

# AnkaScrew™ Xtrem™

## SCREW IN ANCHORS - NON-CRACKED & CRACKED CONCRETE

### GENERAL INFORMATION

Performance Related	Material	Installation Related

### Product

A seismic certified heavy duty screw-in anchor for permanent anchoring into concrete. Certified for seismic C1 & C2 applications.



### Compliance

European Technical Assessment (option1) - ETA-20/0731

Design According to:

- Stud diameter equals hole diameter.
- AS5216 (formerly TS101)
- AS1170.4 - Earthquake Actions
- EN1992-4 (formerly ETAG001 Annex C, E & TR045)
- NZS3101 (A3) Section 17 - Seismic Design C1 & C2

Use Ramset™ iExpert Anchor Software for optimised calculation or where a greater range of anchor layout detail is needed

### Benefits, Advantages and Features

Fire tested to TR020

- Fire rated performance up to 120 minutes
- Highest level of European assessment for mechanical screw-in anchors
- Approved for all directions (floor, wall, overhead)
- Maximum Tensile & Shear capacities in cracked concrete
- Zinc Plating 5µm
- Anchor diameters 6mm to 12mm

Fast and easy to use:

- Install, simply screws into hole.
- Remove, leaving an empty hole.

Close to edge and for close anchor spacing:

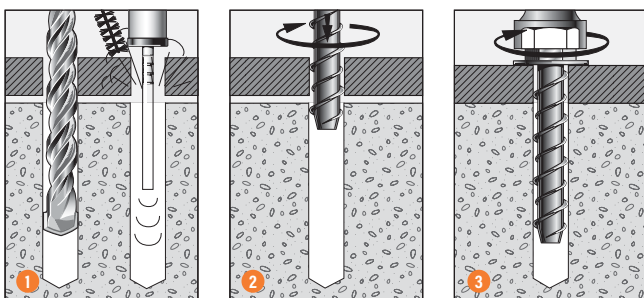
- Does not expand and burst concrete.



### Principal Applications

- Anchoring into cracked & non cracked concrete
- Steel framing
- Mechanical services
- Pallet racking
- Safety barriers
- Conveyors
- Hand rails
- Bottom plates

### Installation



1. Drill hole to correct diameter and depth. Important: Use Ramset™ Dustless Drilling System to ensure holes are clean. Alternatively, clean clean thoroughly with brush and remove debris by way of vacuum or hand pump, compressed air etc.
2. Using a socket wrench, screw the AnkaScrew™ Xtrem™ into the hole using slight pressure until the self tapping action starts.
3. Tighten the AnkaScrew™ Xtrem™ until flush with fixture.  
If resistance is experienced when tightening, unscrew anchor one turn and re-tighten. Ensure not to over tighten. Refer to tightening torque for limitations.

# AnkaScrew™ Xtrem™

## SCREW IN ANCHORS - NON-CRACKED & CRACKED CONCRETE

### Installation and performance details

Anchor size, d <sub>b</sub> (mm)	Drilled hole diameter, d <sub>h</sub> (mm)	Fixture hole diameter, d <sub>f</sub> (mm)	Anchor effective depth, h (mm)	Depth of drill hole, h <sub>i</sub> (mm)	Tightening torque, T <sub>r</sub> (Nm)	Concrete substrate thickness, b <sub>m</sub> (mm) ***	Non-Cracked Concrete Tension, φN <sub>ur</sub> (kN) **		
							Concrete Compressive Strength, f <sub>c</sub>		
							20 MPa	30 MPa	40 MPa
6	6	8	31	45	10	80	2.7	3.3	3.8
			44	60		90	6.0	7.3	8.5
8	8	12	35	55	20	80	5.0	6.1	7.1
			43	65		90	8.0	9.8	11.3
			52	75		105	10.7	13.0	15.0
10	10	14	43	65	40	90	8.0	9.8	11.3
			60	85		120	13.3	16.3	18.8
			68	95		136	17.3	21.1	24.4
12	12	16	50	75	60	100	10.7	13.0	15.0
			67	95		134	18.0	22.8	25.4
			80	110		160	23.5	29.7	33.2

