CSIC
CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS
INSTITUTO EDUARDO TORROJA

Designated according to Article29 of Regulation (EU) Nº 305/2011

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European Technical Assessment

ETA 13/1014 of 01/03/2018

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	**Anchor BZ** **Anchor BZ-G** **Anchor BZ-X**
Product family to which the construction product belongs	Torque controlled expansion anchor made of galvanized steel or sherardized steel of sizes M8, M10, M12, M16, M20 and M24 for use in concrete.
Manufacturer	**KEW Kunststofferzeugnisse GmbH Wilthen** Dresdener Straße 19, 02681 Wilthen, Germany
Manufacturing plants	ETA holder plant 2
This European Technical Assessment contains	14 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
This version replaces	ETA 13/1014 issued on 28/06/2013

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This European Technical Assessment may be withdrawn by the issuing Technical Assessment Body, in particular pursuant to information by the Commission according to article 25 (3) of Regulation (EU) No 305/2011.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 KEW BZ wedge anchor in the range of M8, M10, M12, M16, M20 and M24 is an anchor made of galvanised steel. The KEW BZ-G wedge anchor in the range of M8, M10, M12, M16 and M20 is an anchor made of sherardized steel. The KEW BZ-X wedge anchor in the range of M8, M10, M12, M16 and M20 is an anchor made of galvanized steel. The anchor is installed into a predrilled cylindrical hole and anchored by torque-controlled expansion. The anchorage is characterised by friction between expansion clip and concrete.

Product and 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 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
Characteristic resistance under static or quasi static loading	See annexes C1 to C3
Displacements under tension and shear loads	See annex C4
Characteristic resistance under seismic loading categories C1 and C2	See annex C5 and C6

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Anchorages satisfy requirements for class A1
Resistance to fire	See annex C7

3.3 Hygiene, health and the environment (BWR 3)

This requirement is not relevant for the anchors.

3.4 Safety in use (BWR 4)

The essential characteristics regarding safety in use are included under the basic works requirements Mechanical resistance and stability.

3.5 Protection against noise (BWR 5)

This requirement is not relevant for the anchors.

3.6 Energy economy and heat retention (BWR 6)

This requirement is not relevant for the anchors.

3.7 Sustainable use of natural resources (BWR 7)

No performance determined

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.

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.

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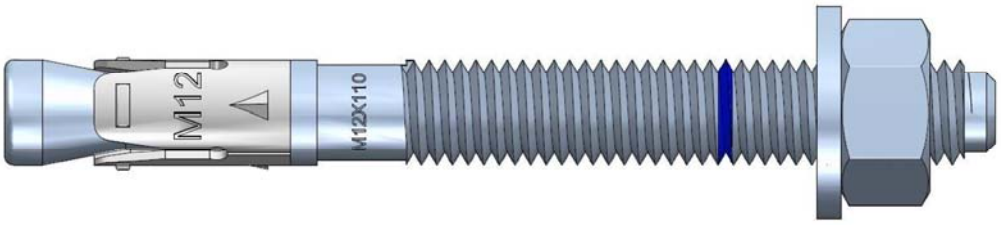
On behalf of the Instituto de Ciencias de la Construcción Eduardo Torroja
Madrid, 1st of March 2018

Marta Mª Castellote Armero
Director

Product and installed condition

BZ, BZ-G, BZ-X anchor



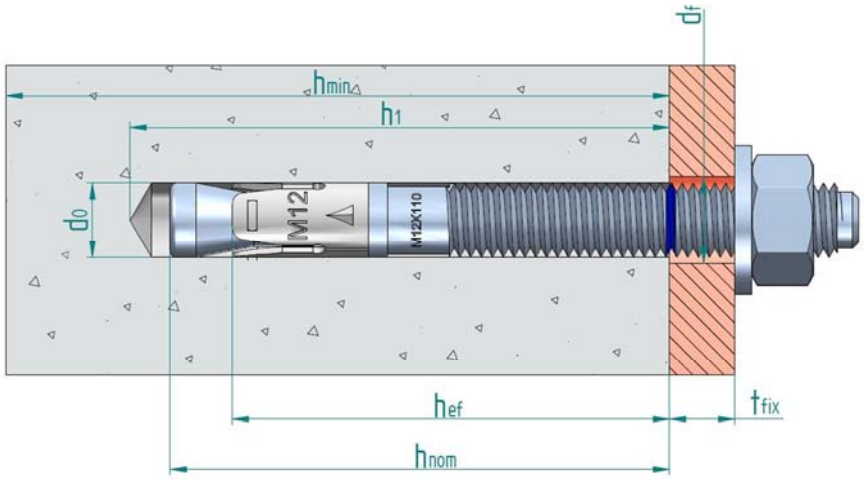
Identification on anchor:

