Deutsches Institut für Bautechnik
Zulassungsstelle für Bauprodukte und Bauarten
Bautechnisches Prüfamt
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Authorised and notified according to Article 10 of the Council Directive of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products (89/106/EEC)

Deutsches Institut für Bautechnik

DIBt

Mitglied der EOTA
Member of EOTA

European Technical Approval ETA-98/0004

English translation prepared by DIBt - Original version in German language

Handelsbezeichnung *Trade name*	fischer-Zykon-Anker FZA, FZA-I, FZA-D *fischer-Zykon-Anchor FZA, FZA-I, FZA-D*
Zulassungsinhaber *Holder of approval*	fischerwerke GmbH & Co. KG Weinhalde 14-18 72178 Waldachtal DEUTSCHLAND
Zulassungsgegenstand und Verwendungszweck *Generic type and use of construction product*	Hinterschnittdübel in den Größen M6, M8, M10, M12 und M16 zur Verankerung im Beton *Undercut anchor of sizes M6, M8, M10, M12 and M16 for use in concrete*
Geltungsdauer: *Validity:*	vom *from* 20 June 2013 bis *to* 20 June 2018
Herstellwerk *Manufacturing plant*	fischerwerke

Diese Zulassung umfasst *This Approval contains*	28 Seiten einschließlich 20 Anhänge *28 pages including 20 annexes*
Diese Zulassung ersetzt *This Approval replaces*	ETA-98/0004 mit Geltungsdauer vom 28.01.2009 bis 28.01.2014 *ETA-98/0004 with validity from 28.01.2009 to 28.01.2014*

I LEGAL BASES AND GENERAL CONDITIONS

1 This European technical approval is issued by Deutsches Institut für Bautechnik in accordance with:

- Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products[1], modified by Council Directive 93/68/EEC[2] and Regulation (EC) N° 1882/2003 of the European Parliament and of the Council[3];
- *Gesetz über das In-Verkehr-Bringen von und den freien Warenverkehr mit Bauprodukten zur Umsetzung der Richtlinie 89/106/EWG des Rates vom 21. Dezember 1988 zur Angleichung der Rechts- und Verwaltungsvorschriften der Mitgliedstaaten über Bauprodukte und anderer Rechtsakte der Europäischen Gemeinschaften (Bauproduktengesetz - BauPG) vom 28. April 1998[4], as amended by Article 2 of the law of 8 November 2011[5];*
- Common Procedural Rules for Requesting, Preparing and the Granting of European technical approvals set out in the Annex to Commission Decision 94/23/EC[6];
- Guideline for European technical approval of "Metal anchors for use in concrete - Part 3: Undercut anchors", ETAG 001-03.

2 Deutsches Institut für Bautechnik is authorized to check whether the provisions of this European technical approval are met. Checking may take place in the manufacturing plant. Nevertheless, the responsibility for the conformity of the products to the European technical approval and for their fitness for the intended use remains with the holder of the European technical approval.

3 This European technical approval is not to be transferred to manufacturers or agents of manufacturers other than those indicated on page 1, or manufacturing plants other than those indicated on page 1 of this European technical approval.

4 This European technical approval may be withdrawn by Deutsches Institut für Bautechnik, in particular pursuant to information by the Commission according to Article 5(1) of Council Directive 89/106/EEC.

5 Reproduction of this European technical approval including transmission by electronic means shall be in full. However, partial reproduction can be made with the written consent of Deutsches Institut für Bautechnik. In this case partial reproduction has to be designated as such. Texts and drawings of advertising brochures shall not contradict or misuse the European technical approval.

6 The European technical approval is issued by the approval body in its official language. This version corresponds fully to the version circulated within EOTA. Translations into other languages have to be designated as such.

1 Official Journal of the European Communities L 40, 11 February 1989, p. 12
2 Official Journal of the European Communities L 220, 30 August 1993, p. 1
3 Official Journal of the European Union L 284, 31 October 2003, p. 25
4 *Bundesgesetzblatt Teil I 1998*, p. 812
5 *Bundesgesetzblatt Teil I 2011*, p. 2178
6 Official Journal of the European Communities L 17, 20 January 1994, p. 34

II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

1 Definition of product and intended use

1.1 Definition of product

The fischer-Zykon-Anchor FZA, FZA-D and FZA-I 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 anchor is anchored by impact acting on the expansion sleeve over the cone bolts in the undercuts of the borehole.

For the different types of installed anchors see Figure given in Annex 1.

1.2 Intended use

The anchor is intended to be used for anchorages for which requirements for mechanical resistance and stability and safety in use in the sense of the Essential Requirements 1 and 4 of Council Directive 89/106 EEC shall be fulfilled and failure of anchorages made with these products would cause risk to human life and/or lead to considerable economic consequences. The anchor is to be used only for anchorages subject to static or quasi-static loading in reinforced or unreinforced normal weight concrete of strength classes C 20/25 at minimum and C 50/60 at most according to EN 206: 2000-12.

It may be anchored in cracked and non-cracked concrete.

<u>fischer-Zykon-Anchor FZA made of galvanised steel:</u>

The anchor may only be used in structures subject to dry internal conditions.

<u>fischer-Zykon-Anchor FZA A4 made of stainless steel:</u>

The anchor made of stainless steel A4 may be used in structures subject to dry internal conditions and also in structures subject to external atmospheric exposure (including industrial and marine environment), or exposure in permanently damp internal 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).

<u>fischer-Zykon-Anchor FZA C made of high corrosion resistant steel:</u>

The anchor made of high corrosion resistant steel may be used in structures subject to dry internal conditions and also in structures subject to external atmospheric exposure, in permanently damp internal conditions or in other particular aggressive conditions. 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 chemical pollution (e.g. in desulphurization plants or road tunnels where de-icing materials are used).

The provisions made in this European technical approval are based on an assumed working life of the anchor of 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.

2 Characteristics of product and methods of verification

2.1 Characteristics of product

The anchor corresponds to the drawings and provisions given in Annexes 2 and 5. The characteristic material values, dimensions and tolerances of the anchor not indicated in Annexes 2 and 5 shall correspond to the respective values laid down in the technical documentation7 of this European technical approval.

The characteristic anchor values for the design of anchorages are given in the Annexes.

Each anchor is marked with the identifying mark of the producer, the commercial name and the external dimensions of the expansion sleeve according to Annex 2. Each anchor made of stainless steel is additional marked with the letter "A4" and each anchor made of high corrosion resistant steel is additional marked with the letters "C".

The anchor shall only be packaged and supplied as a complete unit.

2.2 Methods of verification

The assessment of fitness of the anchor for the intended use in relation to the requirements for mechanical resistance and stability and safety in use in the sense of the Essential Requirements 1 and 4 has been made in accordance with the "Guideline for European technical approval of Metal Anchors for use in concrete", Part 1 "Anchors in general" and Part 3 "Undercut anchors", on the basis of Option 1.

In addition to the specific clauses relating to dangerous substances contained in this European technical approval, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the Construction Products Directive, these requirements need also to be complied with, when and where they apply.

3 Evaluation of Conformity and CE marking

3.1 Attestation of Conformity system

According to the decision 96/582/EG of the European Commission[8] the system 2(i) (referred to as system 1) of attestation of conformity applies.

This system of attestation of conformity is defined as follows:

7 The technical documentation of this European technical approval is deposited at the Deutsches Institut für Bautechnik and, as far as relevant for the tasks of the approved bodies involved in the attestation of conformity procedure, is handed over to the approved bodies.

8 Official Journal of the European Communities L 254 of 08.10.1996.

System 1: Certification of the conformity of the product by an approved certification body on the basis of:

(a) Tasks for the manufacturer:

(1) factory production control;

(2) further testing of samples taken at the factory by the manufacturer in accordance with a prescribed test plan;

(b) Tasks for the approved body:

(3) initial type–testing of the product;

(4) initial inspection of factory and of factory production control;

(5) continuous surveillance, assessment and approval of factory production control.

Note: Approved bodies are also referred to as "notified bodies".

3.2 Responsibilities

3.2.1 Tasks of the manufacturer

3.2.1.1 Factory production control

The manufacturer shall exercise permanent internal control of production. All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures, including records of results performed. This production control system shall insure that the product is in conformity with this European technical approval.

The manufacturer may only use initial/ raw/ constituent materials stated in the technical documentation of this European technical approval.

The factory production control shall be in accordance with the control plan which is part of the technical documentation of this European technical approval. The control plan is laid down in the context of the factory production control system operated by the manufacturer and deposited at Deutsches Institut für Bautechnik[9].

The results of factory production control shall be recorded and evaluated in accordance with the provisions of the control plan.

3.2.1.2 Other tasks of manufacturer

The manufacturer shall, on the basis of a contract, involve a body which is approved for the tasks referred to in section 3.1 in the field of anchors in order to undertake the actions laid down in section 3.2.2. For this purpose, the control plan referred to in sections 3.2.1.1 and 3.2.2 shall be handed over by the manufacturer to the approved body involved.

The manufacturer shall make a declaration of conformity, stating that the construction product is in conformity with the provisions of this European technical approval.

