.0

$\gamma_{Mc,N} = 1.5$

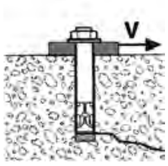


Steel resistance

$N_{Rd,s}$ Steel design tensile resistance				
Anchor size	**M8**	**M10**	**M12**	**M16**
$N_{Rd,s}$ (kN)	8.5	14.4	20.0	29.7

$\gamma_{Ms,N} = 1.8$ for M8 to M12
$\gamma_{Ms,N} = 2.1$ for M16

SHEAR in kN

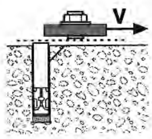


Concrete edge resistance
Concrete strength 30 N/mm²

$V_{Rd,c} = V^0_{Rd,c} \cdot f_B \cdot f_{\beta,V} \cdot \Psi_{s\text{-}c,V}$

$V^0_{Rd,c}$ Design concrete edge resistance at a minimum edge distance (c_{min})				
Anchor size	**M8**	**M10**	**M12**	**M16**
Minimum anchorage depth				
h_{ef} (mm)	35	42	50	64
c_{min}	60	65	100	100
s_{min}	60	75	170	150
$V^0_{Rd,c}$ (kN)	3.6	4.5	9.6	11.1
Maximum anchorage depth				
h_{ef} (mm)	48	58	70	86
c_{min}	60	65	90	105
s_{min}	50	55	75	90
$V^0_{Rd,c}$ (kN)	4.1	4.8	9.0	13.0

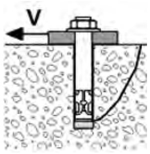
$\gamma_{Mc,V} = 1.5$



Steel resistance

$V_{Rd,s}$ Steel resistance shear resistance				
Anchor size	**M8**	**M10**	**M12**	**M16**
$V_{Rd,s}$ (kN)	7.5	12.0	17.4	25.3

$\gamma_{Ms,V} = 1.5$ for M8 to M12
$\gamma_{Ms,V} = 1.8$ for M16



Concrete pry-out failure

$V_{Rd,cp} = V^0_{Rd,cp} \cdot f_B \cdot \Psi_s \cdot \Psi_{c,N}$

$V^0_{Rd,cp}$ Design pry-out resistance				
Anchor size	**M8**	**M10**	**M12**	**M16**
Minimum anchorage depth				
h_{ef} (mm)	35	42	50	64
$V^0_{Rd,cp}$ (kN)	5.5	7.2	9.4	27.1
Maximum anchorage depth				
h_{ef} (mm)	48	58	70	86
$V^0_{Rd,cp}$ (kN)	8.8	11.7	30.9	42.1

$\gamma_{Mc,V} = 1.5$

$N_{Rd} = \min(N_{Rd,p}\ ;\ N_{Rd,c}\ ;\ N_{Rd,s})$
$\beta N = N_{Sd} / N_{Rd} \leq 1$

$V_{Rd} = \min(V_{Rd,c}\ ;\ V_{Rd,s}\ ;\ V_{Rd,cp})$
$\beta V = V_{Sd} / V_{Rd} \leq 1$

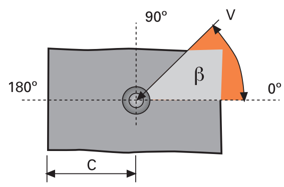
$\beta N + \beta V \leq 1.2$

f_B INFLUENCE OF CONCRETE

Concrete Grade	f_B	Concrete Grade	f_B
C16/20	0.81	C35/45	1.21
C20/25	0.90	C40/50	1.28
C25/30	1.00	C45/55	1.34
C30/37	1.10	C50/60	1.40

$f_{\beta,V}$ INFLUENCE OF SHEAR LOADING DIRECTION

Angle β [°]	$f_{\beta,V}$
0~50	1.0
60	1.1
70	1.2
80	1.5
90~180	2.0



f_T INFLUENCE OF EMBEDMENT DEPTH

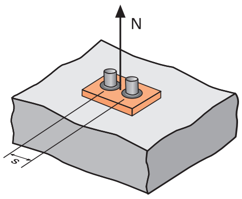
$f_T = \left(\frac{h_{act}}{h_{ef}}\right)^{1.5}$ where: $h_{ef,min} \leq h_{act} \leq 2h_{ef,max}$

FIX Z

Stainless Steel (A4)

CC-Method

Ψ_s INFLUENCE OF SPACING FOR CONCRETE CONE RESISTANCE IN TENSILE LOAD



$\Psi_s = 0.5 + \frac{s}{6h_{ef}}$

$s_{min} < s < s_{cr,N}$

$s_{cr,N} = 3h_{ef}$

Ψ_s must be used for each spacing influenced the anchors group

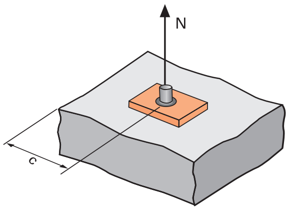
Reduction Factor Ψ_s – Minimum anchorage depth