- Expansion clip:
  - Anchor BZ: Company logo + "BZ" + Metric.
  - Anchor BZ-G: Company logo + "BZ-G" + Metric.
  - Anchor BZ-X: Company logo + "BZ-X" + 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]
P	229 ÷ 240
Q	241 ÷ 253
R	254 ÷ 266
S	267 ÷ 300



d_0: Nominal diameter of drill bit
d_f: Fixture clearance hole diameter
h_{ef}: Effective anchorage depth
h_1: Depth of drilled hole
h_{nom}: Overall anchor embedment depth in the concrete
h_{min}: Minimum thickness of concrete member
t_{fix}: Fixture thickness

BZ, BZ-G, BZ-X anchors	**Annex A1**
Product description Installed condition	

Table A1: materials

Item	Designation	Material for BZ	Material for BZ-G	Material for BZ-X
1	Anchor body	M8 to M20: carbon steel wire rod, galvanized ≥ 5 µm ISO 4042 A2 with antifriction coating M24: machine carbon steel, galvanized ≥ 5 µm ISO 4042 A2 with antifriction coating	Carbon steel wire rod, sherardized ≥ 40 µm EN 13811	Carbon steel wire rod, galvanized ≥ 5 µm ISO 4042 A2 with antifriction coating
2	Washer	DIN 125, DIN 9021 galvanized ≥ 5 µm ISO 4042 A2	DIN 125, DIN 9021 sherardized ≥ 40 µm EN 13811	DIN 125, DIN 9021 galvanized ≥ 5 µm ISO 4042 A2
3	Nut	DIN 934 galvanized ≥ 5 µm ISO 4042 A2, class 6	DIN 934 sherardized ≥ 40 µm EN 13811, class 6	DIN 934 galvanized ≥ 5 µm ISO 4042 A2, class 6
4	Expansion clip	Stainless steel, grade A4	Stainless steel, grade A4	Carbon steel strip, sherardized ≥ 15 µm EN 13811

Specifications of intended use

Anchorages subjected to:

- Static or quasi static loads
- Seismic actions:
  - for performance category C1:
    - BZ: M10, M12 and M16
    - BZ-X: M10, M12, M16 and M20
  - for performance category C2:
    - BZ: M12 and M16
    - BZ-X: M12 and M20
- Resistance to fire exposure up to 120 minutes: all versions and sizes

Base materials:

- Reinforced or unreinforced normal weight concrete according to EN 206-1:2008
- Strength classes C20/25 to C50/60 according to EN 206-1:2008
- Cracked or uncracked concrete

Use conditions (environmental conditions):

- Anchorages subjected to dry internal conditions.

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:
  - ETAG 001, Annex C, edition August 2010
  - CEN/TS 1992-4-1:2009
  - prEN1992-4
- Anchorages under seismic actions (cracked concrete) are designed in accordance with:
  - EOTA Technical Report TR 045, edition February 2013
  - prEN1992-4
  - 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:
  - ETAG 001, Annex C, design method A, edition August 2010 and EOTA Technical Report 020, edition May 2004
  - CEN/TS 1992-4-1:2009, annex D.
  - prEN 1992-4
  - 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.

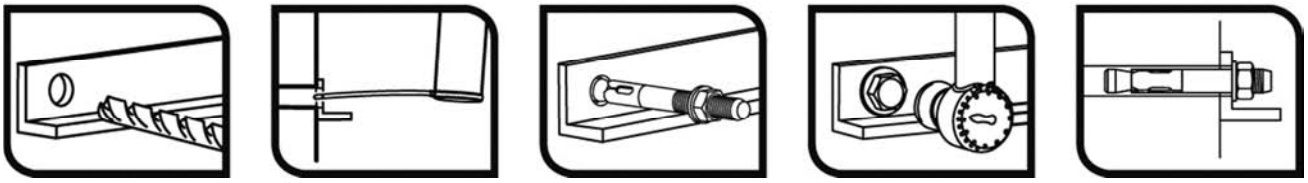
BZ, BZ-G, BZ-X anchor	**Annex B1**
Intended use Specifications	