3.2.2 Tasks of approved bodies

The approved body shall perform the

- initial type-testing of the product ,
- initial inspection of factory and of factory production control,
- continuous surveillance, assessment and approval of factory production control,

in accordance with the provisions laid down in the control plan.

The approved body shall retain the essential points of its actions referred to above and state the results obtained and conclusions drawn in a written report.

[9] The control plan is a confidential part of the documentation of the European technical approval, but not published together with the European technical approval and only handed over to the approved body involved in the procedure of attestation of conformity.
See section 3.2.2.

The approved certification body involved by the manufacturer shall issue an EC certificate of conformity of the product stating the conformity with the provisions of this European technical approval.

In cases where the provisions of the European technical approval and its control plan are no longer fulfilled the certification body shall withdraw the certificate of conformity and inform Deutsches Institut für Bautechnik without delay.

3.3 CE marking

The CE marking shall be affixed on each packaging of the anchor. The letters "CE" shall be followed by the identification number of the approved certification body, where relevant, and be accompanied by the following additional information:

- the name and address of the producer (legal entity responsible for the manufacturer),
- the last two digits of the year in which the CE marking was affixed,
- the number of the EC certificate of conformity for the product,
- the number of the European technical approval,
- the number of the guideline for European technical approval
- use category (ETAG 001-1 Option 1),
- size.

4 Assumptions under which the fitness of the product for the intended use was favourably assessed

4.1 Manufacturing

The European technical approval is issued for the product on the basis of agreed data/information, deposited with the Deutsches Institut für Bautechnik, which identifies the product that has been assessed and judged. Changes to the product or production process, which could result in this deposited data/information being incorrect, should be notified to the Deutsches Institut für Bautechnik before the changes are introduced. Deutsches Institut für Bautechnik will decide whether or not such changes affect the approval and consequently the validity of the CE marking on the basis of the approval and if so whether further assessment or alterations to the approval shall be necessary.

4.2 Design of anchorages

The fitness of the anchor for the intended use is given under the following conditions:

The anchorages are designed either in accordance with the

- ETAG 001 "Guideline for European technical approval of Metal Anchors for use in concrete", Annex C, method A

or in accordance with the

- CEN/TS 1992-4:2009, design method A

under the responsibility of an engineer experienced in anchorages and concrete work.

Verifiable calculation notes and drawings are 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, in cracked or non-cracked concrete, etc.).

The minimum strength class and the minimum screwing depth of the fastening screw or threaded rod for installation of the fixture shall meet the requirements according to Annex 3 and 7. The length of the fastening screw or threaded rod shall be defined according to the available thread length, the minimum screwing depth, the thickness of fixture and tolerances of member and fixture.

4.3 Installation of anchors

The fitness for use of the anchor can only be assumed if the anchor is installed as follows:

- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.
- Use of the anchor only as supplied by the manufacturer without exchanging the components of an anchor.
- For anchor version FZA-I the commercial standard rod may only be used if the following requirements are fulfilled:
  - material, dimensions and mechanical properties of the metal parts according to the specifications given in Annex 3 and 7,
  - confirmation of material and mechanical properties of the metal parts by inspection certificate 3.1 according to EN 10204:2004, the documents should be stored,
- Anchor installation in accordance with the manufacturer's specifications and drawings using the tools indicated in the technical documentation of this European technical approval.
- Checks before placing the anchor to ensure that the strength class of the concrete in which the anchor is to be placed is in the range given and is not lower than that of the concrete to which the characteristic loads apply.
- Check of concrete being well compacted, e.g. without significant voids.
- Clearing of the hole of drilling dust.
- Anchor installation such that the effective anchorage depth is complied with. This compliance is ensured when the expansion sleeve in the case of bolt anchor and anchor with inner thread is placed about 1 mm under the concrete surface and in the case of the through bolt anchor is placed about 1 mm under the surface of the fixture.
- Keeping of the edge distance and spacing to the specified values without minus tolerances.
- Positioning of the drill holes without damaging the reinforcement.
- In case of aborted hole: new drilling at a minimum distance away of twice the depth of the aborted hole or smaller distance if the aborted drill hole is filled with high strength mortar and if under shear or oblique tension load it is not in the direction of load application.
- Application of the torque moment given in Annex 7 using a calibrated torque wrench.

5 Responsibility of the manufacturer

It is in the responsibility of the manufacturer to ensure that the information on the specific conditions according to 1 and 2 including Annexes referred to as well as sections 4.2 and 4.3 is given to those who are concerned. This information may be made by reproduction of the respective parts of the European technical approval. In addition all installation data shall be shown clearly on the package and/or on an enclosed instruction sheet, preferably using illustration(s).

The minimum data required are:

- drill bit (corresponding special drill bit),
- setting tools (corresponding tool for hammering in),
- maximum thickness of the fixture,
- minimum effective anchorage depth,
- hole depth,
- torque moment,
- information on the installation procedure, including cleaning of the hole, preferably by means of an illustration,
- minimum and maximum reach of screw of the fastening screw for the anchor with inner thread,
- identification of the manufacturing batch.

All data shall be presented in a clear and explicit form.

Andreas Kummerow
p.p. Head of Department

beglaubigt:
Baderschneider

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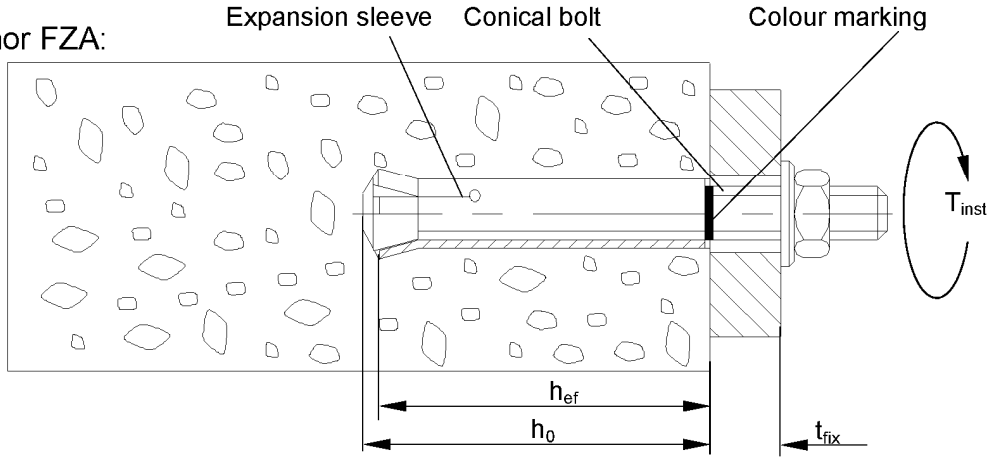
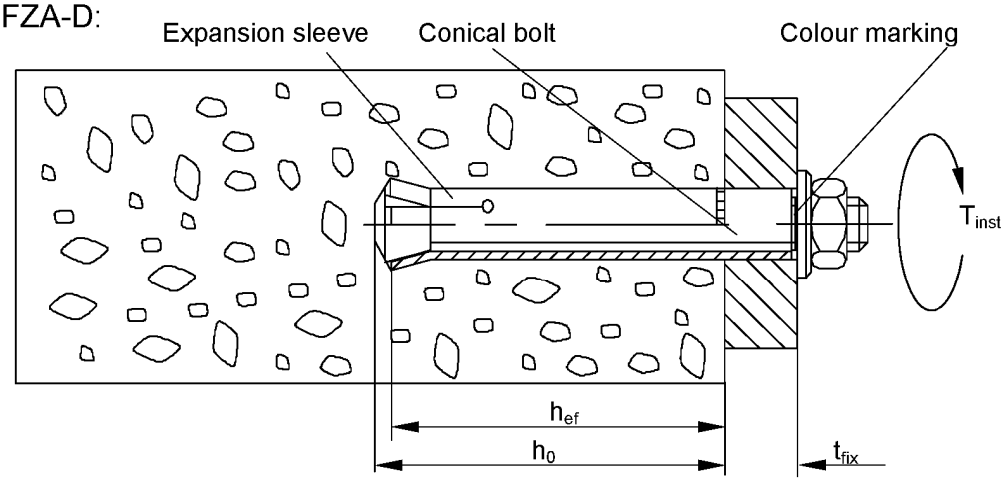
Installed Anchor
- Anchorage in concrete -

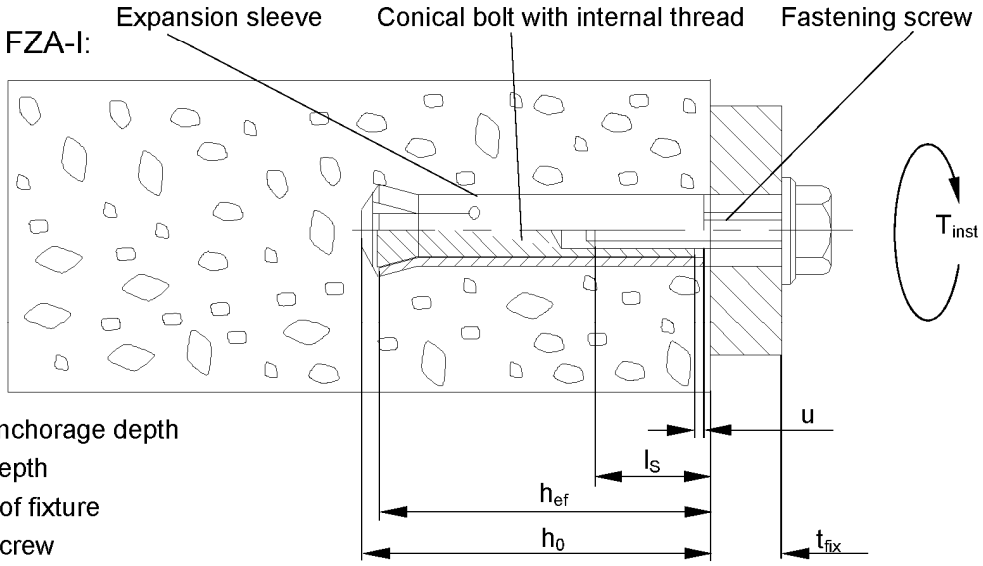
Bolt projecting anchor FZA:



