LEISTUNGSERKLÄRUNG

Nr. 0083 – DE

1. Eindeutiger Kenncode des Produkttyps: **fischer-Zykon-Anker FZA, FZA-D, FZA-I, FZA ST**

2. Verwendungszweck(e):

Produkt	**Verwendungszweck (e)**
Metalldübel zur Verwendung im Beton (hoch belastbar)	Nachträgliche Befestigung im gerissenen und ungerissenen Beton, siehe Anhang, insbesondere Anhänge B 1 bis B 4

3. Hersteller: **fischerwerke GmbH & Co. KG, Klaus-Fischer-Straße 1, 72178 Waldachtal, Deutschland**

4. Bevollmächtigter: **--**

5. System(e) zur Bewertung und Überprüfung der Leistungsbeständigkeit: **1**

6a. Harmonisierte Norm: ---

Notifizierte Stelle(n): ---

6b. Europäisches Bewertungsdokument: **ETAG 001; 2013-04**

Europäische Technische Bewertung: **ETA-98/0004; 2016-09-12**

Technische Bewertungsstelle: **DIBt**

Notifizierte Stelle(n): **1343 – MPA Darmstadt**

7. Erklärte Leistung(en):

Mechanische Festigkeit und Standsicherheit (BWR 1)

Wesentliches Merkmal	**Leistung**
Charakteristischer Widerstand für statische und quasi-statische Einwirkungen unter Zugbeanspruchung	Siehe Anhang, insbesondere Anhänge C 1 bis C 5
Charakteristischer Widerstand für statische und quasi-statische Einwirkungen unter Querbeanspruchung	Siehe Anhang, insbesondere Anhänge C 6 bis C 10
Charakteristischer Widerstand für die seismische Leistungskategorie C 1	Siehe Anhang, insbesondere Anhänge C 11 bis C 12
Verschiebungen	Siehe Anhang, insbesondere Anhänge C 13 bis C 15

Brandschutz (BWR 2)

Wesentliches Merkmal	**Leistung**
Brandverhalten	Der Dübel erfüllt die Anforderungen der Klasse A 1
Feuerwiderstand	KLF

8. Angemessene Technische Dokumentation und/oder Spezifische Technische Dokumentation: ---

Die Leistung des vorstehenden Produkts entspricht der erklärten Leistung/den erklärten Leistungen. Für die Erstellung der Leistungserklärung im Einklang mit der Verordnung (EU) Nr. 305/2011 ist allein der obengenannte Hersteller verantwortlich.

Unterzeichnet für den Hersteller und im Namen des Herstellers von:

Andreas Bucher, Dipl.-Ing.

Wolfgang Hengesbach, Dipl.-Ing., Dipl.-Wirtsch.-Ing.

Tumlingen, 2016-09-16

- Diese Leistungserklärung wurde in verschiedenen Sprachversionen erstellt. Für den Fall unterschiedlicher Auslegung hat immer die englische Version Vorrang.
- Der Anhang enthält freiwillige und ergänzende Informationen in englischer Sprache. Diese gehen über die (sprachneutral angegebenen) gesetzlichen Anforderungen hinaus.

Specific Part

1 Technical description of the product

The fischer-Zykon-Anchor FZA, FZA-D, FZA-I and FZA ST is an anchor made of galvanised or stainless or high corrosion resistant steel which is placed in an undercut hole and anchored by mechanical interlock with displacement-controlled installation.

The bolt projection anchor FZA and the through bolt anchor FZA-D consists of a conical bolt with external thread, an expansion sleeve and a hexagon nut with washer. The internal threaded anchor FZA-I consists of a conical bolt with internal thread and an expansion sleeve. The bold projecting anchor FZA ST consists of a conical bolt with hexagon projecting end, an expansion sleeve with colour marking, a hexagon nut with washer and a plastic sleeve.

The anchor is anchored by impact acting on the expansion sleeve over the cone bolts in the undercuts of the borehole.

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 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 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 for static and quasi static action to tension	See Annex C1 – C5
Characteristic resistance for static and quasi static action to shear load	See Annex C6 – C10
Characteristic resistance for seismic performance category C1	See Annex C11 – C12
Displacements	See Annex C13 - C15

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Anchorages satisfy requirements for Class A1
Resistance to fire	No performance determined

3.4 Safety in use (BWR 4)

The essential characteristics regarding Safety in use are included under the Basic Works Requirement Mechanical resistance and stability.

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

In accordance with guideline for European technical approval ETAG 001, April 2013 used as European Assessment Document (EAD) according to Article 66 Paragraph 3 of Regulation (EU) No 305/2011 the applicable European legal act is: (1996/582/EC, OJ)

The system to be applied is: 1

Bolt projecting anchor FZA:

Through bolt anchor FZA-D:

Internal thread anchor FZA-I:

Bolt projecting anchor FZA ST:

Legend:

h_{ef}	=	Effective anchorage depth
t_{fix}	=	Thickness of fixture
h_0	=	Drill hole depth
h	=	Thickness of concrete member
T_{inst}	=	Required torque moment
l_s	=	Reach of screw
u	=	Gap between conical bolt and expansion sleeve (FZA-I)

fischer-Zykon-Anchor FZA, FZA-D , FZA-I, FZA ST

Product description
Installed condition

Annex A2

Type of anchors (allocation of parts acc. to Annex A7)

Bolt projecting anchor
FZA:

Marking e.g.
FZA 12x40
FZA 12x40 A4
FZA 12x40 C

FZA ST:

Marking e.g.
FZA 14x40 ST A4

Plastic sleeve

Through bolt anchor
FZA-D:

Marking e.g.
FZA 12x50 D/10
FZA 12x50 D/10 A4
FZA 12x50 D/10 C

Internal thread anchor
FZA-I:

Related fastening screws respectively threaded rods must correspond to Annex A7 and with inspection certificate 3.1 acc. to EN 10204: 2004

Zykon drill
FZUB:

Marking e.g.
FZUB 12x40

Setting tool FZE Plus
centring pin for
internal thread anchor

Marking e.g. FZE 12 I

Marking e.g. FZE 12

1) Expansion sleeve with knurling at FZA 12x40 ST

fischer-Zykon-Anchor FZA, FZA-D , FZA-I, FZA ST	**Annex A3**
Product description Anchor Types and tools	

Types of expansion-sleeve

manufactured by punching

manufactured by turning

FZA

Table A1: Dimensions bolt projecting anchor FZA

Type of anchor	Thread	t_{fix} min	t_{fix} max	l_1 min	l_1 max	l_2	Ø d_1	Ø d_2
FZA 10 x 40 M 6 / t_{fix} [1]	M6	1	50	50	100	40	10	10
FZA 12 x 40 M 8 / t_{fix} [1]	M8	1	100	52	154	40	12	12
FZA 14 x 40 M 10 / t_{fix} [1]	M10	1	150	54	204	40	14	14
FZA 12 x 50 M 8 / t_{fix}	M8	1	100	62	164	50	12	12
FZA 14 x 60 M 10 / t_{fix}	M10	1	150	80	232	60	14	14
FZA 18 x 80 M 12 / t_{fix}	M12	1	200	99	301	80	18	18
FZA 22 x 100 M16 / t_{fix}	M16	1	250	122	374	100	22	22
FZA 22 x 125 M16 / t_{fix} [1]	M16	1	250	147	399	125	22	22
FZA 12 x 40 ST A4[1]	M8	1	100	62	164	50[3]	12	12
FZA 14 x 40 ST A4[1]	M10	1	150	54	204	40	14	14
FZA 14 x 60 ST A4	M10	1	150	80	232	60	14	14