Table C1: Installation parameters for BZ, BZ-G, BZ-X anchor

Installation parameters			Performances					
			M8	**M10**	**M12**	**M16**	**M20**	**M24**
d_0	Nominal diameter of drill bit:	[mm]	8	10	12	16	20	24
d_f	Fixture clearance hole diameter:	[mm]	9	12	14	18	22	26
T_{inst}	Nominal installation torque:	[Nm]	20/15[1)]	40	60	100	200	250
L_{min}	Total length of the bolt:	[mm]	68	82	98	119	140	175
L_{max}		[mm]	200	200	250	250	300	400
h_{min}	Minimum thickness of concrete member:	[mm]	100	120	140	170	200	250
h_1	Depth of drilled hole:	[mm]	60	75	85	105	125	155
h_{nom}	Overall anchor embedment depth in the concrete:	[mm]	55	68	80	97	114	143
h_{ef}	Effective anchorage depth:	[mm]	48	60	70	85	100	125
t_{fix}	Thickness of fixture [2)]:	[mm]	L - 66	L – 80	L – 96	L - 117	L - 138	L - 170
s_{min}	Minimum allowable spacing:	[mm]	50	60	70	85/128[1)]	100/150[1)]	125
c_{min}	Minimum allowable distance:	[mm]	50	60	70	85/128[1)]	100/150[1)]	125

[1)] Respective values for anchors BZ / BZ-G, BZ-X
[2)] L = total anchor length

Installation process



BZ, BZ-G, BZ-X anchor	**Annex C1**
Performances Installation parameters and installation procedure	

Table C2: Characteristic values to tension loads of design method A according to ETAG 001, Annex C, CEN/TS 1992-4 o prEN1992-4 for BZ, BZ-G, BZ-X anchor

Characteristic values of resistance to tension loads of design according to design method A				Performances					
				M8	M10	M12	M16	M20	M24
Tension loads: steel failure									
$N_{Rk,s}$	Characteristic resistance:		[kN]	18.1	31.4	40.4	72.7	116.6	179.2
γ_{Ms}	Partial safety factor:		[-]	1.5	1.5	1.5	1.5	1.5	1.5
Tension loads: pull-out failure in concrete									
BZ anchor									
$N_{Rk,p,ucr}$	Characteristic resistance in C20/25 uncracked concrete:		[kN]	9	16	20	35	50	50
$N_{Rk,p,cr}$	Characteristic resistance in C20/25 cracked concrete:		[kN]	5	9	12	25	30	30
BZ-G anchor									
$N_{Rk,p,ucr}$	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	--
BZ-X anchor									
$N_{Rk,p,ucr}$	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	--
γ_{ins} [1)] γ_2 [2)]	Installation safety factor:		[-]	1.2	1.0	1.0	1.0	1.0	1.2
ψ_c	Increasing factor for $N^0_{Rk,p}$:	C30/37	[-]	1.22	1.16	1.22	1.22	1.16	1.22
		C40/50	[-]	1.41	1.31	1.41	1.41	1.31	1.41
		C50/60	[-]	1.55	1.41	1.55	1.55	1.41	1.55
Tension loads: concrete cone and splitting failure									
h_{ef}	Effective embedment depth:		[mm]	48	60	70	85	100	125
$k_{ucr,N}$ [1)]	Factor for uncracked concrete:		[-]	11.0					
$k_{cr,N}$ [1)]	Factor for cracked concrete:		[-]	7,7					
$k_{ucr,N}$ [2)]	Factor for uncracked concrete:		[-]	10.1					
$k_{cr,N}$ [2)]	Factor for cracked concrete:		[-]	7,2					
γ_{ins} [1)] γ_2 [2)]	Installation safety factor:		[-]	1.2	1.0	1.0	1.0	1.0	1.2
$s_{cr,N}$	Concrete cone failure:		[mm]	$3 \times h_{ef}$					
$c_{cr,N}$			[mm]	$1.5 \times h_{ef}$					
$s_{cr,sp}$	Splitting failure:		[mm]	288	300	350	425/510 [3)]	500/600 [3)]	560
$c_{cr,sp}$			[mm]	144	150	175	213/255 [3)]	250/300 [3)]	280

