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

MTP-A4

ETA Assessed Option 1. A4 Stainless shaft. A4 Stainless clip.

PRODUCT INFORMATION

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

OFFICIAL DOCUMENTATION
- AVCP-1404-CPR-2520.
- ETA 15/0145 option 1.
- Declaration of Performance DoP MTP-A4.

SIZES
M8x68 to M16x220.

DESIGN LOAD RANGE
From 6,00 to 23,3 kN (non-cracked).
From 3,3 to 16,67 kN (cracked).

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


Stone


Concrete


Reinforced Concrete


Cracked Concrete

ASSESSMENTS
- Option 1 (Cracked concrete).
- Fire Resistance R30-120
- Seismic C1 M8÷M16.
- Seismic C2 M10÷M16.

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Técnicas Expansivas S.L.
Segador 13. Logroño. Spain
ETA 15/0145
1404
Structural fixings in concrete

CHARACTERISTICS AND BENEFITS
- Easy installation.
- Use in cracked and non-craked concrete.
- Pre-installation or through the drill-hole of the fixture.
- Variety of lengths and diameters: flexibility in assembly.
- For static and quasi-static loads.
- Friction operation. Installation by controlled torque
- Use for medium loads.
- Assessed for fire resistance RF30 to RF120.
- A4 Stainless steel (AISI 316).
- Available at INDEXcal.

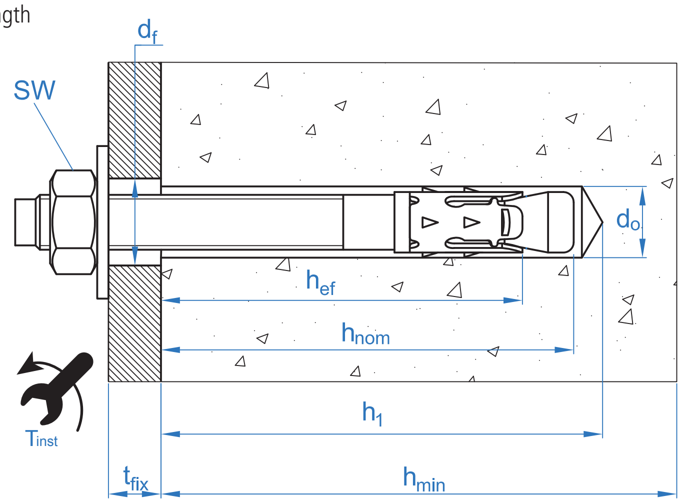
MATERIALS
Shaft: A4 Stainless steel.
Washer: DIN 125, A4 Stainless steel.
Nut: DIN 934, A4 Stainless steel.
Clip: A4 Stainless steel.

APPLICATIONS
- Structural fixings in cracked and non cracked concrete, including industrial and marine environments
- Safety barriers.
- Fixings of steel beams, perforated bracker guides, machinery, boilers, signage, staium seating, facade substructures, etc.
- Fixing of wood structures to concrete.

MECHANICAL PROPERTIES						
			M8	M10	M12	M16
Cone area section						
A_s	(mm²)	Cone area section	22,9	41,8	55,4	103,9
$f_{u,s}$	(N/mm²)	Chracteristic tension resistance	790	750	730	700
$f_{y,s}$	(N/mm²)	Yield strength	632	600	585	560
Threaded area section						
A_s	(mm²)	Cone area section	36,6	58,0	84,3	157,0
$f_{u,s}$	(N/mm²)	Chracteristic tension resistance	600	600	600	600
$f_{y,s}$	(N/mm²)	Yield Strength	480	480	480	480