[1] Expansion sleeve with notch
[2] Design: threaded bolt with cone nut
[3] Expansion sleeve with knurling at FZA 12x40 ST

Dimensions in [mm]

fischer-Zykon-Anchor FZA, FZA-D , FZA-I, FZA ST

Product description
Anchor dimensions

Annex A4

FZA-D

Table A2: Dimensions through bolt anchor FZA-D

Type of anchor	Thread	t_{fix} min	t_{fix} max	l_1	l_2	l_3	∅ d_1	∅ d_2
FZA 12 x 50 M 8 D / 10 [1]	M8	1	10	69	50	40	12	12
FZA 12 x 60 M 8 D / 10	M8	1	10	79	60	50	12	12
FZA 12 x 80 M 8 D / 30	M8	1	30	99	80	50	12	12
FZA 14 x 80 M 10 D / 20	M10	1	20	102	80	60	14	14
FZA 14 x 100 M 10 D / 40	M10	1	40	126	100	60	14	14
FZA 18 x 100 M 12 D / 20	M12	1	20	126	100	80	18	18
FZA 18 x 130 M 12 D / 50	M12	1	50	156	130	80	18	18
FZA 22 x 125 M 16 D / 25	M16	1	25	156	125	100	22	22

[1] Expansion sleeve with notch
[2] Design: threaded bolt with cone nut

FZA-I

Table A3: Dimensions internal thread anchor FZA - I

Type of anchor	Thread	∅ d_1	∅ d_2	l
FZA 12 x 40 M 6 I [1]	M6	12	12	40
FZA 12 x 50 M 6 I	M6	12	12	50
FZA 14 x 60 M 8 I	M8	14	14	60
FZA 18 x 80 M 10 I	M10	18	18	80
FZA 22 x 100 M 12 I	M12	22	22	100
FZA 22 x 125 M 12 I [1]	M12	22	22	125

[1] Expansion sleeve with notch

Dimensions in [mm]

fischer-Zykon-Anchor FZA, FZA-D , FZA-I, FZA ST

Product description
Anchor dimensions

Annex A5

Zykon drill FZUB

Table A4: Dimensions Zykon drill FZUB

Type of drill	Connection	l_1	$l_2 \geq$	$d_1 \leq$	d_2	$\varnothing\ d_3 \leq$
FZUB 10 x 40	SDS plus	126	40	10,80	$d_2 \leq d_1$	39,5
FZUB 12 x 40		127	40	12,82		
FZUB 12 x 50		137	50	12,82		
FZUB 12 x 60		147	60	12,82		
FZUB 12 x 80		167	80	12,82		
FZUB 14 x 40		130	40	14,82		
FZUB 14 x 60		152	60	14,82		
FZUB 14 x 80		172	80	14,82		
FZUB 14 x 100		192	100	14,82		
FZUB 18 x 80		172	80	19,40		
FZUB 18 x 100		192	100	19,40		
FZUB 18 x 130		222	130	19,40		
FZUB 22 x 100		197	100	22,95		43,5
FZUB 22 x 125		222	125	22,95		

Setting tool FZE Plus:

Zykon drills FZUB and setting tools to use, acc. to Annex B2

Dimensions in [mm]

fischer-Zykon-Anchor FZA, FZA-D , FZA-I, FZA ST

Product description
Zykon drill FZUB and setting tool FZE Plus

Annex A6

Table A5: Materials FZA, FZA-D, FZA-I (zinc plated ≥ 5µm, ISO 4042:1999)
FZA, FZA-D (hot-dip galvanized [1)], ISO 10684: 2004 ≥ 50 µm)

Part	Designation	Material
1	Cone bolt with external thread	Cold form steel or free cutting steel Nominal steel tensile strength: f_{uk} ≤ 1000 N/mm²
	Conical bolt with internal thread [2)]	Steel, EN 10277:2008 Nominal steel tensile strength f_{uk} ≤ 1000 N/mm²
2	Expansion sleeve seamless or rolled	Steel
3	Washer	Cold strip, EN 10139:2016
4	Hexagon nut	Steel, property class min. 8, EN ISO 898-2:2012

Table A6: Materials FZA A4, FZA-D A4, FZA-I A4, FZA ST A4

Part	Designation	Material
1	Cone bolt with external thread	Stainless steel EN 10088:2014 Nominal steel tensile strength: f_{uk} ≤ 1000 N/mm²
	Conical bolt with internal thread [3)]	Stainless steel EN 10088:2014 Nominal steel tensile strength: f_{uk} ≤ 1000 N/mm²
2	Expansion sleeve seamless or rolled	Stainless steel EN 10088:2014
3	Washer	Stainless steel EN 10088:2014
4	Hexagon nut	Stainless steel EN 10088:2014; ISO 3506-2:2010; property class – min. 70

Table A7: Materials FZA C, FZA-D C, FZA-I C

Part	Designation	Material
1	Cone bolt with external thread	High corrosion resistant steel EN 10088:2014 Nominal steel tensile strength: f_{uk} ≤ 1000 N/mm²
	Conical bolt with internal thread [4)]	High corrosion resistant steel EN 10088:2014 Nominal steel tensile strength: f_{uk} ≤ 1000 N/mm²
2	Expansion sleeve seamless or rolled	High corrosion resistant steel EN 10088:2014
3	Washer	High corrosion resistant steel EN 10088:2014
4	Hexagon nut	High corrosion resistant steel EN 10088:2014; ISO 3506-2:2010; property class – min. 70

[1)] Alternative method sherardized, EN 13811:2003 ≥ 50 µm
[2)] Related screws or threaded rods: property class 8.8 according to EN ISO 898-1:2013; ductility A_5 > 8%; zinc plated.
[3)] Related screws or threaded rods: property class ≥ 70 according to EN ISO 3506-1:2010; ductility A_5 > 8%; stainless steel 1.4401, 1.4404, 1.4578, 1.4571, 1.4439, 1.4362 according EN 10088:2014.
[4)] Related screws or threaded rods: property class ≥70 according to EN ISO 3506-1:2010; ductility A_5 > 8%; high corrosion resistant steel 1.4529, 1.4565 according EN 10088:2014.

Specifications of intended use

Anchorages subject to:

- Static and quasi-static loads
- Seismic Performance Category C1 sizes FZA14x40, FZA14x60, FZA18x80, FZA22x100, FZA 22x125 and FZA14x80D/20, FZA14x100D/40, FZA18x100D/20, FZA18x130D/50, FZA22x125D/25

Base materials:

- Reinforced and unreinforced normal weight concrete according to EN 206-1:2000
- Strength classes C20/25 to C50/60 according to EN 206-1:2000
- Cracked and non-cracked concrete

Use conditions (Environmental conditions):

- Structures subject to dry internal conditions
  (Zinc plated steel, hot-dip galvanized steel, stainless steel, high corrosion- resistant steel)
- Structures subject to external atmospheric exposure (including industrial and marine environment) and to permanently damp internal condition, if no particular aggressive conditions exist
  (stainless steel, high corrosion-resistant steel)
- Structures subject to external atmospheric exposure and permanently damp internal condition, if other particular aggressive conditions exist
  (high corrosion-resistant steel)
  Note: 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)

Design:

- Anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete work
- Verifiable calculation notes and drawings be prepared taking 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 be designed in accordance with (please choose the relevant design method):
  - ETAG 001, Annex C, design method A, Edition August 2010 or
  - CEN/TS 1992-4:2009, design method A
- Anchorages under seismic actions (cracked concrete) be designed in accordance with:
  - EOTA Technical Report TR 045, Edition February 2013
  - Anchorages shall be positioned outside of critical regions (e.g. plastic hinges) of the concrete structure.
  - Fastenings in stand-off installation or with a grout layer under seismic action are not allowed

