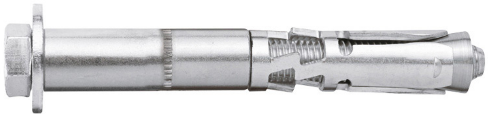
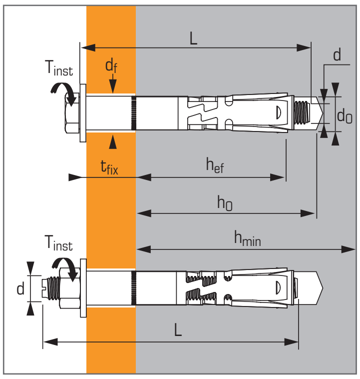


TRIGA Z - A4

High security, high performance fixing for use in cracked and non-cracked concrete

INOX STAINLESS STEEL



Technical data

Anchor size	Min. anchor depth (mm) h_{ef}	Max. thick. of part to be fixed (mm) t_{fix}	Min. thick. of base material (mm) h_{min}	Thread diameter (mm) d	Drilling depth (mm) h_0	Drilling diameter (mm) d_0	Clearance diameter (mm) d_f	Total anchor length (mm) L	Tighten torque (Nm) T_{inst}	Code
V6-10/10	50	10	100	M6	70	10	12	70	10	050694
V8-12/10		10						80		050595
V8-12/30	60	30	120	M8	80	12	14	100	25	050596
E8-12/45		45						124		050598
V10-15/25		25						115		050601
E10-15/45	70	45	140	M10	90	15	17	139	50	050604
V12-18/25		25						120		050605
E12-18/15	80	15	160	M12	105	18	20	122	80	050606
E12-18/45		45						152		050608
E16-24/25	95	25	200	M16	130	24	26	157	120	052940

APPLICATION

- Safety critical loads
- Overhead crane rails
- Steel columns and walkways
- Wall plates
- Safety rail

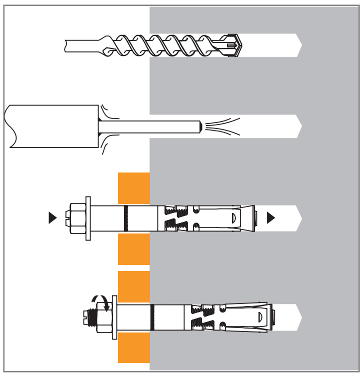
MATERIAL

- **Bolt :** class 80 NF EN ISO 3506-1
- **Threaded stud :** class 70 NF E 25100-0
- **Nut :** class 80 NF E 25100-4
- **Washer :** X5CrNiMo 17-12-2
- **Expansion cone :** X2CrNiMo 17-12-2
- **Expansion sleeve:** X2CrNiMo 17-12-2

Anchor mechanical properties

Anchor size		M6	M8	M10	M12	M16
Type V						
f_{uk} (N/mm^2)	Min. tensile strength	800	800	800	800	800
f_{yk} (N/mm^2)	Yield strength	600	600	600	600	600
$M^0_{rk,s}$ (Nm)	Characteristic bending moment	12,2	30,0	59,8	104,8	266,4
M (Nm)	Recommended bending moment	5,8	12,4	24,8	43,5	110,7
Type E						
f_{uk} (N/mm^2)	Min. tensile strength	700	700	700	700	700
f_{yk} (N/mm^2)	Yield strength	350	350	350	350	350
$M^0_{rk,s}$ (Nm)	Characteristic bending moment	10,6	26,2	52,3	91,7	233,1
M (Nm)	Recommended bending moment	4,4	10,9	21,8	38,2	97,1
Type V and type E						
$S_{eq,V}$ (mm^2)	Equivalent stressed cross-section bolt version	39,2	76,1	108,8	175,3	335,1
$S_{eq,E}$ (mm^2)	Equivalent stressed cross-section threaded stud version	35,2	61,8	82,0	104,1	183,3
W_{el} (mm^3)	Elastic section modulus	12,7	31,2	62,3	109,2	277,5

INSTALLATION



The loads specified on this page allow judging the product's performances, but cannot be used for the designing.
The data given in the pages "CC method" have to be applied (3/4 and 4/4).