Through bolt anchor FZA-D:



Internal thread anchor FZA-I:



Legend:
h_{ef} : Effective anchorage depth
h_0 : Drill hole depth
t_{fix} : Thickness of fixture
l_S : Reach of screw
u : Gap between conical bolt and expansion sleeve

fischer-Zykon-Anchor FZA, FZA-I, FZA-D	Annex 1
Product and intended use	

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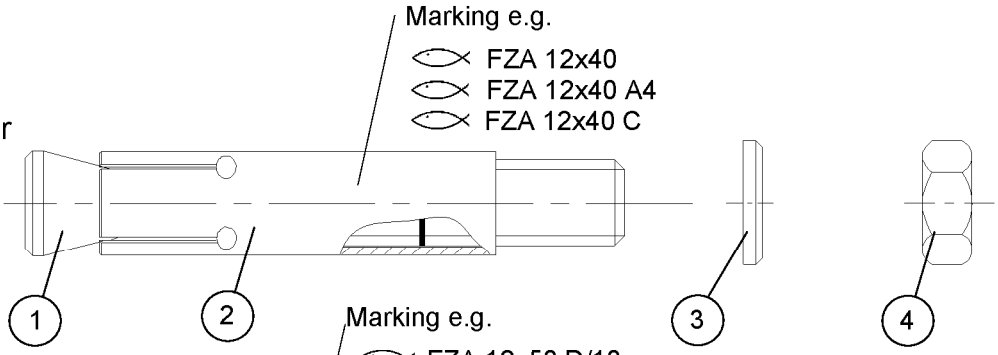
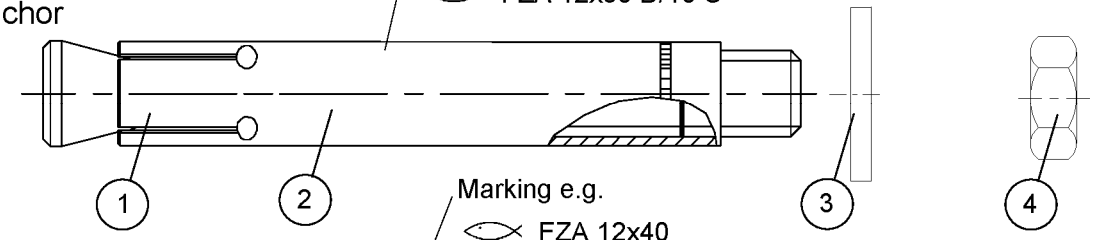
Type of anchors:

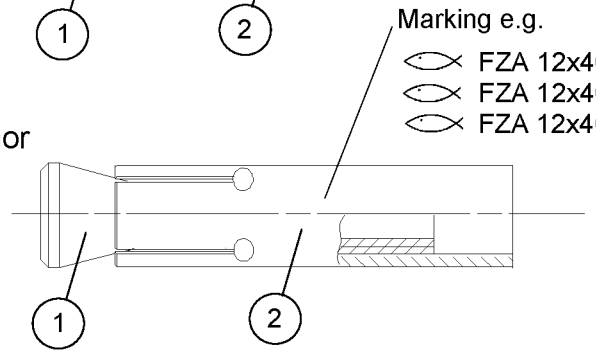
Bolt projecting anchor
FZA:



Through bolt anchor
FZA-D:

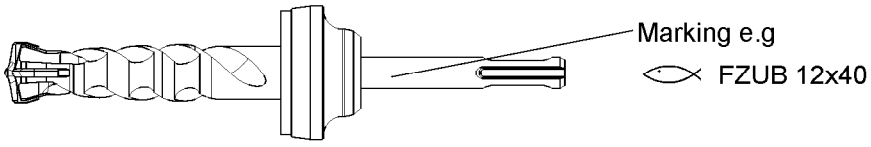


Internal thread anchor
FZA – I:

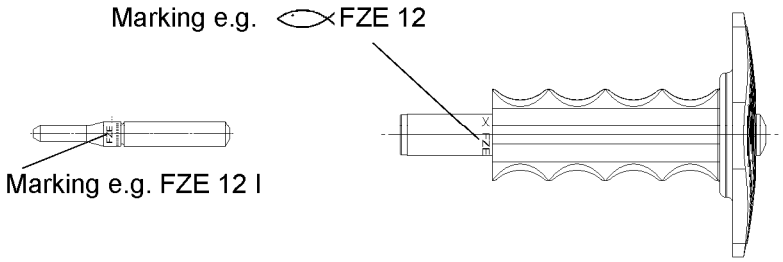


Related fastening screws respectively threaded rods must correspond to Annex 3

Zykon drill
FZUB:



Setting tool FZE Plus with centring pin for internal thread anchor



fischer-Zykon-Anchor FZA, FZA-I, FZA-D	Annex 2
Product - marking and tools	

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Table 1a: Materials FZA

Part	Designation	Material
1	Conical bolt with external thread	Steel, property class 8, DIN EN ISO 898-1 galvanised ≥ 5 µm according EN ISO 4042
	Conical bolt with internal thread [1)]	steel, EN 10 227 nominal steel tensile strength f_{uk} ≤ 1000 N/mm² galvanised ≥ 5 µm according EN ISO 4042
2	Expansion sleeve seamless or rolled	Steel, galvanised ≥ 5 µm according EN ISO 4042
3	Washer	Steel EN 10 139, galvanised ≥ 5 µm according EN ISO 4042
4	Hexagon nut	Steel, property class 8 EN ISO 898-2 galvanised ≥ 5 µm according EN ISO 4042

Table 1b: Materials FZA A4

Part	Designation	Material
1	Conical bolt with external thread	Stainless steel EN 10 088 nominal steel tensile strength f_{uk} ≤ 1000 N/mm²
	Conical bolt with internal thread [2)]	Stainless steel EN 10 088 nominal steel tensile strength f_{uk} ≤ 1000 N/mm²
2	Expansion sleeve seamless or rolled	Stainless steel EN 10 088
3	Washer	Stainless steel EN 10 088
4	Hexagon nut	Stainless steel EN 10 088; ISO 3506-2; property class 70

Table 1c: Materials FZA C

Part	Designation	Material
1	Conical bolt with external thread	High corrosion resistant steel EN 10 088 nominal steel tensile strength f_{uk} ≤ 1000 N/mm²
	Conical bolt with internal thread [3)]	High corrosion resistant steel EN 10 088 nominal steel tensile strength f_{uk} ≤ 1000 N/mm²
2	Expansion sleeve seamless or rolled	High corrosion resistant steel EN 10 088
3	Washer	High corrosion resistant steel EN 10 088
4	Hexagon nut	High corrosion resistant steel EN 10 088; ISO 3506-2; property class 70

1) related Screws or threaded rods: property class 8.8 according to EN ISO 989-1; ductility A_5 > 8%; galvanized > 5µm according to EN ISO 4042

2) related Screws or threaded rods: property class 70 according to EN ISO 3506-1; ductility A_5 > 8%; Stainless steel 1.4401, 1.4404, 1.4578, 1.4571, 1.4439, 1.4362 according EN 10088.

