#### **Deutsches Institut für Bautechnik**

#### Zulassungsstelle für Bauprodukte und Bauarten

#### **Bautechnisches Prüfamt**

Eine vom Bund und den Ländern gemeinsam getragene Anstalt des öffentlichen Rechts

Kolonnenstraße 30 B D-10829 Berlin Tel.: +493078730-0 Fax: +493078730-320 E-Mail: dibt@dibt.de www.dibt.de





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 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

of construction product

Geltungsdauer:

Validity:

Generic type and use

vom

from bis

20 June 2013

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





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#### 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<sup>1</sup>, modified by Council Directive 93/68/EEC<sup>2</sup> and Regulation (EC) N° 1882/2003 of the European Parliament and of the Council<sup>3</sup>;
  - 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<sup>4</sup>, as amended by Article 2 of the law of 8 November 2011<sup>5</sup>;
  - Common Procedural Rules for Requesting, Preparing and the Granting of European technical approvals set out in the Annex to Commission Decision 94/23/EC<sup>6</sup>;
  - Guideline for European technical approval of "Metal anchors for use in concrete Part 3: Undercut anchors", ETAG 001-03.
- 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.
- 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.
- 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.
- 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.
- 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.

Official Journal of the European Communities L 40, 11 February 1989, p. 12

Official Journal of the European Communities L 220, 30 August 1993, p. 1

Official Journal of the European Union L 284, 31 October 2003, p. 25

Bundesgesetzblatt Teil I 1998, p. 812

<sup>5</sup> Bundesgesetzblatt Teil I 2011, p. 2178

Official Journal of the European Communities L 17, 20 January 1994, p. 34



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# 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.

fischer-Zykon-Anchor FZA made of galvanised steel:

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

#### fischer-Zykon-Anchor FZA A4 made of stainless steel:

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).

## fischer-Zykon-Anchor FZA C made of high corrosion resistant steel:

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).



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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<sup>8</sup> the system 2(i) (referred to as system 1) of attestation of conformity applies.

This system of attestation of conformity is defined as follows:

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.

Official Journal of the European Communities L 254 of 08.10.1996.



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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<sup>9</sup>.

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.

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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.



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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.



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#### 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).



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The minimum data required are:

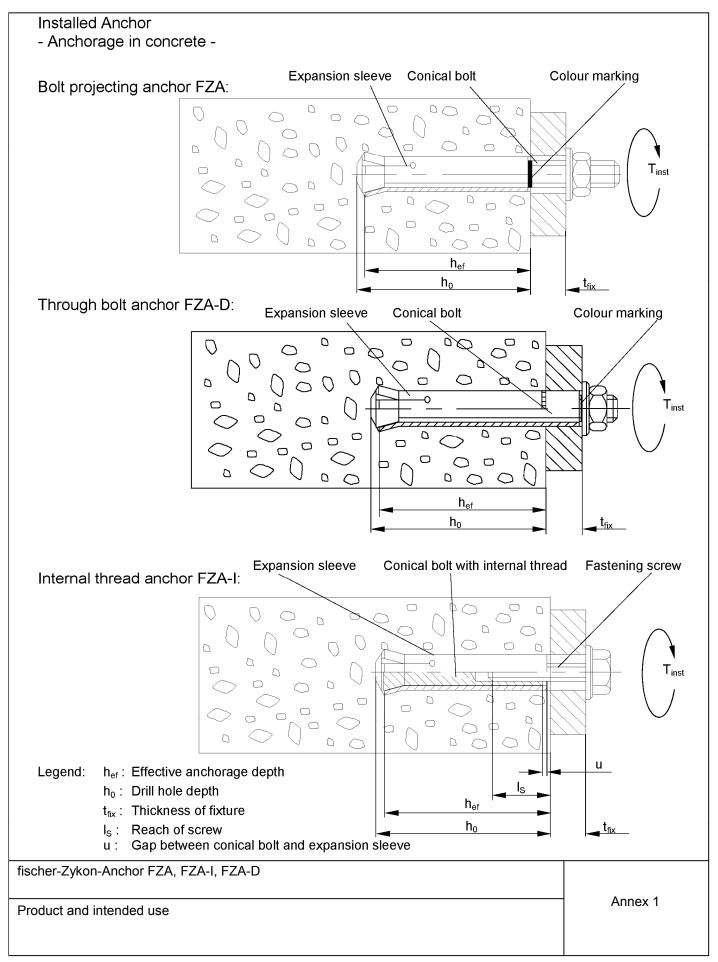
- drill bit (corresponding special drill bit),
- setting tools (corresponding tool for hammering in),
- maximum thickness of the fixture,
- minimum effective anchorage depth,
- hole depth,
- torque moment,
- information on the installation procedure, including cleaning of the hole, preferably by means 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.