Ultimate ($N_{Ru,m}$, $V_{Ru,m}$) and characteristic loads (N_{Rk}, V_{Rk}) in kN

Mean Ultimate loads are derived from test results in admissible service conditions, and characteristic loads are statistically determined.

TENSILE

Anchor size	M6	M8	M10	M12	M16
Non-cracked concrete (C20/25)					
h_{ef}	**50**	**60**	**70**	**80**	**95**
$N_{Ru,m}$	16,7	22,4	38,7	41,3	64,2
N_{Rk}	16	17	26	28	56
Cracked concrete (C20/25)					
h_{ef}	**50**	**60**	**70**	**80**	**95**
$N_{Ru,m}$	14,8	25,2	33,8	40,4	55,9
N_{Rk}	11	21	25	28,8	38

SHEAR

Anchor size		M6	M8	M10	M12	M16
Cracked & non-cracked concrete (C20/25)						
Type V	$V_{Ru,m}$	26,8	37,6	70,1	67,4	140,7
	V_{Rk}	21,6	31,3	58,4	60,1	117,2
Type E	$V_{Ru,m}$	17,5	22,9	37,7	49,9	101,5
	V_{Rk}	14,6	19,1	31,4	41,5	84,6

Design loads (N_{Rd}, V_{Rd}) for one anchor without edge or spacing influence in kN

$$N_{Rd} = \frac{N_{Rk}^{*}}{\gamma_{Mc}}$$

*Derived from test results

$$V_{Rd} = \frac{V_{Rk}^{*}}{\gamma_{Ms}}$$

TENSILE

Anchor size	M6	M8	M10	M12	M16
Non-cracked concrete (C20/25)					
h_{ef}	**50**	**60**	**70**	**80**	**95**
N_{Rd}	10,7	11,6	17,3	18,5	31,0
Cracked concrete (C20/25)					
h_{ef}	**50**	**60**	**70**	**80**	**95**
N_{Rd}	7,3	14,0	16,7	19,2	21,1

γ_{Mc} = 1,5 for M8-M12 and γ_{Mc} = 1,8 for M16

SHEAR

Anchor size		M6	M8	M10	M12	M16
Cracked & non-cracked concrete (C20/25)						
Type V/T	V_{Rd}	16,2	23,6	36,9	45,2	88,1
Type E	V_{Rd}	7,3	9,5	15,7	20,8	42,3

γ_{Ms} = 1,33 for Type V and γ_{Ms} = 2,0 for Type E

Recommended loads (N_{rec}, V_{rec}) for one anchor without edge or spacing influence in kN

$$N_{rec} = \frac{N_{Rk}^{*}}{\gamma_M \cdot \gamma_F}$$

*Derived from test results

$$V_{rec} = \frac{V_{Rk}^{*}}{\gamma_M \cdot \gamma_F}$$

TENSILE

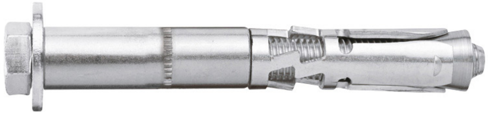
Anchor size	M6	M8	M10	M12	M16
Non-cracked concrete (C20/25)					
h_{ef}	**50**	**60**	**70**	**80**	**95**
N_{rec}	7,7	8,3	12,3	13,2	22,1
Cracked concrete (C20/25)					
h_{ef}	**50**	**60**	**70**	**80**	**95**
N_{rec}	5,2	10,0	11,9	13,7	15,1

γ_F = 1,4 ; γ_{Mc} = 1,5 for M8-M12 and γ_{Mc} = 1,8 for M16

SHEAR

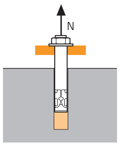
Anchor size		M6	M8	M10	M12	M16
Cracked & non-cracked concrete (C20/25)						
Type V/T	V_{rec}	11,6	16,8	26,4	32,2	63,0
Type E	V_{rec}	5,2	6,8	11,2	14,8	30,2