3) related Screws or threaded rods: property class 70 according to EN ISO 3506-1; ductility A_5 > 8%; High corrosion resistant steel 1.4529, 1.4565 according EN 10088.

fischer-Zykon-Anchor FZA, FZA-I, FZA-D	Annex 3
Materials	

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FZA

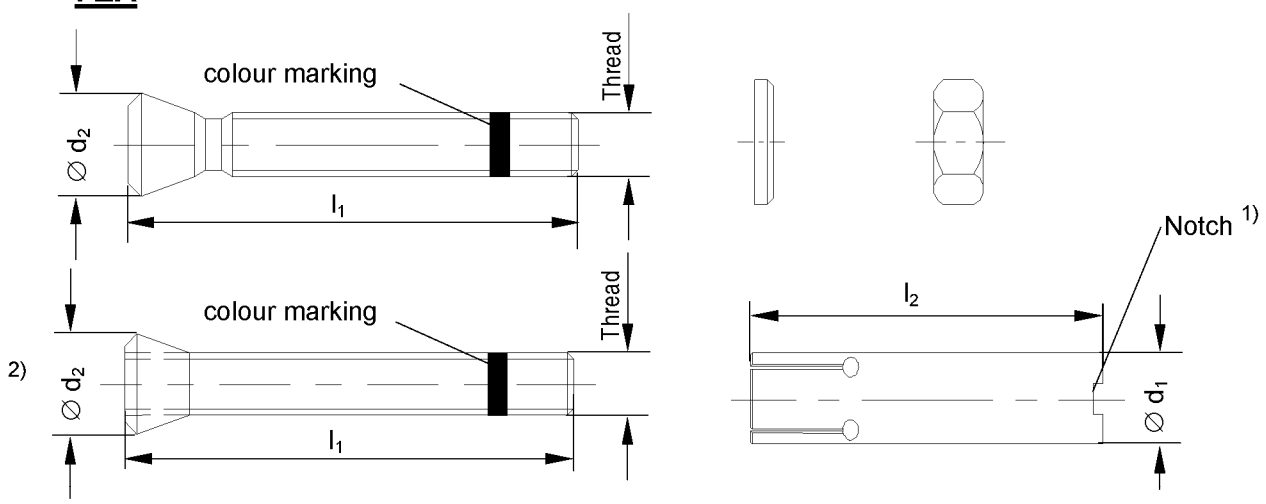

Table 2: Dimensions bolt projecting anchor FZA

Type of anchor	Thread	t_{fix} min	t_{fix} max	l_1 min	l_1 max	l_2	∅ d_1	∅ 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

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

Dimensions in [mm]

fischer-Zykon-Anchor FZA, FZA-I, FZA-D	Annex 4
Dimensions bolt projecting anchor	

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FZA-D

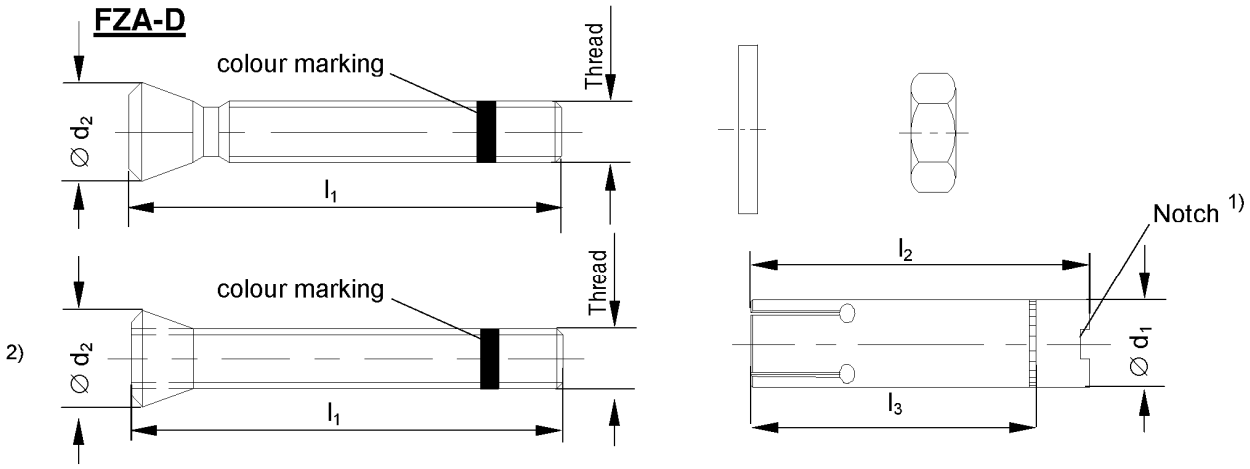

Table 3: Dimensions through bolt anchor FZA-D

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

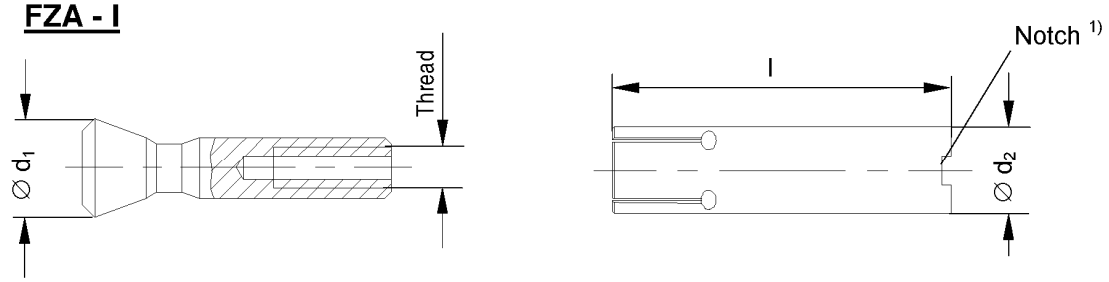

Table 4: Dimensions internal thread anchor FZA - I

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-I, FZA-D	Annex 5
Dimensions through bolt anchor, internal thread anchor	

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Zykon drill FZUB

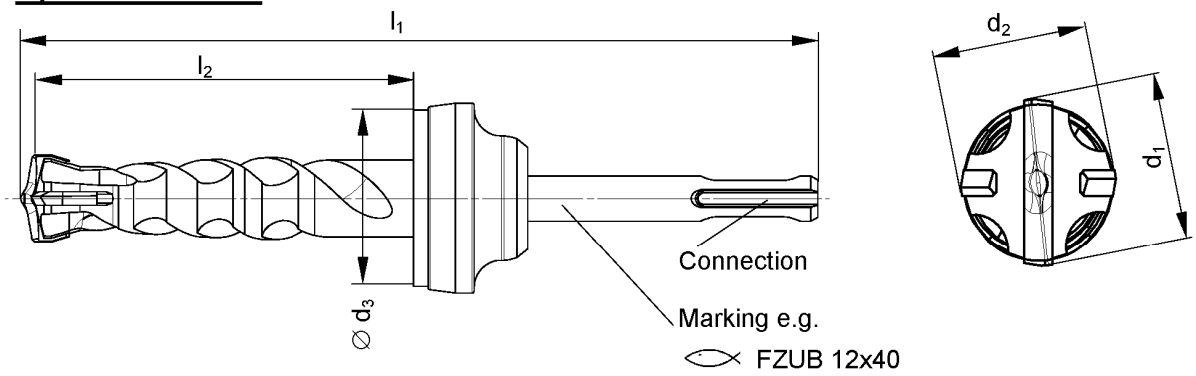
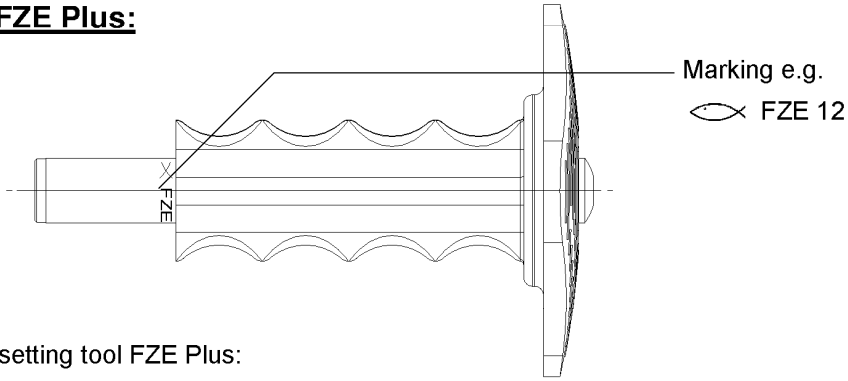


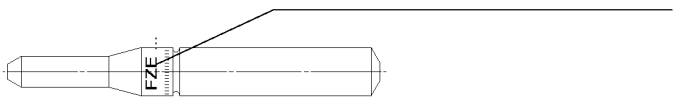
Table 5: Dimensions Zykon drill FZUB

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:



Centring pin for setting tool FZE Plus:



Zykon drills FZUB and setting tools to use, see Table 6.

Dimensions in [mm]

