European Technical Assessment	ETA-21/0973 of 17 December 2021

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	Ramset TruBolt Xtrem / TruBolt Xtrem SS
Product family to which the construction product belongs	Mechanical fasteners for use in concrete
Manufacturer	Ramset 1 Ramset Drive, Chirnside Parc VIC AUSTRALIA 3116 AUSTRALIEN
Manufacturing plant	Plant 1
This European Technical Assessment contains	32 pages including 3 annexes which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	EAD 330232-01-0601, Edition 05/2021

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Specific Part

1 Technical description of the product

The Ramset TruBolt Xtrem / TruBolt Xtrem SS Torque-controlled expansion anchor is made of galvanized steel (TruBolt Xtrem) or stainless steel (TruBolt Xtrem SS) which is placed into a drilled hole and anchored by application of the installation torque.

The product description is given in Annex A.

2 Specification of the intended use in accordance with the applicable European Assessment Document

The performances given in Section 3 are only valid if the fastener is used in compliance with the specifications and conditions given in Annex B.

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the fastener of at least 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

3 Performance of the product and references to the methods used for its assessment

3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic resistance to tension load (static and quasi-static loading) Method A	See Annex B4 to B5, C1 to C4
Characteristic resistance to shear load (static and quasi-static loading)	See Annex C5 to C6
Displacements and Durability	See Annex C7 to C9
Characteristic resistance and displacements for seismic performance category C1 and C2	See Annex C10 to C15

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire	See Annex C16 to C18

3.3 Aspects of durability linked with the Basic Works Requirements

Essential characteristic	Performance
Durability	See Annex B1

4   Assessment and verification of constancy of performance (AVCP) system applied, with reference to its legal base

In accordance with the European Assessment Document EAD 330232-01-0601 the applicable European legal act is: [96/582/EC].
The system to be applied is: 1

5   Technical details necessary for the implementation of the AVCP system, as provided for in the applicable European Assessment Document

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with Deutsches Institut für Bautechnik.

Issued in Berlin on 17 December 2021 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock   *beglaubigt:*
Head of Section   Johanna Badershneider

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Product and intended
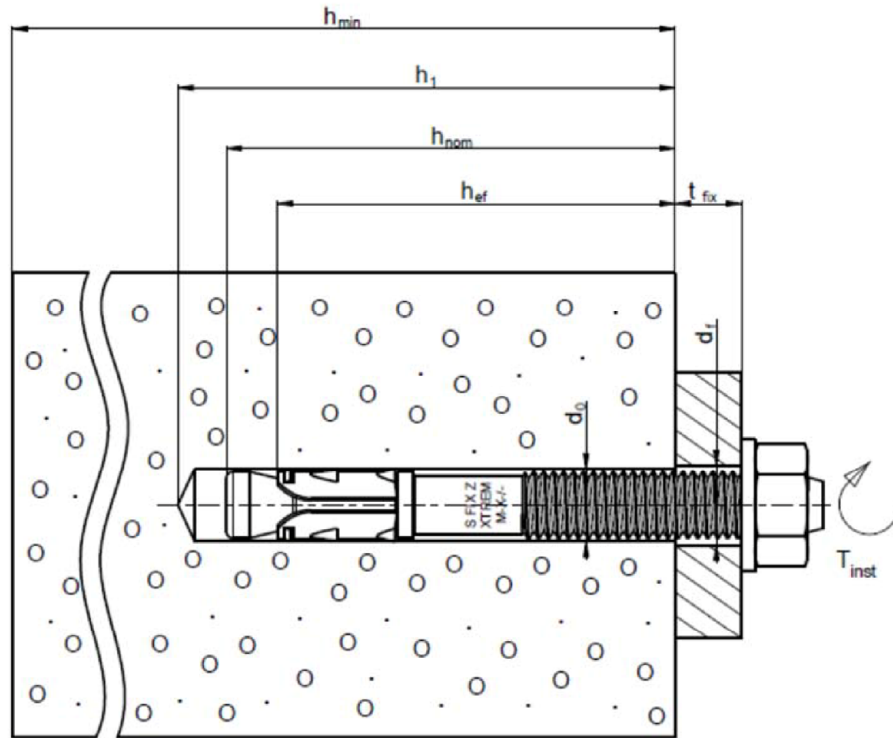
|		
h_{min}	:	Minimum thickness of concrete member
h_1	:	Depth of drilled hole to deepest point
d_0	:	Diameter of drilled hole
d_f	:	Diameter of clearance hole in the fixture
h_{nom}	:	Installation depth
h_{ef}	:	Effective embedment depth
t_{fix}	:	Thickness of the fixture
T_{inst}	:	Installation torque

Ramset TruBolt Xtrem, Ramset TruBolt Xtrem SS **Torque-controlled expansion anchor**	**Annex A1**
Product description **Installation condition**	

Different parts of the fastener:

• Size M8 - Galvanized steel version

Code letter   ②   ①   ③   ④
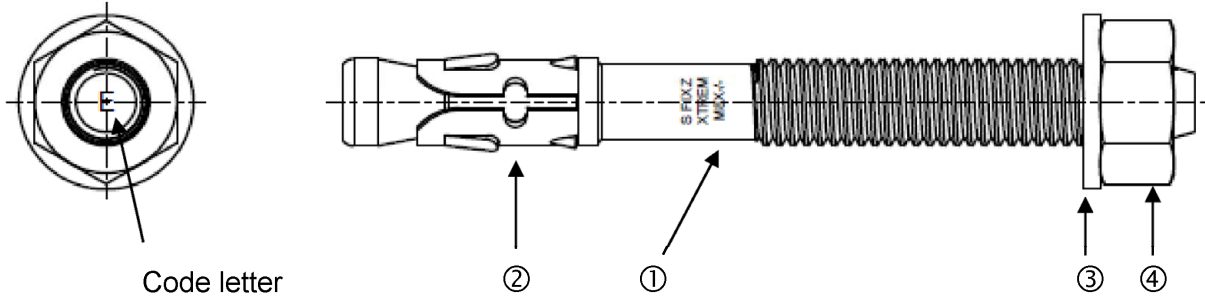
• Size M10 to M20 - Galvanized steel version

L

Code letter   ②   ①   ③   ④
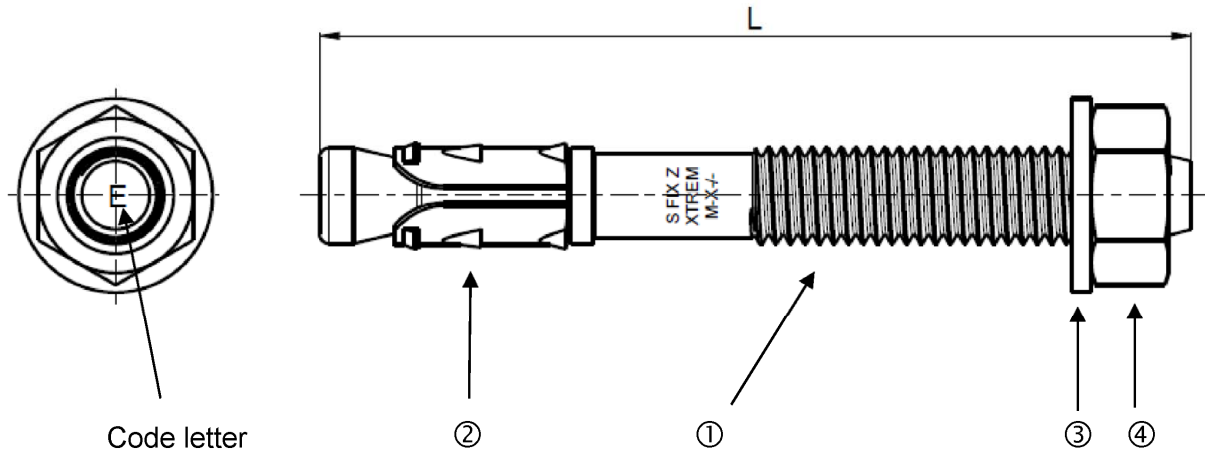
Designation of ① to ④, see Table A1, Annex A4

