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## European Technical Assessment

## ETA 22/0100 of 03/02/2022

English translation prepared by IETcc. Original version in Spanish language

### General Part

**Technical Assessment Body issuing the ETA designated according to Art. 29 of Regulation (EU) 305/2011:**

Instituto de Ciencias de la Construcción Eduardo Torroja (IETcc)

**Trade name of the construction product:**

**Novipro through bolt EXBE-G  
Novipro through bolt EXBE-X  
Novipro through bolt EXBE-A4**

**Product family to which the construction product belongs:**

Torque controlled expansion anchor made of galvanized steel, sherardized steel or stainless steel of sizes M8, M10, M12, M16 and M20 for use in cracked or uncracked concrete.

**Manufacturer:**

**Dahl Sverige AB**  
Bryggerivägen 9  
168 67 Bromma. Sweden.  
website: [www.dahl.se](http://www.dahl.se)

**Manufacturing plants:**

Dahl Sverige AB plant 1

**This European Technical Assessment contains:**

17 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:**

European Technical Assessment EAD 330232-00-0601 "Mechanical Fasteners for use in concrete", ed. October 2016

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This European Technical Assessment is issued by the Technical Assessment Body in its official language. Translations of this European Technical Assessment in other languages shall fully correspond to the original issued document and should be identified as such.

This European Technical Assessment may be withdrawn by the issuing Technical Assessment Body, in particular pursuant to information by the Commission according to article 25 (3) of Regulation (EU) No 305/2011.

## SPECIFIC PART

### 1. Technical description of the product

The Novipro EXBE-G wedge anchor in the range of M8, M10, M12, M16 and M20 is an anchor made of sherardized steel. The Novipro EXBE-X wedge anchor in the range of M8, M10, M12, M16 and M20 is an anchor made of galvanized steel. The Novipro EXBE-A4 wedge anchor in the range of M8, M10, M12, M16 and M20 is an anchor made of stainless steel. The anchor is installed into a predrilled cylindrical hole and anchored by torque-controlled expansion. The anchorage is characterized by friction between expansion clip and concrete.

Product and installation descriptions are given in annexes A1 and A2.

### 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 anchor 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 anchor 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 mean to 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
Essential characteristics under static or quasi static loading	See annexes C1 to C5
Displacements under tension and shear loads	See annex C6
Essential characteristics under seismic loading categories C1 and C2	See annex C7 and C8

#### 3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Anchorage satisfy requirements for class A1
Resistance to fire	See annexes C9 and C10

### 4. Assessment and Verification of Constancy of Performances (hereinafter AVCP) system applied, with reference to its legal base

The applicable European legal act for the system of Assessment and Verification of Constancy of Performances (see annex V to Regulation (EU) No 305/2011) is 96/582/EC.

The system to be applied is 1.

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

The technical details necessary for the implementation of the AVCP system are laid down in the quality plan deposited at Instituto de Ciencias de la Construcción Eduardo Torroja.



Instituto de Ciencias de la Construcción Eduardo Torroja  
CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS

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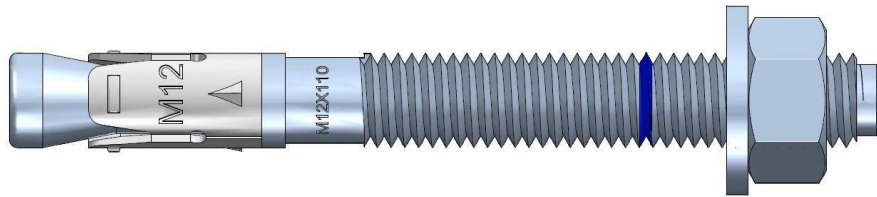
On behalf of the Instituto de Ciencias de la Construcción Eduardo Torroja  
Madrid, 3<sup>rd</sup> of February 2022



Director IETcc - CSIC

**Product and installed condition**

EXBE-G, EXBE-X. EXBE-A4 anchor



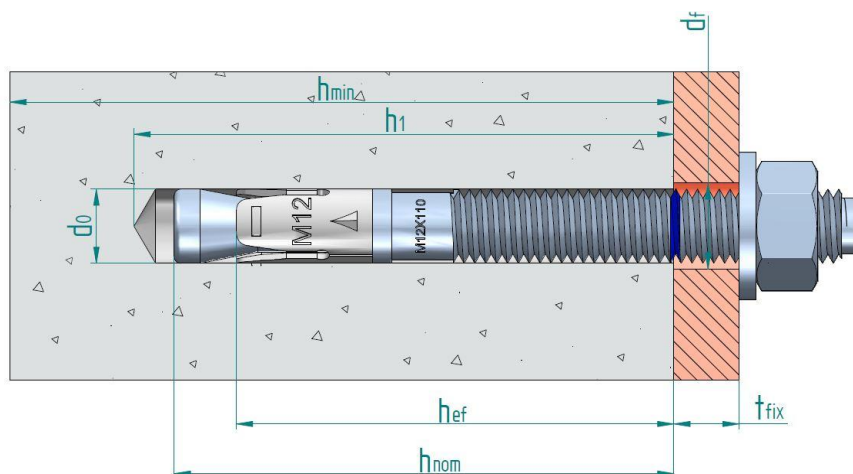
Identification on anchor:

- Expansion clip:
  - Anchor EXBE-G: Company logo + “EXBE-G” + Metric.
  - Anchor EXBE-X: Company logo + “EXBE-X” + Metric
  - Anchor EXBE-A4: Company logo + “EXBE-A4” + Metric
- Anchor body: Metric x Length
- Blue ring mark to show embedment depth
- Length letter code on head:

Letter on head	Length [mm]
C	68 ÷ 75
D	76 ÷ 88
E	89 ÷ 101
F	102 ÷ 113
G	114 ÷ 126
H	127 ÷ 139

Letter on head	Length [mm]
I	140 ÷ 151
J	152 ÷ 164
K	165 ÷ 177
L	178 ÷ 190
M	191 ÷ 202
N	203 ÷ 215

Letter on head	Length [mm]
O	216 ÷ 228
P	229 ÷ 240
Q	241 ÷ 253
R	254 ÷ 266
S	267 ÷ 300



- d<sub>0</sub>: Nominal diameter of drill bit
- d<sub>r</sub>: Fixture clearance hole diameter
- h<sub>ef</sub>: Effective anchorage depth
- h<sub>1</sub>: Depth of drilled hole
- h<sub>nom</sub>: Overall anchor embedment depth in the concrete
- h<sub>min</sub>: Minimum thickness of concrete member
- t<sub>fix</sub>: Fixture thickness

**EXBE-G, EXBE-X, EXBE-A4 anchors**

**Product description**

Installed condition

**Annex A1**

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**Table A1: materials**

Item	Designation	Material for EXBE-G	Material for EXBE-X
1	Anchor body	Carbon steel wire rod, sherardized $\geq 40 \mu\text{m}$ EN 13811	Carbon steel wire rod, galvanized $\geq 5 \mu\text{m}$ ISO 4042 Zn5/An/T0 with antifriction coating
2	Washer	DIN 125, DIN 9021, DIN 440 sherardized $\geq 40 \mu\text{m}$ EN 13811	DIN 125, DIN 9021, DIN 440 galvanized $\geq 5 \mu\text{m}$ ISO 4042 Zn5/An/T0
3	Nut	DIN 934 class 6, sherardized $\geq 40 \mu\text{m}$ EN 13811	DIN 934 class 6 galvanized $\geq 5 \mu\text{m}$ ISO 4042 Zn5/An/T0
4	Expansion clip	Stainless steel, grade A4	Carbon steel strip, sherardized $\geq 15 \mu\text{m}$ EN 13811

Item	Designation	Material for EXBE-A4
1	Anchor body	Stainless steel, grade A4
2	Washer	DIN 125, DIN 9021, DIN 440 stainless steel, grade A4
3	Nut	Stainless steel, grade A4 with antifriction coating
4	Expansion clip	Stainless steel, grade A4, galvanized $\geq 5 \mu\text{m}$ ISO 4042 Zn5/An/T0

EXBE-G, EXBE-X, EXBE-A4 anchor

Product description

Materials

**Annex A2**

### **Specifications of intended use**

#### **Anchorage subjected to:**

- Static or quasi static loads
- Seismic actions:

Version	Category	M6	M8	M10	M12	M16	M20
EXBE-X	C1		✓	✓	✓	✓	✓
	C2			✓	✓		✓

- Resistance to fire exposure up to 120 minutes: all versions and sizes

#### **Base materials:**

- Reinforced or unreinforced normal weight concrete without fibres according to EN 206:2013+A1:2016
- Strength classes C20/25 to C50/60 according to EN 206:2013+A1:2016
- Cracked or uncracked concrete

#### **Use conditions (environmental conditions):**

- Anchorages subjected to dry internal conditions: all anchors
- EXBE-A4: anchorages subjected to dry internal conditions, to external atmospheric exposure (including industrial and marine environment) or to permanent internal damp conditions if no particular aggressive conditions exist. Such particular aggressive conditions are e.g. permanent, alternating immersion in seawater or the splash zone of seawater, chloride atmosphere of indoor swimming pools or atmosphere with extreme chemical pollution (e.g. in desulphurization plants or road tunnels where de-icing materials are used). Atmospheres under Corrosion Resistance Class CRC III according to EN 1993-1-4:2006+A1:2015 annex A.