fischer-Zykon-Anchor FZA, FZA-I, FZA-D	Annex 6
Zykon drill FZUB, setting tool	

Table 6: Anchor- and installation parameters for FZA, FZA A4 and FZA C

Type of anchor	Drill hole depth	Drill	Setting tool	Centring pin	Diameter of the clearance hole in the fixture	Torque moment[1)]	Gap	Reach of screw l_S [mm]	
	h_0 [mm]	FZUB	FZE plus	FZE I plus	≤ [mm]	T_{inst} [Nm]	u [mm]	max	min
FZA 10 x 40 M 6 / t_{fix}	≥ 43	10 x 40	FZE 10	-	7	8,5		-	-
FZA 12 x 40 M 8 / t_{fix}	≥ 43	12 x 40	FZE 12	-	9	20	-	-	-
FZA 14 x 40 M 10 / t_{fix}	≥ 43	14 x 40	FZE 14	-	12	40	-	-	-
FZA 12 x 50 M 8 / t_{fix}	≥ 54	12 x 50	FZE 12	-	9	20	-	-	-
FZA 14 x 60 M 10 / t_{fix}	≥ 63	14 x 60	FZE 14	-	12	40	-	-	-
FZA 18 x 80 M 12 / t_{fix}	≥ 83	18 x 80	FZE 18	-	14	60	-	-	-
FZA 22 x 100 M16 / t_{fix}	≥ 103	22 x 100	FZE 22	-	18	100	-	-	-
FZA 22 x 125 M16 / t_{fix}	≥ 127	22 x 125	FZE 22	-	18	100	-	-	-
FZA 12 x 50 M 8 D / 10	≥ 43	12 x 50	FZE 12	-	14	20	-	-	-
FZA 12 x 60 M 8 D / 10	≥ 53	12 x 60	FZE 12	-	14	20	-	-	-
FZA 12 x 80 M 8 D / 30	≥ 53	12 x 80	FZE 12	-	14	20	-	-	-
FZA 14 x 80 M 10 D / 20	≥ 63	14 x 80	FZE 14	-	16	40	-	-	-
FZA 14 x 100 M 10 D / 40	≥ 63	14 x 100	FZE 14	-	16	40	-	-	-
FZA 18 x 100 M 12 D / 20	≥ 83	18 x 100	FZE 18	-	20	60	-	-	-
FZA 18 x 130 M 12 D / 50	≥ 83	18 x 130	FZE 18	-	20	60	-	-	-
FZA 22 x 125 M 16 D / 25	≥ 105	22 x 125	FZE 22	-	24	100	-	-	-
FZA 12 x 40 M 6 I	≥ 43	12 x 40	FZE 12 with FZE 12 I		7	8,5	0 – 4,0	13	8
FZA 12 x 50 M 6 I	≥ 53	12 x 50	FZE 12 with FZE 12 I		7	8,5	0 – 4,0	13	8
FZA 14 x 60 M 8 I	≥ 63	14 x 60	FZE 14 with FZE 14 I		9	15	0 – 4,0	17	11
FZA 18 x 80 M 10 I	≥ 83	18 x 80	FZE 18 with FZE 18 I		12	30	0 – 4,5	21	13
FZA 22 x 100 M 12 I	≥ 103	22 x 100	FZE 22 with FZE 22 I		14	60	0 – 4,5	25	15
FZA 22 x 125 M 12 I	≥ 127	22 x 125	FZE 22 with FZE 22 I		14	60	0 – 4,5	25	15

1) If the FZA with an internal thread (FZA-I) is used with a threaded rod or a screw according to annex 3 the torque moment must be applied as given in the table.

fischer-Zykon-Anchor FZA, FZA-I, FZA-D	Annex 7
Characteristic Anchor- and installation parameters	

Table 7: Characteristic values of resistance of **bolt projecting anchor** to tension loads of design method A

Anchor type, - size *(footnote see Annex 9)*				**FZA 10x40 M6 / t_{fix}**	**FZA 12x40 M8 / t_{fix}**	**FZA 14x40 M10 / t_{fix}**	**FZA 12x50 M8 / t_{fix}**	**FZA 14x60 M10 / t_{fix}**	**FZA 18x80 M12 / t_{fix}**	**FZA 22x100 M16 / t_{fix}**	**FZA 22x125 M16 / t_{fix}**
Steel failure FZA											
Characteristic resistance	$N_{Rk,s}$	[kN]		16,1	29,3	46,4	29,3	46,4	67,4	126	126
Partial safety factor	γ_{Ms} [1)]	[-]		1,5							
Steel failure FZA A4											
Characteristic resistance	$N_{Rk,s}$	[kN]		14,1	25,6	40,6	25,6	40,6	59,0	110	110
Partial safety factor	γ_{Ms} [1)]	[-]		1,87							
Steel failure FZA C											
Characteristic resistance	$N_{Rk,s}$	[kN]		14,1	25,6	40,6	25,6	40,6	59,0	110	110
Partial safety factor	γ_{Ms} [1)]	[-]		1,5							
Pullout failure FZA, FZA A4, FZA C											
Character. resistance in cracked concrete	$N_{Rk,p}$ [kN]	C20/25		6	6	6	9	12	20	40	40
Character. resistance in non-cracked concrete		C20/25		9	9	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							
Partial safety factor	γ_{Mp} [1)]	[-]		1,8 [2)]			1,5 [2)]				
Concrete cone and splitting failure FZA, FZA A4, FZA C											
Effective anchorage depth	h_{ef}	[mm]		40	40	40	50	60	80	100	125
Spacing	$s_{cr,N} = s_{cr,sp}$	[mm]		120	120	120	150	180	240	300	375
Edge distance	$c_{cr,N} = c_{cr,sp}$	[mm]		60	60	60	75	90	120	150	190
Partial safety factor	$\gamma_{Mc} = \gamma_{M,Sp}$ [1)]	[-]		1,8 [2)]			1,5 [2)]				
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	60	80	100	125
Minimum edge distance	c_{min}	[mm]		35	40	70	45	55	70	100	125
Minimum thickness of concrete member	h_{min}	[mm]		100	100	100	110	130	160	200	250

Table 8: Displacements of anchors due to tension load

Tension load in cracked concrete		[kN]		2,0	2,0	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		[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 9: Characteristic values of resistance of **bolt projecting anchor** to shear loads of design method A

Anchor type, - size			FZA 10x40 M6 / t_{fix}	FZA 12x40 M8 / t_{fix}	FZA 14x40 M10 / t_{fix}	FZA 12x50 M8 / t_{fix}	FZA 14x60 M10 / t_{fix}	FZA 18x80 M12 / t_{fix}	FZA 22x100 M16 / t_{fix}	FZA 22x125 M16 / t_{fix}
Steel failure without lever arm FZA										
Characteristic resistance	$V_{Rk,s}$	[kN]	8,0	14,7	23,2	14,7	23,2	33,8	62,8	62,8
Partial safety factor	γ_{Ms} 1)	[-]	1,25							
Steel failure with lever arm FZA										
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	12,2	30,0	59,8	30,0	59,8	105	266	266
Partial safety factor	γ_{Ms} 1)	[-]	1,25							
Steel failure without lever arm FZA A4										
Characteristic resistance	$V_{Rk,s}$	[kN]	7,0	12,8	20,3	12,8	20,3	29,5	55,0	55,0
Partial safety factor	γ_{Ms} 1)	[-]	1,56							
Steel failure with lever arm FZA A4										
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	10,7	26,2	52,3	26,2	52,3	91,6	232	232
Partial safety factor	γ_{Ms} 1)	[-]	1,56							
Steel failure without lever arm FZA C										
Characteristic resistance	$V_{Rk,s}$	[kN]	7,0	12,8	20,3	12,8	20,3	29,5	55,0	55,0
Partial safety factor	γ_{Ms} 1)	[-]	1,25							
Steel failure with lever arm FZA C										
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	10,7	26,2	52,3	26,2	52,3	91,6	232	232
Partial safety factor	γ_{Ms} 1)	[-]	1,25							
Concrete pryout failure FZA, FZA A4, FZA C										
Factor in equation (5.6) of ETAG Annex C, 5.2.3.3	k	[-]	1,3	1,3	1,3	1,3	2,0	2,0	2,0	2,0
Partial safety factor	γ_{Mc} 1)	[-]	1,5 2)							
Concrete edge failure FZA, FZA A4, FZA C										
Effective length of anchor in shear loading	l_f	[mm]	40	40	40	50	60	80	100	125
Effective diameter of anchor	d_{nom}	[mm]	10	12	14	12	14	18	22	22
Partial safety factor	γ_{Mc} 1)	[-]	1,5 2)							

Table 10: Displacements of anchors under shear load

Shear load in cracked and non-cracked concrete		[kN]	4,0	5,0	9,0	5,0	12,5	19,0	30,0	30,0
Displacement	δ_{V0}	[mm]	2,0	0,7	1,9	0,7	1,9	2,1	2,1	2,1
	$\delta_{V\infty}$	[mm]	3,0	1,0	2,8	1,0	2,8	3,1	3,1	3,1

1) In absent of other national regulations.
2) The partial safety factor γ_2 is included.

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

Design method A according to ETAG 001, Annex C
Characteristic values to shear loads
Bolt projecting anchor

Annex 9

Table 11: Characteristic values of resistance of **through bolt anchor** to tension loads of design method A

Anchor type, - size *(footnote see Annex 11)*				FZA 12x50 M8D/10	FZA 12x60 M8D/10	FZA 12x80 M8D/30	FZA 14x80 M10D/20	FZA 14x100 M10D/40	FZA 18x100 M12D/20	FZA 18x130 M12D/50	FZA 22x125 M16D/25
Steel failure FZA											
Characteristic resistance	$N_{Rk,s}$	[kN]		29,3	29,3	29,3	46,4	46,4	67,4	67,4	126
Partial safety factor	γ_{Ms} [1)]	[-]		1,5							
Steel failure FZA A4											
Characteristic resistance	$N_{Rk,s}$	[kN]		25,6	25,6	25,6	40,6	40,6	59,0	59,0	110
Partial safety factor	γ_{Ms} [1)]	[-]		1,87							
Steel failure FZA C											
Characteristic resistance	$N_{Rk,s}$	[kN]		25,6	25,6	25,6	40,6	40,6	59,0	59,0	110
Partial safety factor	γ_{Ms} [1)]	[-]		1,5							
Pullout failure FZA, FZA A4, FZA C											
Character. resistance in cracked concrete	$N_{Rk,p}$ [kN]	C20/25		6	9	9	12	12	20	20	40
Character. resistance in non-cracked concrete		C20/25		9	12	12	20	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							
Partial safety factor	γ_{Mp} [1)]	[-]		1,8 [2)]	1,5 [2)]						
Concrete cone and splitting failure FZA, FZA A4, FZA C											
Effective anchorage depth	h_{ef}	[mm]		40	50	50	60	60	80	80	100
Spacing	$s_{cr,N} = s_{cr,sp}$	[mm]		120	150	150	180	180	240	240	300
Edge distance	$c_{cr,N} = c_{cr,sp}$	[mm]		60	75	75	90	90	120	120	150
Partial safety factor	$\gamma_{Mc} = \gamma_{M,Sp}$ [1)]	[-]		1,8 [2)]	1,5 [2)]						
Minimum thickness of concrete member, minimum spacings and minimum edge distances of anchors FZA, FZA A4, FZA C											
Minimum spacing	s_{min}	[mm]		40	50	50	60	60	80	80	100
Minimum edge distance	c_{min}	[mm]		35	45	45	55	55	70	70	100
Minimum thickness of concrete member	h_{min}	[mm]		100	110	110	130	130	160	160	200