Marking e.g.:   Ramset TruBolt Xtrem 10x100/40-20
         S TRUBOLT XTREM :   Marking
      M10 :   Size of fastener
      100 :   Length of the bolt
      40 :   Maximum thickness of the fixture for Reduced Embedment depth $h_{nom,2}$
      20 :   Maximum thickness of the fixture for maximum embedment depth $h_{nom,1}$

Ramset TruBolt Xtrem, Ramset TruBolt Xtrem SS **Torque-controlled expansion anchor**	**Annex A2**
Product description **Product and marking**	

- Size M8 - Stainless steel version

Marking impact number   ②   ①   ③ ④
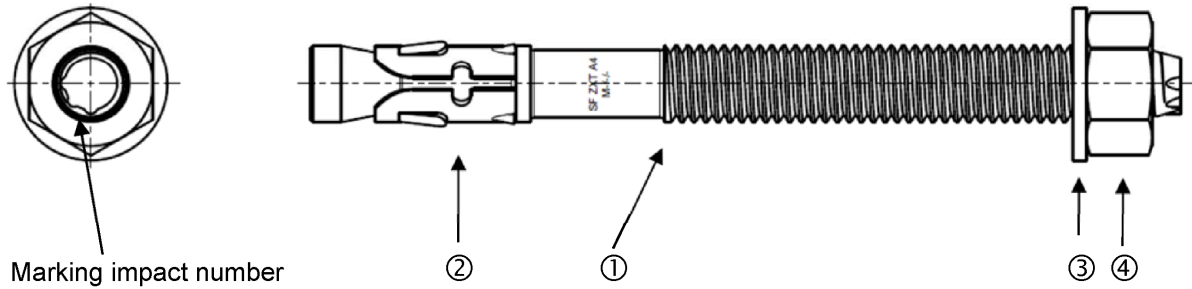
- Size M10 to M16 - Stainless steel version

Marking impact number   ②   ①   ③ ④
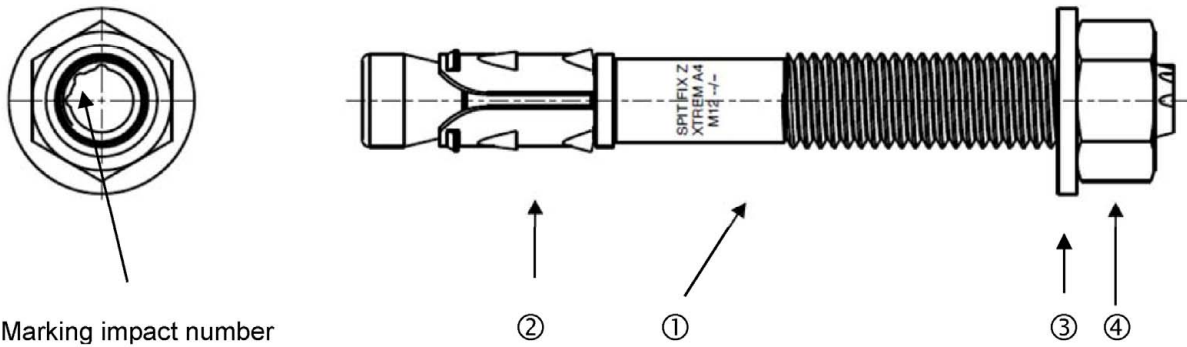
Designation of ① to ④, see Table A2, Annex A4.

Marking e.g.:   Ramset TruBolt Xtrem SS M10x95/35-15

S TRUBOLT XTREM SS:	Marking
A4 :	Stainless steel
M10 :	Size of fastener
95 :	Length of the bolt
35 :	Maximum thickness of the fixture for Reduced Embedment depth $h_{nom,2}$
15 :	Maximum thickness of the fixture for maximum embedment depth $h_{nom,1}$

|	
Ramset TruBolt Xtrem, Ramset TruBolt Xtrem SS **Torque-controlled expansion anchor**	
Product description **Product and marking**	**Annex A3**

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Table A1: Materials

Part (see Annex A2 & A3)	Designation	Material
TruBolt Xtrem (Galvanized steel version)		
①	Bolt	M8 : Carbon steel, Zinc electroplated (> 5µm), EN ISO 4042:2018
		M10 - M20 : Carbon steel, Zinc electroplated (>5µm) EN ISO 4042:2018, coated
②	Clip	M8 : Stainless steel (1.4404), scouring
		M10 - M20 : Carbon steel Zinc electroplated (> 5µm) EN ISO 4042:2018
③	Washer[1]	M8-M20 : EN ISO 7092:2000, Zinc electroplated (> 5µm) EN ISO 4042:2018
④	Nut	M8 - M10 : Steel , strength class 8, ISO 898-2:2012, Zinc electroplated (> 5µm) EN ISO 4042:2018
		M12 - M20 : Steel , strength class 8, ISO 898-2:2012, Zinc electroplated (> 5µm) EN ISO 4042:2018, coated
TruBolt Xtrem SS (Stainless steel version)		
①	Bolt	M8 - M16 : Stainless steel A4, EN 10088-3:2014, coated
②	Clip	M8 - M16 : Stainless steel A4, EN 10088-3:2014
③	Washer	M8 - M16 : EN ISO 7092:2000, Stainless steel A4
④	Nut	M8 - M16 : Stainless steel A4-80, EN ISO 3506-2:2020, coated

[1]   Different washer versions are available (see Table A2)

Table A2 : Washer dimensions

Washer type		M8	M10	M12	M16	M20
Narrow (standard version)	d_1 [mm] inner Ø	8,4	10,5	13	17	21
	d_2 [mm] outer Ø	16	20	24	30	36
Broad	d_1 [mm] inner Ø	8,4	10,5	13	17	21
	d_2 [mm] outer Ø	22.5	22	32	40	50
X-broad acc. to EN ISO 7094:2000	d_1 [mm] inner Ø	9	11	13,5	17,5	-
	d_2 [mm] outer Ø	28	34	44	56	-

Ramset TruBolt Xtrem, Ramset TruBolt Xtrem SS Torque-controlled expansion anchor	**Annex A4**
Product descripion Material, Washer dimensions	

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Specifications of intended use

Table B1 : Overview of use and performance categories TruBolt Xtrem, TruBolt Xtrem SS