#### **Design:**

- Anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete.
- Verifiable calculation rules and drawings are prepared taking into account of the loads to be anchored. The position of the anchor is indicated on the design drawings (e.g. position of the anchor relative to reinforcement or to supports, etc.).
- Anchorages under static or quasi-static actions are designed for design method A in accordance with EN 1994-4:2018
- Anchorages under seismic actions are designed in accordance with EN 1992-4:2018. Anchorages shall be positioned outside of critical regions (e.g. plastic hinges) of the concrete structure. Fastening in stand-off installation or with grout layer are not allowed.
- Anchorages under fire exposure are designed in accordance with EN 1992-4:2018. It must be ensured that local spalling of the concrete cover does not occur.

#### **Installation:**

- Hole drilling by rotary plus hammer mode.
- Anchor installation carried out by appropriately qualified personal and under the supervision of the person responsible for technical matters of the site.
- In case of aborted hole: new drilling at a minimum distance away of twice the depth of aborted hole or smaller distance if the aborted hole is filled with high strength mortar and if under shear or oblique tension load it is not the direction of the load application.

**EXBE-G, EXBE-X, EXBE-A4 anchor**

**Intended use**

Specifications

**Annex B1**

English translation prepared by IETcc

**Table C1: Installation parameters for EXBE-G, EXBE-X anchors**

Installation parameters			Performances				
			M8	M10	M12	M16	M20
d <sub>0</sub>	Nominal diameter of drill bit:	[mm]	8	10	12	16	20
d <sub>f</sub>	Fixture clearance hole diameter:	[mm]	9	12	14	18	22
T <sub>inst</sub>	Nominal installation torque:	[Nm]	15	40	60	100	200
L <sub>min</sub>	Minimum total length of the bolt:	[mm]	68	82	98	119	140
h <sub>min</sub>	Minimum thickness of concrete member:	[mm]	100	120	140	170	200
h <sub>1</sub>	Depth of drilled hole:	[mm]	60	75	85	105	125
h <sub>nom</sub>	Overall anchor embedment depth in the concrete:	[mm]	55	68	80	97	114
h <sub>ef</sub>	Effective anchorage depth:	[mm]	48	60	70	85	100
t <sub>fix</sub>	Thickness of fixture for washer DIN 125 ≤ <sup>2)</sup>	[mm]	L - 66	L - 80	L - 96	L - 117	L - 138
t <sub>fix</sub>	Thickness of fixture for washers DIN 9021, DIN 440 ≤ <sup>1)</sup>	[mm]	L - 67	L - 81	L - 97	L - 118	L - 139
s <sub>min</sub>	Minimum allowable spacing:	[mm]	50	60	70	128	150
c <sub>min</sub>	Minimum allowable distance:	[mm]	50	60	70	128	150

<sup>1)</sup> L = total anchor length

**Table C2: Installation parameters for EXBE-A4 anchor**

Installation parameters			Performances				
			M8	M10	M12	M16	M20
d <sub>0</sub>	Nominal diameter of drill bit:	[mm]	8	10	12	16	20
d <sub>f</sub>	Fixture clearance hole diameter:	[mm]	9	12	14	18	22
T <sub>inst</sub>	Nominal installation torque:	[Nm]	15	30	60	100	200
L <sub>min</sub>	Minimum total length of the bolt:	[mm]	68	82	98	119	140
h <sub>min</sub>	Minimum thickness of concrete member:	[mm]	100	120	140	170	200
h <sub>1</sub>	Depth of drilled hole:	[mm]	60	75	85	105	125
h <sub>nom</sub>	Overall anchor embedment depth in the concrete:	[mm]	55	68	80	97	114
h <sub>ef</sub>	Effective anchorage depth:	[mm]	48	60	70	85	100
t <sub>fix</sub>	Thickness of fixture for washer DIN 125 ≤ <sup>1)</sup>	[mm]	L - 66	L - 80	L - 96	L - 117	L - 138
t <sub>fix</sub>	Thickness of fixture for washers DIN 9021, DIN 440 ≤ <sup>1)</sup>	[mm]	L - 67	L - 81	L - 97	L - 118	L - 139
s <sub>min</sub>	Minimum allowable spacing:	[mm]	42	47	57	75	100
c <sub>min</sub>	Minimum allowable distance:	[mm]	47	52	62	75	90