Installation:

- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site

- Anchor must be installed to comply with the correct anchorage depth. This is assured when the front face of the sleeve, for the internal thread, is approximately 1mm below the concrete surface or, in the case of the through fixing versions, approximately 1mm below the front surface of fixture. When using the FZA 12x40 ST the knurling on the sleeve is flush or below the concrete surface

Table B1: Installation parameters for FZA, FZA-D, FZA-I

Type of anchor	Drill hole depth h_0 [mm]	Drill FZUB	Setting tool FZE Plus	d_f [2] ≤ [mm]	Torque moment[1] T_{inst} [Nm]	Gap u [mm]	Reach of screw l_S [mm] max	min
FZA 10 x 40 M 6 / t_{fix}	≥ 43	10 x 40	10	7	8,5		-	-
FZA 12 x 40 M 8 / t_{fix}	≥ 43	12 x 40	12	9	20	-	-	-
FZA 14 x 40 M 10 / t_{fix}	≥ 43	14 x 40	14	12	40	-	-	-
FZA 12 x 50 M 8 / t_{fix}	≥ 54	12 x 50	12	9	20	-	-	-
FZA 14 x 60 M 10 / t_{fix}	≥ 63	14 x 60	14	12	40	-	-	-
FZA 18 x 80 M 12 / t_{fix}	≥ 83	18 x 80	18	14	60	-	-	-
FZA 22 x 100 M16 / t_{fix}	≥ 103	22 x 100	22	18	100	-	-	-
FZA 22 x 125 M16 / t_{fix}	≥ 127	22 x 125	22	18	100	-	-	-
FZA 12 x 40 ST A4	≥ 43	12 x 40	12	17[3]	20	-	-	-
FZA 14 x 40 ST A4	≥ 43	14 x 40	14	17[3]	20	-	-	-
FZA 14 x 60 ST A4	≥ 63	14 x 60	14	17[3]	20	-	-	-
FZA 12 x 50 M 8 D / 10	≥ 43	12 x 50	12	14	20	-	-	-
FZA 12 x 60 M 8 D / 10	≥ 53	12 x 60	12	14	20	-	-	-
FZA 12 x 80 M 8 D / 30	≥ 53	12 x 80	12	14	20	-	-	-
FZA 14 x 80 M 10 D / 20	≥ 63	14 x 80	14	16	40	-	-	-
FZA 14 x 100 M 10 D / 40	≥ 63	14 x 100	14	16	40	-	-	-
FZA 18 x 100 M 12 D / 20	≥ 83	18 x 100	18	20	60	-	-	-
FZA 18 x 130 M 12 D / 50	≥ 83	18 x 130	18	20	60	-	-	-
FZA 22 x 125 M 16 D / 25	≥ 105	22 x 125	22	24	100	-	-	-
FZA 12 x 40 M 6 I	≥ 43	12 x 40	12 +FZE 12 I	7	8,5	0 – 4,0	15	10
FZA 12 x 50 M 6 I	≥ 53	12 x 50	12 +FZE 12 I	7	8,5	0 – 4,0	15	10
FZA 14 x 60 M 8 I	≥ 63	14 x 60	14 + FZE 14 I	9	15	0 – 4,0	18	12
FZA 18 x 80 M 10 I	≥ 83	18 x 80	18 + FZE 18 I	12	30	0 – 4,5	24	16
FZA 22 x 100 M 12 I	≥ 103	22 x 100	22 + FZE 22 I	14	60	0 – 4,5	26	16
FZA 22 x 125 M 12 I	≥ 127	22 x 125	22 + FZE 22 I	14	60	0 – 4,5	26	16

[1] If the FZA with an internal thread (FZA-I) is used with a threaded rod or a screw according to Annex A7 the torque moment must be applied as given in the table
[2] Diameter of the clearance hole in the fixture
[3] The displacements due to tension and shear loads given in table C13 and C16 do not apply for FZA ST

Table B2: Minimum thickness of concrete members, minimum spacings and minimum edge distances of **bolt projecting anchor FZA**

Type of anchor			**FZA 10x40 M6 / t_{fix}**	**FZA 12x40 12x40 ST M8 / t_{fix}**	**FZA 14x40 14x40 ST M10 / t_{fix}**	**FZA 12x50 M8 / t_{fix}**
Minimum thickness of concrete member, minimum spacings and minimum edge distances of anchors FZA, FZA A4, FZA C						
Minimum spacing	s_{min}	[mm]	40	40	70	50
Minimum edge distance	c_{min}	[mm]	35	40	70	45
Minimum thickness of concrete member	h_{min}	[mm]	100	100	100	110
Type of anchor			**FZA 14x60 14x60 ST M10 / t_{fix}**	**FZA 18x80 M12 / t_{fix}**	**FZA 22x100 M16 / t_{fix}**	**FZA 22x125 M16 / t_{fix}**
Minimum thickness of concrete member, minimum spacings and minimum edge distances of anchors FZA, FZA A4, FZA C						
Minimum spacing	s_{min}	[mm]	60	80	100	125
Minimum edge distance	c_{min}	[mm]	55	70	100	125
Minimum thickness of concrete member	h_{min}	[mm]	130	160	200	250

Table B3: Minimum thickness of concrete members, minimum spacings and minimum edge distances of **through bolt anchor FZA D**

Type of anchor			**FZA 12x50 M8D/10**	**FZA 12x60 M8D/10**	**FZA 12x80 M8D/30**	**FZA 14x80 M10D/20**
Minimum thickness of concrete member, minimum spacings and minimum edge distances of anchors FZA D, FZA D A4, FZA D C						
Minimum spacing	s_{min}	[mm]	40	50	50	60
Minimum edge distance	c_{min}	[mm]	35	45	45	55
Minimum thickness of concrete member	h_{min}	[mm]	100	110	110	130
Type of anchor			**FZA 14x100 M10D/40**	**FZA 18x100 M12D/20**	**FZA 18x130 M12D/50**	**FZA 22x125 M16D/25**
Minimum thickness of concrete member, minimum spacings and minimum edge distances of anchors FZA D, FZA D A4, FZA D C						
Minimum spacing	s_{min}	[mm]	60	80	80	100
Minimum edge distance	c_{min}	[mm]	55	70	70	100
Minimum thickness of concrete member	h_{min}	[mm]	130	160	160	200

Table B4: Minimum thickness of concrete members, minimum spacings and minimum edge distances of **interal thread anchor FZA-I**

Type of anchor			**FZA 12x40 M6 I**	**FZA 12x50 M6 I**	**FZA 14x60 M8 I**	**FZA 18x80 M10 I**	**FZA 22x100 M12 I**	**FZA 22x125 M12 I**
Minimum thickness of concrete member, minimum spacings and minimum edge distances of anchors FZA I, FZA I A4, FZA I C								
Minimum spacing	s_{min}	[mm]	40	50	60	80	100	125
Minimum edge distance	c_{min}	[mm]	35	45	55	70	100	125
Minimum thickness of concrete member	h_{min}	[mm]	100	110	130	160	200	250

Installation instructions for FZA, FZA-D, FZA-I, FZA ST

Pre-positioned installation

FZA

FZA-I

Create a drill hole at right angles to the surface of the anchor base with a hammer drill, using the corresponding Zykon universal drill bit FZUB. The required drill depth is reached once the FZUB depth stop meets the concrete.