Fasteners subject to	TruBolt Xtrem, TruBolt Xtrem SS	
Static, quasi-static	TruBolt Xtrem TruBolt Xtrem SS	M8 bis M20 M8 bis M16
Seismic performance category C1	TruBolt Xtrem TruBolt Xtrem SS	M8 bis M20 M8 bis M16
Seismic performance category C2	TruBolt Xtrem TruBolt Xtrem SS	M10 bis M20 (für $h_{ef,1}$) M10 bis M16 (für $h_{ef,1}$)
Fire exposure	TruBolt Xtrem TruBolt Xtrem SS	M8 bis M20 M8 bis M16

Base materials:
- Compacted reinforced or unreinforced normal weight concrete without fibres of strength classes C20/25 to C50/60 according to EN 206:2013 + A1:2016
- Cracked or uncracked concrete

Table B2: Use conditions (Environmental conditions)

TruBolt Xtrem Galvanized steel version TruBolt Xtrem SS Stainless steel version	Structure subject to dry internal conditions,
TruBolt Xtrem SS Stainless steel version	Structures subject to all other conditions corrosion resistance class CRC III according to EN 1993-1-4:2015 Annex A Table A.3

Design:
- The fasteners are designed in accordance with EN 1992-4 : 2018 and EOTA Technical Report TR 055, 02/2018 under the responsibility of an engineer experienced in fasteners and concrete work
- Verifiable calculation notes and drawings are prepared taking account of the loads to be anchored. The position of the fastener is indicated on the design drawings (e.g. position of the fastener relative to reinforcement or to supports, etc.).

Installation:
- Fastener installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.
- Use of the fastener only as supplied by the manufacturer without exchanging the components of an fastener.
- Fastener installation in accordance with the manufacturer's specifications and drawings and using the appropriate tools.
- Effective anchorage depth, edge distances and spacing not less than the specified values without minus tolerances.

In case of aborted hole, drilling of new hole at a minimum distance away of twice the depth of the aborted hole, or smaller distance provided that the aborted drill hole is filled with high strength mortar and no shear or oblique tension loads in the direction of aborted hole.

Ramset TruBolt Xtrem, Ramset TruBolt Xtrem SS Torque-controlled expansion anchor	**Annex B1**
Intended use **Specifications**	

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Table B3: Setting data for TruBolt Xtrem

Ramset TruBolt Xtrem Galvanized Steel version	L [mm]	Code letter	Standard embedment					Reduced embedment					Diameter - T_{inst}		
			$h_{nom,1}$ [mm]	$h_{ef,1}$ [mm]	$t_{fix,max,1}$ [mm]	$h_{1,1}$ [mm]	$h_{min,1}$ [mm]	$h_{nom,2}$ [mm]	$h_{ef,2}$ [mm]	$t_{fix,max,2}$ [mm]	$h_{1,2}$ [mm]	$h_{min,2}$ [mm]	d_0 [mm]	d_f [mm]	T_{inst} [Nm]
(0)			(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
8x65/5	68	B	55	46	5	65	100	-	-	-	-	-	8	9	20
8x75/15	78	D			15										
8x90/30	93	E			30										
8x120/60	123	G			60										
8x130/70	133	H			70										
8x140/80	143	I			80										
10x85/25-5	85	D	68	60	5	75	120	48	40	25	55	100	10	12	45
10x90/30-10	90	E			10					30					
10x100/40-20	100	F			20					40					
10x120/60-40	120	G			40					60					
10x140/80-60	140	I			60					80					
10x160/100-80	160	-			80					100					
12x105/30-10	100	F	80	70	10	90	140	60	50	30	70	100	12	14	60
12x115/40-20	115	G			20					40					
12x135/60-40	135	I			40					60					
12x155/80-60	155	J			60					80					
12x180/105-85	180	L			85					105					
16x145/45-25	142,5	I	98	85	25	110	170	78	65	45	90	130	16	18	110
16x170/70-50	167,5	K			50					70					
16x180/80-60	177,5	L			60					80					
20x170/30	168	K	113	100	30	130	200	-	-	-	-	-	20	22	160
20x200/60	198	M			60										
20x220/80	218	O			80										

Ramset TruBolt Xtrem, Ramset TruBolt Xtrem SS
Torque-controlled expansion anchor

Intended use

Specifications

Annex B2

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Table B4: Setting data for for TruBolt Xtrem SS

Ramset TruBolt Xtrem SS Stainless steel version	L [mm]	Marking impact number	Standard embedment					Reduced embedment					Diameter - T_{inst}		
			$h_{nom,1}$ [mm]	$h_{ef,1}$ [mm]	$t_{fix,max,1}$ [mm]	$h_{1,1}$ [mm]	$h_{min,1}$ [mm]	$h_{nom,2}$ [mm]	$h_{ef,2}$ [mm]	$t_{fix,max,2}$ [mm]	$h_{1,2}$ [mm]	$h_{min,2}$ [mm]	d_0 [mm]	d_f [mm]	T_{inst} [Nm]
(0)			(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
8x55/5	56	0	55	48	-	65	100	42	35	-	52	100	8	9	20
8x70/20-7	71	1			7					20					
8x90/40-27	91	3			27					40					
10x70/10	70	1	68	60	10	75	120	48	40	-	55	100	10	12	45
10x95/35-15	95	2			15					35					
10x105/45-25	105	3			25					45					
10x130/70-50	130	4			50					70					
12x95/20	95	1	80	70	20	90	140	60	50	-	70	100	12	14	75
12x110/35-15	110	2			15					35					
12x120/45-25	120	3			25					45					
12x140/65-45	140	4			45					65					
16x120/20	120	1	98	85	20	110	170	78	65	-	90	130	16	18	110
16x140/40-20	140	2			20					40					

Dimensions illustrated in Annex A1 and A2: Installation

- (0) Total length of the bolt, L [mm]
- (1) Minimum installation depth, h_{nom} [mm]
- (2) Effective anchorage depth, h_{ef} [mm]
- (3) Maximum thickness of the fixture, $t_{fix,max}$ [mm]
- (4) Depth of drilled hole to deepes point, h_1 [mm]
- (5) Minimum thickness of the concrete member, h_{min} [mm]
- (6) Diameter of drilled hole, d_0 [mm]
- (7) Diameter of clearance hole in the fixture, d_f [mm]
- (8) Required torque moment, T_{inst} [Nm]

Ramset TruBolt Xtrem, Ramset TruBolt Xtrem SS Torque-controlled expansion anchor	
Intended use **Specifications**	**Annex B3**

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Table B5 : Minimum member thickness, spacing and edge distance for TruBolt Xtrem