Data is based on optimal dimensions, anchor spacing = 3\*h, edge distance = 1.5\*h

For shear loads acting towards an edge or where optimum dimensions are not achievable, please use the simplified strength limit state design process to verify capacity

\*\* Reduced characteristic ultimate tensile capacity = φN<sub>ur</sub>, where φ = 0.67 and N<sub>ur</sub> is based on characteristic ultimate pull-out tensile capacity for sizes 6-10 and concrete tensile capacity for size 12 where h≥67.

For conversion to Working Load Limit MULTIPLY φN<sub>ur</sub> x 0.50

For Cracked Concrete performance, please use the simplified strength limit state design process to verify capacity.

\*\*\*Note: For performance based on smaller concrete substrate thickness, refer to iExpert Anchor Software or Ramset™ Engineer.

### DESCRIPTION AND PART NUMBERS

Anchor size, d <sub>b</sub> (mm)	Drilled hole diameter, d <sub>h</sub> (mm)	Effective Length, L <sub>e</sub> (mm)	Maximum Fixture Thickness, t <sub>fix,max</sub> (mm)	AnkaScrew™ Xtrem™ Description	Part Number
6	6	41	10	6mmx50mm zinc	AS06050X
		71	40	6mmx80mm zinc	AS06080X
8	8	50	15	8mmx60mm zinc	AS08060X
		67	32	8mmx80mm zinc	AS08080X
10	10	48	5	10mmx60mm zinc	AS10060X
		88	45	10mmx100mm zinc	AS10100X
12	12	65	15	12mmx80mm zinc	AS12080X
		95	45	12mmx110mm zinc	AS12110X
		135	85	12mmx150mm zinc	AS12150X

Effective depth, h (mm)

$$h = L_e - t$$

t = total thickness of material(s) being fixed

### ENGINEERING PROPERTIES

Anchor size, d <sub>b</sub> (mm)	Minimum cross sectional diameter (mm)	Stress area, A <sub>s</sub> (mm <sup>2</sup> )	Yield strength, f <sub>y</sub> (MPa)	UTS, F <sub>u</sub> (Mpa)
6	5.1	20.4	560	700
8	7.1	39.6	560	700
10	9.1	65.0	560	700
12	11.1	96.8	560	700