<sup>1)</sup> L = total anchor length

EXBE-G, EXBE-X, EXBE-A4 anchor

Performances

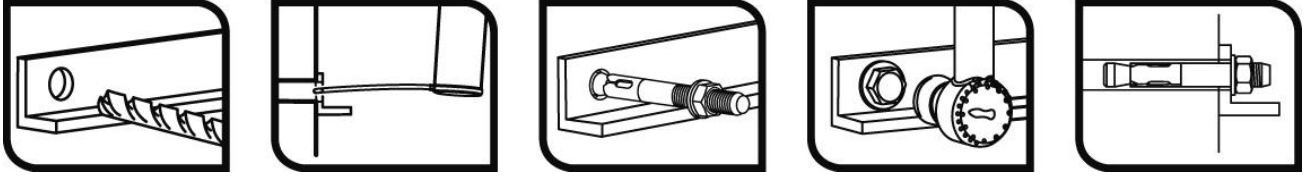
Installation parameters

Annex C1



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### **Installation process**



**EXBE-G, EXBE-X, EXBE-A4 anchors**

**Performances**

Installation procedure

**Annex C2**

English translation prepared by IETcc

**Table C3: Essential characteristics under static or quasi-static tension loads according to design method A according to EN 1992-4 for EXBE-G, EXBE-X anchors**

Essential characteristics under static or quasi-static tension loads according to design method A		Performances					
		M8	M10	M12	M16	M20	
<b>Tension loads: steel failure</b>							
$N_{Rk,s}$	Characteristic resistance: [kN]	18.1	31.4	40.4	72.7	116.6	
$\gamma_{Ms}$	Partial safety factor: [-]	1.5	1.5	1.5	1.5	1.5	
<b>Tension loads: pull-out failure in concrete</b>							
<b>EXBE-G anchor</b>							
$N_{Rk,p,ucr}$	Characteristic resistance in C20/25 uncracked concrete: [kN]	9	16	30	35	50	
$N_{Rk,p,cr}$	Characteristic resistance in C20/25 cracked concrete: [kN]	6	9	16	25	30	
<b>EXBE-X anchor</b>							
$N_{Rk,p,ucr}$	Characteristic resistance in C20/25 uncracked concrete: [kN]	9	16	25	35	50	
$N_{Rk,p,cr}$	Characteristic resistance in C20/25 cracked concrete: [kN]	6	9	16	25	30	
$\gamma_{ins}$	Installation safety factor: [-]	1.2	1.0	1.0	1.0	1.0	
$\psi_c$	Increasing factor for $N^0_{Rk,p}$ :	C30/37 [-]	1.22	1.16	1.22	1.22	1.16
		C40/50 [-]	1.41	1.31	1.41	1.41	1.31
		C50/60 [-]	1.55	1.41	1.55	1.55	1.41
<b>Tension loads: concrete cone and splitting failure</b>							
$h_{ef}$	Effective embedment depth: [mm]	48	60	70	85	100	
$K_{ucr,N}$	Factor for uncracked concrete: [-]	11.0					
$K_{cr,N}$	Factor for cracked concrete: [-]	7,7					
$\gamma_{ins}$	Installation safety factor: [-]	1.2	1.0	1.0	1.0	1.0	
$S_{cr,N}$	Concrete cone failure: [mm]	3 x $h_{ef}$					
$C_{cr,N}$		1.5 x $h_{ef}$					
$S_{cr,sp}$	Splitting failure: [mm]	288	300	350	510	600	
$C_{cr,sp}$		144	150	175	255	300	

EXBE-G, EXBE-X anchors

Performances

Essential characteristics under static or quasi-static tension loads

Annex C3

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**Table C4: Essential characteristics under static or quasi-static tension loads according to design method A according to EN 1992-4 for EXBE-A4 anchor**