Fastener size			M8	M10	M12	M16	M20
TruBolt Xtrem – Standard embedment depth							
Effective anchorage depth	$h_{ef,1}$	[mm]	46	60	70	85	100
Minimum thickness of concrete member	$h_{min,1}$	[mm]	100	120	140	170	200
Cracked concrete							
Minimum spacing	s_{min}	[mm]	50	55	60	90	100
	for c ≥	[mm]	65	70	100	100	120
Minimum edge distance	c_{min}	[mm]	50	55	60	80	100
	for s ≥	[mm]	75	90	145	110	130
Uncracked concrete							
Minimum spacing	s_{min}	[mm]	50	55	60	90	130
	for c ≥	[mm]	90	70	100	105	120
Minimum edge distance	c_{min}	[mm]	50	60	60	90	100
	for s ≥	[mm]	75	120	145	140	160
TruBolt Xtrem – reduced embedment depth							
Effective anchorage depth	$h_{ef,2}$	[mm]	- [1]	40	50	65	- [1]
Minimum thickness of concrete member	$h_{min,2}$	[mm]	- [1]	120	140	170	- [1]
Cracked concrete							
Minimum spacing	s_{min}	[mm]	- [1]	55	60	90	- [1]
	for c ≥	[mm]	- [1]	70	100	100	- [1]
Minimum edge distance	c_{min}	[mm]	- [1]	55	60	80	- [1]
	for s ≥	[mm]	- [1]	90	145	110	- [1]
Uncracked concrete							
Minimum spacing	s_{min}	[mm]	- [1]	55	60	90	- [1]
	for c ≥	[mm]	- [1]	70	100	105	- [1]
Minimum edge distance	c_{min}	[mm]	- [1]	60	60	90	- [1]
	for s ≥	[mm]	- [1]	120	145	140	- [1]

[1] No performance assessed

Ramset TruBolt Xtrem, Ramset TruBolt Xtrem SS **Torque-controlled expansion anchor**	
Intended use **Minimum thickness of member, spacing and edge distance**	**Annex B4**

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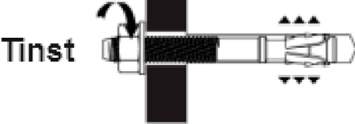**Table B6 : Minimum member thickness, spacing and edge distance for for TruBolt Xtrem SS**
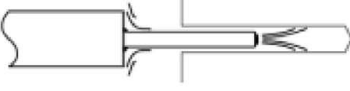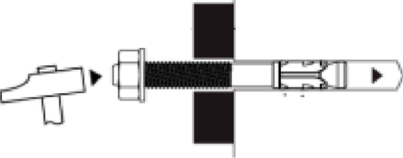
Fastener size			M8	M10	M12	M16
TruBolt Xtrem SS– Standard embedment depth						
Effective anchorage depth	$h_{ef,1}$	[mm]	46	60	70	85
Minimum thickness of concrete member	$h_{min,1}$	[mm]	100	120	140	170
Cracked concrete						
Minimum spacing	s_{min}	[mm]	60	55	60	90
	for c ≥	[mm]	60	65	100	100
Minimum edge distance	c_{min}	[mm]	60	55	60	80
	for s ≥	[mm]	60	90	145	110
Uncracked concrete						
Minimum spacing	s_{min}	[mm]	50	55	60	90
	for c ≥	[mm]	60	65	100	105
Minimum edge distance	c_{min}	[mm]	60	60	60	90
	for s ≥	[mm]	50	120	145	140
TruBolt Xtrem SS– reduced embedment depth						
Effective anchorage depth	$h_{ef,2}$	[mm]	35	40	50	65
Minimum thickness of concrete member	$h_{min,2}$	[mm]	100	120	140	170
Cracked concrete						
Minimum spacing	s_{min}	[mm]	60	55	60	90
	for c ≥	[mm]	60	65	100	100
Minimum edge distance	c_{min}	[mm]	60	55	60	80
	for s ≥	[mm]	60	90	145	110
Uncracked concrete						
Minimum spacing	s_{min}	[mm]	60	55	60	90
	for c ≥	[mm]	60	65	100	105
Minimum edge distance	c_{min}	[mm]	60	60	60	90
	for s ≥	[mm]	60	120	145	140

Ramset TruBolt Xtrem, Ramset TruBolt Xtrem SS Torque-controlled expansion anchor	**Annex B5**
Intended used Minimum thickness of member, spacing and edge distance	

Installation instruction

	Drill hole perpendicular to concrete surface, positioning of the drill holes without damaging the reinforcement. In case of aborted hole : new drilling at a minimum distance away of twice the depth of the aborted hole or smaller distance if the aborted drill hole is filled with high strength mortar and if under shear or oblique tension load it is not in the direction of the load application.
	blow out dust beginning from the depth of the bore hole
	Drive in fastener, such that h_{ef} is met. This is ensured, if the thickness of fixture is not greater than the maximum thickness of fixture marked on the fastener according to Annex B2.
	Apply installation torque T_{inst} by using calibrated torque wrench.

**Ramset TruBolt Xtrem, Ramset TruBolt Xtrem SS
Torque-controlled expansion anchor**

Intended used

Installation instructions

Annex B6

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**Table C1 : Characteristic resistance under tension loads for TruBolt Xtrem
for static and quasi-static actions in cracked and uncracked concrete**

Fastener size			M8	M10	M12	M16	M20
TruBolt Xtrem							
Steel failure							
Characteristic resistance	$N_{Rk,s}$	[kN]	22,1	29,3	38,2	64,7	99,1
Partial factor	γ_{Ms}[1]	[-]	1,4	1,48	1,48	1,48	1,5
Pull-out failure							
Standard Embedment depth $h_{ef,1}$							
Effective anchorage depth	$h_{ef,1}$	[mm]	46	60	70	85	100
Characteristic resistance in uncracked concrete C20/25	$N_{Rk,p}$	[kN]	9	20	30	40	49,2
Characteristic resistance in cracked concrete C20/25	$N_{Rk,p}$	[kN]	5	9	16	20	30
Partial factor	γ_{inst}	[-]	1,0				
Reduced Embedment depth $h_{ef,2}$							
Effective anchorage depth	$h_{ef,2}$	[mm]	- [2]	40	50	65	- [2]
Characteristic resistance in uncracked concrete C20/25	$N_{Rk,p}$	[kN]	- [2]	12,4	17,4	25,8	- [2]
Characteristic resistance in cracked concrete C20/25	$N_{Rk,p}$	[kN]	- [2]	8,7	12,2	18,0	- [2]
Partial factor	γ_{inst}	[-]	1,0				
Increasing factor for $N_{Rk,p}$ $N_{Rk,p} = \psi_c \cdot N_{Rk,p}$ (C20/25)	ψ_c	C25/30	1,12	1,05	1,05	1,08	1,12
		C30/37	1,22	1,08	1,08	1,15	1,22
		C35/45	1,32	1,12	1,12	1,22	1,32
		C40/50	1,41	1,15	1,15	1,27	1,41
		C45/55	1,50	1,18	1,18	1,33	1,50
		C50/60	1,58	1,20	1,20	1,38	1,58