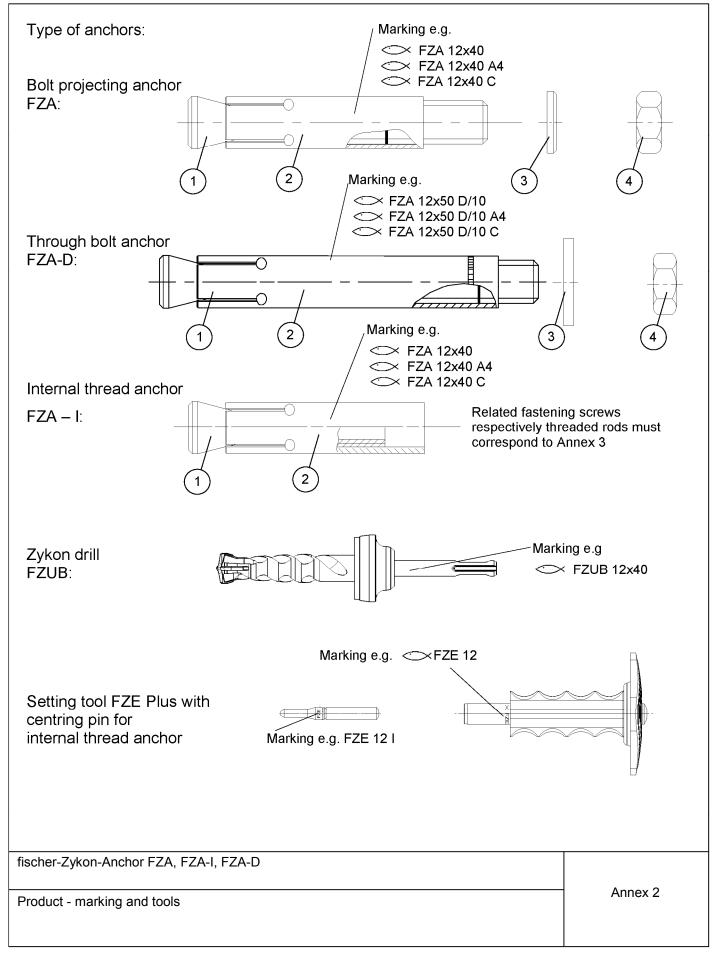
Andreas Kummerow p.p. Head of Department

beglaubigt: Baderschneider









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# Table 1a: Materials FZA

Part	Designation	Material
	Conical bolt with external thread	Steel, property class 8, DIN EN ISO 898-1 galvanised ≥ 5 µm according EN ISO 4042
1	Conical bolt with internal thread <sup>1)</sup>	steel, EN 10 227 nominal steel tensile strength $f_{uk} \le 1000 \text{ N/mm}^2$ galvanised $\ge 5  \mu \text{m}$ 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
	Conical bolt with external thread	Stainless steel EN 10 088 nominal steel tensile strength f <sub>uk</sub> ≤ 1000 N/mm²
'	Conical bolt with internal thread <sup>2)</sup>	Stainless steel EN 10 088 nominal steel tensile strength f <sub>uk</sub> ≤ 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
	Conical bolt with external thread	High corrosion resistant steel EN 10 088 nominal steel tensile strength f <sub>uk</sub> ≤ 1000 N/mm²
'	Conical bolt with internal thread 3)	High corrosion resistant steel EN 10 088 nominal steel tensile strength f <sub>uk</sub> ≤ 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

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

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.