[1)] Parameter relevant only for design according to CEN/TS 1992-4:2009, prEN 1994-2
[2)] Parameter relevant only for design according to ETAG 001, Annex C
[3)] Respective values for anchors BZ / BZ-G, BZ-X

Table C3: Characteristic values to shear loads of design method A according to ETAG 001, Annex C, CEN/TS 1992-4 or prEN1992-4 for BZ, BZ-G, BZ-X anchor

Characteristic values of resistance to shear loads of design according to design method A			Performances					
			M8	M10	M12	M16	M20	M24
Shear loads: steel failure without lever arm								
$V_{Rk,s}$	Characteristic resistance:	[kN]	11.0	17.4	25.3	47.1	73.1	84.7
k_2 [1)]	k_2 factor:	[-]	1.0					
k_7 [2)]	k_7 factor:	[-]	1.0					
γ_{Ms}	Partial safety factor:	[-]	1.25	1.25	1.25	1.25	1.25	1.25
Shear loads: steel failure with lever arm								
$M^0_{Rk,s}$	Characteristic bending moment:	[Nm]	22.5	44.8	78.6	199.8	389.4	673.5
γ_{Ms}	Partial safety factor:	[-]	1.25	1.25	1.25	1.25	1.25	1.25
Shear loads: concrete pryout failure								
k_3 [1)]=k_8 [2)] k [3)]	k factor:	[-]	1	2	2	2	2	2
γ_{ins} [1) 2)] γ_2 [3)]	Installation safety factor:	[-]	1.0					
Shear loads: concrete edge failure								
l_f	Effective length of anchor under shear loads:	[mm]	48	60	70	85	100	125
d_{nom}	Outside anchor diameter:	[mm]	8	10	12	16	20	24
γ_{ins} [1) 2)] γ_2 [3)]	Installation safety factor:	[-]	1.0					

[1)] Parameter relevant only for design according to CEN/TS 1992-4:2009
[2)] Parameter relevant only for design according to prEN 1992-4
[3)] Parameter relevant only for design according to ETAG 001, Annex C

Table C4: Displacements under tension load for BZ, BZ-G, BZ-X anchor

Displacements under tension loads			Performances					
			M8	M10	M12	M16	M20	M24
BZ anchor								
N	Service tension load:	[kN]	2.5	4.3	6.3	10.4	13.9	18.0
δ_{N0}	Short term displacement:	[mm]	1.1	0.7	1.0	0.4	1.6	0.4
$\delta_{N\infty}$	Long term displacement:	[mm]	1.9	1.9	1.9	1.9	1.9	2.0
BZ-G anchor								
N	Service tension load:	[kN]	2.5	4.3	6.3	10.4	13.9	--
δ_{N0}	Short term displacement:	[mm]	1.0	1.1	0.9	1.5	1.2	--
$\delta_{N\infty}$	Long term displacement:	[mm]	1.9	1.9	1.9	1.9	1.9	--
BZ-X anchor								
N	Service tension load:	[kN]	2.5	4.3	7.6	11.9	14.3	--
δ_{N0}	Short term displacement:	[mm]	1.0	1.1	0.9	1.5	1.3	--
$\delta_{N\infty}$	Long term displacement:	[mm]	1.6	1.6	1.6	1.6	1.6	--

Table C5: Displacements under shear load for BZ, BZ-G, BZ-X anchor

Displacements under shear loads			Performances					
			M8	M10	M12	M16	M20	M24
BZ anchor								
V	Service shear load:	[kN]	4.9	6.8	8.5	15.1	24.6	33.6
δ_{V0}	Short term displacement:	[mm]	1.0	1.5	1.8	1.9	3.1	1.4
$\delta_{V\infty}$	Long term displacement:	[mm]	1.5	2.3	2.7	2.9	4.7	2.1
BZ-G anchor								
V	Service shear load:	[kN]	4.9	6.8	8.5	15.1	24.6	-
δ_{V0}	Short term displacement:	[mm]	1.0	1.5	1.8	1.9	3.1	--
$\delta_{V\infty}$	Long term displacement:	[mm]	1.5	2.3	2.7	2.9	4.7	--
BZ-X anchor								
V	Service shear load:	[kN]	4.9	6.8	8.5	15.1	24.6	--
δ_{V0}	Short term displacement:	[mm]	1.0	1.5	1.8	1.9	3.1	--
$\delta_{V\infty}$	Long term displacement:	[mm]	1.5	2.3	2.7	2.9	4.7	--