[1]   In absence of other national regulation,
[2]   No performance assessed

**Ramset TruBolt Xtrem, Ramset TruBolt Xtrem SS
Torque-controlled expansion anchor**

**Characteristic resistance under tension loads for static and
quasi-static actions**

Annex C1

Table C1 continued

Fastener size			M8	M10	M12	M16	M20
TruBolt Xtrem							
Concrete cone failure and splitting failure							
Standard Embedment depth $h_{ef,1}$							
Effective anchorage depth	$h_{ef,1}$	[mm]	46	60	70	85	100
Factor for uncracked concrete	$k_{ucr,N}$	[-]	11,0				
Factor for cracked concrete	$k_{cr,N}$	[-]	7,7				
Characteristic resistance	$N^0_{Rk,sp}$	[kN]	$\min(N_{Rk,p}; N^0_{Rk,c}{}^{(2)})$				
Spacing	$s_{cr,N}$	[mm]	138	180	210	255	300
	$s_{cr,sp}$	[mm]	276	226	252	306	370
Edge distance	$c_{cr,N}$	[mm]	69	90	105	127,5	150
	$c_{cr,sp}$	[mm]	138	113	126	153	185
Partial safety factor	γ_{inst}	[-]	1,0				
Reduced Embedment depth $h_{ef,2}$							
Effective anchorage depth	$h_{ef,2}$	[mm]	- [1]	40	50	65	- [1]
Factor for uncracked concrete	$k_{ucr,N}$	[-]	11,0				
Factor for cracked concrete	$k_{cr,N}$	[-]	7,7				
Characteristic resistance	$N^0_{Rk,sp}$	[kN]	$\min(N_{Rk,p}; N^0_{Rk,c}{}^{(2)})$				
Spacing	$s_{cr,N}$	[mm]	- [1]	120	150	195	- [1]
	$s_{cr,sp}$	[mm]	- [1]	226	252	306	- [1]
Edge distance	$c_{cr,N}$	[mm]	- [1]	60	75	97,5	- [1]
	$c_{cr,sp}$	[mm]	- [1]	113	126	153	- [1]
Partial factor	γ_{inst}	[-]	1,0				

[1] No performance assessed

[2] $N^0_{Rk,c}$ according to EN 1992-4:2018

Ramset TruBolt Xtrem, Ramset TruBolt Xtrem SS Torque-controlled expansion anchor	Annex C2
Characteristic resistance under tension loads for static and quasi-static actions	

**Table C2 : Characteristic resistance under tension loads for TruBolt Xtrem SS
for static and quasi-static actions in cracked and uncracked concrete**

Fastener size			M8	M10	M12	M16
TruBolt Xtrem SS						
Steel failure						
Characteristic resistance	$N_{Rk,s}$	[kN]	16,7	36,0	52,3	91,1
Partial factor	γ_{Ms} [1]	[-]	1,81	1,76	1,76	2,11
Pull-out failure						
Standard Embedment depth $h_{ef,1}$						
Effective anchorage depth	$h_{ef,1}$	[mm]	48	60	70	85
Characteristic resistance in uncracked concrete C20/25	$N_{Rk,p}$	[kN]	12	20	30	40
Characteristic resistance in cracked concrete C20/25	$N_{Rk,p}$	[kN]	4	9	16	20
Partial factor	γ_{inst}	[-]	1,0			
Reduced Embedment depth $h_{ef,2}$						
Effective anchorage depth	$h_{ef,2}$	[mm]	35	40	50	65
Characteristic resistance in uncracked concrete C20/25	$N_{Rk,p}$	[kN]	9	12,4	17,4	25,8
Characteristic resistance in cracked concrete C20/25	$N_{Rk,p}$	[kN]	3	8,7	12,2	18,0
Partial factor	γ_{inst}	[-]	1,0			
Increasing factor for $N_{Rk,p}$ $N_{Rk,p} = \psi_c \cdot N_{Rk,p}$ (C20/25)	ψ_c	C25/30	1,12	1,05	1,05	1,08
		C30/37	1,22	1,08	1,08	1,15
		C35/45	1,32	1,12	1,12	1,22
		C40/50	1,41	1,15	1,15	1,27
		C45/55	1,50	1,18	1,18	1,33
		C50/60	1,58	1,20	1,20	1,38

[1]   In absence of other national regulation,

Ramset TruBolt Xtrem, Ramset TruBolt Xtrem SS **Torque-controlled expansion anchor**	**Annex C3**
Characteristic resistance under tension load for static and quasi-static actions	

Table C2 continued

Fastener size			M8	M10	M12	M16
TruBolt Xtrem SS						
Concrete cone failure and splitting failure						
Standard Embedment depth $h_{ef,1}$						
Effective anchorage depth	$h_{ef,1}$	[mm]	48	60	70	85
Factor for uncracked concrete	$k_{ucr,N}$	[-]	11,0			
Factor for cracked concrete	$k_{cr,N}$	[-]	7,7			
Characteristic resistance	$N^0_{Rk,sp}$	[kN]	$\min(N_{Rk,p}\,;\,N^0_{Rk,c}\,^{[1]})$			
Spacing	$s_{cr,N}$	[mm]	144	180	210	255
	$s_{cr,sp}$	[mm]	290	226	252	306
Edge distance	$c_{cr,N}$	[mm]	72	90	105	127,5
	$c_{cr,sp}$	[mm]	145	113	126	153
Partial factor	γ_{inst}	[-]	1,0			
Reduced Embedment depth $h_{ef,2}$						
Effective anchorage depth	$h_{ef,2}$	[mm]	35	40	50	65
Factor for uncracked concrete	$k_{ucr,N}$	[-]	11,0			
Factor for cracked concrete	$k_{cr,N}$	[-]	7,7			
Characteristic resistance	$N^0_{Rk,sp}$	[kN]	$\min(N_{Rk,p}\,;\,N^0_{Rk,c}\,^{[1]})$			
Spacing	$s_{cr,N}$	[mm]	105	120	150	195
	$s_{cr,sp}$	[mm]	210	226	252	306
Edge distance	$c_{cr,N}$	[mm]	52,5	60	75	97,5
	$c_{cr,sp}$	[mm]	105	113	126	153
Partial factor	γ_{inst}	[-]	1,0			

[1] $N^0_{Rk,c}$ according to EN 1992-4:2018

Ramset TruBolt Xtrem, Ramset TruBolt Xtrem SS **Torque-controlled expansion anchor**	**Annex C4**
Characteristic resistance under tension loads for static and quasi-static actions	

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**Table C3: Characteristic resistance under shear loads for TruBolt Xtrem
for static and quasi-static actions in cracked and uncracked concrete**

Fastener size			M8	M10	M12	M16	M20
TruBolt Xtrem							
Steel failure without lever arm							
Characteristic resistance	$V^0_{Rk,s}$	[kN]	13,7	16	23	45	61
Partial factor	γ_{Ms} [1]	[-]	1,5	1,27	1,27	1,25	1,50
Steel failure with lever arm							
Characteristic resistance	$M^0_{Rk,s}$	[N,m]	28	52,8	91,3	194,0	315,7
Partial factor	γ_{Ms} [1]	[-]	1,5	1,27	1,27	1,25	1,50
Concrete pry-out failure							
Standard Embedment depth $h_{ef,1}$							
Effective anchorage depth	$h_{ef,1}$	[mm]	46	60	70	85	100
Pryout factor	k_8	[-]	1	2	2	2	2
Partial factor	γ_{inst}	[-]	1,0				
Reduced Embedment depth $h_{ef,2}$							
Effective anchorage depth	$h_{ef,2}$	[mm]	– [2]	40	50	65	– [2]
Pryout factor	k_8	[-]	– [2]	1	1	2	– [2]
Partial safety factor	γ_{inst}	[-]	1,0				
Concrete edge failure							
Effective length of fastener under shear loading	$l_{f,1}$	[mm]	46	60	70	85	100
Effective length of fastener under shear loading with Reduced Embedment depth	$l_{f,2}$	[mm]	– [2]	40	50	65	– [2]
Outside diameter of fastener	d_{nom}	[mm]	8	10	12	16	20
Partial factor	γ_{inst}	[-]	1,0				