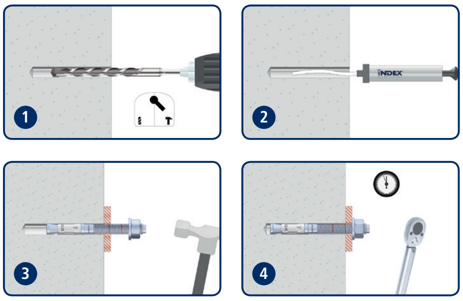
INSTALLATION DATA						
SIZE			M8	M10	M12	M16
Code			APA408XXX	APA410XXX	APA412XXX	APA416XXX
d_0	Nominal diameter of drill bit	[mm]	8	10	12	16
T_{ins}	Installation torque moment	[Nm]	20	40	60	120
$d_f \leq$	Diameter of clearance hole in the fixture	[mm]	9	12	14	18
h_1	Minimum drill hole depth	[mm]	70	80	100	115
h_{nom}	Installation depth	[mm]	54	67	81	97
h_{ef}	Effective embedment depth	[mm]	48	60	72	86
h_{min}	Minimum base material thickness	[mm]	100	120	150	170
t_{fix}	Maximum thickness of fixture	[mm]	L-65	L-80	L-100	L-120
$s_{cr,N}$	Critical spacing	[mm]	144	180	216	258
$c_{cr,N}$	Critical edge distance	[mm]	72	90	108	129
$s_{cr,sp}$	Critical distance (splitting)	[mm]	144	180	216	258
$c_{cr,sp}$	Critical edge distance (splitting)	[mm]	72	90	108	129
s_{min}	Minimum spacing	[mm]	50	55	60	70
c_{min}	Minimum edge distance	[mm]	50	55	60	70
SW	Installation wrench		13	17	19	24

*L = Total anchor length



Code	INSTALLATION PRODUCTS
	Hammer drill
BHDSXXXXX	Concrete Drill bits
MOBOMBA	Blow pump
MORCEPKIT	Cleaning Brush
DOMTAXX	Installation hammering tool
	Torque wrench
	Hexagonal socket

INSTALLATION



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

Characteristic Resistance N_{Rk} and V_{Rk}														
TENSION							SHEAR							
Size			M8	M10	M12	M16	Size			M8	M10	M12	M16
N_{Rk}	Non-cracked concrete	[kN]	9,0	16,0	20,0	35,0	V_{Rk}	Non-cracked concrete	[kN]	11,9	18,8	27,4	51,0
N_{Rk}	Cracked concrete	[kN]	5,0	9,0	12,0	25,0	V_{Rk}	Cracked concrete	[kN]	11,9	18,8	27,4	51,0

Design Resistance N_{Rd} and V_{Rd}													
TENSION							SHEAR						
Size			M8	M10	M12	M16	Size			M8	M10	M12	M16
N_{Rd}	Non-cracked concrete	[kN]	6,0	10,7	13,3	23,3	V_{Rd}	Non-cracked concrete	[kN]	9,2	14,5	21,1	39,2
N_{Rd}	Cracked concrete	[kN]	3,3	6,0	8,0	16,7	V_{Rd}	Cracked concrete	[kN]	9,2	14,5	21,1	39,2

Maximum Loads Recommended N_{rec} and V_{rec}													
TENSION							SHEAR						
Size			M8	M10	M12	M16	Size			M8	M10	M12	M16
N_{rec}	Non-cracked concrete	[kN]	4,3	7,6	9,5	16,7	V_{rec}	Non-cracked concrete	[kN]	6,5	10,3	15,1	28,0
N_{rec}	Cracked concrete	[kN]	2,4	4,3	5,7	11,9	V_{rec}	Cracked concrete	[kN]	6,5	10,3	15,1	28,0

Simplified calculation method

European Technical Assessment ETA 15/0145

Simplified version of the calculation method according to ETAG 001, annex C. Resistance is calculated according to the data shown in assessment ETA 15/0145.

- 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.