Table C6: Design information for seismic performance C1 BZ, BZ-X anchor

Design information for seismic performance C1			Performances					
			M8	**M10**	**M12**	**M16**	**M20**	**M24**
Steel failure for tension and shear failure								
$N_{Rk,s,seis}$	Characteristic tension steel failure:	[kN]	--	31.4	40.4	72.7	116.6	--
$\gamma_{Ms,N}$	Partial safety factor:	[-]	--	1.5	1.5	1.5	1.5	--
$V_{Rk,p,seis}$	Characteristic shear steel failure:	[kN]	--	12.2	17.8	33.0	58.5	--
$\gamma_{Ms,V}$	Partial safety factor:	[-]	--	1.25	1.25	1.25	1.25	--
Pull out failure								
BZ anchor								
$N_{Rk,p,seis}$	Characteristic pull out failure:	[kN]	--	5.3	8.4	17.5	--	--
BZ-X anchor								
$N_{Rk,p,seis}$	Characteristic pull out failure:	[kN]	--	3.9	16.0	25.0	30.0	--
γ_{ins} [1)] γ_2 [2)]	Installation safety factor:	[-]	--	1.0	1.0	1.0	1.0	--
Concrete cone failure								
h_{ef}	Effective embedment depth:	[mm]	--	60	70	85	100	--
$s_{cr,N}$	Spacing:	[mm]	--	$3 \times h_{ef}$				--
$c_{cr,N}$	Edge distance:	[mm]	--	$1.5 \times h_{ef}$				--
γ_{ins} [1)] γ_2 [2)]	Installation safety factor:	[-]	--	1.0	1.0	1.0	1.0	--
Concrete pryout failure								
k_3 [1)] k [2)]	k factor:	[-]	--	2	2	2	2	--
Concrete edge failure								
l_f	Effective length of anchor:	[kN]	--	60	70	85	100	--
d_{nom}	Outside anchor diameter:	[-]	--	10	12	16	20	--

[1)] Parameter relevant only for design according to CEN/TS 1992-4:2009, prEN 1992-4
[2)] Parameter relevant only for design according to ETAG 001, Annex C

Table C7: Design information for seismic performance C2 BZ, BZ-X anchor

Design information for seismic performance C2			Performances					
			M8	M10	M12	M16	M20	M24
Steel failure for tension and shear failure								
$N_{Rk,s,seis}$	Characteristic tension steel failure:	[kN]	--	--	40.4	72.7	116.6	--
$\gamma_{Ms,N}$	Partial safety factor:	[-]	--	--	1.5	1.5	1.5	--
$V_{Rk,p,seis}$	Characteristic shear steel failure:	[kN]	--	--	17.8	33.0	58.5	--
$\gamma_{Ms,V}$	Partial safety factor:	[-]	--	--	1.25	1.25	1.25	--
Pull out failure								
BZ anchor								
$N_{Rk,p,seis}$	Characteristic pull out failure:	[kN]	--	--	5.2	8.9	--	--
BZ-X anchor								
$N_{Rk,p,seis}$	Characteristic pull out failure:	[kN]	--	--	9.1	--	21.0	--
γ_{ins} [1)] γ_2 [2)]	Installation safety factor:	[-]	--	--	1.0	1.0	1.0	--
Concrete cone failure								
h_{ef}	Effective embedment depth:	[mm]	--	--	70	85	100	--
$s_{cr,N}$	Spacing:	[mm]	--	--	3 x h_{ef}			--
$c_{cr,N}$	Edge distance:	[mm]	--	--	1.5 x h_{ef}			--
γ_{ins} [1)] γ_2 [2)]	Installation safety factor:	[-]	--	--	1.0	1.0	1.0	--
Concrete pryout failure								
k_3 [1)] k [2)]	k factor:	[-]	--	--	2	2	2	--
Concrete edge failure								
l_f	Effective length of anchor:	[kN]	--	--	70	85	100	--
d_{nom}	Outside anchor diameter:	[-]	--	--	12	16	20	--
Displacements								
BZ anchor								
$\delta_{N,seis\ (DLS)}$	Displacement Damage Limitation State: [3) 4)]	[mm]	--	--	2.34	3.99	--	--
$\delta_{V\ seis\ (DLS)}$		[mm]	--	--	5.53	5.96	--	--
$\delta_{N,seis\ (ULS)}$	Displacement Ultimate Limit State: [3)]	[mm]	--	--	9.54	10.17	--	--
$\delta_{V,seis\ (ULS)}$		[mm]	--	--	9.08	10.66	--	--
BZ-X anchor								
$\delta_{N,seis\ (DLS)}$	Displacement Damage Limitation State: [3) 4)]	[mm]	--	--	5.57	--	6.82	--
$\delta_{V\ seis\ (DLS)}$		[mm]	--	--	5.53	--	6.37	--
$\delta_{N,seis\ (ULS)}$	Displacement Ultimate Limit State: [3)]	[mm]	--	--	20.31	--	29.12	--
$\delta_{V,seis\ (ULS)}$		[mm]	--	--	9.08	--	12.32	--