γ_F = 1,4 ; γ_{Ms} = 1,33 for Type V and γ_{Ms} = 2,0 for Type E



SPIT CC Method

TENSILE in kN

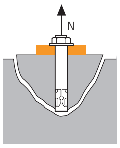


Pull-out resistance

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

$N^0_{Rd,p}$					Design pull-out resistance
Anchor size	M6	M8	M10	M12	M16
Non-cracked concrete					
h_{ef}	**50**	**60**	**70**	**80**	**95**
$N^0_{Rd,p}$ (C20/25)	-	10,6	13,3	16,6	-
Cracked concrete					
h_{ef}	**50**	**60**	**70**	**80**	**95**
$N^0_{Rd,p}$ (C20/25)	3,3	6	10,6	-	-

γ_{Mc} = 1,5 for M6-M12

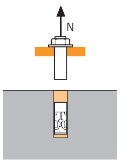


Concrete cone resistance

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

$N^0_{Rd,c}$					Design cone resistance
Anchor size	M6	M8	M10	M12	M16
Non-cracked concrete					
h_{ef}	**50**	**60**	**70**	**80**	**95**
$N^0_{Rd,c}$ (C20/25)	11,9	15,6	19,7	24,0	25,9
Cracked concrete					
h_{ef}	**50**	**60**	**70**	**80**	**95**
$N^0_{Rd,c}$ (C20/25)	8,5	11,2	14,1	17,2	18,5

γ_{Mc} = 1,5 for M6-M12 and γ_{Mc} = 1,8 for M16

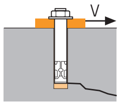


Steel resistance

$N_{Rd,s}$					Steel design tensile resistance
Anchor size	M6	M8	M10	M12	M16
$N_{Rd,s}$ (Type V)	10,0	18,2	28,8	42,0	78,9
$N_{Rd,s}$ (Type E)	5,8	10,6	16,8	24,4	45,9

γ_{Ms} = 1,6 for Type V and γ_{Ms} = 2,4 for Type E

SHEAR in kN

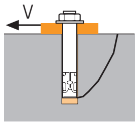


Concrete edge resistance

$V_{Rd,c} = V^0_{Rd,c} \cdot f_b \cdot f_{\beta,V} \cdot \Psi_{S\text{-}C,V}$

$V^0_{Rd,c}$					Design concrete edge resistance at minimum edge distance (C_{min})
Anchor size	M6	M8	M10	M12	M16
Non-cracked concrete					
h_{ef}	**50**	**60**	**70**	**80**	**95**
C_{min}	50	60	70	80	100
S_{min}	100	100	160	200	220
$V^0_{Rd,c}$ (C20/25)	3,4	4,9	6,8	9,3	13,6
Cracked concrete					
h_{ef}	**50**	**60**	**70**	**80**	**95**
C_{min}	50	60	70	80	100
S_{min}	100	100	160	200	220
$V^0_{Rd,c}$ (C20/25)	2,4	3,5	4,8	6,6	9,7

γ_{Mc} = 1,5

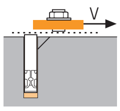


Pryout failure

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

$V^0_{Rd,cp}$					Design pryout resistance
Anchor size	M6	M8	M10	M12	M16
Non-cracked concrete					
h_{ef}	**50**	**60**	**70**	**80**	**95**
$V^0_{Rd,cp}$ (C20/25)	11,9	31,2	39,4	48,1	62,2
Cracked concrete					
h_{ef}	**50**	**60**	**70**	**80**	**95**
$V^0_{Rd,cp}$ (C20/25)	8,5	22,3	28,1	34,3	44,4

γ_{Mcp} = 1,5



Steel resistance

$V_{Rd,s}$					Steel design shear resistance
Anchor size	M6	M8	M10	M12	M16
$V_{Rd,s}$ (Type V)	16,2	23,6	36,9	45,2	88,2
$V_{Rd,s}$ (Type E)	6,3	8,3	13,6	20,7	40,7

γ_{Ms} = 1,33 for Type V and γ_{Ms} = 2,0 for Type E

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

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

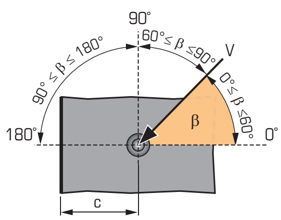
$$\beta_N + \beta_V \leq 1,2$$

f_b INFLUENCE OF CONCRETE

Concrete class	f_b	Concrete class	f_b
C25/30	1,1	C40/50	1,41
C30/37	1,22	C45/55	1,48
C35/45	1,34	C50/60	1,55