Spacing, s	M8	M10	M12	M16
60	0.79			
75	0.86	0.80		
100	0.98	0.90	0.83	
105	1.00	0.92	0.85	0.77
110		0.94	0.87	0.79
125		1.00	0.92	0.83
150			1.00	0.89
170				0.94
192				1.00

Reduction Factor Ψ_s – Maximum anchorage depth

Spacing, s	M8	M10	M12	M16
50	0.67			
55	0.69	0.66		
75	0.76	0.72	0.68	
90	0.81	0.76	0.71	0.67
110	0.88	0.82	0.76	0.71
130	0.95	0.87	0.81	0.75
145	1.00	0.92	0.85	0.78
155		0.95	0.87	0.80
175		1.00	0.92	0.84
205			0.99	0.90
210			1.00	0.91
258				1.00

$\Psi_{c,N}$ INFLUENCE OF EDGE FOR CONCRETE CONE RESISTANCE IN TENSILE LOAD



$\Psi_{c,N} = 0.5 + 0.33 \cdot \frac{c}{h_{ef}}$

$c_{min} < c < c_{cr,N}$

$c_{cr,N} = 1.5 \cdot h_{ef}$

$\Psi_{c,N}$ must be used for each distance influenced the anchors group

Reduction Factor $\Psi_{c,N}$ – Minimum anchorage depth

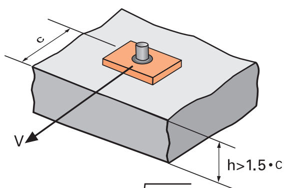
Edge, c	M8	M10	M12	M16
60	1.00			
65		1.00		
100			1.00	
100				1.00

$\Psi_{c,N,min}$ = 1.0, no reduction is permitted

Reduction Factor $\Psi_{c,N}$ – Maximum anchorage depth

Edge, c	M8	M10	M12	M16
60	0.91			
65	0.95	0.87		
72	1.00	0.91		
80		0.96	0.88	
90		1.00	0.92	0.85
105			1.00	0.90
130				1.00

$\Psi_{s\text{-}c,V}$ INFLUENCED OF SPACING AND EDGE DISTANCE FOR CONCRETE EDGE RESISTANCE IN SHEAR LOAD

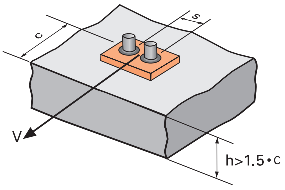


$\Psi_{s\text{-}c,V} = \frac{c}{c_{min}} \cdot \sqrt{\frac{c}{c_{min}}}$

FOR SINGLE ANCHOR FASTENING

Reduction Factor $\Psi_{s\text{-}c,V}$ – Non-cracked concrete

$\frac{c}{c_{min}}$	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2
$\Psi_{s\text{-}c,V}$	1.00	1.31	1.66	2.02	2.41	2.83	3.26	3.72	4.19	4.69	5.20	5.72

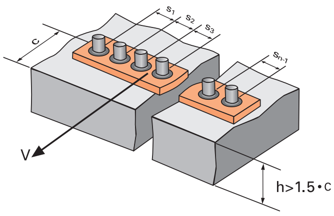


$\Psi_{s\text{-}c,V} = \frac{3c + s}{6c_{min}} \cdot \sqrt{\frac{c}{c_{min}}}$

FOR 2 ANCHORS FASTENING

Reduction Factor $\Psi_{s\text{-}c,V}$ – Non-cracked concrete

$\frac{s}{c_{min}}$ \ $\frac{c}{c_{min}}$	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2
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
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
2.0	0.83	1.02	1.22	1.43	1.65	1.89	2.12	2.38	2.63	2.90	3.18	3.46
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
3.0	1.00	1.20	1.42	1.64	1.88	2.12	2.37	2.63	2.90	3.18	3.46	3.76
3.5		1.30	1.52	1.75	1.99	2.24	2.50	2.76	3.04	3.32	3.61	3.91
4.0			1.62	1.86	2.10	2.36	2.62	2.89	3.17	3.46	3.75	4.05
4.5				1.96	2.21	2.47	2.74	3.02	3.31	3.60	3.90	4.20
5.0					2.33	2.59	2.87	3.15	3.44	3.74	4.04	4.35
5.5						2.71	2.99	3.28	3.57	3.88	4.19	4.50
6.0						2.83	3.11	3.41	3.71	4.02	4.33	4.65



FOR OTHER CASE OF FASTENINGS

$\Psi_{s\text{-}c,V} = \frac{3c + s_1 + s_2 + s_3 + \ldots + s_{n-1}}{3nc_{min}} \cdot \sqrt{\frac{c}{c_{min}}}$