Table 12: Displacements of anchors due to tension load

Tension load in cracked concrete		[kN]		2,0	3,5	3,5	5,0	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		[kN]		3,3	4,8	4,8	7,5	7,5	12,7	12,7	17,9
Displacement	δ_{N0}	[mm]		0,8							
	$\delta_{N\infty}$	[mm]		1,1							

Table 13: Characteristic values of resistance of **through bolt anchor** to shear loads of design method A

Anchor type, - size			FZA 12x50 M8D/10	FZA 12x60 M8D/10	FZA 12x80 M8D/30	FZA 14x80 M10D/20	FZA 14x100 M10D/40	FZA 18x100 M12D/20	FZA 18x130 M12D/50	FZA 22x125 M16D/25
Steel failure without lever arm FZA										
Characteristic resistance	$V_{Rk,s}$	[kN]	14,7	14,7	14,7	23,2	23,2	33,8	33,8	62,8
Partial safety factor	γ_{Ms} [1)]	[-]	1,25							
Steel failure with lever arm FZA										
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	30,0	30,0	30,0	59,8	59,8	105	105	266
Partial safety factor	γ_{Ms} [1)]	[-]	1,25							
Steel failure without lever arm FZA A4										
Characteristic resistance	$V_{Rk,s}$	[kN]	12,8	12,8	12,8	20,3	20,3	29,5	29,5	55,0
Partial safety factor	γ_{Ms} [1)]	[-]	1,56							
Steel failure with lever arm FZA A4										
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	26,2	26,2	26,2	52,3	52,3	91,6	91,6	232
Partial safety factor	γ_{Ms} [1)]	[-]	1,56							
Steel failure without lever arm FZA C										
Characteristic resistance	$V_{Rk,s}$	[kN]	12,8	12,8	12,8	20,3	20,3	29,5	29,5	55,0
Partial safety factor	γ_{Ms} [1)]	[-]	1,25							
Steel failure with lever arm FZA C										
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	26,2	26,2	26,2	52,3	52,3	91,6	91,6	232
Partial safety factor	γ_{Ms} [1)]	[-]	1,25							
Concrete pryout failure FZA, FZA A4, FZA C										
Factor in equation (5.6) of ETAG Annex C, 5.2.3.3	k	[-]	1,3	1,3	1,3	2,0	2,0	2,0	2,0	2,0
Partial safety factor	γ_{Mc} [1)]	[-]	1,5 [2)]							
Concrete edge failure FZA, FZA A4, FZA C										
Effective length of anchor in shear loading	l_f	[mm]	40	50	50	60	60	80	80	100
Effective diameter of anchor	d_{nom}	[mm]	12	12	12	14	14	18	18	22
Partial safety factor	γ_{Mc} [1)]	[-]	1,5 [2)]							

Table 14: Displacements of anchors under shear load

Shear load in cracked and non-cracked concrete		[kN]	5,0	5,0	5,0	12,5	12,5	19,0	19,0	30,0
Displacement	δ_{V0}	[mm]	0,7	0,7	0,7	1,9	1,9	2,1	2,1	2,1
	$\delta_{V\infty}$	[mm]	1,0	1,0	1,0	2,8	2,8	3,1	3,1	3,1

[1)] In absent of other national regulations.
[2)] The partial safety factor γ_2 is included.

Table 15: Characteristic values of resistance of **internal thread anchor** to tension loads of design method A

Anchor type, - size *(footnote see Annex 13)*				FZA 12x40 M6 I	FZA 12x50 M6 I	FZA 14x60 M8 I	FZA 18x80 M10 I	FZA 22x100 M12 I	FZA 22x125 M12 I
Steel failure FZA [1]									
Characteristic resistance	$N_{Rk,s}$	[kN]		17,2	17,2	22,9	26,9	63,0	63,0
Partial safety factor	γ_{Ms} [2]	[-]		1,75	1,75	1,75	2,0	2,0	2,0
Steel failure FZA A4 [1]									
Characteristic resistance	$N_{Rk,s}$	[kN]		13,5	13,5	17,9	22,7	53,1	53,1
Partial safety factor	γ_{Ms} [2]	[-]		1,8					
Steel failure FZA C [1]									
Characteristic resistance	$N_{Rk,s}$	[kN]		13,5	13,5	17,9	22,7	53,1	53,1
Partial safety factor	γ_{Ms} [2]	[-]		1,8					
Pullout failure FZA, FZA A4, FZA C									
Character. resistance in cracked concrete	$N_{Rk,p}$ [kN]	C20/25		6	9	12	20	40	40
Character. resistance in non-cracked concrete		C20/25		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					
Partial safety factor	γ_{Mp} [2]	[-]		1,8 [3]	1,5 [3]				
Concrete cone and splitting failure FZA, FZA A4, FZA C									
Effective anchorage depth	h_{ef}	[mm]		40	50	60	80	100	125
Spacing	$s_{cr,N} = s_{cr,sp}$	[mm]		120	150	180	240	300	375
Edge distance	$c_{cr,N} = c_{cr,sp}$	[mm]		60	75	90	120	150	190
Partial safety factor	$\gamma_{Mc} = \gamma_{M,Sp}$ [2]	[-]		1,8 [3]	1,5 [3]				
Minimum thickness of concrete member, minimum spacings and minimum edge distances of anchors FZA, FZA A4, FZA 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

Table 16: Displacements of anchors due to tension load

Tension load in cracked concrete		[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		[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 17: Characteristic values of resistance of **internal thread anchor** to shear loads of design method A

Anchor type, - size			FZA 12x40 M6 I	FZA 12x50 M6 I	FZA 14x60 M8 I	FZA 18x80 M10 I	FZA 22x100 M12 I	FZA 22x125 M12 I
Steel failure without lever arm FZA [1]								
Characteristic resistance	$V_{Rk,s}$	[kN]	8,6	8,6	11,4	13,4	31,5	31,5
Partial safety factor	γ_{Ms} [2]	[-]	1,5	1,5	1,5	1,7	1,7	1,7
Steel failure with lever arm FZA [1]								
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	12,2	12,2	30,0	59,8	105	105
Partial safety factor	γ_{Ms} [2]	[-]	1,25					
Steel failure without lever arm FZA A4 [1]								
Characteristic resistance	$V_{Rk,s}$	[kN]	6,7	6,7	9,0	11,3	26,6	26,6
Partial safety factor	γ_{Ms} [2]	[-]	1,5					
Steel failure with lever arm FZA A4 [1]								
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} [2]	[-]	1,56					
Steel failure without lever arm FZA C [1]								
Characteristic resistance	$V_{Rk,s}$	[kN]	6,7	6,7	9,0	11,3	26,6	26,6
Partial safety factor	γ_{Ms} [2]	[-]	1,5					
Steel failure with lever arm FZA C [1]								
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} [2]	[-]	1,56					
Concrete pryout failure FZA, FZA A4, FZA C								
Factor in equation (5.6) of ETAG Annex C, 5.2.3.3	k	[-]	1,3	1,3	2,0	2,0	2,0	2,0
Partial safety factor	γ_{Mc} [2]	[-]	1,5 [3]					
Concrete edge failure FZA, FZA A4, FZA C								
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
Partial safety factor	γ_{Mc} [2]	[-]	1,5 [3]					

Table 18: Displacements of anchors under shear load

Shear load in cracked and non-cracked concrete		[kN]	5,0	5,0	12,5	19,0	30,0	30,0
Displacement	δ_{V0}	[mm]	0,7	0,7	1,9	2,1	2,1	2,1
	$\delta_{V\infty}$	[mm]	1,0	1,0	2,8	3,1	3,1	3,1

[1] Related fastening screws respectively threaded rods must correspond to Annex 3.
[2] In absent of other national regulations.
[3] The partial safety factor γ_2 is included.

