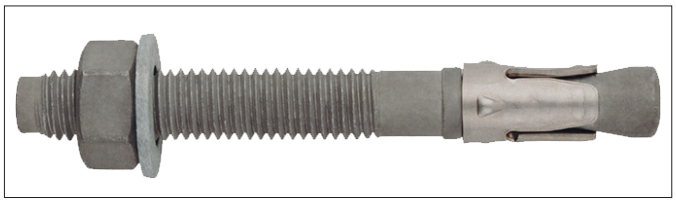
WEDGE ANCHORS - ETA Approved (38AG)



PRODUCT DATA

Head Type: Hexagon Bolt

Coating: Galvanised 40µm (DIN 125 or DIN 9021)

Nut: Galvanised 40µm (DIN 934)

Clip: 304 Stainless Steel

PRODUCT DESCRIPTION

The Macsim Wedge Anchor is an expansion anchor with controlled torque with an ETA Approval (Option 1) for use in cracked and non cracked concrete.

DESIGN LOAD RANGE

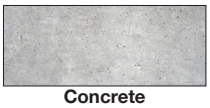
From 5,00 to 33,3 kN (non-cracked).

From 3,3 to 20,0 kN (cracked).

BASE MATERIAL

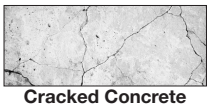
Concrete class from C20/25 to C50/60 cracked or non-cracked.

Stone



Concrete

Reinforced Concrete



Cracked Concrete

INSTALLATION METHOD

1. Drill Correct Diameter and depth of hole as specified.
2. Clean hole by brushing and blowing out dust carefully.
3. Push Anchor through fixture and hammer down until flush with surface.
4. Using a calibrated Torque Wrench apply correct torque setting as specified. The torque setting is critical, under torque may lead to slipping of the anchor before load capacity is reached, over torque may lead to permanent damage to the anchor and potential critical failure under loads.

OVERHEAD PROCEDURE

5. Following the installation procedure (steps 1-4 above) it is critical to ensure the Anchor is then locked into position. This is attained by pulling the Anchor down approximately 5mm away from the hole employing the use of a Claw Hammer or other applicable tool. This procedure ensures the Anchor is expanded fully and hence locked correctly into position.

APPLICATIONS

- Anchor plates.
- Metallic structures.
- Bridges.
- Urban fitments.
- Protective fences.
- Catenaries.
- Elevators.
- Pipe supports.

• ASSESSMENTS

- Option 1 (Cracked and non-cracked concrete).
- Fire Resistance R30-120.

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1219
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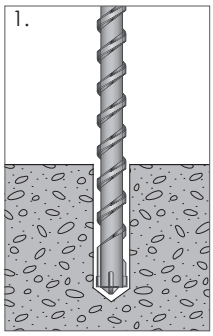
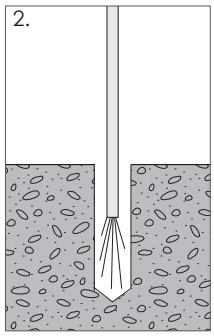
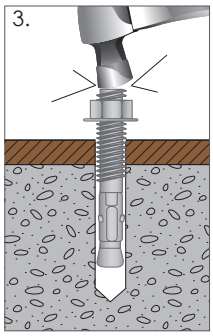
FIRE RESISTANCE

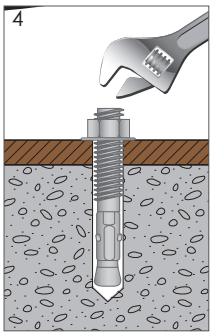
ADVANTAGES

- Easy installation.
- Use in cracked and non-craked 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.