[1)] Parameter relevant only for design according to CEN/TS 1992-4:2009, prEN 1992-4
[2)] Parameter relevant only for design according to ETAG 001, Annex C
[3)] The listed displacements represent mean values
[4)] 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.

Table C8: Characteristic values for resistance to fire BZ, BZ-G, BZ-X anchor

Characteristic values for resistance to fire					Performances					
					M8	M10	M12	M16	M20	M24
Steel failure										
$N_{Rk,s,fi}$	Characteristic tension resistance:		R30	[kN]	0,4	0,9	1,7	3,1	4,9	7,1
			R60	[kN]	0,3	0,8	1,3	2,4	3,7	5,3
			R90	[kN]	0,3	0,6	1,1	2,0	3,2	4,6
			R120	[kN]	0,2	0,5	0,8	1,6	2,5	3,5
$V_{Rk,s,fi}$	Characteristic shear resistance:		R30	[kN]	0,4	0,9	1,7	3,1	4,9	7,1
			R60	[kN]	0,3	0,8	1,3	2,4	3,7	5,3
			R90	[kN]	0,3	0,6	1,1	2,0	3,2	4,5
			R120	[kN]	0,2	0,5	0,8	1,6	2,5	3,5
$M^0_{Rk,s,fi}$	Characteristic bending resistance:		R30	[kN]	0,4	1,1	2,6	6,7	13,0	22,5
			R60	[kN]	0,3	1,0	2,0	5,0	9,7	16,8
			R90	[kN]	0,3	0,7	1,7	4,3	8,4	14,6
			R120	[kN]	0,2	0,6	1,3	3,3	6,5	11,2
Pull out failure										
$N_{Rk,p,fi}$	Characteristic resistance:		R30 R60 R90	[kN]	1,3/1,5[3]	2,3	3,0/4,0[3]	6,3	7,5	7,5
			R120	[kN]	1,0/1,2[3]	1,8	2,4/3,2[3]	5,0	6,0	6,0
Concrete cone failure [4]										
$N_{Rk,p,fi}$	Characteristic resistance:		R30 R60 R90	[kN]	2.9	5,0	7,4	12,0	18,0	31,4
			R120	[kN]	2,3	4,0	5,9	9,6	14,4	25,2
$s_{cr,N,fi}$	Critical spacing:	R30 to R120		[mm]	$4 \times h_{ef}$					
$s_{min,fi}$	Minimum spacing:	R30 to R120		[mm]	50	60	70	85/128[3]	100/150[3]	125
$c_{cr,N,fi}$	Critical edge distance:	R30 to R120		[mm]	$2 \times h_{ef}$					
$c_{min,fi}$	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 ≥ 300 mm and ≥ $2 \times h_{ef}$					
Concrete pry out failure										
k_3[1] k[2]	k factor:	R30 to R120		[-]	1	2	2	2	2	2

[1] Parameter relevant only for design according to CEN/TS 1992-4:2009, prEN 1992-4
[2] Parameter relevant only for design according to ETAG 001, Annex C
[3] Respective values for anchors BZ / BZ-G, BZ-X
[4] 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