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Table 19: Characteristic values of resistance of **bolt projecting anchor** to tension loads of design method A

Anchor type, - size *(footnote see Annex 15)*				**FZA 10x40 M6 / t_{fix}**	**FZA 12x40 M8 / t_{fix}**	**FZA 14x40 M10 / t_{fix}**	**FZA 12x50 M8 / t_{fix}**	**FZA 14x60 M10 / t_{fix}**	**FZA 18x80 M12 / t_{fix}**	**FZA 22x100 M16 / t_{fix}**	**FZA 22x125 M16 / t_{fix}**
Steel failure FZA											
Characteristic resistance	$N_{Rk,s}$	[kN]		16,1	29,3	46,4	29,3	46,4	67,4	126	126
Partial safety factor	γ_{Ms} [1)]	[-]		1,5							
Steel failure FZA A4											
Characteristic resistance	$N_{Rk,s}$	[kN]		14,1	25,6	40,6	25,6	40,6	59,0	110	110
Partial safety factor	γ_{Ms} [1)]	[-]		1,87							
Steel failure FZA C											
Characteristic resistance	$N_{Rk,s}$	[kN]		14,1	25,6	40,6	25,6	40,6	59,0	110	110
Partial safety factor	γ_{Ms} [1)]	[-]		1,5							
Pullout failure FZA, FZA A4, FZA C											
Character. resistance in cracked concrete	$N_{Rk,p}$ [kN]	C20/25		6	6	6	9	12	20	40	40
Character. resistance in non-cracked concrete				9	9	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							
Partial safety factor	γ_{Mp} [1)]	[-]		1,8 [2)]			1,5 [2)]				
Concrete cone and splitting failure FZA, FZA A4, FZA C											
Effective anchorage depth	h_{ef}	[mm]		40	40	40	50	60	80	100	125
Factor for uncracked concrete	k_{ucr}	[-]		10,1							
Factor for cracked concrete	k_{cr}	[-]		7,2							
Spacing	$s_{cr,N} = s_{cr,sp}$	[mm]		120	120	120	150	180	240	300	375
Edge distance	$c_{cr,N} = c_{cr,sp}$	[mm]		60	60	60	75	90	120	150	190
Partial safety factor	$\gamma_{Mc} = \gamma_{M,Sp}$ [1)]	[-]		1,8 [2)]			1,5 [2)]				
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	60	80	100	125
Minimum edge distance	c_{min}	[mm]		35	40	70	45	55	70	100	125
Minimum thickness of concrete member	h_{min}	[mm]		100	100	100	110	130	160	200	250

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

Design method A according to CEN/TS 1992-4: 2009
Characteristic values to tension loads
Bolt projecting anchor

Annex 14

Table 20: Characteristic values of resistance of **bolt projecting anchor** to shear loads of design method A

Anchor type, - size				FZA 10x40 M6 / t_{fix}	FZA 12x40 M8 / t_{fix}	FZA 14x40 M10 / t_{fix}	FZA 12x50 M8 / t_{fix}	FZA 14x60 M10 / t_{fix}	FZA 18x80 M12 / t_{fix}	FZA 22x100 M16 / t_{fix}	FZA 22x125 M16 / t_{fix}
Steel failure without lever arm FZA											
Characteristic resistance	$V_{Rk,s}$	[kN]		8,0	14,7	23,2	14,7	23,2	33,8	62,8	62,8
Partial safety factor	γ_{Ms} [1)]	[-]		1,25							
Steel failure with lever arm FZA											
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]		12,2	30,0	59,8	30,0	59,8	105	266	266
Partial safety factor	γ_{Ms} [1)]	[-]		1,25							
Steel failure without lever arm FZA A4											
Characteristic resistance	$V_{Rk,s}$	[kN]		7,0	12,8	20,3	12,8	20,3	29,5	55,0	55,0
Partial safety factor	γ_{Ms} [1)]	[-]		1,56							
Steel failure with lever arm FZA A4											
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]		10,7	26,2	52,3	26,2	52,3	91,6	232	232
Partial safety factor	γ_{Ms} [1)]	[-]		1,56							
Steel failure without lever arm FZA C											
Characteristic resistance	$V_{Rk,s}$	[kN]		7,0	12,8	20,3	12,8	20,3	29,5	55,0	55,0
Partial safety factor	γ_{Ms} [1)]	[-]		1,25							
Steel failure with lever arm FZA C											
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]		10,7	26,2	52,3	26,2	52,3	91,6	232	232
Partial safety factor	γ_{Ms} [1)]	[-]		1,25							
Ductility factor	k_2	[-]		1,0							
Concrete pryout failure FZA, FZA A4, FZA C											
Factor in equation (16) of the CEN/TS 1992-4-4, Section 6.2.2.3	k_3	[-]		1,3	1,3	1,3	1,3	2,0	2,0	2,0	2,0
Partial safety factor	γ_{Mc} [1)]	[-]		1,5 [2)]							
Concrete edge failure FZA, FZA A4, FZA C											
Effective length of anchor in shear loading	l_f	[mm]		40	40	40	50	60	80	100	125
Effective diameter of anchor	d_{nom}	[mm]		10	12	14	12	14	18	22	22
Partial safety factor	γ_{Mc} [1)]	[-]		1,5 [2)]							

[1)] In absent of other national regulations.
[2)] The partial safety factor γ_{inst} is included.

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

Design method A according to CEN/TS 1992-4: 2009
Characteristic values to shear loads
Bolt projecting anchor

Annex 15

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Table 21: Characteristic values of resistance of **through bolt anchor** to tension loads of design method A

Anchor type, - size *(footnote see Annex 17)*				FZA 12x50 M8D/10	FZA 12x60 M8D/10	FZA 12x80 M8D/30	FZA 14x80 M10D/20	FZA 14x100 M10D/40	FZA 18x100 M12D/20	FZA 18x130 M12D/50	FZA 22x125 M16D/25
Steel failure FZA											
Characteristic resistance	$N_{Rk,s}$		[kN]	29,3	29,3	29,3	46,4	46,4	67,4	67,4	126
Partial safety factor	γ_{Ms} [1)]		[-]	1,5							
Steel failure FZA A4											
Characteristic resistance	$N_{Rk,s}$		[kN]	25,6	25,6	25,6	40,6	40,6	59,0	59,0	110
Partial safety factor	γ_{Ms} [1)]		[-]	1,87							
Steel failure FZA C											
Characteristic resistance	$N_{Rk,s}$		[kN]	25,6	25,6	25,6	40,6	40,6	59,0	59,0	110
Partial safety factor	γ_{Ms} [1)]		[-]	1,5							
Pullout failure FZA, FZA A4, FZA C											
Character. resistance in cracked concrete	$N_{Rk,p}$ [kN]	C20/25		6	9	9	12	12	20	20	40
Character. resistance in non-cracked concrete		C20/25		9	12	12	20	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							
Partial safety factor	γ_{Mp} [1)]		[-]	1,8 [2)]	1,5 [2)]						
Concrete cone and splitting failure FZA, FZA A4, FZA C											
Effective anchorage depth	h_{ef}		[mm]	40	50	50	60	60	80	80	100
Factor for uncracked concrete	k_{ucr}		[-]	10,1							
Factor for cracked concrete	k_{cr}		[-]	7,2							
Spacing	$s_{cr,N} = s_{cr,sp}$		[mm]	120	150	150	180	180	240	240	300
Edge distance	$c_{cr,N} = c_{cr,sp}$		[mm]	60	75	75	90	90	120	120	150
Partial safety factor	$\gamma_{Mc} = \gamma_{M,Sp}$ [1)]		[-]	1,8 [2)]	1,5 [2)]						
Minimum thickness of concrete member, minimum spacings and minimum edge distances of anchors FZA, FZA A4, FZA C											
Minimum spacing	s_{min}		[mm]	40	50	50	60	60	80	80	100
Minimum edge distance	c_{min}		[mm]	35	45	45	55	55	70	70	100
Minimum thickness of concrete member	h_{min}		[mm]	100	110	110	130	130	160	160	200

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

Design method A according to CEN/TS 1992-4: 2009
Characteristic values to tension loads
Through bolt anchor

Annex 16

Table 22: Characteristic values of resistance of **through bolt anchor** to shear loads of design method A

Anchor type, - size			FZA 12x50 M8D/10	FZA 12x60 M8D/10	FZA 12x80 M8D/30	FZA 14x80 M10D/20	FZA 14x100 M10D/40	FZA 18x100 M12D/20	FZA 18x130 M12D/50	FZA 22x125 M16D/25
Steel failure without lever arm FZA										
Characteristic resistance	$V_{Rk,s}$	[kN]	14,7	14,7	14,7	23,2	23,2	33,8	33,8	62,8
Partial safety factor	γ_{Ms} [1)]	[-]	1,25							
Steel failure with lever arm FZA										
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	30,0	30,0	30,0	59,8	59,8	105	105	266
Partial safety factor	γ_{Ms} [1)]	[-]	1,25							
Steel failure without lever arm FZA A4										
Characteristic resistance	$V_{Rk,s}$	[kN]	12,8	12,8	12,8	20,3	20,3	29,5	29,5	55,0
Partial safety factor	γ_{Ms} [1)]	[-]	1,56							
Steel failure with lever arm FZA A4										
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	26,2	26,2	26,2	52,3	52,3	91,6	91,6	232
Partial safety factor	γ_{Ms} [1)]	[-]	1,56							
Steel failure without lever arm FZA C										
Characteristic resistance	$V_{Rk,s}$	[kN]	12,8	12,8	12,8	20,3	20,3	29,5	29,5	55,0
Partial safety factor	γ_{Ms} [1)]	[-]	1,25							
Steel failure with lever arm FZA C										
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	26,2	26,2	26,2	52,3	52,3	91,6	91,6	232
Partial safety factor	γ_{Ms} [1)]	[-]	1,25							
Ductility factor	k_2	[-]	1,0							
Concrete pryout failure FZA, FZA A4, FZA C										
Factor in equation (16) of the CEN/TS 1992-4-4, Section 6.2.2.3	k_3	[-]	1,3	1,3	1,3	2,0	2,0	2,0	2,0	2,0
Partial safety factor	γ_{Mc} [1)]	[-]	1,5 [2)]							
Concrete edge failure FZA, FZA A4, FZA C										
Effective length of anchor in shear loading	l_f	[mm]	40	50	50	60	60	80	80	100
Effective diameter of anchor	d_{nom}	[mm]	12	12	12	14	14	18	18	22
Partial safety factor	γ_{Mc} [1)]	[-]	1,5 [2)]							

[1)] In absent of other national regulations.
[2)] The partial safety factor γ_{inst} is included.