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

INDEXcal
For a more accurate calculation and to take more constructive provisions into account, we recommend using our calculation program INDEXcal. It may be easily downloaded from our website **www.indexfix.com**

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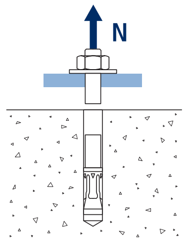
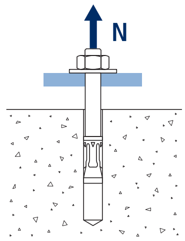
TENSION LOADS

- Steel design resistance: $N_{Rd,s}$
- Pull-out design resistance: $N_{Rd,p} = N^o_{Rd,p} \cdot \Psi_c$
- Concrete cone design resistance: $N_{Rd,c} = N^o_{Rd,c} \cdot \Psi_b \cdot \Psi_{s,N} \cdot \Psi_{c,N} \cdot \Psi_{re,N}$
- Concrete splitting design resistance: $N_{Rd,sp} = N^o_{Rd,c} \cdot \Psi_b \cdot \Psi_{s,sp} \cdot \Psi_{c,sp} \cdot \Psi_{re,N} \cdot \Psi_{h,sp}$

Steel Design resistance					
$N_{Rd,s}$					
Size		M8	M10	M12	M16
N^o_{Rd}	[kN]	14,0	22,7	32,7	58,7

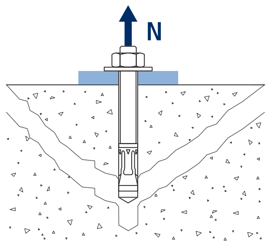


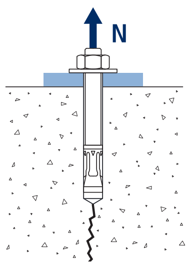
Pull-out design resistance						
$N_{Rd,p} = N^o_{Rd,p} \cdot \Psi_c$						
Size			M8	M10	M12	M16
$N^o_{Rd,p}$	Non-cracked concrete	[kN]	6,0	10,7	13,3	23,3
$N^o_{Rd,p}$	Cracked concrete	[kN]	3,3	6,0	8,0	16,7



Concrete cone design resistance						
$N_{Rd,c} = N^o_{Rd,c} \cdot \Psi_b \cdot \Psi_{s,N} \cdot \Psi_{c,N} \cdot \Psi_{re,N}$						
Concrete splitting design resistance*						
$N_{Rd,sp} = N^o_{Rd,c} \cdot \Psi_b \cdot \Psi_{s,sp} \cdot \Psi_{c,sp} \cdot \Psi_{re,N} \cdot \Psi_{h,sp}$						
Size			M8	M10	M12	M16
$N^o_{Rd,c}$	Non-cracked concrete	[kN]	11,2	15,6	20,6	26,9
$N^o_{Rd,c}$	Cracked concrete	[kN]	8,0	11,2	14,7	19,1

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





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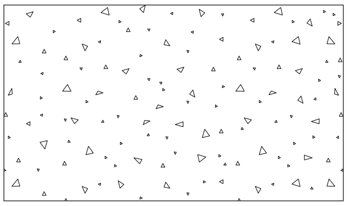
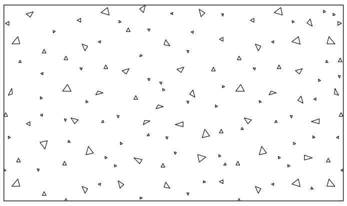
Coefficients of influence

Influence of concrete strength resistance in pul-out failure Ψ_c					
		M8	M10	M12	M16
Ψ_c	C 20/25	1,00			
	C 30/37	1,22			
	C 40/50	1,41			
	C 50/60	1,55			



Influence of concrete strength in concrete cone and splitting failure Ψ_b					
		M8	M10	M12	M16
Ψ_b	C 20/25	1,00			
	C 30/37	1,22			
	C 40/50	1,41			
	C 50/60	1,55			