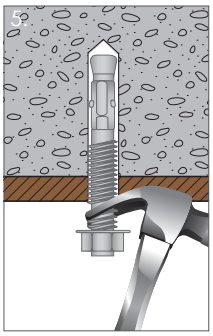








OVERHEAD PROCEDURE



WEDGE ANCHORS - ETA Approved (38AG)

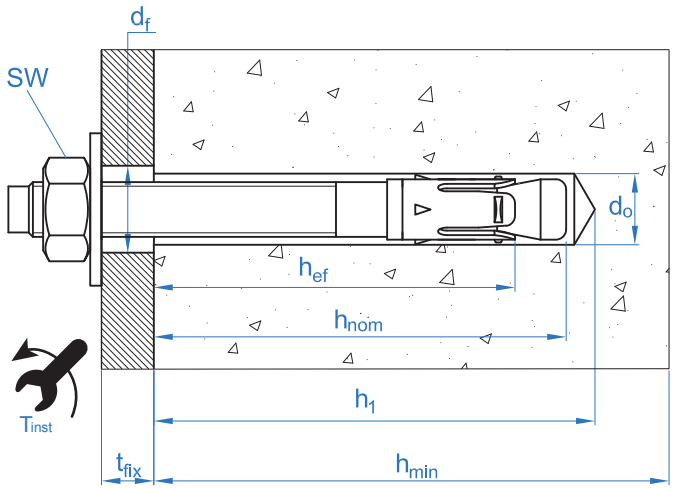
MECHANICAL PROPERTIES

SIZE			M10	M12	M16
Cone area section					
A_s	(mm²)	Cone area section	41,8	55,4	103,9
$f_{u,s}$	(N/mm²)	Characteristic tension resistance	750	730	700
$f_{y,s}$	(N/mm²)	Yield strength	600	585	560
Threaded area section					
A_s	(mm²)	Cone area section	58,0	84,3	157,0
$f_{u,s}$	(N/mm²)	Characteristic tension resistance	600	600	600
$f_{y,s}$	(N/mm²)	Yield strength	480	480	480

INSTALLATION DATA

SIZE			M10	M12	M16
Code			38AG10XXX	38AG12XXX	38AG16XXX
d_0	(mm)	Nominal diameter of drill bit	10	12	16
T_{ins}	(Nm)	Installation torque moment	40	60	100
$d_f \leq$	(mm)	Diameter of clearance hole in the fixture	12	14	18
h_1	(mm)	Minimum drill hole depth	75	85	105
h_{nom}	(mm)	Installation depth	68	80	97
h_{ef}	(mm)	Effective embedment depth	60	70	85
h_{min}	(mm)	Minimum base material thickness	120	140	170
t_{fix}	(mm)	Maximum thickness of fixture	L-80	L-96	L-117
$S_{cr,N}$	(mm)	Critical spacing	180	210	255
$C_{cr,N}$	(mm)	Critical edge distance	90	105	128
$S_{cr,sp}$	(mm)	Critical distance (splitting)	300	350	510
$C_{cr,sp}$	(mm)	Critical edge distance	150	175	255
S_{min}	(mm)	Minimum spacing	60	70	128
C_{min}	(mm)	Minimum edge spacing	60	70	128
SW	(mm)	Installation wrench	17	19	24

***L = Total anchor length**



WEDGE ANCHORS - ETA Approved (38AG)

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			M10	M12	M16	SIZE			M10	M12	M16
N_{Rk}	Non-cracked concrete	kN	16,0	30,0	35,0	V_{Rk}	Non-cracked concrete	kN	17,4	25,3	47,1
N_{Rk}	Cracked concrete	kN	9,0	16,0	25,0	V_{Rk}	Cracked concrete	kN	17,4	25,3	47,1

Design Resistance N_{Rd} and V_{Rd}

TENSION						SHEAR					
SIZE			M10	M12	M16	SIZE			M10	M12	M16
N_{Rd}	Non-cracked concrete	kN	10,7	20,0	23,3	V_{Rd}	Non-cracked concrete	kN	13,9	20,2	37,7
N_{Rd}	Cracked concrete	kN	6,0	10,7	16,7	V_{Rd}	Cracked concrete	kN	13,9	20,2	37,7

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

TENSION						SHEAR					
SIZE			M10	M12	M16	SIZE			M10	M12	M16
N_{rec}	Non-cracked concrete	kN	7,6	14,3	16,7	V_{rec}	Non-cracked concrete	kN	9,9	14,5	26,9
N_{rec}	Cracked concrete	kN	4,3	7,6	11,9	V_{rec}	Cracked concrete	kN	9,9	14,5	26,9

Simplified calculation method

European Technical Assessment ETA 12/0397

Simplified version of the calculation method according to ETAG 001, annex C. Resistance is calculated according to the data shown in assessment ETA 12/0397.