Essential characteristics under static or quasi-static tension loads according to design method A				Performances				
				M8	M10	M12	M16	M20
<b>Tension loads: steel failure</b>								
$N_{Rk,s}$	Characteristic resistance:	[kN]	18.5	30.9	45.5	71.5	122.5	
$\gamma_{Ms}$	Partial safety factor:	[-]	1.4	1.4	1.4	1.4	1.4	
<b>Tension loads: pull-out failure in concrete</b>								
$N_{Rk,p,ucr}$	Characteristic resistance in C20/25 uncracked concrete:	[kN]	12	16	22	-- <sup>1)</sup>	-- <sup>1)</sup>	
$\Psi_c$	Increasing factor for $N^0_{Rk,p}$ :	C30/37	[-]	1.22	1.22	1.22	1.22	1.09
		C40/50	[-]	1.41	1.41	1.41	1.41	1.16
		C50/60	[-]	1.58	1.58	1.58	1.58	1.22
$N_{Rk,p,cr}$	Characteristic resistance in C20/25 cracked concrete:	[kN]	8.5	14	19	-- <sup>1)</sup>	-- <sup>1)</sup>	
$\Psi_c$	Increasing factor for $N^0_{Rk,p}$ :	C30/37	[-]	1.01	1.00	1.09	1.09	1.17
		C40/50	[-]	1.02	1.00	1.15	1.16	1.32
		C50/60	[-]	1.02	1.00	1.20	1.22	1.44
$\gamma_{ins}$	Installation safety factor:	[-]	1.0	1.0	1.2	1.2	1.2	
<b>Tension loads: concrete cone and splitting failure</b>								
$h_{ef}$	Effective embedment depth:	[mm]	48	60	70	85	100	
$k_{ucr,N}$	Factor for uncracked concrete:	[-]	11.0					
$k_{cr,N}$	Factor for cracked concrete:	[-]	7,7					
$\gamma_{ins}$	Installation safety factor:	[-]	1.0	1.0	1.2	1.2	1.2	
$S_{cr,N}$	Concrete cone failure:	[mm]	3 x $h_{ef}$					
$C_{cr,N}$		[mm]	1.5 x $h_{ef}$					
$S_{cr,sp}$	Splitting failure:	[mm]	164	204	238	290	380	
$C_{cr,sp}$		[mm]	82	102	119	145	190	

1) Pull out failure is not decisive

EXBE-A4 anchor

Performances

Essential characteristics under static or quasi-static tension loads

Annex C4

English translation prepared by IETcc

**Table C5: Essential characteristics under static or quasi-static shear loads of design method A according to EN 1992-4 for EXBE-G, EXBE-X anchors**

Essential characteristics under static or quasi-static shear loads according to design method A		Performances				
		M8	M10	M12	M16	M20
<b>Shear loads: steel failure without lever arm</b>						
$V_{Rk,s}$	Characteristic resistance: [kN]	11.0	17.4	25.3	47.1	73.1
$k_7$	Ductility factor: [-]	1.00				
$\gamma_{Ms}$	Partial safety factor: [-]	1.25	1.25	1.25	1.25	1.25
<b>Shear loads: steel failure with lever arm</b>						
$M^0_{Rk,s}$	Characteristic bending moment: [Nm]	22.5	44.8	78.6	199.8	389.4
$\gamma_{Ms}$	Partial safety factor: [-]	1.25	1.25	1.25	1.25	1.25
<b>Shear loads: concrete pryout failure</b>						
$k_8$	Pryout factor: [-]	1	2	2	2	2
$\gamma_{ins}$	Installation safety factor: [-]	1.00				
<b>Shear loads: concrete edge failure</b>						
$l_f$	Effective length of anchor under shear loads: [mm]	48	60	70	85	100
$d_{nom}$	Outside anchor diameter: [mm]	8	10	12	16	20
$\gamma_{ins}$	Installation safety factor: [-]	1.00				

**Table C6 Essential characteristics under static or quasi-static shear loads of design method A according to EN 1992-4 for EXBE-A4 anchor**

Essential characteristics under static or quasi-static shear loads according to design method A		Performances				
		M8	M10	M12	M16	M20
<b>Shear loads: steel failure without lever arm</b>						
$V_{Rk,s}$	Characteristic resistance: [kN]	11.9	18.9	27.4	55.0	85.9
$k_7$	Ductility factor: [-]	1.00				
$\gamma_{Ms}$	Partial safety factor: [-]	1.25	1.25	1.25	1.25	1.25
<b>Shear loads: steel failure with lever arm</b>						
$M^0_{Rk,s}$	Characteristic bending moment: [Nm]	26.2	52.3	91.7	233.1	454.3
$\gamma_{Ms}$	Partial safety factor: [-]	1.25	1.25	1.25	1.25	1.25
<b>Shear loads: concrete pryout failure</b>						
$k_8$	Pryout factor: [-]	1	2	2	2	2
$\gamma_{ins}$	Installation safety factor: [-]	1.00				
<b>Shear loads: concrete edge failure</b>						
$l_f$	Effective length of anchor under shear loads: [mm]	48	60	70	85	100
$d_{nom}$	Outside anchor diameter: [mm]	8	10	12	16	20
$\gamma_{ins}$	Installation safety factor: [-]	1.00				