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	
Materials	Annex 3



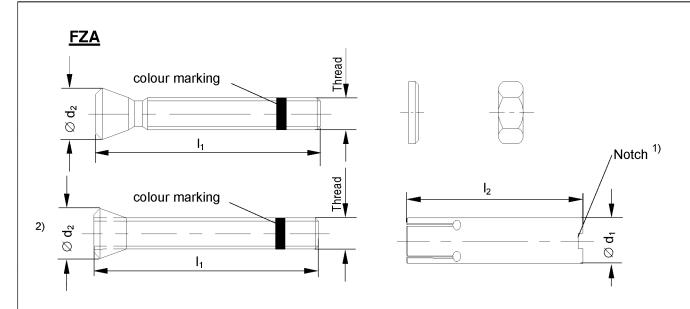


Table 2: Dimensions bolt projecting anchor FZA

Type of anchor	Thread	t <sub>fix</sub> min	t <sub>fix</sub> max	I <sub>1</sub> min	I₁ max	$I_2$	$\emptyset d_1$	$\emptyset d_2$
FZA 10 x 40 M 6 / t <sub>fix</sub> 1)	М6	1	50	50	100	40	10	10
FZA 12 x 40 M 8 / t <sub>fix</sub> 1)	М8	1	100	52	154	40	12	12
FZA 14 x 40 M 10 / $t_{\rm fix}^{-1}$	M10	1	150	54	204	40	14	14
FZA 12 x 50 M 8 / t <sub>fix</sub>	M8	1	100	62	164	50	12	12
FZA 14 x 60 M 10 / t <sub>fix</sub>	M10	1	150	80	232	60	14	14
FZA 18 x 80 M 12 / t <sub>fix</sub>	M12	1	200	99	301	80	18	18
FZA 22 x 100 M16 / t <sub>fix</sub>	M16	1	250	122	374	100	22	22
FZA 22 x 125 M16 / t <sub>fix</sub> 1)	M16	1	250	147	399	125	22	22

Dimensions in [mm]

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

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Expansion sleeve with notch Design: threaded bolt with cone nut

English translation prepared by DIBt

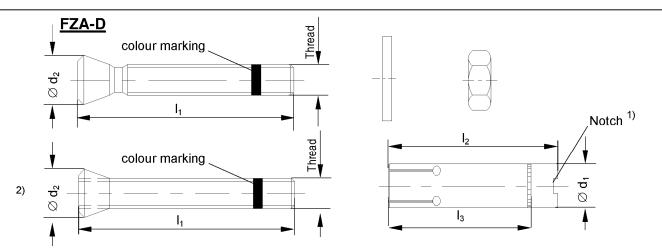
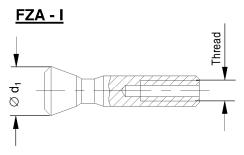


Table 3: Dimensions through bolt anchor FZA-D

Type of anchor	Thread	t <sub>fix</sub> min	t <sub>fix</sub> max	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>	$\emptyset d_1$	$\emptyset d_2$
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

<sup>1)</sup> Expansion sleeve with notch

Design: threaded bolt with cone nut



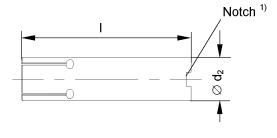


Table 4: Dimensions internal thread anchor FZA - I

Type of anchor	Thread	$\emptyset$ d <sub>1</sub>	$\emptyset d_2$	I
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

<sup>1)</sup> Expansion sleeve with notch

Dimensions in [mm]

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

English translation prepared by DIBt



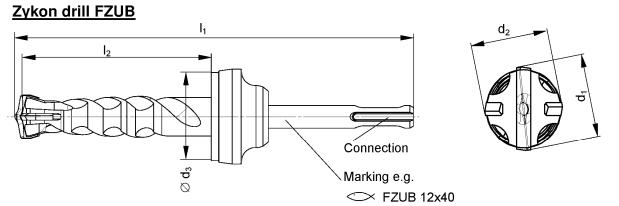
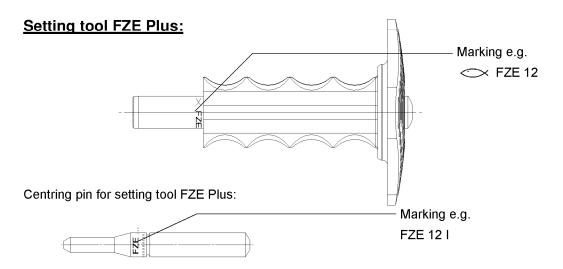