Once the FZUB depth stop meets the concrete, create the drill hole undercut by making circular swiveling movements with the hammer drill while the hammer mechanism is engaged. Press the hammer drill firmly against the anchor base: 1-2 swiveling movements are sufficient for ∅ 14 mm, with 3-5 movements for ∅ 18 mm and ∅ 22 mm

Clean drill hole.

Insert the anchor into the drill hole and then drive the expansion sleeve in with hammer-set device FZE Plus, using a manual hammer.

The anchor is correctly expanded if the colour marking on the thread of the tapered bolt is visible or the gap u is fulfilled.
When using the FZA 12x40 ST the knurling on the sleeve is flush or below the concrete surface.

Mount installation object (e.g. anchor plate), washer and nut, screw (for FZA-I) or threaded rod with washer and nut (for FZA-I) and apply installation torque with torque spanner.

Push-through installation

FZA-D

Create a drill hole through the installation object at right angles to the surface of the anchor base with a hammer drill, using the corresponding Zykon universal drill bit FZUB. The required drill depth is reached once the FZUB depth stop meets the fixture.

Once the FZUB depth stop meets the fixture, create the drill hole undercut by making circular swiveling movements with the hammer drill while the hammer mechanism is engaged. Press the hammer drill firmly against the anchor base: 1-2 swiveling movements are sufficient for ∅ 14 mm, with 3-5 movements for ∅ 18 mm and ∅ 22 mm

Clean drill hole.

Insert the anchor into the drill hole and then drive the expansion sleeve in with hammer-set device FZE Plus, using a manual hammer. The setting depth marking (knurl) is approx. 1mm behind the surface of the concrete.

The anchor is correctly expanded if the colour marking on the thread of the tapered bolt is visible.

Mount installation object (e.g. anchor plate), washer and nut and apply installation torque with torque spanner.

Table C1: Characteristic values of **tension** resistance under static and quasi-static action **for bolt projecting anchor FZA** (Design method A, according to **ETAG 001, Annex C** or **CEN/TS 1992-4**)

Type of anchor / size			FZA (bolt projecting anchor)			
			10x40 M6 / t_{fix}	**12x40 12x40 ST M8 / t_{fix}**	**14x40 14x40 ST M10 / t_{fix}**	**12x50 M8 / t_{fix}**
Steel failure for FZA galvanized						
Characteristic resistance	$N_{Rk,s}$	[kN]	16,1	29,3	46,4	29,3
Partial safety factor	γ_{Ms} [1)]		1,5			
Steel failure for FZA hot-dip galvanized						
Characteristic resistance	$N_{Rk,s}$	[kN]	13,1	25,0	40,7	25,0
Partial safety factor	γ_{Ms} [1)]		1,5			
Steel failure for FZA A4						
Characteristic resistance	$N_{Rk,s}$	[kN]	14,1	25,6	40,6	25,6
Partial safety factor	γ_{Ms} [1)]		1,87			
Steel failure for FZA C						
Characteristic resistance	$N_{Rk,s}$	[kN]	14,1	25,6	40,6	25,6
Partial safety factor	γ_{Ms} [1)]		1,5			
Pullout failure for FZA, FZA A4, FZA C						
Characteristic resistance in cracked concrete C20/25	$N_{Rk,p}$	[kN]	6	6	6	9
Characteristic resistance in non - cracked concrete C20/25	$N_{Rk,p}$	[kN]	9	9	9	12
Increasing factors for $N_{Rk,p}$ for cracked and non – cracked concrete	ψ_c	C25/30	1,10			
		C30/37	1,22			
		C35/45	1,34			
		C40/50	1,41			
		C45/55	1,48			
		C50/60	1,55			
Installation safety factor	$\gamma_2 = \gamma_{inst}$		1,2			1,0
Concrete cone failure and splitting failure for FZA, FZA A4, FZA C						
Effective anchorage depth	h_{ef}	[mm]	40	40	40	50
Factor for non-cracked concrete	k_{ucr}	[-]	10,1			
Factor for cracked concrete	k_{cr}	[-]	7,2			
Min. thickness of concrete member	h_{min}	[mm]	100	100	100	110
Characteristic spacing	$s_{cr,N} = s_{cr,sp}$	[mm]	3 h_{ef}			
Characteristic edge distance	$c_{cr,N} = c_{cr,sp}$	[mm]	1,5 h_{ef}			

[1)] In absence of other national regulations

Table C2: Characteristic values of **tension** resistance under static and quasi-static action **for bolt projecting anchor FZA** (Design method A, according to **ETAG 001, Annex C** or **CEN/TS 1992-4**)

Type of anchor / size			FZA (bolt projecting anchor)			
			14x60 14x60 ST M10 / t_{fix}	**18x80 M12 / t_{fix}**	**22x100 M16 / t_{fix}**	**22x125 M16 / t_{fix}**
Steel failure for FZA galvanized						
Characteristic resistance	$N_{Rk,s}$	[kN]	46,4	67,4	126	126
Partial safety factor	γ_{Ms} [1)]		1,5			
Steel failure for FZA hot-dip galvanized						
Characteristic resistance	$N_{Rk,s}$	[kN]	40,7	60,1	115	115
Partial safety factor	γ_{Ms} [1)]		1,5			
Steel failure for FZA A4						
Characteristic resistance	$N_{Rk,s}$	[kN]	40,6	59,0	110	110
Partial safety factor	γ_{Ms} [1)]		1,87			
Steel failure for FZA C						
Characteristic resistance	$N_{Rk,s}$	[kN]	40,6	59,0	110	110
Partial safety factor	γ_{Ms} [1)]		1,5			
Pullout failure for FZA, FZA A4, FZA C						
Characteristic resistance in cracked concrete C20/25	$N_{Rk,p}$	[kN]	12	20	40	40
Characteristic resistance in non - cracked concrete C20/25	$N_{Rk,p}$	[kN]	20	30	40	40
Increasing factors for $N_{Rk,p}$ for cracked and non – cracked concrete	ψ_c	C25/30	1,10			
		C30/37	1,22			
		C35/45	1,34			
		C40/50	1,41			
		C45/55	1,48			
		C50/60	1,55			
Installation safety factor	$\gamma_2 = \gamma_{inst}$		1,0			
Concrete cone failure and splitting failure for FZA, FZA A4, FZA C						
Effective anchorage depth	h_{ef}	[mm]	60	80	100	125
Factor for non-cracked concrete	k_{ucr}	[-]	10,1			
Factor for cracked concrete	k_{cr}	[-]	7,2			
Min. thickness of concrete member	h_{min}	[mm]	130	160	200	250
Characteristic spacing	$s_{cr,N} = s_{cr,sp}$	[mm]	3 h_{ef}			
Characteristic edge distance	$c_{cr,N} = c_{cr,sp}$	[mm]	1,5 h_{ef}			

[1)] In absence of other national regulations

Table C3: Characteristic values of **tension** resistance under static and quasi-static action **for through bolt anchor FZA D** (Design method A, according to **ETAG 001, Annex C** or **CEN/TS 1992-4**)