- 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.

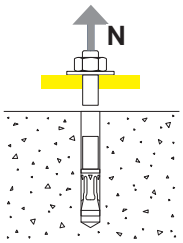
WEDGE ANCHORS - ETA Approved (38AG)

Tension Loads

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

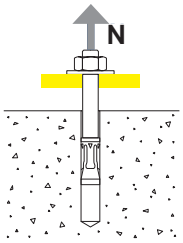
Steel Design resistance

$N_{Rd,s}$				
SIZE		**M10**	**M12**	**M16**
N°_{Rd}	kN	20,9	26,9	48,5



Pull-out design resistance

$N_{Rd,p} = N^{\circ}_{Rd,p} \bullet \Psi_c$					
SIZE			**M10**	**M12**	**M16**
$N^{\circ}_{Rd,p}$	Non-cracked concrete	kN	10,7	20,0	23,3
$N^{\circ}_{Rd,p}$	Cracked concrete	kN	6,0	10,7	16,7



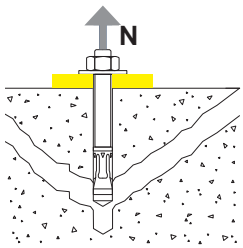
Concrete cone design resistance

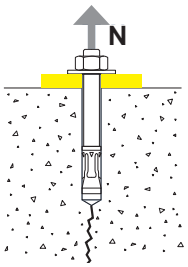
$N_{Rd,c} = N^{\circ}_{Rd,c} \bullet \Psi_b \bullet \Psi_{s,N} \bullet \Psi_{c,N} \bullet \Psi_{re,N}$

Concrete splitting design resistance*

$N_{Rd,sp} = N^{\circ}_{Rd,c} \bullet \Psi_b \bullet \Psi_{s,sp} \bullet \Psi_{c,sp} \bullet \Psi_{re,N} \bullet \Psi_{h,sp}$					
SIZE			**M10**	**M12**	**M16**
$N^{\circ}_{Rd,c}$	Non-cracked concrete	kN	15,6	19,7	26,4
$N^{\circ}_{Rd,c}$	Cracked concrete	kN	11,2	14,1	18,8

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





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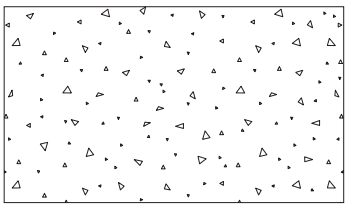
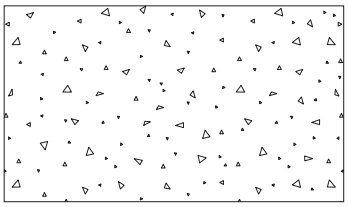
Coefficients of influence

Influence of concrete strength resistance in pull-out failure Ψ_c				
		M10	**M12**	**M16**
Ψ_c	C 20/25	1,0	1,0	1,0
	C 30/37	1,16	1,22	1,22
	C 40/50	1,31	1,41	1,41
	C 50/60	1,41	1,55	1,55



Influence of concrete strength in concret cone and splitting failure Ψ_b				
		M10	**M12**	**M16**
Ψ_b	C 20/25	1,0		
	C 30/37	1,22		
	C 40/50	1,41		
	C 50/60	1,55		

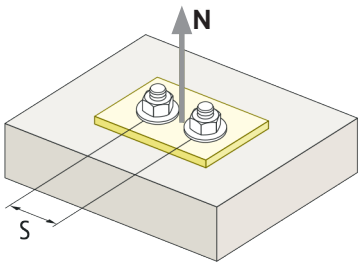


$$\Psi_b = \sqrt{\frac{f_{ck,cube}}{25}} \geq 1$$

WEDGE ANCHORS - ETA Approved (38AG)