# AnkaScrew Xtrem™

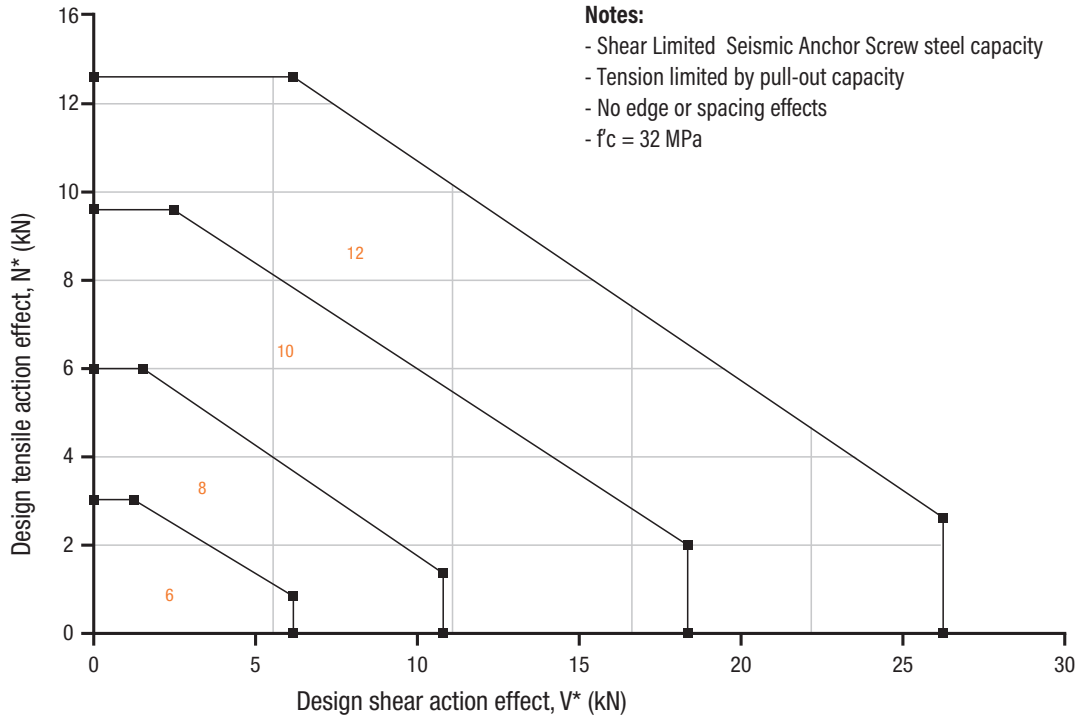
## STRENGTH LIMIT STATE DESIGN

### STEP 1

#### Select anchor to be evaluated

Table 1a Indicative combined loading - interaction diagram

Table 1b Absolute minimum edge distance and anchor spacing values,  $e_m$  and  $a_m$  (mm)



Anchor size, $d_b$	6		8			10			12		
Effective depth, h (mm)	31	44	35	43	52	43	60	68	50	67	80
*Min. member thickness (mm)	80	90	80	90	105	90	120	136	100	134	160
Min. Anchor Spacing - $a_m$	40	40	40	50	50	50	50	50	50	50	70
Min. Edge Distance - $e_m$	40	40	40	50	50	50	50	50	50	50	70

\*Note: For calculations based on smaller member thickness, refer to iExpert Anchor Software or Ramset™ Engineer.

#### Step 1c Calculate anchor effective depth, h (mm)

Refer to "Description and Part Numbers" table on the previous page.

Effective depth, h (mm)

$$h = L_e - t$$

t = total thickness of material(s) being fixed

### Checkpoint 1

Anchor size determined, absolute minima compliance achieved, effective depth (h) calculated.

# AnkaScrew™ Xtrem™

## STRENGTH LIMIT STATE DESIGN

Mechanical Anchoring - AnkaScrew™ Xtrem™

### STEP 2

#### Verify Non-cracked & cracked concrete tensile resistance - per anchor

Table 2a - Reduced characteristic ultimate concrete tensile capacity,  $\phi N_{uc}$  (kN),  $\phi_c = 1/1.5 = 0.67$ ,  $f'_c = 32$  MPa

Anchor size, $d_b$	6	8	10	12
Drill hole dia, $d_h$ (mm)	6	8	10	12
Effective depth, $h$ (mm)				
31	7.2			
35		8.6		
43		11.7	11.7	
44	12.1			
50				14.7
52		15.6		
60			19.3	
67				22.8
68			23.3	
80				29.7

For optimised performance data, please use Ramset iExpert Anchoring Software.

Table 2a-2-Cracked Concrete effect, tension,  $X_{ncr}$

Anchor size, $d_b$	6	8	10	12
$X_{ncr}$	0.70			

Table 2b - Concrete compressive strength effect, tension,  $X_{nc}$  and Pull-out,  $X_{npc}$

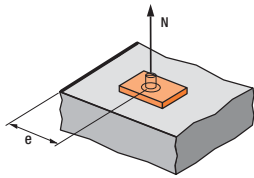
$f'_c$ (MPa)	20	25	32	40	50
Tension $X_{nc}$	0.79	0.88	1.00	1.12	1.25
Pull-out $X_{npc}$	0.82	0.92	1.00	1.16	1.30