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

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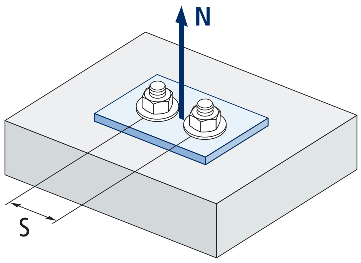

$$\Psi_{s,N} = 0,5 + \frac{s}{2 \cdot s_{cr,N}} \leq 1$$

Influence of spacing (concrete cone) $\Psi_{s,N}$				
s [mm]	MTP-A4			
	M8	M10	M12	M16
50	0,67		Invalid value	
55	0,68	0,67		
60	0,70	0,68	0,67	
65	0,72	0,70	0,68	
70	0,73	0,71	0,69	0,67
80	0,77	0,74	0,72	0,69
85	0,78	0,76	0,74	0,70
90	0,80	0,77	0,75	0,71
100	0,83	0,80	0,78	0,74
105	0,85	0,82	0,79	0,75
110	0,87	0,83	0,81	0,76
120	0,90	0,86	0,83	0,79
125	0,92	0,88	0,85	0,80
126	0,92	0,88	0,85	0,80
128	0,93	0,89	0,86	0,80
130	0,93	0,89	0,86	0,81
135	0,95	0,91	0,88	0,82
144	0,98	0,94	0,90	0,84
150	1,00	0,95	0,92	0,86
165		1,00	0,96	0,89
170			0,97	0,90
180			1,00	0,93
195	Value without reduction = 1			0,96
200				0,98
210				1,00

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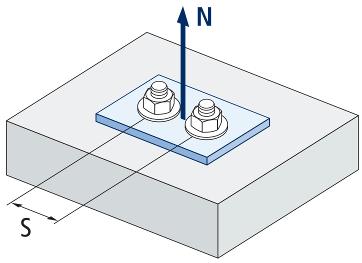
Influence of spacing (concrete splitting) $\Psi_{s,sp}$				
s [mm]	MTP-A4			
	M8	M10	M12	M16
50	0,67	**Invalid value**		
55	0,68	0,67		
60	0,70	0,68	0,67	
65	0,72	0,70	0,68	
70	0,73	0,71	0,69	0,67
80	0,77	0,74	0,72	0,69
85	0,78	0,76	0,74	0,70
90	0,80	0,77	0,75	0,71
100	0,83	0,80	0,78	0,74
110	0,87	0,83	0,81	0,76
125	0,92	0,88	0,85	0,80
128	0,93	0,89	0,86	0,80
135	0,95	0,91	0,88	0,82
140	0,97	0,92	0,89	0,83
150	1,00	0,95	0,92	0,86
160		0,98	0,94	0,88
165		1,00	0,96	0,89
168			0,97	0,90
180			1,00	0,93
192	**Value without reduction = 1**			0,96
200				0,98
210				1,00



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

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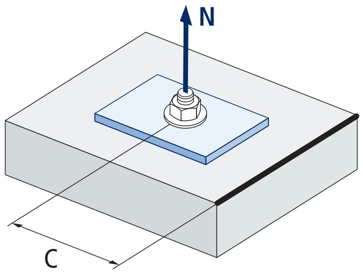

$$\Psi_{c,sp} = 0{,}35 + \frac{0{,}5 \cdot c}{C_{cr,sp}} + \frac{0{,}15 \cdot c^2}{C_{cr,sp}^{\;2}} \leq 1$$

Influence of concrete edge distance (splitting) $\Psi_{c,sp}$				
c [mm]	MTP-A4			
	M8	M10	M12	M16
50	0,75	0,71	**Invalid value**	
60	0,85	0,79	0,75	
65	0,90	0,84	0,79	
70	0,95	0,88	0,83	0,75
75	1,00	0,93	0,87	0,78
80		0,98	0,91	0,82
83		1,00	0,94	0,84
84			0,95	0,85
85			0,96	0,85
90			1,00	0,89
96	**Value without reduction = 1**			0,93
100				0,96
105				1,00