Type of anchor / size			FZA D (through bolt anchor)			
			12x50 M8D/10	**12x60 M8D/10**	**12x80 M8D/30**	**14x80 M10D/20**
Steel failure for FZA D galvanized						
Characteristic resistance	$N_{Rk,s}$	[kN]	29,3	29,3	29,3	46,4
Partial safety factor	γ_{Ms} [1)]		1,5			
Steel failure for FZA D hot-dip galvanized						
Characteristic resistance	$N_{Rk,s}$	[kN]	25,0	25,0	25,0	40,7
Partial safety factor	γ_{Ms} [1)]		1,5			
Steel failure for FZA D A4						
Characteristic resistance	$N_{Rk,s}$	[kN]	25,6	25,6	25,6	40,6
Partial safety factor	γ_{Ms} [1)]		1,87			
Steel failure for FZA D C						
Characteristic resistance	$N_{Rk,s}$	[kN]	25,6	25,6	25,6	40,6
Partial safety factor	γ_{Ms} [1)]		1,5			
Pullout failure for FZA D, FZA D A4, FZA D C						
Characteristic resistance in cracked concrete C20/25	$N_{Rk,p}$	[kN]	6	9	9	12
Characteristic resistance in non - cracked concrete C20/25	$N_{Rk,p}$	[kN]	9	12	12	20
Increasing factors for $N_{Rk,p}$ for cracked and non – cracked concrete	ψ_c	C25/30	1,10			
		C30/37	1,22			
		C35/45	1,34			
		C40/50	1,41			
		C45/55	1,48			
		C50/60	1,55			
Installation safety factor	$\gamma_2 = \gamma_{inst}$		1,2	1,0		
Concrete cone failure and splitting failure for FZA D, FZA D A4, FZA D C						
Effective anchorage depth	h_{ef}	[mm]	40	50	50	60
Factor for non-cracked concrete	k_{ucr}	[-]	10,1			
Factor for cracked concrete	k_{cr}	[-]	7,2			
Min. thickness of concrete member	h_{min}	[mm]	100	110	110	130
Characteristic spacing	$s_{cr,N} = s_{cr,sp}$	[mm]	3 h_{ef}			
Characteristic edge distance	$c_{cr,N} = c_{cr,sp}$	[mm]	1,5 h_{ef}			

[1)] In absence of other national regulations

Table C4: Characteristic values of **tension** resistance under static and quasi-static action **for through bolt anchor FZA D** (Design method A, according to **ETAG 001, Annex C** or **CEN/TS 1992-4**)

Type of anchor / size			FZA D (through bolt anchor)			
			14x100 M10D/40	**18x100 M12D/20**	**18x130 M12D/50**	**22x125 M16D/25**
Steel failure for FZA D galvanized						
Characteristic resistance	$N_{Rk,s}$	[kN]	46,6	67,4	67,4	126,0
Partial safety factor	γ_{Ms} [1)]		1,5			
Steel failure for FZA D hot-dip galvanized						
Characteristic resistance	$N_{Rk,s}$	[kN]	40,7	60,1	60,1	115
Partial safety factor	γ_{Ms} [1)]		1,5			
Steel failure for FZA D A4						
Characteristic resistance	$N_{Rk,s}$	[kN]	40,6	59,0	59,0	110,0
Partial safety factor	γ_{Ms} [1)]		1,87			
Steel failure for FZA D C						
Characteristic resistance	$N_{Rk,s}$	[kN]	40,6	59,0	59,0	110,0
Partial safety factor	γ_{Ms} [1)]		1,5			
Pullout failure for FZA D, FZA D A4, FZA D C						
Characteristic resistance in cracked concrete C20/25	$N_{Rk,p}$	[kN]	12	20	20	40
Characteristic resistance in non - cracked concrete C20/25	$N_{Rk,p}$	[kN]	20	30	30	40
Increasing factors for $N_{Rk,p}$ for cracked and non – cracked concrete	ψ_c	C25/30	1,10			
		C30/37	1,22			
		C35/45	1,34			
		C40/50	1,41			
		C45/55	1,48			
		C50/60	1,55			
Installation safety factor	$\gamma_2 = \gamma_{inst}$		1,0			
Concrete cone failure and splitting failure for FZA D, FZA D A4, FZA D C						
Effective anchorage depth	h_{ef}	[mm]	60	80	80	100
Factor for non-cracked concrete	k_{ucr}	[-]	10,1			
Factor for cracked concrete	k_{cr}	[-]	7,2			
Min. thickness of concrete member	h_{min}	[mm]	130	160	160	200
Characteristic spacing	$s_{cr,N} = s_{cr,sp}$	[mm]	3 h_{ef}			
Characteristic edge distance	$c_{cr,N} = c_{cr,sp}$	[mm]	1,5 h_{ef}			

[1)] In absence of other national regulations

Table C5: Characteristic values of **tension** resistance under static and quasi-static action **for internal thread anchor FZA I** (Design method A, according to **ETAG 001, Annex C** or **CEN/TS 1992-4**)

Type of anchor / size			FZA I (internal thread anchor)					
			12x40 M6 I	**12x50 M6 I**	**14x60 M8 I**	**18x80 M10 I**	**22x100 M12 I**	**22x125 M12 I**
Steel failure for FZA I								
Characteristic resistance	$N_{Rk,s}$	[kN]	16,1	16,1	22,9	26,9	63,0	63,0
Partial safety factor	γ_{Ms} [1)]		1,75			2,0		
Steel failure for FZA I A4								
Characteristic resistance	$N_{Rk,s}$	[kN]	13,5	13,5	17,9	22,7	53,1	53,1
Partial safety factor	γ_{Ms} [1)]		1,8					
Steel failure for FZA I C								
Characteristic resistance	$N_{Rk,s}$	[kN]	13,5	13,5	17,9	22,7	53,1	53,1
Partial safety factor	γ_{Ms} [1)]		1,8					
Pullout failure for FZA I, FZA I A4, FZA I C								
Characteristic resistance in cracked concrete C20/25	$N_{Rk,p}$	[kN]	6	9	12	20	40	40
Characteristic resistance in non - cracked concrete C20/25	$N_{Rk,p}$	[kN]	9	12	20	30	40	40
Increasing factors for $N_{Rk,p}$ for cracked and non – cracked concrete	ψ_c	C25/30	1,10					
		C30/37	1,22					
		C35/45	1,34					
		C40/50	1,41					
		C45/55	1,48					
		C50/60	1,55					
Installation safety factor	$\gamma_2 = \gamma_{inst}$		1,2	1,0				
Concrete cone failure and splitting failure for FZA I, FZA I A4, FZA I C								
Effective anchorage depth	h_{ef}	[mm]	40	50	60	80	100	125
Factor for non-cracked concrete	k_{ucr}	[-]	10,1					
Factor for cracked concrete	k_{cr}	[-]	7,2					
Min. thickness of concrete member	h_{min}	[mm]	100	110	130	160	200	250
Characteristic spacing	$s_{cr,N} = s_{cr,sp}$	[mm]	3 h_{ef}					
Characteristic edge distance	$c_{cr,N} = c_{cr,sp}$	[mm]	1,5 h_{ef}					

[1)] In absence of other national regulations

Table C6: Characteristic values of **shear** resistance under static and quasi-static action **for bolt projecting anchor FZA** (Design method A, according to **ETAG 001, Annex C or CEN/TS 1992-4:2009**)