[1]   In absence of other national regulation.
[2]   No performance assessed

Ramset TruBolt Xtrem, Ramset TruBolt Xtrem SS Torque-controlled expansion anchor	**Annex C5**
Characteristic resistance under shear loads for static and quasi-static actions	

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Table C4: Characteristic shear resistance under shear loads for TruBolt Xtrem Ss for static and quasi-static actions in cracked and uncracked concrete

Fastener size			M8	M10	M12	M16
TruBolt Xtrem SS						
Steel failure without lever arm						
Characteristic resistance	$V^0_{Rk,s}$	[kN]	12,4	18,7	28,2	51,9
Partial factor	γ_{Ms} [1]	[-]	1,51	1,47	1,47	1,75
Steel failure with lever arm						
Characteristic resistance	$M^0_{Rk,s}$	[N,m]	25	44,9	77,5	187,5
Partial factor	γ_{Ms} [1]	[-]	1,51	1,47	1,47	1,75
Concrete pry-out failure						
Standard Embedment depth $h_{ef,1}$						
Effective anchorage depth	$h_{ef,1}$	[mm]	48	60	70	85
Pryout factor	k_8	[-]	1	2	2	2
Partial factor	γ_{inst}	[-]	1,0			
Reduced Embedment depth $h_{ef,2}$						
Effective anchorage depth	$h_{ef,2}$	[mm]	35	40	50	65
Pryout factor	k_8	[-]	1	1	1	2
Partial factor	γ_{inst}	[-]	1,0			
Concrete edge failure						
Effective length of fastener under shear loading	$l_{f,1}$	[mm]	48	60	70	85
Effective length of fastener under shear loading with Reduced Embedment depth	$l_{f,2}$	[mm]	35	40	50	65
Outside diameter of fastener	d_{nom}	[mm]	8	10	12	16
Partial factor	γ_{inst}	[-]	1,0			

[1]   In absence of other national regulation,

Ramset TruBolt Xtrem, Ramset TruBolt Xtrem SS Torque-controlled expansion anchor	
Characteristic resistance under shear loads for static and quasi-static actions	**Annex C6**

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Table C5 : Displacement under tension loads for static and quasi-static actions for TruBolt Xtrem

Fastener size			M8	M10	M12	M16	M20
TruBolt Xtrem							
Displacement under tension loading							
Standard Embedment depth $h_{ef,1}$							
Effective anchorage depth	$h_{ef,1}$	[mm]	46	60	70	85	100
Tension load in cracked concrete C20/25	N	[kN]	1,4	4,3	7,6	9,5	14,3
Displacements in cracked concrete under tension	δ_{N0}	[mm]	0,3	0,4	0,4	0,4	0,4
	$\delta_{N\infty}$	[mm]	1,3	1,6	1,7	1,7	1,7
Tension load in uncracked concrete C20/25	N	[kN]	3,6	9,5	14,3	19,0	23,8
Displacements in uncracked concrete under tension	δ_{N0}	[mm]	0,1	0,4	0,4	0,4	0,4
	$\delta_{N\infty}$	[mm]	1,3	1,6	1,7	1,7	1,7
Reduced Embedment depth $h_{ef,2}$							
Effective anchorage depth	$h_{ef,2}$	[mm]	- [1]	40	50	65	- [1]
Tension load in cracked concrete C20/25	N	[kN]	- [1]	4,1	5,8	8,6	- [1]
Displacements in cracked concrete under tension	δ_{N0}	[mm]	- [1]	0,3	0,3	0,4	- [1]
	$\delta_{N\infty}$	[mm]	- [1]	1,6	1,7	1,7	- [1]
Tension load in uncracked concrete C20/25	N	[kN]	- [1]	5,9	8,3	13,3	- [1]
Displacements in uncracked concrete under tension	δ_{N0}	[mm]	- [1]	0,3	0,3	0,4	- [1]
	$\delta_{N\infty}$	[mm]	- [1]	1,6	1,7	1,7	- [1]

[1] No performance assessed

Ramset TruBolt Xtrem, Ramset TruBolt Xtrem SS Torque-controlled expansion anchor	
Displacements under tension loadsfor static and quasi-static actions	**Annex C7**

Table C6 : Displacement under tension loads for static and quasi-static actions for TruBolt Xtrem SS

Fastener size			M8	M10	M12	M16
TruBolt Xtrem SS						
Displacement under tension loading						
Standard Embedment depth $h_{ef,1}$						
Effective anchorage depth	$h_{ef,1}$	[mm]	48	60	70	85
Tension load in cracked concrete C20/25	N	[kN]	1,6	4,3	7,6	9,5
Displacements in cracked concrete under tension	δ_{N0}	[mm]	0,6	0,4	0,4	0,4
	$\delta_{N\infty}$	[mm]	1,0	1,6	1,7	1,7
Tension load in uncracked concrete C20/25	N	[kN]	3,6	9,5	14,3	19,0
Displacements in uncracked concrete under tension	δ_{N0}	[mm]	0,1	0,4	0,4	0,4
	$\delta_{N\infty}$	[mm]	0,4	1,6	1,7	1,7
Reduced Embedment depth $h_{ef,2}$						
Effective anchorage depth	$h_{ef,2}$	[mm]	35	40	50	65
Tension load in cracked concrete C20/25	N	[kN]	1,2	4,1	5,8	8,6
Displacements in cracked concrete under tension	δ_{N0}	[mm]	0,4	0,3	0,3	0,4
	$\delta_{N\infty}$	[mm]	0,5	1,6	1,7	1,7
Tension load in uncracked concrete C20/25	N	[kN]	3,6	5,9	8,3	13,3
Displacements in uncracked concrete under tension	δ_{N0}	[mm]	0,1	0,3	0,3	0,4
	$\delta_{N\infty}$	[mm]	0,4	1,6	1,7	1,7

Ramset TruBolt Xtrem, Ramset TruBolt Xtrem SS **Torque-controlled expansion anchor**	
Displacements under tension loads for static and quasi-static actions	**Annex C8**

Table C7 : Displacement under shear loads for static and quasi-static actions for TruBolt Xtrem

Fastener size			M8	M10	M12	M16	M20
TruBolt Xtrem							
Displacement under shear loading							
Standard Embedment depth $h_{ef,1}$							
Effective anchorage depth	$h_{ef,1}$	[mm]	46	60	70	85	100
Shear load	V	[kN]	6,5	9	12,9	25,4	34,5
Displacements	δ_{V0}	[mm]	2,0	1,5	1,5	1,5	1,5
	$\delta_{V\infty}$	[mm]	3,0	2,3	2,3	2,3	2,3
Reduced Embedment depth $h_{ef,2}$							
Effective anchorage depth	$h_{ef,2}$	[mm]	- [1]	40	50	65	- [1]
Shear load	V	[kN]	- [1]	9,0	12,9	25,4	- [1]
Displacements	δ_{V0}	[mm]	- [1]	1,5	1,5	1,5	- [1]
	$\delta_{V\infty}$	[mm]	- [1]	2,3	2,3	2,3	- [1]

Table C8 : Displacement under shear loads for static and quasi-static actions for TruBolt Xtrem SS