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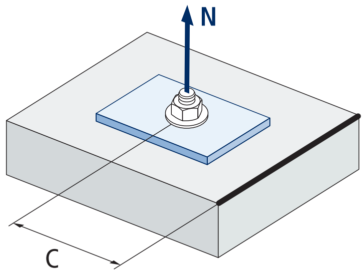
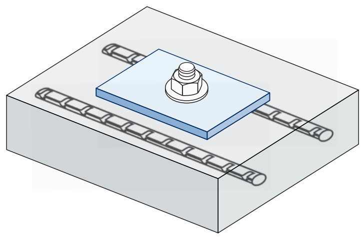
Influence of concrete edge distance (concrete cone) $\Psi_{c,N}$				
c [mm]	MTP-A4			
	M8	M10	M12	M16
50	0,75	0,71	Invalid value	
53	0,78	0,73		
60	0,85	0,79	0,75	
63	0,88	0,82	0,77	
65	0,90	0,84	0,79	
70	0,95	0,88	0,83	0,75
72	0,97	0,90	0,85	0,76
75	1,00	0,93	0,87	0,78
80	1,05	0,98	0,91	0,82
83		1,00	0,94	0,84
85			0,96	0,85
90			1,00	0,89
98	Value without reduction = 1			0,95
100				0,96
105				1,00



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

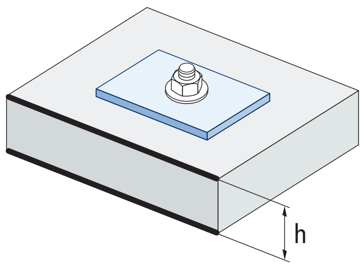
Influence of reinforcements $\Psi_{re,N}$				
$\Psi_{re,N}$	MTP-A4			
	M8	M10	M12	M16
	0,74	0,80	0,85	0,93

*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 $f_{re,N}$ = 1 factor may be applied.



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

Influence of base material thickness $\Psi_{h,sp}$											
$\Psi_{h,sp}$	MTP-A4										
	h/hef	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



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

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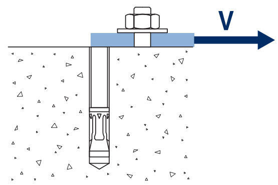
SHEAR LOADS

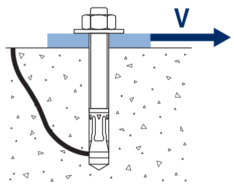
- Steel design resistance without lever arm: $V_{Rd,s}$
- Pry-out design resistance: $V_{Rd,cp} = k \cdot N^o_{Rd,c}$
- Concrete edge design resistance: $V_{Rd,c} = V^o_{Rd,c} \cdot \Psi_b \cdot \Psi_{se,V} \cdot \Psi_{c,V} \cdot \Psi_{re,V} \cdot \Psi_{\alpha,V} \cdot \Psi_{h,V}$

Steel design resistance					
$V_{Rd,s}$					
Size		M8	M10	M12	M16
$V_{Rd,s}$	[kN]	9,2	14,5	21,1	39,2

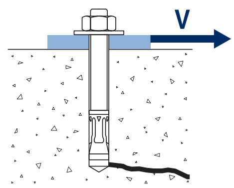


Pry-out design resistance*				
$V_{Rd,cp} = k \cdot N^o_{Rd,c}$				
Size	M8	M10	M12	M16
k	1	2	2	2

* $N^o_{Rd,c}$ Concrete cone design resistance for tension loads



Concrete edge resistance						
$V_{Rd,c} = V^o_{Rd,c} \cdot \Psi_b \cdot \Psi_{se,V} \cdot \Psi_{c,V} \cdot \Psi_{re,V} \cdot \Psi_{\alpha,V} \cdot \Psi_{h,V}$						
Size			M8	M10	M12	M16
$V^o_{Rd,c}$	Non-cracked concrete	[kN]	6,2	8,9	12,0	16,2
	Cracked concrete	[kN]	4,4	6,3	8,5	11,5



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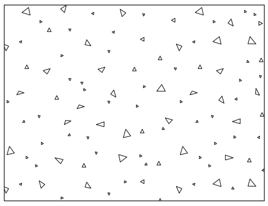
Coefficients of influence