Coefficients of influence

Influence of spacing (concrete cone) $\Psi_{s,N}$			
S (mm)	**M10**	**M12**	**M16**
60	0,67	Invalid value	
65	0,68		
70	0,68	0,67	
80	0,72	0,69	
85	0,74	0,70	
90	0,75	0,71	
100	0,78	0,74	
105	0,79	0,75	
110	0,81	0,76	
120	0,83	0,79	
125	0,85	0,80	
126	0,85	0,80	
128	0,86	0,80	0,75
130	0,86	0,81	0,76
135	0,88	0,82	0,78
144	0,90	0,84	0,79
150	0,92	0,86	0,82
165	0,96	0,89	0,83
170	0,97	0,90	0,85
180	1,00	0,93	0,88
195		0,96	0,89
200		0,98	0,91
210		1,00	0,93
220			0,94
225			0,99
252	Value without reduction = 1		1,00

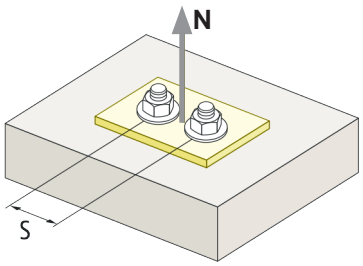


$$\Psi_{s,N} = 0,5 + \frac{s}{2 \cdot S_{cr,N}} \leq 1$$

WEDGE ANCHORS - ETA Approved (38AG)

Coefficients of influence

Influence of spacing (concrete splitting) $\Psi_{s,sp}$			
S (mm)	**M10**	**M12**	**M16**
60	0,60	Invalid value	
65	0,61		
70	0,62	0,60	
80	0,63	0,61	
85	0,64	0,62	
90	0,65	0,63	
100	0,67	0,64	
110	0,68	0,66	
125	0,71	0,68	
128	0,71	0,68	0,63
135	0,73	0,69	0,63
140	0,73	0,70	0,64
150	0,75	0,71	0,65
160	0,77	0,73	0,66
165	0,78	0,74	0,66
168	0,78	0,74	0,66
180	0,80	0,76	0,68
192	0,82	0,77	0,69
200	0,83	0,79	0,70
210	0,85	0,80	0,71
220	0,87	0,81	0,72
260	0,93	0,87	0,75
288	0,98	0,91	0,78
300	1,00	0,93	0,79
336		0,98	0,83
350		1,00	0,84
412			0,90
425			0,92
500			0,99
510	Value without reduction = 1		1,00

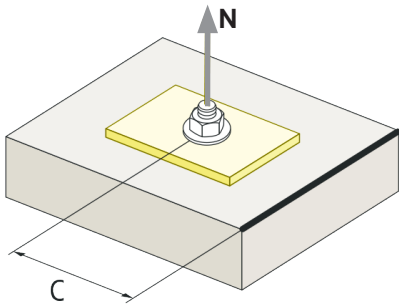


$$\Psi_{s,sp} = 0,5 + \frac{s}{2 \cdot S_{cr,sp}} \leq 1$$

WEDGE ANCHORS - ETA Approved (38AG)

Coefficients of influence

Influence of concrete edge distance (splitting) $\Psi_{c,sp}$			
S (mm)	**M10**	**M12**	**M16**
60	0,57	Invalid value	
65	0,59		
70	0,62	0,57	
75	0,64	0,59	
80	0,66	0,61	
83	0,67	0,62	
84	0,68	0,62	
85	0,68	0,63	
90	0,70	0,65	
96	0,73	0,67	
100	0,75	0,68	
105	0,77	0,70	
110	0,80	0,72	
125	0,87	0,78	
128	0,89	0,80	0,64
130	0,90	0,80	0,64
135	0,92	0,82	0,66
144	0,97	0,86	0,68
150	1,00	0,89	0,70
168		0,97	0,74
175		1,00	0,76
180		1,02	0,78
206			0,85
213			0,87
250			0,98
255	Value without reduction = 1		1,00



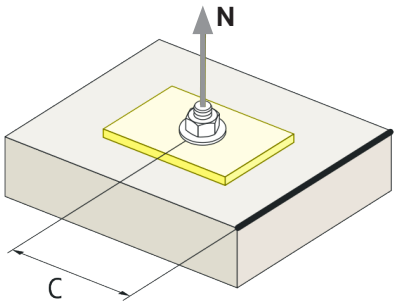
$$\Psi_{c,sp} = 0,35 + \frac{0,5 \cdot c}{C_{cr,sp}} + \frac{0,15 \cdot c^2}{C_{cr,sp}^{\ 2}} \leq 1$$