Type of anchor / size			FZA (bolt projecting anchor)			
			10x40 M6 / t_{fix}	**12x40 12x40 ST M8 / t_{fix}**	**14x40 14x40 ST M10 / t_{fix}**	**12x50 M8 / t_{fix}**
Steel failure without lever arm FZA galvanized / hot-dip galvanized						
Characteristic resistance	$V_{Rk,s}$	[kN]	8,0	14,7	23,2	14,7
Partial safety factor	γ_{Ms} [1)]		1,25			
Factor for ductility	k_2	[-]	1,0			
Steel failure with lever arm FZA galvanized / hot-dip galvanized						
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	12,2	30,0	59,8	30,0
Partial safety factor	γ_{Ms} [1)]		1,25			
Factor for ductility	k_2	[-]	1,0			
Steel failure without lever arm FZA A4						
Characteristic resistance	$V_{Rk,s}$	[kN]	7,0	12,8	20,3	12,8
Partial safety factor	γ_{Ms} [1)]		1,56			
Factor for ductility	k_2	[-]	1,0			
Steel failure with lever arm FZA A4						
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	10,7	26,2	52,3	26,2
Partial safety factor	γ_{Ms} [1)]		1,56			
Factor for ductility	k_2	[-]	1,0			
Steel failure without lever arm FZA C						
Characteristic resistance	$V_{Rk,s}$	[kN]	7,0	12,8	20,3	12,8
Partial safety factor	γ_{Ms} [1)]		1,25			
Factor for ductility	k_2	[-]	1,0			
Steel failure with lever arm FZA C						
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	10,7	26,2	52,3	26,2
Partial safety factor	γ_{Ms} [1)]		1,25			
Factor for ductility	k_2	[-]	1,0			
Concrete pryout failure FZA, FZA A4, FZA C						
Factor k according to ETAG 001, Annex C or k_3 according to CEN/TS 1992-4	$k = k_3$	[-]	1,3			
Concrete edge failure						
Effective length of anchor in shear loading	l_f	[mm]	40	40	40	50
Effective diameter of anchor	d_{nom}	[mm]	10	12	14	12
Installation safety factor	$\gamma_2 = \gamma_{inst}$		1,0			

[1)] In absence of other national regulations

Table C7: Characteristic values of **shear** resistance under static and quasi-static action **for bolt projecting anchor FZA** (Design method A, according to **ETAG 001, Annex C or CEN/TS 1992-4:2009**)

Type of anchor / size			FZA (bolt projecting anchor)			
			14x60 14x60 ST M10 / t_{fix}	**18x80 M12 / t_{fix}**	**22x100 M16 / t_{fix}**	**22x125 M16 / t_{fix}**
Steel failure without lever arm FZA galvanized / hot-dip galvanized						
Characteristic resistance	$V_{Rk,s}$	[kN]	23,2	33,8	62,8	62,8
Partial safety factor	γ_{Ms} [1)]		1,25			
Factor for ductility	k_2	[-]	1,0			
Steel failure with lever arm FZA galvanized / hot-dip galvanized						
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	59,8	105	266	266
Partial safety factor	γ_{Ms} [1)]		1,25			
Factor for ductility	k_2	[-]	1,0			
Steel failure without lever arm FZA A4						
Characteristic resistance	$V_{Rk,s}$	[kN]	20,3	29,5	55,0	55,0
Partial safety factor	γ_{Ms} [1)]		1,56			
Factor for ductility	k_2	[-]	1,0			
Steel failure with lever arm FZA A4						
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	52,3	91,6	232	232
Partial safety factor	γ_{Ms} [1)]		1,56			
Factor for ductility	k_2	[-]	1,0			
Steel failure without lever arm FZA C						
Characteristic resistance	$V_{Rk,s}$	[kN]	20,3	29,5	55,0	55,0
Partial safety factor	γ_{Ms} [1)]		1,25			
Factor for ductility	k_2	[-]	1,0			
Steel failure with lever arm FZA C						
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	52,3	91,6	232	232
Partial safety factor	γ_{Ms} [1)]		1,25			
Factor for ductility	k_2	[-]	1,0			
Concrete pryout failure FZA, FZA A4, FZA C						
Factor k according to ETAG 001, Annex C or k_3 according to CEN/TS 1992-4	$k = k_3$	[-]	2,0			
Concrete edge failure						
Effective length of anchor in shear loading	l_f	[mm]	60	80	100	125
Effective diameter of anchor	d_{nom}	[mm]	14	18	22	22
Installation safety factor	$\gamma_2 = \gamma_{inst}$		1,0			

[1)] In absence of other national regulations

Table C8: Characteristic values of **shear** resistance under static and quasi-static action **for through bolt anchor FZA D** (Design method A, according to **ETAG 001, Annex C or CEN/TS 1992-4:2009**)

Type of anchor / size			FZA D (through bolt anchor)			
			12x50 M8D/10	**12x60 M8D/10**	**12x80 M8D/30**	**14x80 M10D/20**
Steel failure without lever arm FZA D galvanized / hot-dip galvanized						
Characteristic resistance	$V_{Rk,s}$	[kN]	14,7	14,7	14,7	23,2
Partial safety factor	γ_{Ms} [1)]		1,25			
Factor for ductility	k_2	[-]	1,0			
Steel failure with lever arm FZA D galvanized / hot-dip galvanized						
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	30,0	30,0	30,0	59,8
Partial safety factor	γ_{Ms} [1)]		1,25			
Factor for ductility	k_2	[-]	1,0			
Steel failure without lever arm FZA D A4						
Characteristic resistance	$V_{Rk,s}$	[kN]	12,8	12,8	12,8	20,3
Partial safety factor	γ_{Ms} [1)]		1,56			
Factor for ductility	k_2	[-]	1,0			
Steel failure with lever arm FZA D A4						
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	26,2	26,2	26,2	52,3
Partial safety factor	γ_{Ms} [1)]		1,56			
Factor for ductility	k_2	[-]	1,0			
Steel failure without lever arm FZA D C						
Characteristic resistance	$V_{Rk,s}$	[kN]	12,8	12,8	12,8	20,3
Partial safety factor	γ_{Ms} [1)]		1,25			
Factor for ductility	k_2	[-]	1,0			
Steel failure with lever arm FZA D C						
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	26,2	26,2	26,2	52,3
Partial safety factor	γ_{Ms} [1)]		1,25			
Factor for ductility	k_2	[-]	1,0			
Concrete pryout failure FZA D, FZA D A4, FZA D C						
Factor k according to ETAG 001, Annex C or k_3 according to CEN/TS 1992-4	$k = k_3$	[-]	1,3	1,3	1,3	2,0
Concrete edge failure						
Effective length of anchor in shear loading	l_f	[mm]	40	50	50	60
Effective diameter of anchor	d_{nom}	[mm]	12	12	12	14
Installation safety factor	$\gamma_2 = \gamma_{inst}$		1,0			

[1)] In absence of other national regulations

Table C9: Characteristic values of **shear** resistance under static and quasi-static action **for through bolt anchor FZA D** (Design method A, according to **ETAG 001, Annex C or CEN/TS 1992-4:2009**)