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

Design method A according to CEN/TS 1992-4: 2009
Characteristic values to shear loads
Through bolt anchor

Annex 17

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Table 23: Characteristic values of resistance of **internal thread anchor** to tension loads of design method A

Anchor type, - size *(footnote see Annex 19)*				FZA 12x40 M6 I	FZA 12x50 M6 I	FZA 14x60 M8 I	FZA 18x80 M10 I	FZA 22x100 M12 I	FZA 22x125 M12 I
Steel failure FZA [1]									
Characteristic resistance	$N_{Rk,s}$		[kN]	17,2	17,2	22,9	26,9	63,0	63,0
Partial safety factor	γ_{Ms} [2]		[-]	1,75	1,75	1,75	2,0	2,0	2,0
Steel failure FZA A4 [1]									
Characteristic resistance	$N_{Rk,s}$		[kN]	13,5	13,5	17,9	22,7	53,1	53,1
Partial safety factor	γ_{Ms} [2]		[-]	1,8					
Steel failure FZA C [1]									
Characteristic resistance	$N_{Rk,s}$		[kN]	13,5	13,5	17,9	22,7	53,1	53,1
Partial safety factor	γ_{Ms} [2]		[-]	1,8					
Pullout failure FZA, FZA A4, FZA C									
Character. resistance in cracked concrete	$N_{Rk,p}$ [kN]	C20/25		6	9	12	20	40	40
Character. resistance in non-cracked concrete		C20/25		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					
Partial safety factor	γ_{Mp} [2]		[-]	1,8 [3]	1,5 [3]				
Concrete cone and splitting failure FZA, FZA A4, FZA C									
Effective anchorage depth	h_{ef}		[mm]	40	50	60	80	100	125
Factor for uncracked concrete	k_{ucr}		[-]	10,1					
Factor for cracked concrete	k_{cr}		[-]	7,2					
Spacing	$s_{cr,N} = s_{cr,sp}$		[mm]	120	150	180	240	300	375
Edge distance	$c_{cr,N} = c_{cr,sp}$		[mm]	60	75	90	120	150	190
Partial safety factor	$\gamma_{Mc} = \gamma_{M,Sp}$ [2]		[-]	1,8 [3]	1,5 [3]				
Minimum thickness of concrete member, minimum spacings and minimum edge distances of anchors FZA, FZA A4, FZA 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

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

Design method A according to CEN/TS 1992-4: 2009
Characteristic values to tension loads
Internal thread anchor

Annex 18

Table 24: Characteristic values of resistance of **internal thread anchor** to shear loads of design method A

Anchor type, - size			FZA 12x40 M6 I	FZA 12x50 M6 I	FZA 14x60 M8 I	FZA 18x80 M10 I	FZA 22x100 M12 I	FZA 22x125 M12 I
Steel failure without lever arm FZA [1]								
Characteristic resistance	$V_{Rk,s}$	[kN]	8,6	8,6	11,4	13,4	31,5	31,5
Partial safety factor	γ_{Ms} [2]	[-]	1,5	1,5	1,5	1,7	1,7	1,7
Steel failure with lever arm FZA [1]								
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	12,2	12,2	30,0	59,8	105	105
Partial safety factor	γ_{Ms} [2]	[-]	1,25					
Steel failure without lever arm FZA A4 [1]								
Characteristic resistance	$V_{Rk,s}$	[kN]	6,7	6,7	9,0	11,3	26,6	26,6
Partial safety factor	γ_{Ms} [2]	[-]	1,5					
Steel failure with lever arm FZA A4 [1]								
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} [2]	[-]	1,56					
Steel failure without lever arm FZA C [1]								
Characteristic resistance	$V_{Rk,s}$	[kN]	6,7	6,7	9,0	11,3	26,6	26,6
Partial safety factor	γ_{Ms} [2]	[-]	1,5					
Steel failure with lever arm FZA C [1]								
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} [2]	[-]	1,56					
Ductility factor	k_2	[-]	1,0					
Concrete pryout failure FZA, FZA A4, FZA C								
Factor in equation (16) of the CEN/TS 1992-4-4, Section 6.2.2.3	k_3	[-]	1,3	1,3	2,0	2,0	2,0	2,0
Partial safety factor	γ_{Mc} [2]	[-]	1,5 [3]					
Concrete edge failure FZA, FZA A4, FZA C								
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
Partial safety factor	γ_{Mc} [2]	[-]	1,5 [3]					

[1] Related fastening screws respectively threaded rods must correspond to Annex 3.
[2] In absent of other national regulations.
[3] The partial safety factor γ_{inst} is included.

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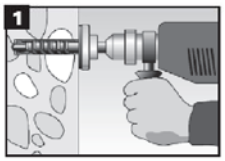
Installation instructions bolt projecting anchor FZA, FZA-D and FZA-I:

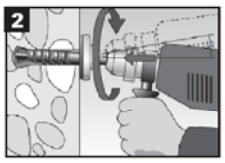
Pre-positioned anchorage

FZA

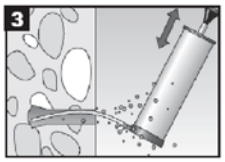
FZA-I



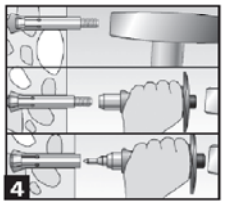
Create a drill hole at right angles to the surface of the anchor base with a hammer drill, using the corresponding Zykon universal drill bit FZUB. The required drill depth is reached once the FZUB depth stop meets the concrete.



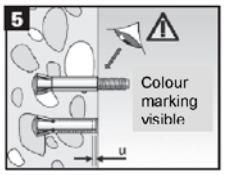
Once the FZUB depth stop meets the concrete, create the drill hole undercut by making circular swivelling movements with the hammer drill while the hammer mechanism is engaged. Press the hammer drill firmly against the anchor base; 1–2 swivelling movements is sufficient for ⌀ 14 mm, with 3–5 movements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



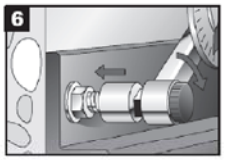
Clean drill hole;
blow or brush out.



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. 1 mm behind the surface of the concrete or the non-load-bearing layer



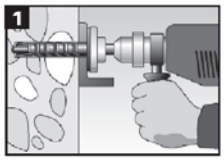
The anchor is correctly expanded if the green colour on the thread of the tapered bolt is visible or the gap u is fulfilled.



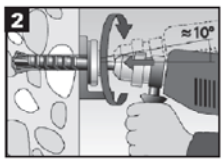
Mount installation object (e.g. anchor plate), washer and nut, screw (for FZA-I) or threaded rod with washer and nut (for FZA-I) and apply installation torque with torque spanner.

Push-through installation

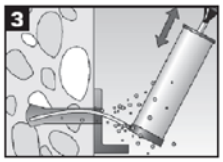
FZA-D



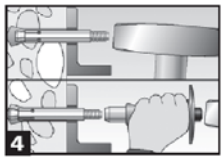
Create a drill hole through the installation object at right angles to the surface of the anchor base with a hammer drill, using the corresponding Zykon universal drill bit FZUB. The required drill depth is reached once the FZUB depth stop meets the concrete.



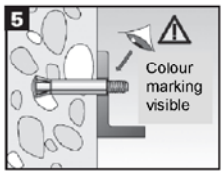
Once the FZUB depth stop meets the fixture, create the drill hole undercut by making circular swivelling movements with the hammer drill while the hammer mechanism is engaged. Press the hammer drill firmly against the anchor base; 1–2 swivelling movements is sufficient for ⌀ 14 mm, with 3–5 movements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



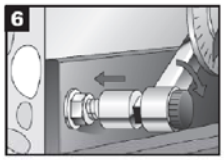
Clean drill hole;
blow or brush out.



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. 1 mm behind the surface of the concrete or the non-load-bearing layer



The anchor is correctly expanded if the green colour 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.

fischer-Zykon-Anchor FZA, FZA-I, FZA-D	Annex 20
Installation instructions	