Fastener size			M8	M10	M12	M16
TruBolt Xtrem SS						
Displacement under shear loading (cracked and uncracked concrete)						
Standard Embedment depth $h_{ef,1}$						
Effective anchorage depth	$h_{ef,1}$	[mm]	48	60	70	85
Shear load	V	[kN]	5,4	9,1	13,7	21,2
Displacements	δ_{V0}	[mm]	4,2	1,6	1,6	1,7
	$\delta_{V\infty}$	[mm]	5,1	2,4	2,4	2,6
Reduced Embedment depth $h_{ef,2}$						
Effective anchorage depth	$h_{ef,2}$	[mm]	- [1]	40	50	65
Shear load	V	[kN]	- [1]	9,1	13,7	21,2
Displacements	δ_{V0}	[mm]	- [1]	1,6	1,6	1,7
	$\delta_{V\infty}$	[mm]	- [1]	2,4	2,4	2,6

[1] No performance assessed

Ramset TruBolt Xtrem, Ramset TruBolt Xtrem SS Torque-controlled expansion anchor	Annex C9
Displacements under shear loads for static and quasi-static actions	

Table C9: Characteristic tension resistance for seismic loading for TruBolt Xtrem, category C1

Fastener size			M8	M10	M12	M16	M20
TruBolt Xtrem							
Steel failure							
Effective anchorage depth	$h_{ef,1}$	[mm]	46	60	70	85	100
Characteristic resistance	$N_{Rk,s,C1}$	[kN]	18,5	29,3	38,2	64,7	99,1
Pull-out failure							
Effective anchorage depth	$h_{ef,1}$	[mm]	46	60	70	85	100
Characteristic resistance	$N_{Rk,p,C1}$	[kN]	4,7	7,4	16,0	20,0	30,0

Table C10 : Characteristic tension resistances under seismic loading for TruBolt Xtrem SS, category C1

Fastener size			M8	M10	M12	M16
TruBolt Xtrem SS - Standard Embedment depth						
Steel failure						
Effective anchorage depth	$h_{ef,1}$	[mm]	48	60	70	85
Characteristic resistance	$N_{Rk,s,C1}$	[kN]	16,7	36,0	52,3	91,1
Pull-out failure						
Effective anchorage depth	$h_{ef,1}$	[mm]	48	60	70	85
Characteristic resistance	$N_{Rk,p,C1}$	[kN]	4,0	7,4	16,0	20,0

Ramset TruBolt Xtrem, Ramset TruBolt Xtrem SS Torque-controlled expansion anchor	Annex C10
Characteristic values of tension resistance under seismic actions, category C1	

Table C11 : Characteristic shear resistances for seismic loading for TruBolt Xtrem, category C1

Fastener size				M8	M10	M12	M16	M20
TruBolt Xtrem								
Steel failure								
Characteristic resistance		$V_{Rk,s,C1}$	[kN]	6	16	23	45	61
Factor for fasteners	with annular gap	α_{gap}	[-]	0,5				
	without annular gap	α_{gap}	[-]	- [1]				

[1] No performance assessed

Table C12 : Characteristic shear resistances for seismic loading for TruBolt Xtrem SS, category C1

Fastener size				M8	M10	M12	M16
TruBolt Xtrem SS							
Steel failure							
Characteristic resistance		$V_{Rk,s,C1}$	[kN]	5,7	12,2	17,8	33,7
Factor for fasteners	with annular gap	α_{gap}	[-]	0,5			
	without annular gap	α_{gap}	[-]	- [1]			

[1] No performance assessed

Ramset TruBolt Xtrem, Ramset TruBolt Xtrem SS Torque-controlled expansion anchor	Annex C11
Characteristic shear resistances under seismic actions, category C1	

Table C13 : Characteristic tension resistances under seismic loading for TruBolt Xtrem, category C2

Fastener size			M10	M12	M16	M20
TruBolt Xtrem						
Effective anchorage depth	$h_{ef,1}$	[mm]	60	70	85	100
Steel failure						
Characteristic resistance	$N_{Rk,s,C2}$	[kN]	29,3	38,2	64,7	99,1
Pull-out failure						
Characteristic resistance	$N_{Rk,p,C2}$	[kN]	2,8	6,0	18,0	25,6

Table C14 : Displacement under tension loads for seismic loading for TruBolt Xtrem, category C2

Fastener size			M10	M12	M16	M20
TruBolt Xtrem						
Displacement DLS	$\delta_{N,C2\,(DLS)}$	[mm]	3,1	2,1	5,1	5,0
Displacement ULS	$\delta_{N,C2\,(ULS)}$	[mm]	14	7	14	13

Ramset TruBolt Xtrem, Ramset TruBolt Xtrem SS Torque-controlled expansion anchor	
Characteristic tension resistance and displacements under tension loads under seismic loading, category C2	**Annex C12**

Table C15 : Characteristic tension resistances under seismic loading for TruBolt Xtrem SS, category C2

Fastener size			M10	M12	M16
TruBolt Xtrem SS					
Effective anchorage depth	$h_{ef,1}$	[mm]	60	70	85
Steel failure					
Characteristic resistance	$N_{Rk,s,C2}$	[kN]	36,0	52,3	91,1
Pull-out failure					
Characteristic resistance	$N_{Rk,p,C2}$	[kN]	2,6	6,0	14,6

Table C16 : Displacement under tension loads for seismic loading for TruBolt Xtrem SS, category C2

Fastener size			M10	M12	M16
TruBolt Xtrem SS					
Displacement DLS	$\delta_{N,C2\,(DLS)}$	[mm]	0,5	4,3	5,0
Displacement ULS	$\delta_{N,C2\,(ULS)}$	[mm]	14,4	14,8	20,6

Ramset TruBolt Xtrem, Ramset TruBolt Xtrem SS **Torque-controlled expansion anchor**	**Annex C13**
Characteristic tension resistances and displacements under tension loads under seismic loading, category C2	

Table C17 : Characteristic shear resistances under seismic loading for TruBolt Xtrem, category C2

Fastener size				M10	M12	M16	M20
TruBolt Xtrem							
Steel failure							
Characteristic resistance		$V_{Rk,s,C2}$	[kN]	9,7	14,0	33,9	44,7
Factor for fasteners	with annular gap	α_{gap}	[-]	0,5			
	without annular gap	α_{gap}	[-]	- [1]			

[1]   No performance assessed

Table C18 : Displacement under shear loads for seismic loading for TruBolt Xtrem, category C2

Fastener size			M10	M12	M16	M20
TruBolt Xtrem						
Displacement DLS	$\delta_{V,C2\,(DLS)}$	[mm]	3,8	4,1	4,7	4,9
Displacement ULS	$\delta_{V,C2\,(ULS)}$	[mm]	6,0	6,3	9,0	9,0

Ramset TruBolt Xtrem, Ramset TruBolt Xtrem SS Torque-controlled expansion anchor	Annex C14
Characteristic shear resistances and displacements under shear loads under seismic loading, category C2	

Table C19 : Characteristic shear resistances under seismic loading for TruBolt Xtrem SS, category C2

Fastener size				M10	M12	M16
TruBolt Xtrem SS						
Steel failure						
Characteristic resistance		$V_{Rk,s,C2}$	[kN]	7,3	10,7	25,3
Factor for fasteners	with annular gap	α_{gap}	[-]		0,5	
	without annular gap	α_{gap}	[-]		$-^{1)}$	