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

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

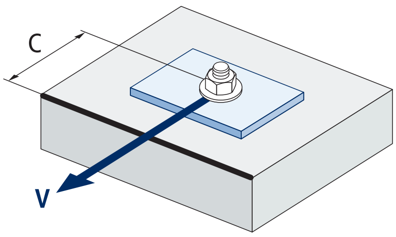
Influence of edge distance and spacing $\Psi_{se,V}$

FOR ONE ANCHOR ONLY

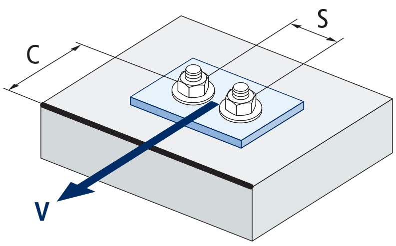
c/h_{ef}	0,50	0,75	1,00	1,25	1,50	1,75	2,00	2,25	2,50	2,75	3,00	3,25	3,50	3,75	4,00	4,50	5,00
Isolated	0,35	0,65	1,00	1,40	1,84	2,32	2,83	3,38	3,95	4,56	5,20	5,86	6,55	7,26	8,00	9,55	11,18

FOR TWO ANCHORS

s/c	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

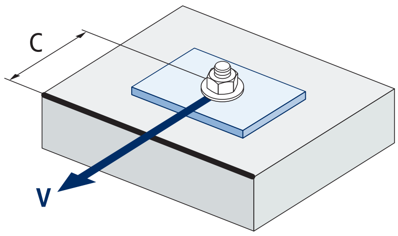


$$\Psi_{se,V} = \left(\frac{c}{h_{ef}}\right)^{1,5}$$



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

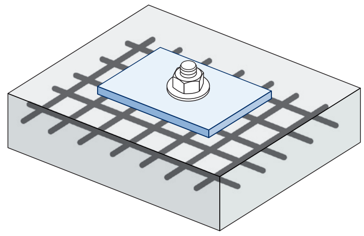
MTP-A4



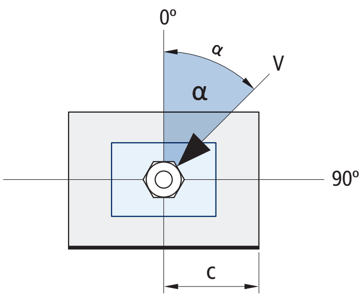
$$\Psi_{c,V} = \left(\frac{d}{c}\right)^{0,20}$$

Influence of concrete edge distance $\Psi_{c,V}$				
c [mm]	MTP-A4			
	M8	M10	M12	M16
40	Invalid value			
45				
50	0,69			
55	0,68			
60	0,67	0,70		
65	0,66	0,69	0,71	
70	0,65	0,68	0,70	
80	0,63	0,66	0,68	
85	0,62	0,65	0,68	0,72
90	0,62	0,64	0,67	0,71
100	0,60	0,63	0,65	0,69
105	0,60	0,62	0,65	0,69
110	0,59	0,62	0,64	0,68
120	0,58	0,61	0,63	0,67
125	0,58	0,60	0,63	0,66
130	0,57	0,60	0,62	0,66
135	0,57	0,59	0,62	0,65
140	0,56	0,59	0,61	0,65
150	0,56	0,58	0,60	0,64
160	0,55	0,57	0,60	0,63
170	0,54	0,57	0,59	0,62
175	0,54	0,56	0,59	0,62
180	0,54	0,56	0,58	0,62
190	0,53	0,55	0,58	0,61
200	0,53	0,55	0,57	0,60
210	0,52	0,54	0,56	0,60
220	0,52	0,54	0,56	0,59
230	0,51	0,53	0,55	0,59
240	0,51	0,53	0,55	0,58
250	0,50	0,53	0,54	0,58
260	0,50	0,52	0,54	0,57
270	0,49	0,52	0,54	0,57
280	0,49	0,51	0,53	0,56
290	0,49	0,51	0,53	0,56
300	0,48	0,51	0,53	0,56