Type of anchor / size			FZA D (through bolt anchor)			
			14x100 M10D/40	**18x100 M12D/20**	**18x130 M12D/50**	**22x125 M16D/25**
Steel failure without lever arm FZA D galvanized / hot-dip galvanized						
Characteristic resistance	$V_{Rk,s}$	[kN]	23,2	33,8	33,8	62,8
Partial safety factor	γ_{Ms} [1)]		1,25			
Factor for ductility	k_2	[-]	1,0			
Steel failure with lever arm FZA D galvanized / hot-dip galvanized						
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	59,8	105	105	266
Partial safety factor	γ_{Ms} [1)]		1,25			
Factor for ductility	k_2	[-]	1,0			
Steel failure without lever arm FZA D A4						
Characteristic resistance	$V_{Rk,s}$	[kN]	20,3	29,5	29,5	55,0
Partial safety factor	γ_{Ms} [1)]		1,56			
Factor for ductility	k_2	[-]	1,0			
Steel failure with lever arm FZA D A4						
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	52,3	91,6	91,6	232
Partial safety factor	γ_{Ms} [1)]		1,56			
Factor for ductility	k_2	[-]	1,0			
Steel failure without lever arm FZA D C						
Characteristic resistance	$V_{Rk,s}$	[kN]	20,3	29,5	29,5	55,0
Partial safety factor	γ_{Ms} [1)]		1,25			
Factor for ductility	k_2	[-]	1,0			
Steel failure with lever arm FZA D C						
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	52,3	91,6	91,6	232
Partial safety factor	γ_{Ms} [1)]		1,25			
Factor for ductility	k_2	[-]	1,0			
Concrete pryout failure FZA D, FZA D A4, FZA D C						
Factor k according to ETAG 001, Annex C or k_3 according to CEN/TS 1992-4	$k = k_3$	[-]	2,0			
Concrete edge failure						
Effective length of anchor in shear loading	l_f	[mm]	60	80	80	100
Effective diameter of anchor	d_{nom}	[mm]	14	18	18	22
Installation safety factor	$\gamma_2 = \gamma_{inst}$		1,0			

[1)] In absence of other national regulations

Table C10: Characteristic values of **shear** resistance under static and quasi-static action **internal thread anchor FZA I** (Design method A, according to **ETAG 001, Annex C or CEN/TS 1992-4:2009**)

Type of anchor / size			FZA I (internal thread anchor)					
			12x40 M6 I	**12x50 M6 I**	**14x60 M8 I**	**18x80 M10 I**	**22x100 M12 I**	**22x125 M12 I**
Steel failure without lever arm FZA I								
Characteristic resistance	$V_{Rk,s}$	[kN]	8,6	8,6	11,4	13,4	31,5	31,5
Partial safety factor	γ_{Ms} [1)]		1,5	1,5	1,5	1,7	1,7	1,7
Factor for ductility	k_2	[-]	1,0					
Steel failure with lever arm FZA I								
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	12,2	12,2	30,0	59,8	105	105
Partial safety factor	γ_{Ms} [1)]		1,25					
Factor for ductility	k_2	[-]	1,0					
Steel failure without lever arm FZA I A4								
Characteristic resistance	$V_{Rk,s}$	[kN]	6,7	6,7	9,0	11,3	26,6	26,6
Partial safety factor	γ_{Ms} [1)]		1,5					
Factor for ductility	k_2	[-]	1,0					
Steel failure with lever arm FZA I A4								
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	10,7	10,7	26,2	52,3	91,6	91,6
Partial safety factor	γ_{Ms} [1)]		1,56					
Factor for ductility	k_2	[-]	1,0					
Steel failure without lever arm FZA I C								
Characteristic resistance	$V_{Rk,s}$	[kN]	6,7	6,7	9,0	11,3	26,6	26,6
Partial safety factor	γ_{Ms} [1)]		1,5					
Factor for ductility	k_2	[-]	1,0					
Steel failure with lever arm FZA I C								
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	10,7	10,7	26,2	52,3	91,6	91,6
Partial safety factor	γ_{Ms} [1)]		1,56					
Factor for ductility	k_2	[-]	1,0					
Concrete pryout failure FZA I, FZA I A4, FZA I C								
Factor k according to ETAG 001, Annex C or k_3 according to CEN/TS 1992-4	$k = k_3$	[-]	1,3	1,3	2,0	2,0	2,0	2,0
Concrete edge failure								
Effective length of anchor in shear loading	l_f	[mm]	40	50	60	80	100	125
Effective diameter of anchor	d_{nom}	[mm]	12	12	14	18	22	22
Installation safety factor	$\gamma_2 = \gamma_{inst}$		1,0					

[1)] In absence of other national regulations

Table C11: Characteristic values of **tension and shear** resistance under **seismic action for bolt projecting anchor** FZA (Design according to **TR 045: Performance category C1**)

Type of anchor / size		FZA (bolt projecting anchor)				
		14x40 M10 / t_{fix}	**14x60 M10 / t_{fix}**	**18x80 M12 / t_{fix}**	**22x100 M16 / t_{fix}**	**22x125 M16 / t_{fix}**
Steel failure FZA galvanized						
Characteristic resistance tension load C1	$N_{Rk,s,C1}$ [kN]	46,4	46,4	67,4	126	126
Partial safety factor	$\gamma_{Ms,C1}$ [1)] [-]	1,5				
Steel failure FZA hot-dip galvanized						
Characteristic resistance tension load C1	$N_{Rk,s,C1}$ [kN]	40,7	40,7	60,1	115	115
Partial safety factor	$\gamma_{Ms,C1}$ [1)] [-]	1,5				
Steel failure FZA A4						
Characteristic resistance tension load C1	$N_{Rk,s,C1}$ [kN]	40,6	40,6	59,0	110	110
Partial safety factor	$\gamma_{Ms,C1}$ [1)] [-]	1,87				
Steel failure FZA C						
Characteristic resistance tension load C1	$N_{Rk,s,C1}$ [kN]	40,6	40,6	59,0	110	110
Partial safety factor	$\gamma_{Ms,C1}$ [1)] [-]	1,5				
Pullout failure						
Characteristic resistance tension load in cracked concrete C1	$N_{Rk,p,C1}$ [kN]	6,0	6,0	20,0	40,0	40,0
Installation safety factor	$\gamma_{2,C1}$ [-]	1,0				
Steel failure without lever arm FZA						
Characteristic resistance shear load C1	$V_{Rk,s,C1}$ [kN]	20,9	20,9	33,8	62,8	62,8
Partial safety factor	$\gamma_{Ms,C1}$ [1)] [-]	1,25				
Steel failure without lever arm FZA A4						
Characteristic resistance shear load C1	$V_{Rk,s,C1}$ [kN]	18,3	18,3	29,5	55,0	55,0
Partial safety factor	$\gamma_{Ms,C1}$ [1)] [-]	1,56				
Steel failure without lever arm FZA C						
Characteristic resistance shear load C1	$V_{Rk,s,C1}$ [kN]	18,3	18,3	29,5	55,0	55,0
Partial safety factor	$\gamma_{Ms,C1}$ [1)] [-]	1,25				

1) In absence of other national regulations

Table C12: Characteristic values of **tension and shear** resistance under **seismic action for through bolt anchor FZA D** (Design according to **TR 045: Performance category C1**)

Type of anchor / size		FZA D (through bolt anchor)				
		14x80 M10D/20	**14x100 M10D/40**	**18x100 M12D/20**	**18x130 M12D/50**	**22x125 M16D/25**
Steel failure FZA D galvanized						
Characteristic resistance tension load C1	$N_{Rk,s,C1}$ [kN]	46,4	46,4	67,4	67,4	126
Partial safety factor	$\gamma_{Ms,C1}$ [1)] [-]	1,5				
Steel failure FZA D hot-dip galvanized						
Characteristic resistance tension load C1	$N_{Rk,s,C1}$ [kN]	40,7	40,7	60,1	60,1	115
Partial safety factor	$\gamma_{Ms,C1}$ [1)] [-]	1,5				
Steel failure FZA D A4						
Characteristic resistance tension load C1	$N_{Rk,s,C1}$ [kN]	40,6	40,6	59,0	59,0	110
Partial safety factor	$\gamma_{Ms,C1}$ [1)] [-]	1,87				
Steel failure FZA D C						
Characteristic resistance tension load C1	$N_{Rk,s,C1}$ [kN]	40,6	40,6	59,0	59,0	110
Partial safety factor	$\gamma_{Ms,C1}$ [1)] [-]	1,5				
Pullout failure						
Characteristic resistance tension load in cracked concrete C1	$N_{Rk,p,C1}$ [kN]	6,0	6,0	20,0	20,0	40,0
Installation safety factor	$\gamma_{2,C1}$ [-]	1,0				
Steel failure without lever arm FZA D						
Characteristic resistance shear load C1	$V_{Rk,s,C1}$ [kN]	20,9	20,9	33,8	33,8	62,8
Partial safety factor	$\gamma_{Ms,C1}$ [1)] [-]	1,25				
Steel failure without lever arm FZA D A4						
Characteristic resistance shear load C1	$V_{Rk,s,C1}$ [kN]	18,3	18,3	29,5	29,5	55,0
Partial safety factor	$\gamma_{Ms,C1}$ [1)] [-]	1,56				
Steel failure without lever arm FZA D C						
Characteristic resistance shear load C1	$V_{Rk,s,C1}$ [kN]	18,3	18,3	29,5	29,5	55,0
Partial safety factor	$\gamma_{Ms,C1}$ [1)] [-]	1,25				