WEDGE ANCHORS - ETA Approved (38AG)

Coefficients of influence

Influence of concrete edge distance (concrete cone) $\Psi_{c,N}$			
S (mm)	**M10**	**M12**	**M16**
60	0,75	Invalid value	
63	0,77		
65	0,79		
70	0,83	0,75	
72	0,85	0,76	
75	0,87	0,78	
180	0,91	0,82	
83	0,94	0,84	
85	0,96	0,85	
90	1,00	0,89	
98		0,95	
100		0,96	
105		1,00	
110			
113			
125			
126			
128	Value without reduction = 1		1,00

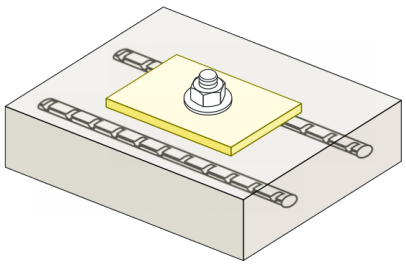
*The critical concrete edge distance matches the minimum concrete edge distance



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

Influence of reinforcements $\Psi_{re,N}$			
$\Psi_{re,N}$	**M10**	**M12**	**M16**
	0,80	0,85	0,93

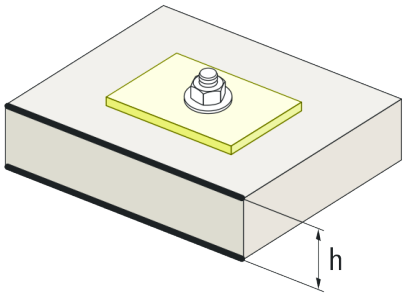
*This factor only applies for a high density of reinforcements. If in the area of the anchor there are reinforcements with a distancing of ≥ 150 mm (any diameter) or with a diameter ≤ 10 mm and a distancing of ≥ 100 mm, a $f_{re,N}$ =1 factor may be applied.



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

Influence of base material thickness $\Psi_{h,sp}$											
$\Psi_{h,sp}$	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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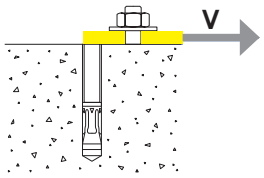
Shear Loads

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

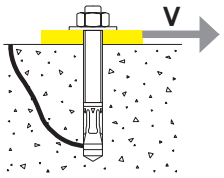
Steel Design resistance

$V_{Rd,s}$				
SIZE		**M10**	**M12**	**M16**
$V_{Rd,s}$	kN	13,9	20,2	37,7



Pry-out design resistance*

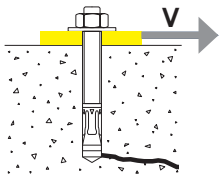
$V_{Rd,cp} = k \bullet N^{o}_{Rd,c}$			
SIZE	**M10**	**M12**	**M16**
k	2	2	2



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

Concrete edge resistance

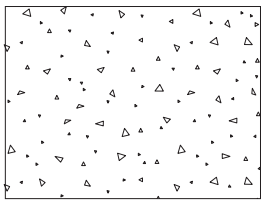
$V_{Rd,c} = V^{o}_{Rd,c} \bullet \Psi_b \bullet \Psi_{se,V} \bullet \Psi_{c,V} \bullet \Psi_{re,V} \bullet \Psi_{,V} \bullet \Psi_{h,V}$					
	SIZE		**M10**	**M12**	**M16**
$V^{o}_{Rd,c}$	Non-cracked concrete	kN	8,9	11,5	15,9
	Cracked concrete	kN	6,3	8,2	11,3



WEDGE ANCHORS - ETA Approved (38AG)

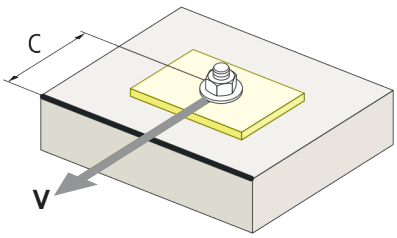
Coefficients of influence

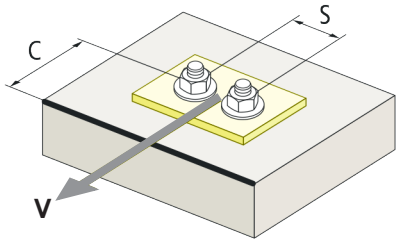
Influence of concrete strength in concrete edge failure Ψ_b				
		M10	M12	M16
Ψ_b	C 20/25	1,00		
	C 30/37	1,22		
	C 40/50	1,41		
	C 50/60	1,55		