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

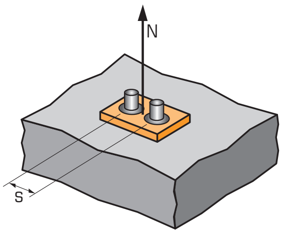
Angle β [°]	$f_{\beta,V}$
0 to 55	1
60	1,1
70	1,2
80	1,5
90 to 180	2



Mechanical anchors

SPIT CC Method

Ψ_s INFLUENCE OF SPACING FOR CONCRETE CONE RESISTANCE IN TENSILE LOAD



$$\Psi_s = 0{,}5 + \frac{s}{6.h_{ef}}$$

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

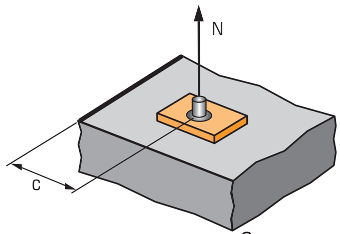
$\mathbf{s_{cr,N} = 3.h_{ef}}$

Ψ_s must be used for each spacing influenced the anchors group.

SPACING S — Reduction factor Ψ_s — Cracked & non-cracked concrete

Anchor size	M6	M8	M10	M12	M16
50	0,67				
60	0,70	0,67			
70	0,73	0,69	0,67		
80	0,77	0,72	0,69	0,67	
100	0,83	0,78	0,74	0,71	0,67
125	0,92	0,85	0,80	0,76	0,71
150	1,00	0,92	0,86	0,81	0,75
180		1,00	0,93	0,88	0,80
210			1,00	0,94	0,85
240				1,00	0,90
300					1,00

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



$$\Psi_{c,N} = 0{,}25 + 0{,}5 \,.\, \frac{c}{h_{ef}}$$

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

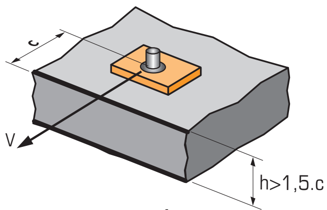
$\mathbf{c_{cr,N} = 1{,}5.h_{ef}}$

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

EDGE C — Reduction factor $\Psi_{c,N}$ — Cracked & non-cracked concrete

Anchor size	M6	M8	M10	M12	M16
50	0,75				
60	0,85	0,75			
70	0,95	0,83	0,75		
80	1,00	0,92	0,82	0,75	
90		1,00	0,89	0,81	
100			0,96	0,88	0,75
120				1,00	0,85
150					1,00

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

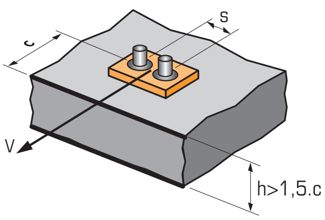


$$\Psi_{s\text{-}c,V} = \frac{c}{c_{min}} \,.\, \sqrt{\frac{c}{c_{min}}}$$

For single anchor fastening

Reduction factor $\Psi_{s\text{-}c,V}$ — Cracked & non-cracked concrete

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

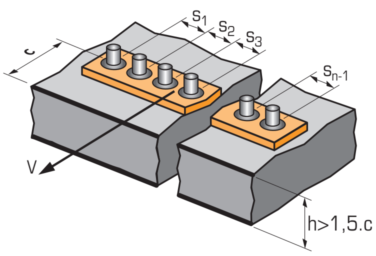


$$\Psi_{s\text{-}c,V} = \frac{3.c + s}{6.c_{min}} \,.\, \sqrt{\frac{c}{c_{min}}}$$

For 2 anchors fastening

Reduction factor $\Psi_{s\text{-}c,V}$ — Cracked & non-cracked concrete

s/c_{min} \ 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	3,71	4,02	4,33	4,65
6,0						2,83	3,11	3,41	3,71	4,02	4,33	4,65



For 3 anchors fastening and more

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