Influence of reinforcements $\Psi_{re,V}$			
	Without perimetral reinforcements	Perimetral reinforcements ≥ Ø12 mm	Perimetral reinforcements with brackets ≤ 100 mm
Non-cracked concrete	1	1	1
Cracked concrete	1	1,2	1,4

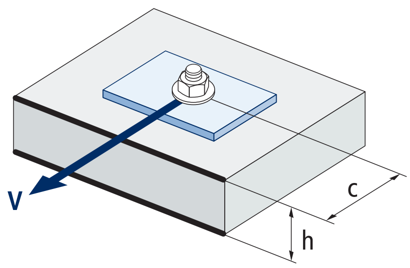


Influence of load application angle $\Psi_{\alpha,V}$										
Angle, α(°)	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°
$\Psi_{\alpha,V}$	1,00	1,01	1,05	1,13	1,24	1,40	1,64	1,97	2,32	2,50



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

Influence of base material thickness $\Psi_{h,V}$										
MTP-A4										
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



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

MTP-A4

FIRE RESISTANCE

Characteristic Resistance*								
	TENSION				SHEAR			
	M8	M10	M12	M16	M8	M10	M12	M16
RF30	0,5	1,1	1,8	3,3	0,7	1,5	2,5	4,7
RF60	0,4	0,9	1,5	2,7	0,6	1,2	2,1	3,9
RF90	0,3	0,7	1,2	2,2	0,4	0,9	1,7	3,1
RF120	0,3	0,6	1,0	1,8	0,4	0,8	1,4	2,5

*The safety factor for design resistance under fire exposure is $\gamma_{M,fi}$=1 (in abscence of other national regulations). As a eresult the Characteristic Resistance is the same as Design Resistance.

Maximum Load Recommended								
	TENSION				SHEAR			
	M8	M10	M12	M16	M8	M10	M12	M16
RF30	0,4	0,8	1,3	2,4	0,5	1,1	1,8	3,4
RF60	0,3	0,6	1,1	1,9	0,4	0,9	1,5	2,8
RF90	0,2	0,5	0,9	1,6	0,3	0,6	1,2	2,2
RF120	0,2	0,4	0,7	1,3	0,3	0,6	1,0	1,8

RANGE

Code	Seismic assessment	Size	Maximum thickness of fixture	Axle letter (length)		
APA408068	C1	M8 x 68 Ø8	4	A	100	600
APA408075	C1	M8 x 75 Ø8	10	B	100	600
APA408090	C1	M8 x 90 Ø8	25	C	100	600
APA408115	C1	M8 x 115 Ø8	50	D	100	400
APA408135	C1	M8 x 135 Ø8	70	E	50	300
APA408165	C1	M8 x 165 Ø8	100	G	50	200
APA410090	C1&C2	M10 x 90 Ø10	10	A	100	400
APA410105	C1&C2	M10 x 105 Ø10	25	B	50	300
APA410115	C1&C2	M10 x 115 Ø10	35	C	50	300
APA410135	C1&C2	M10 x 135 Ø10	55	D	50	300
APA410155	C1&C2	M10 x 155 Ø10	75	E	50	300

Code	Seismic assessment	Size	Maximum thickness of fixture	Axle letter (length)		
APA410185	C1&C2	M10 x 185 Ø10	105	F	50	100
APA412110	C1&C2	M12 x 110 Ø12	10	A	50	300
APA412120	C1&C2	M12 x 120 Ø12	20	B	50	300
APA412145	C1&C2	M12 x 145 Ø12	45	C	50	200
APA412170	C1&C2	M12 x 170 Ø12	70	D	50	100
APA412200	C1&C2	M12 x 200 Ø12	100	E	50	100
APA416130	C1&C2	M16 x 130 Ø16	10	A	50	100
APA416150	C1&C2	M16 x 150 Ø16	30	B	25	100
APA416185	C1&C2	M16 x 185 Ø16	60	C	25	50
APA416220	C1&C2	M16 x 220 Ø16	100	D	20	40