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

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





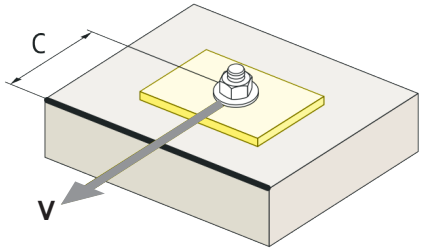
$$\Psi_{se,V} = \left(\frac{c}{h_{ef}}\right)^{1,5}$$

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

WEDGE ANCHORS - ETA Approved (38AG)

Coefficients of influence

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

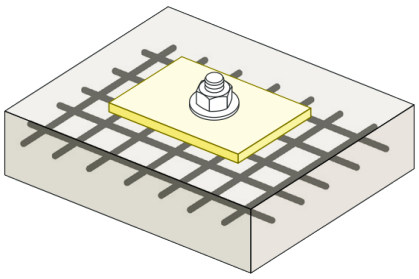


$$\Psi_{c,V} = \left(\frac{d}{c}\right)^{0,20}$$

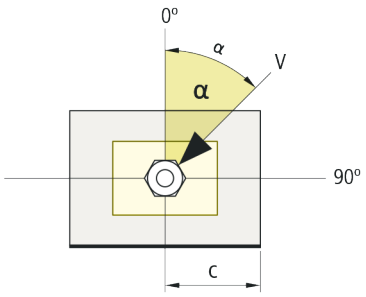
WEDGE ANCHORS - ETA Approved (38AG)

Coefficients of influence

Influence of reinforcements $\Psi_{re,V}$			
	Without perimetral reinforcements	**Perimetral reinforcements ≥Ø12mm**	**Perimetral reinforcements with brackets ≤ 100mm**
Non-cracked concrete	1	1	1
Cracked concrete	1	1,2	1,4

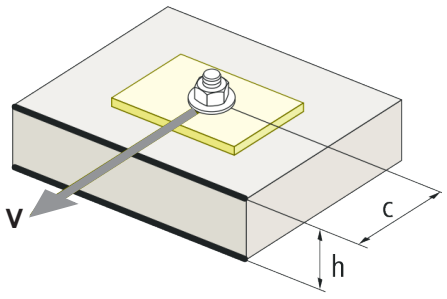


Influence of load application angle $\Psi_{\alpha,V}$										
Angle, α(°)	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°
$\Psi_{\alpha,V}$	1,00	1,01	1,05	1,13	1,24	1,40	1,64	1,97	2,32	2,50



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

Influence of load application angle $\Psi_{\alpha,V}$										
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



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

WEDGE ANCHORS - ETA Approved (38AG)

FIRE RESISTANCE

Characteristic Resistance*

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

*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			
	M10	M12	M16		M10	M12	M16
RF30	0,6	1,2	2,2	RF30	0,6	1,2	2,2
RF60	0,6	0,9	1,7	RF60	0,6	0,9	1,7
RF90	0,4	0,8	1,4	RF90	0,4	0,8	1,4
RF120	0,4	0,6	1,1	RF120	0,4	0,6	1,1

RANGE INFORMATION

CODE	SIZE	Ø	Maximum thickness of fixture	Box Qty	Outer Box Qty
38AG10070	M10 X 70	10	5	100	400
38AG10090	M10 X 90	10	10	100	400
38AG10120	M10 X 120	10	35	100	200
38AG12080	M12 X 80	12	4	50	300
38AG12110	M12 X 110	12	14	50	200
38AG12130	M12 X 130	12	34	50	200
38AG12150	M12 X 150	12	54	50	100
38AG12180	M12 X 180	12	84	50	150
38AG16125	M16 X 125	16	8	25	100
38AG16145	M16 X 145	16	28	25	100
38AG16175	M16 X 175	16	58	25	50