EXBE-G, EXBE-X, EXBE-A4 anchors

Performances

Essential characteristics under static or quasi-static shear loads

Annex C5

**Table C7: Displacements under tension loads for EXBE-G, EXBE-X, EXBE-A4 anchors**

Displacements under tension loads		Performances					
		M8	M10	M12	M16	M20	
<b>MTP anchor</b>							
N	Service tension load:	[kN]	2.5	4.3	6.3	10.4	13.9
$\bar{\delta}_{N0}$	Short term displacement:	[mm]	1.1	0.7	1.0	0.4	1.6
$\bar{\delta}_{N\infty}$	Long term displacement:	[mm]	1.9	1.9	1.9	1.9	1.9
<b>EXBE-G anchor</b>							
N	Service tension load:	[kN]	2.5	4.3	6.3	10.4	13.9
$\bar{\delta}_{N0}$	Short term displacement:	[mm]	1.0	1.1	0.9	1.5	1.2
$\bar{\delta}_{N\infty}$	Long term displacement:	[mm]	1.9	1.9	1.9	1.9	1.9
<b>EXBE-X anchor</b>							
N	Service tension load:	[kN]	2.5	4.3	7.6	11.9	14.3
$\bar{\delta}_{N0}$	Short term displacement:	[mm]	1.0	1.1	0.9	1.5	1.3
$\bar{\delta}_{N\infty}$	Long term displacement:	[mm]	1.6	1.6	1.6	1.6	1.6
<b>EXBE-A4 anchor</b>							
N	Service tension load in non cracked concrete:	[kN]	5.7	7.6	8.7	15.3	19.5
$\bar{\delta}_{N0}$	Short term displacement:	[mm]	1.4	1.4	1.4	1.8	1.8
$\bar{\delta}_{N\infty}$	Long term displacement:	[mm]	1.9	1.9	1.9	1.9	1.9
<b>EXBE-A4 anchor</b>							
N	Service tension load in cracked concrete:	[kN]	4.0	6.7	7.5	10.7	13.7
$\bar{\delta}_{N0}$	Short term displacement:	[mm]	1.2	1.3	1.3	1.3	1.3
$\bar{\delta}_{N\infty}$	Long term displacement:	[mm]	1.7	1.7	1.7	1.7	1.7

**Table C8: Displacements under shear loads for EXBE-G, EXBE-X, EXBE-A4 anchors**

Displacements under shear loads		Performances					
		M8	M10	M12	M16	M20	
<b>EXBE-G anchor</b>							
V	Service shear load:	[kN]	4.9	6.8	8.5	15.1	24.6
$\bar{\delta}_{V0}$	Short term displacement:	[mm]	1.0	1.5	1.8	1.9	3.1
$\bar{\delta}_{V\infty}$	Long term displacement:	[mm]	1.5	2.3	2.7	2.9	4.7
<b>EXBE-X anchor</b>							
V	Service shear load:	[kN]	4.9	6.8	8.5	15.1	24.6
$\bar{\delta}_{V0}$	Short term displacement:	[mm]	1.0	1.5	1.8	1.9	3.1
$\bar{\delta}_{V\infty}$	Long term displacement:	[mm]	1.5	2.3	2.7	2.9	4.7
<b>EXBE-A4 anchor</b>							
V	Service shear load:	[kN]	6.8	10.8	15.7	31.4	46.9
$\bar{\delta}_{V0}$	Short term displacement:	[mm]	1.9	1.6	1.6	2.2	2.2
$\bar{\delta}_{V\infty}$	Long term displacement:	[mm]	2.4	2.4	2.4	3.3	3.3

**EXBE-G, EXBE-X, EXBE-A4 anchors**

**Performances**

Displacements under static or quasi-static tension and shear loads

**Annex C6**

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**Table C9: Essential characteristics for seismic performance category C1 EXBE-X anchors**

Essential characteristics for seismic performance category C1			Performances				
			M8	M10	M12	M16	M20
<b>Steel failure for tension and shear failure</b>							
$N_{Rk,s,C1}$	Characteristic tension steel failure:	[kN]	18.1	31.4	40.4	72.7	116.6
$\gamma_{Ms,N}$	Partial safety factor:	[-]	1.5	1.5	1.5	1.5	1.5
$V_{Rk,s,C1}$	Characteristic shear steel failure:	[kN]	7.7	12.2	17.8	33.0	58.5
$\gamma_{Ms,V}$	Partial safety factor:	[-]	1.25	1.25	1.25	1.25	1.25
<b>Pull out failure</b>							
$N_{Rk,p,C1}$	Characteristic pull out failure:	[kN]	5.9	8.9	16.0	25.0	30.0
$\gamma_{ins}$	Installation safety factor:	[-]	1.2	1.0	1.0	1.0	1.0
<b>Concrete cone failure</b>							
$h_{ef}$	Effective embedment depth:	[mm]	48	60	70	85	100
$s_{Cr,N}$	Spacing:	[mm]	3 x $h_{ef}$				
$c_{Cr,N}$	Edge distance:	[mm]	1.5 x $h_{ef}$				
$\gamma_{ins}$	Installation safety factor:	[-]	1.2	1.0	1.0	1.0	1.0
<b>Concrete pryout failure</b>							
$k_8$	Pryout factor:	[-]	1	2	2	2	2
<b>Concrete edge failure</b>							
$l_f$	Effective length of anchor:	[mm]	48	60	70	85	100
$d_{nom}$	Outside anchor diameter:	[-]	8	10	12	16	20