Table 2c - Concrete Edge distance effect, tension,  $X_{ne}$

Anchor size, $d_b$	6	8	10	12
Effective depth, $h$ (mm)	44	52	68	80
Edge distance, $e$ (mm)				
40	0.70			
50	0.82	0.73	0.62	
55	0.88	0.78	0.65	
70	1	0.92	0.76	0.69
75		0.97	0.80	0.72
80		1	0.84	0.75
85			0.88	0.78
90			0.91	0.81
100			0.99	0.88
105			1	0.91
110				0.94
115				0.97
120				1

Table 2d - Concrete anchor spacing effect, tension,  $X_{na}$

Anchor size, $d_b$	6	8	10	12
Effective depth, $h$ (mm)	44	52	68	80
Edge distance, $a$ (mm)				
40	0.65			
50	0.69	0.66	0.62	
60	0.73	0.69	0.65	
70	0.77	0.72	0.67	
80	0.80	0.76	0.70	
90	0.84	0.79	0.72	
100	0.88	0.82	0.75	0.71
110	0.92	0.85	0.77	0.73
120	0.95	0.88	0.79	0.75
130	0.99	0.92	0.82	0.77
140	1	0.95	0.84	0.79
150		0.98	0.87	0.81
160		1	0.89	0.83
170			0.92	0.85
180			0.94	0.88
190			0.97	0.90
200			0.99	0.92
250			1	1

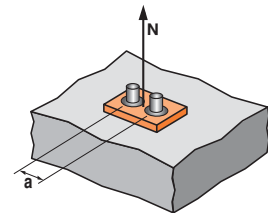


$$X_{ne} = 0.25 + 0.5 \cdot (e/h)$$

Where  $e_m \leq e \leq e_c$

$$e_c = 1.5 \cdot h$$

Note: Tabled values are based on the nominal effective depth,  $h$  shown in the installation details. For other values of  $X_{ne}$ , please use equation shown above.



$$X_{na} = 0.5 + a/(6 \cdot h)$$

Where  $a_m \leq a \leq a_c$

$$a_c = 3 \cdot h$$

Note: Tabled values are based on the nominal effective depth,  $h$  shown in the installation details. For other values of  $X_{na}$ , please use equation shown above.

### Checkpoint 2

**Design reduced ultimate cracked concrete tensile capacity  $\phi N_{urc}$**

$$\phi N_{urc} = \phi N_{uc} \cdot X_{ncr} \cdot X_{nc} \cdot X_{ne} \cdot X_{na}$$

# AnkaScrew™ Xtrem™

## STRENGTH LIMIT STATE DESIGN

### STEP 3

#### Verify Non-cracked & cracked concrete tensile resistance - per anchor

Table 3a Reduced characteristic ultimate steel tensile capacity,  $\phi N_{usr}$  (kN) where  $\phi_n = (1/1.5) = 0.67$

Anchor size, db	6	8	10	12
AnkaScrew™ Xtrem™	9.3	18.0	30.0	44.7

Table 3b-1 - Reduced characteristic ultimate pull-out capacity,  $\phi N_{up}$  (kN)  $\phi_p = 0.67, f'c = 32$  MPa

Anchor size, d <sub>b</sub>	6	8	10	12
Drill hole dia, d <sub>h</sub> (mm)	6	8	10	12
Effective depth, h (mm)				
31	3.3			
35		6.1		
43		9.8	9.8	
44	7.3			
50				13.0
52		13.0		
60			16.3	
67				N/A
68			21.1	
80				N/A

Table 3b-2 Cracked Concrete effect, pull-out,  $X_{pcr}$

Anchor size, db	6	8	10	12
Effective Depth, h (mm)	$X_{pcr}$			
31	0.50			
35		0.67		
43		0.75	0.75	
44	0.44			
50				0.75
52		0.75		
60			N/A*	
67				N/A*
68			N/A*	
80				N/A*