[1] No performance assessed

Table C20 : Displacement under shear loads for seismic loading for TruBolt Xtrem SS, category C2

Fastener size			M10	M12	M16
TruBolt Xtrem SS					
Displacement DLS	$\delta_{V,C2\,(DLS)}$	[mm]	3,8	4,1	4,8
Displacement ULS	$\delta_{V,C2\,(ULS)}$	[mm]	6,0	6,3	8,9

Ramset TruBolt Xtrem, Ramset TruBolt Xtrem SS Torque-controlled expansion anchor	
Characteristic values of shear resistance and displacements under shear loads under seismic loading, category C2	**Annex C15**

**Table C21 : Characteristic tension resistance under fire exposure
in cracked and uncracked concrete for TruBolt Xtrem**

Fastener size			M8	M10	M12	M16	M20
TruBolt Xtrem							
Steel failure							
Effective anchorage depth	$h_{ef,1}$	[mm]	46	60	70	85	100
Characteristic resistance	R30	$N_{Rk,s,fi}$ [kN]	0,9	2,8	3,6	6,6	10,4
	R60	$N_{Rk,s,fi}$ [kN]	0,7	2,3	3,1	5,7	9,0
	R90	$N_{Rk,s,fi}$ [kN]	0,5	1,8	2,6	4,9	7,6
	R120	$N_{Rk,s,fi}$ [kN]	0,4	1,6	2,4	4,4	6,9

**Table C22 : Characteristic tension resistance under fire exposure
in cracked and uncracked concrete for TruBolt Xtrem SS**

Fastener size			M8	M10	M12	M16
TruBolt Xtrem SS						
Steel failure						
Effective anchorage depth	$h_{ef,1}$	[mm]	48	60	70	85
Characteristic resistance	R30	$N_{Rk,s,fi}$ [kN]	4,9	9,9	9,2	16,1
	R60	$N_{Rk,s,fi}$ [kN]	3,2	6,3	6,5	11,3
	R90	$N_{Rk,s,fi}$ [kN]	1,5	2,6	3,7	6,5
	R120	$N_{Rk,s,fi}$ [kN]	0,7	0,8	2,3	4,1
Effective anchorage depth	$h_{ef,2}$	[mm]	35	40	50	65
Characteristic resistance	R30	$N_{Rk,s,fi}$ [kN]	- [1]	9,9	9,2	16,1
	R60	$N_{Rk,s,fi}$ [kN]	- [1]	6,3	6,5	11,3
	R90	$N_{Rk,s,fi}$ [kN]	- [1]	2,6	3,7	6,5
	R120	$N_{Rk,s,fi}$ [kN]	- [1]	0,8	2,3	4,1

- In absence of other national regulations the partial safety factor for resistance under fire exposure $\gamma_{M,fi}$ = 1,0 is recommended
- $N_{Rk,p,fi}$ according to EN 1992-4:2018

[1]   No performance assessed

Ramset TruBolt Xtrem, Ramset TruBolt Xtrem SS **Torque-controlled expansion anchor**	**Annex C16**
Characteristic values of tension resistance under fire exposure	

**Table C23 : Characteristic shear resistance under fire exposure
in cracked and uncracked concrete for TruBolt Xtrem**

Fastener size			M8	M10	M12	M16	M20
TruBolt Xtrem							
Effective anchorage depth	$h_{ef,1}$	[mm]	46	60	70	85	100
Steel failure without level arm							
Characteristic resistance	R30	$V_{Rk,s,fi}$ [kN]	0,9	2,8	3,6	6,6	10,4
	R60	$V_{Rk,s,fi}$ [kN]	0,7	2,3	3,1	5,7	9,0
	R90	$V_{Rk,s,fi}$ [kN]	0,5	1,8	2,6	4,9	7,6
	R120	$V_{Rk,s,fi}$ [kN]	0,4	1,6	2,4	4,4	6,9
Steel failure with level arm							
Characteristic resistance	R30	$M^0_{Rk,s,fi}$ [Nm]	0,9	3,5	5,5	14,1	27,5
	R60	$M^0_{Rk,s,fi}$ [Nm]	0,7	2,9	4,8	12,2	23,8
	R90	$M^0_{Rk,s,fi}$ [Nm]	0,5	2,3	4,0	10,3	20,1
	R120	$M^0_{Rk,s,fi}$ [Nm]	0,4	2,0	3,7	9,3	18,2

In absence of other national regulations the partial safety factor for resistance under fire exposure $\gamma_{M,fi} = 1,0$ is recommended

Ramset TruBolt Xtrem, Ramset TruBolt Xtrem SS Torque-controlled expansion anchor	**Annex C17**
Characteristic shear resistance under fire exposure	

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Table C24 : Characteristic shear resistance under fire exposure in cracked and uncracked concrete for TruBolt Xtrem SS

Fastener size				M8	M10	M12	M16
TruBolt Xtrem SS							
Steel failure without level arm							
Effective anchorage depth	$h_{ef,1}$		[mm]	48	60	70	85
Characteristic resistance	R30	$V_{Rk,s,fi}$	[kN]	4,9	9,9	9,2	16,1
	R60	$V_{Rk,s,fi}$	[kN]	3,2	6,3	6,5	11,3
	R90	$V_{Rk,s,fi}$	[kN]	1,5	2,6	3,7	6,5
	R120	$V_{Rk,s,fi}$	[kN]	0,7	0,8	2,3	4,1
Effective anchorage depth	$h_{ef,2}$		[mm]	35	40	50	65
Characteristic resistance	R30	$V_{Rk,s,fi}$	[kN]	-[1]	9,9	9,2	16,1
	R60	$V_{Rk,s,fi}$	[kN]	-[1]	6,3	6,5	11,3
	R90	$V_{Rk,s,fi}$	[kN]	-[1]	2,6	3,7	6,5
	R120	$V_{Rk,s,fi}$	[kN]	-[1]	0,8	2,3	4,1
Steel failure with level arm							
Effective anchorage depth	$h_{ef,1}$		[mm]	48	60	70	85
Characteristic resistance	R30	$M^0_{Rk,s,fi}$	[Nm]	5,0	12,7	14,4	34,1
	R60	$M^0_{Rk,s,fi}$	[Nm]	3,3	8,1	10,1	23,9
	R90	$M^0_{Rk,s,fi}$	[Nm]	1,5	3,3	5,7	13,8
	R120	$M^0_{Rk,s,fi}$	[Nm]	0,7	1,0	3,6	8,7
Effective anchorage depth	$h_{ef,2}$		[mm]	35	40	50	65
Characteristic resistance	R30	$M^0_{Rk,s,fi}$	[Nm]	-[1]	12,7	14,4	34,1
	R60	$M^0_{Rk,s,fi}$	[Nm]	-[1]	8,1	10,1	23,9
	R90	$M^0_{Rk,s,fi}$	[Nm]	-[1]	3,3	5,7	13,8
	R120	$M^0_{Rk,s,fi}$	[Nm]	-[1]	1,0	3,6	8,7

In absence of other national regulations the partial safety factor for resistance under fire exposure $\gamma_{M,fi}$ = 1,0 is recommended

[1] No performance assessed

Ramset TruBolt Xtrem, Ramset TruBolt Xtrem SS **Torque-controlled expansion anchor**	**Annex C18**
Characteristic shear resistance under fire exposure	