**EXBE-X anchors**

**Performances**

Essential characteristics for seismic performance category C1

**Annex C7**

English translation prepared by IETcc

**Table C10: Essential characteristics for seismic performance category C2 EXBE-X anchors**

Essential characteristics for seismic performance category C2			Performances				
			M8	M10	M12	M16	M20
<b>Steel failure for tension and shear failure</b>							
$N_{Rk,s,C2}$	Characteristic tension steel failure:	[kN]	--	31.4	40.4	--	116.6
$\gamma_{Ms,N}$	Partial safety factor:	[-]	--	1.5	1.5	--	1.5
$V_{Rk,s,C2}$	Characteristic shear steel failure:	[kN]	--	12.2	17.8	--	58.5
$\gamma_{Ms,V}$	Partial safety factor:	[-]	--	1.25	1.25	--	1.25
<b>Pull out failure</b>							
<b>MTP anchor</b>							
$N_{Rk,p,C2}$	Characteristic pull out failure:	[kN]	--	--	5.2	--	--
<b>EXBE-X anchor</b>							
$N_{Rk,p,C2}$	Characteristic pull out failure:	[kN]	--	3.9	9.1	--	21.0
$\gamma_{ins}$	Installation safety factor:	[-]	--	1.0	1.0	--	1.0
<b>Concrete cone failure</b>							
$h_{ef}$	Effective embedment depth:	[mm]	--	60	70	--	100
$s_{cr,N}$	Spacing:	[mm]	--	3 x $h_{ef}$			
$c_{cr,N}$	Edge distance:	[mm]	--	1.5 x $h_{ef}$			
$\gamma_{ins}$	Installation safety factor:	[-]	--	1.0	1.0	--	1.0
<b>Concrete pryout failure</b>							
$k_8$	Pryout factor:	[-]	--	2	2	--	2
<b>Concrete edge failure</b>							
$l_f$	Effective length of anchor:	[mm]	--	60	70	--	100
$d_{nom}$	Outside anchor diameter:	[-]	--	10	12	--	20
<b>Displacements</b>							
$\bar{\delta}_{N,C2} (DLS)$	Displacement Damage Limitation State: <sup>1) 2)</sup>	[mm]	--	3.15	5.57	--	6.82
$\bar{\delta}_{V,C2} (DLS)$	Displacement Damage Limitation State: <sup>1) 2)</sup>	[mm]	--	5.61	5.53	--	6.37
$\bar{\delta}_{N,C2} (ULS)$	Displacement Ultimate Limit State: <sup>1)</sup>	[mm]	--	14.77	20.31	--	29.12
$\bar{\delta}_{V,C2} (ULS)$	Displacement Ultimate Limit State: <sup>1)</sup>	[mm]	--	8.68	9.08	--	12.32

<sup>1)</sup> The listed displacements represent mean values

<sup>2)</sup> A small displacement may be required in the design in the case of displacements sensitive fastening of "rigid" supports. The characteristics resistance associated with such small displacements may be determined by linear interpolation or proportional reduction.