\*Governed by cracked concrete tensile capacity

For Non-Cracked concrete  $X_{pcr} = 1$

### Checkpoint 3a

Design reduced ultimate pull-out capacity,  $\phi N_{urp}$

$$\phi N_{urp} = \phi N_{up} * X_{pcr} * X_{npc}$$

### Checkpoint 3b

Design reduced ultimate tensile capacity,  $\phi N_{ur}$

$$\phi N_{ur} = \text{minimum of } \phi N_{urc}, \phi N_{urp}, \phi N_{us}$$

Check  $N^*/\phi N_{ur} \leq 1$ ,

if not satisfied return to step 1

# AnkaScrew™ Xtrem™

## STRENGTH LIMIT STATE DESIGN

Mechanical Anchoring - AnkaScrew™ Xtrem™

### STEP 4

### Verify cracked concrete edge shear resistance - per anchor

Table 4a Reduced characteristic ultimate concrete edge shear capacity,  $\phi V_{uc}$  (kN),  $\phi = 1/1.5 = 0.67$ ,  $f'_c = 32$  MPa

Anchor size, $d_b$	6		8		
Effective Depth, $h$ (mm)	31	44	35	43	52
Edge distance, $e_m$					
40	3.4	3.6	3.6	3.7	3.9
50			4.9	5.0	5.2

Anchor size, $d_b$	10			12		
Effective Depth, $h$ (mm)	43	60	68	50	67	80
Edge distance, $e_m$						
50	5.2	5.5	5.7	5.5	5.9	6.1
70				8.6	9.1	9.4

For optimised performance data, please use Ramset iExpert Anchoring Software.

Table 4a-2 Cracked Concrete effect, shear,  $X_{vcr}$

Anchor size, $d_b$	6	8	10	12
$X_{vcr}$	0.7			

Table 4b Concrete compressive strength effect, concrete edge shear,  $X_{vc}$

$f'_c$ (MPa)	20	25	32	40	50
$X_{vc}$	0.82	0.90	1.00	1.16	1.27

Table 4c - Concrete load direction effect, concrete edge shear,  $X_{vd}$

Angle, $\alpha^\circ$	0-55	60	70	80	90-180
$X_{vd}$	1	1.1	1.2	1.5	2

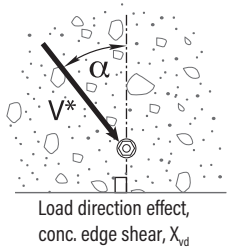


Table 4d - Anchor spacing and edge distance effect, concrete edge shear,  $X_{ve}$

For single anchor fastening  $X_{ve}$

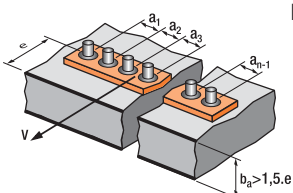
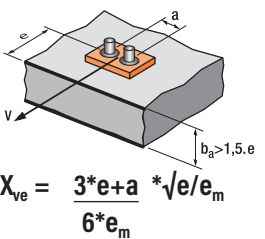
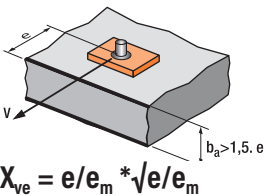
$e/e_m$	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2
$X_{ve}$	1.00	1.31	1.66	2.02	2.41	2.83	3.26	3.72	4.19	4.69	5.20	5.72

For 2 anchors fastening  $X_{ve}$

$e/e_m$	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2
$a/e_m$												
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

For 3 anchors fastening and more  $X_{ve}$

$$X_{ve} = \frac{3 \cdot e + a_1 + a_2 + a_3 + \dots + a_{n-1}}{3 \cdot n \cdot e_m} \cdot \sqrt{e/e_m}$$



# AnkaScrew™ Xtrem™

## STRENGTH LIMIT STATE DESIGN

Table 4e Reduced characteristic ultimate concrete pryout capacity,  $\phi V_{ucp}$  (kN),  $\phi = 1/1.5 = 0.67$ ,  $f'_c = 32$  MPa