1) In absence of other national regulations

Table C13: Displacements due to tension loads for **bolt projecting anchor FZA** (Design method A, according to **ETAG 001, Annex C** or **CEN/TS 1992-4:2009**)

Type of anchor / size			FZA (bolt projecting anchor)			
			10x40 M6 / t_{fix}	**12x40 M8 / t_{fix}**	**14x40 M10 / t_{fix}**	**12x50 M8 / t_{fix}**
Tension load in cracked concrete	N	[kN]	2,0	2,0	2,0	3,5
Displacement	δ_{N0}	[mm]	0,8			
	$\delta_{N\infty}$	[mm]	1,1			
Tension load in non - cracked concrete	N	[kN]	3,3	3,3	3,3	4,8
Displacement	δ_{N0}	[mm]	0,8			
	$\delta_{N\infty}$	[mm]	1,1			
			14x60 M10 / t_{fix}	**18x80 M12 / t_{fix}**	**22x100 M16 / t_{fix}**	**22x125 M16 / t_{fix}**
Tension load in cracked concrete	N	[kN]	5,0	8,0	16,0	16,0
Displacement	δ_{N0}	[mm]	0,8			
	$\delta_{N\infty}$	[mm]	1,1			
Tension load in non - cracked concrete	N	[kN]	7,5	12,7	17,9	17,9
Displacement	δ_{N0}	[mm]	0,8			
	$\delta_{N\infty}$	[mm]	1,1			

The displacements do not apply for FZA ST

Table C14: Displacements due to tension loads for **through bolt anchor FZA D** (Design method A, according to **ETAG 001, Annex C** or **CEN/TS 1992-4:2009**)

Type of anchor / size			FZA (through bolt anchor FZA D)			
			12x50 M8D/10	**12x60 M8D/10**	**12x80 M8D/30**	**14x80 M10D/20**
Tension load in cracked concrete	N	[kN]	2,0	3,5	3,5	5,0
Displacement	δ_{N0}	[mm]	0,8			
	$\delta_{N\infty}$	[mm]	1,1			
Tension load in non - cracked concrete	N	[kN]	3,3	4,8	4,8	7,5
Displacement	δ_{N0}	[mm]	0,8			
	$\delta_{N\infty}$	[mm]	1,1			
			14x100 M10D/40	**18x100 M12D/20**	**18x130 M12D/50**	**22x125 M16D/25**
Tension load in cracked concrete	N	[kN]	5,0	8,0	8,0	16,0
Displacement	δ_{N0}	[mm]	0,8			
	$\delta_{N\infty}$	[mm]	1,1			
Tension load in non - cracked concrete	N	[kN]	7,5	12,7	12,7	17,9
Displacement	δ_{N0}	[mm]	0,8			
	$\delta_{N\infty}$	[mm]	1,1			

Table C15: Displacements due to tension loads for **internal thread anchor FZA I**
(Design method A, according to **ETAG 001, Annex C** or **CEN/TS 1992-4:2009**)

Type of anchor / size			FZA I (internal thread anchor FZA I)					
			12x40 M6 I	**12x50 M6 I**	**14x60 M8 I**	**18x80 M10 I**	**22x100 M12 I**	**22x125 M12 I**
Tension load in cracked concrete	N	[kN]	2,0	3,5	5,0	8,0	16,0	16,0
Displacement	δ_{N0}	[mm]	0,8					
	$\delta_{N\infty}$	[mm]	1,1					
Tension load in non - cracked concrete	N	[kN]	3,3	4,8	7,5	12,7	17,9	17,9
Displacement	δ_{N0}	[mm]	0,8					
	$\delta_{N\infty}$	[mm]	1,1					

Table C16: Displacements due to shear loads for **bolt projecting anchor FZA** (Design method A, according to **ETAG 001, Annex C** or **CEN/TS 1992-4:2009**)

Type of anchor / size			FZA (bolt projecting anchor)			
			10x40 M6 / t_{fix}	**12x40 M8 / t_{fix}**	**14x40 M10 / t_{fix}**	**12x50 M8 / t_{fix}**
Shear load in cracked and non-cracked concrete	V	[kN]	4,0	5,0	9,0	5,0
Displacement	δ_{V0}	[mm]	2,0	0,7	1,9	0,7
	$\delta_{V\infty}$	[mm]	3,0	1,0	2,8	1,0
			14x60 M10 / t_{fix}	**18x80 M12 / t_{fix}**	**22x100 M16 / t_{fix}**	**22x125 M16 / t_{fix}**
Shear load in cracked and non-cracked concrete	V	[kN]	12,5	19,0	30,0	30,0
Displacement	δ_{V0}	[mm]	1,9	2,1	2,1	2,1
	$\delta_{V\infty}$	[mm]	2,8	3,1	3,1	3,1

The displacements do not apply for FZA ST

Table C17: Displacements due to shear loads **for through bolt anchor FZA D** (Design method A, according to **ETAG 001, Annex C** or **CEN/TS 1992-4:2009**)

Type of anchor / size			FZA D (through bolt anchor)			
			12x50 M8D/10	**12x60 M8D/10**	**12x80 M8D/30**	**14x80 M10D/20**
Shear load in cracked and non-cracked concrete	V	[kN]	5,0	5,0	5,0	12,5
Displacement	δ_{V0}	[mm]	0,7	0,7	0,7	1,9
	$\delta_{V\infty}$	[mm]	1,0	1,0	1,0	2,8
			14x100 M10D/40	**18x100 M12D/20**	**18x130 M12D/50**	**22x125 M16D/25**
Shear load in cracked and non-cracked concrete	V	[kN]	12,5	19,0	19,0	30,0
Displacement	δ_{V0}	[mm]	1,9	2,1	2,1	2,1
	$\delta_{V\infty}$	[mm]	2,8	3,1	3,1	3,1

Table C18: Displacements due to shear loads for **internal thread anchor FZA I** (Design method A, according to **ETAG 001, Annex C** or **CEN/TS 1992-4:2009**)

Type of anchor / size			FZA I (internal thread anchor)					
			12x40 M6 I	**12x50 M6 I**	**14x60 M8 I**	**18x80 M10 I**	**22x100 M12 I**	**22x125 M12 I**
Shear load in cracked and non-cracked concrete	V	[kN]	5,0	5,0	12,5	19,0	30,0	30,0
Displacement	δ_{N0}	[mm]	0,7	0,7	1,9	2,1	2,1	2,1
	$\delta_{N\infty}$	[mm]	1,0	1,0	2,8	3,1	3,1	3,1