**EXBE-X anchors**

**Performances**

Essential characteristics for seismic performance category C2

**Annex C8**

**Table C11: Essential characteristics under fire exposure EXBE-G, EXBE-X anchors**

Essential characteristics under fire exposure				Performances				
				M8	M10	M12	M16	M20
<b>Steel failure</b>								
$N_{Rk,s,fi}$	Characteristic tension resistance:	R30	[kN]	0,4	0,9	1,7	3,1	4,9
		R60	[kN]	0,3	0,8	1,3	2,4	3,7
		R90	[kN]	0,3	0,6	1,1	2,0	3,2
		R120	[kN]	0,2	0,5	0,8	1,6	2,5
$V_{Rk,s,fi}$	Characteristic shear resistance:	R30	[kN]	0,4	0,9	1,7	3,1	4,9
		R60	[kN]	0,3	0,8	1,3	2,4	3,7
		R90	[kN]	0,3	0,6	1,1	2,0	3,2
		R120	[kN]	0,2	0,5	0,8	1,6	2,5
$M^0_{Rk,s,fi}$	Characteristic bending resistance:	R30	[Nm]	0,4	1,1	2,6	6,7	13,0
		R60	[Nm]	0,3	1,0	2,0	5,0	9,7
		R90	[Nm]	0,3	0,7	1,7	4,3	8,4
		R120	[Nm]	0,2	0,6	1,3	3,3	6,5
<b>Pull out failure</b>								
$N_{Rk,p,fi}$	Characteristic resistance:	R30						
		R60	[kN]	1,5	2,3	4,0	6,3	7,5
		R90						
		R120	[kN]	1,2	1,8	3,2	5,0	6,0
<b>Concrete cone failure <sup>1)</sup></b>								
$N_{Rk,c,fi}$	Characteristic resistance:	R30						
		R60	[kN]	2,9	5,0	7,4	12,0	18,0
		R90						
		R120	[kN]	2,3	4,0	5,9	9,6	14,4
$S_{cr,N,fi}$	Critical spacing:	R30 to R120	[mm]	4 x $h_{ef}$				
$S_{min,fi}$	Minimum spacing:	R30 to R120	[mm]	50	60	70	128	150
$C_{cr,N,fi}$	Critical edge distance:	R30 to R120	[mm]	2 x $h_{ef}$				
$C_{min,fi}$	Minimum edge distance:	R30 to R120	[mm]	$C_{min} = 2 \times h_{ef}$ ; if fire attack comes from more than one side, the edge distance of the anchor has to be $\geq 300$ mm and $\geq 2 \times h_{ef}$				
<b>Concrete pry out failure</b>								
$k_8$	Pryout factor:	R30 to R120	[-]	1	2	2	2	2ñ

<sup>1)</sup> As a rule, splitting failure can be neglected since cracked concrete and reinforcement is assumed.

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

**EXBE-G, EXBE-X anchors**

**Performances**

Essential characteristics under fire exposure

**Annex C9**



**Table C12: Essential characteristics under fire exposure EXBE-A4 anchor**

Essential characteristics under fire exposure				Performances				
				M8	M10	M12	M16	M20
<b>Steel failure</b>								
$N_{Rk,s,fi}$	Characteristic tension resistance:	R30	[kN]	0,7	1,5	2,5	4,7	7,4
		R60	[kN]	0,6	1,2	2,1	3,9	6,1
		R90	[kN]	0,4	0,9	1,7	3,1	4,9
		R120	[kN]	0,4	0,8	1,3	2,5	3,9
$V_{Rk,s,fi}$	Characteristic shear resistance:	R30	[kN]	0,7	1,5	2,5	4,7	7,4
		R60	[kN]	0,6	1,2	2,1	3,9	6,1
		R90	[kN]	0,4	0,9	1,7	3,1	4,9
		R120	[kN]	0,4	0,8	1,3	2,5	3,9
$M^0_{Rk,s,fi}$	Characteristic bending resistance:	R30	[Nm]	0,7	1,9	3,9	10,0	19,5
		R60	[Nm]	0,6	1,5	3,3	8,3	16,2
		R90	[Nm]	0,4	1,2	2,6	6,7	13,0
		R120	[Nm]	0,4	1,0	2,1	5,3	10,4
<b>Pull out failure</b>								
$N_{Rk,p,fi}$	Characteristic resistance:	R30						
		R60	[kN]	2,1	3,5	4,8	-- <sup>1)</sup>	-- <sup>1)</sup>
		R90						
		R120	[kN]	1,7	2,8	3,8	-- <sup>1)</sup>	-- <sup>1)</sup>
<b>Concrete cone failure <sup>1)</sup></b>								
$N_{Rk,c,fi}$	Characteristic resistance:	R30						
		R60	[kN]	2,7	4,8	7,1	11,5	17,2
		R90						
		R120	[kN]	2,2	43,8	5,6	9,2	13,8
$S_{cr,N,fi}$	Critical spacing:	R30 to R120	[mm]	4 x $h_{ef}$				
$S_{min,fi}$	Minimum spacing:	R30 to R120	[mm]	42	47	57	75	100
$C_{cr,N,fi}$	Critical edge distance:	R30 to R120	[mm]	2 x $h_{ef}$				
$C_{min,fi}$	Minimum edge distance:	R30 to R120	[mm]	$C_{min} = 2 \times h_{ef}$ ; if fire attack comes from more than one side, the edge distance of the anchor has to be $\geq 300$ mm and $\geq 2 \times h_{ef}$				
<b>Concrete pry out failure</b>								
$k_8$	Pryout factor:	R30 to R120	[-]	1	2	2	2	2

<sup>1)</sup> Pull out failure is not decisive

<sup>2)</sup> As a rule, splitting failure can be neglected since cracked concrete and reinforcement is assumed.

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

EXBE-A4 anchor

Performances

Essential characteristics under fire exposure

Annex C10