Anchor size, db	6	8	10	12
Effective depth, h (mm)				
31	7.2			
35		8.6		
43		11.7	11.7	
44	12.1			
50				14.7
52		15.6		
60			38.6	
67				45.5
68			46.5	
80				59.4

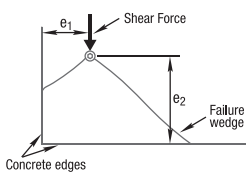


Table 4f Anchor at a corner effect, concrete edge shear,  $X_{vs}$

Note: For  $e_1/e_2 > 1.25$ ,  $X_{vs} = 1.0$

Edge distance, $e_2$ (mm)	25	30	35	50	60	75	125	200	300	400	600	900
Edge distance, $e_1$ (mm)												
25	0.86	0.77	0.70	0.58	0.53	0.49	0.41	0.37	0.35	0.34	0.32	0.32
30	0.97	0.86	0.78	0.64	0.58	0.52	0.43	0.38	0.36	0.34	0.33	0.32
35	1.00	0.95	0.86	0.69	0.63	0.56	0.46	0.40	0.37	0.35	0.33	0.32
50	1.00	1.00	1.00	0.86	0.77	0.67	0.52	0.44	0.39	0.37	0.35	0.33
60	1.00	1.00	1.00	0.97	0.86	0.75	0.57	0.47	0.41	0.38	0.36	0.34
75	1.00	1.00	1.00	1.00	1.00	0.86	0.64	0.51	0.44	0.41	0.37	0.35
125	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.65	0.53	0.48	0.42	0.38
200	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.67	0.58	0.49	0.42
300	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.72	0.58	0.49
400	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.67	0.55
500	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.77	0.61
600	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.67
900	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.86

Checkpoint **4a**

Design reduced ultimate concrete edge shear capacity,  $\phi V_{urc}$

$$\phi V_{urc} = \phi V_{uc} * X_{vcr} * X_{vc} * X_{vd} * X_{ve} * X_{vs}$$

Checkpoint **4b**

Design reduced ultimate concrete pryout capacity,  $\phi V_{urcp}$

$$\phi V_{urcp} = \phi V_{ucp} * X_{ncr} * X_{nc} * X_{ne} * X_{na}$$

STEP **5**

Verify cracked concrete shear resistance - per anchor

Table 5a Reduced characteristic ultimate steel shear capacity,  $\phi V_{usr}$  (kN) where  $\phi_v = 0.8$

Anchor size, db	6			8		
	Effective depth, h (mm)	31	44	35	43	52
AnkaScrew™ Xtrem™		5.6	5.6	10.8	10.8	13.6

Anchor size, db	10			12			
	Effective depth, h (mm)	43	60	68	50	67	80
AnkaScrew™ Xtrem™		18.0	27.2	27.2	26.8	33.6	33.6

Checkpoint **5**

Design reduced ultimate tensile capacity,  $\phi V_{ur}$

$$\phi V_{ur} = \text{minimum of } \phi V_{urc}, \phi V_{urcp}, \phi V_{us}$$

Check  $V^*/\phi V_{ur} \leq 1$ ,

if not satisfied return to step 1

# AnkaScrew™ Xtrem™

## STRENGTH LIMIT STATE DESIGN

### STEP 6 Combined Loading

#### Checkpoint 6

Check

$$N^*/\phi N_{ur} + V^*/\phi V_{ur} \leq 1.2,$$

if not satisfied return to step 1

#### Specify

Ramset™ AnkaScrew™ Xtrem™ Anchor,  
(Anchor Size) (Part Number)  
Maximum fixed thickness to be (t) mm.

#### Example

Ramset™ AnkaScrew™ Xtrem™ Anchor, 12mm AS12110X.  
Maximum fixed thickness to be 20mm.  
To be installed in accordance to Ramset™ Installation  
Instructions..

Use Ramset™ iExpert Anchor Software for optimised calculation or where a greater range of anchor layout detail is needed.