Table 5: Dimensions Zykon drill FZUB

Type of drill	Connection	I <sub>1</sub>	$l_2 \ge$	$d_1 \le$	d <sub>2</sub>	$\emptyset d_3 \le$
FZUB 10 x 40		126	40	10,80		
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		39,5
FZUB 14 x 60	SDS plus	152	60	14,82	] d < d	39,3
FZUB 14 x 80	- 3D3 pius	172	80	14,82	$d_2 \le d_1$	
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		43,5



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

Dimensions in [mm]

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

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					Diameter of the				,
Type of anchor	Drill hole depth	Drill	Setting tool	Centring pin	clearance hole in the fixture	Torque moment <sup>1)</sup>	Gap	Reach Is	Reach of screw I <sub>s</sub> [mm]
	h <sub>0</sub> [mm]	FZUB	FZE plus	FZE I plus	<pre>  [mm]  </pre>	T <sub>inst</sub> [Nm]	u [mm]	max	min
$FZA 10 \times 40 M 6 / t_{fix}$	≥ 43	10 × 40	FZE 10	-	2	8,5		-	-
FZA 12 x 40 M 8 / t <sub>fix</sub>	≥ 43	12 × 40	FZE 12	-	6	20	•	-	-
FZA 14 x 40 M 10 / t <sub>fix</sub>	≥ 43	14 × 40	FZE 14		12	40	,	•	
FZA 12 x 50 M 8 / t <sub>fix</sub>	> 54	12 × 50	FZE 12		6	20	,		
FZA 14 x 60 M 10 / t <sub>fix</sub>	≥ 63	14 × 60	FZE 14	ı	12	40	•	•	
FZA 18 x 80 M 12 / t <sub>fix</sub>	> 83	18 x 80	FZE 18	ı	14	09	,		
FZA 22 x 100 M16 / t <sub>fix</sub>	≥ 103	22 × 100	FZE 22	-	18	100	-	-	•
FZA 22 x 125 M16 / t <sub>fix</sub>	> 127	22 × 125	FZE 22	-	18	100	•	-	-
FZA 12 x 50 M 8 D / 10	> 43	12 × 50	FZE 12	•	14	20		•	
FZA 12 x 60 M 8 D / 10	≥ 53	12 × 60	FZE 12	-	14	20	•	-	•
FZA 12 x 80 M 8 D / 30	≥ 53	12 × 80	FZE 12		14	20	•		
FZA 14 x 80 M 10 D / 20	≥ 63	14 × 80	FZE 14	-	16	40	-	-	-
FZA 14 x 100 M 10 D / 40	> 63	14 × 100	FZE 14	-	16	40	•	-	-
FZA 18 x 100 M 12 D / 20	≥ 83	18 × 100	FZE 18	1	20	09			
FZA 18 x 130 M 12 D / 50	≥ 83	18 x 130	FZE 18	-	20	09	-	-	-
FZA 22 x 125 M 16 D / 25	≥ 105	22 × 125	FZE 22	-	24	100	-	•	-
FZA 12 x 40 M 6 I	≥ 43	12 × 40	FZE 12 wi	FZE 12 with FZE 12 I	2	8,5	0-4,0	13	8
FZA 12 x 50 M 6 I	≥ 53	12 x 50	FZE 12 wi	12 with FZE 12 I	2	8,5	0-4,0	13	8
FZA 14 x 60 M 8 I	≥ 63	14 × 60	FZE 14 wi	FZE 14 with FZE 14 I	6	15	0-4,0	17	11
FZA 18 x 80 M 10 I	≥ 83	18 x 80	FZE 18 wi	FZE 18 with FZE 18 I	12	30	0 - 4,5	21	13
FZA 22 x 100 M 12 I	≥ 103	22 × 100	FZE 22 wi	FZE 22 with FZE 22 I	14	09	0 – 4,5	25	15
FZA 22 x 125 M 12 I	> 127	22 × 125	FZE 22 wi	22 with FZE 22 I	14	09	0 - 4,5	25	15

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

Characteristic Anchor- and installation parameters



			•	,						
Anchor type, - size <i>(footnote see Annex 9)</i>	nnex 9)		FZA 10x40 M6 / t <sub>fix</sub>	FZA 12x40 M8 / t <sub>fix</sub>	FZA 14x40 M10 / t <sub>fix</sub>	FZA 12x50 M8 / t <sub>fix</sub>	FZA 14x60 M10 / t <sub>fix</sub>	FZA 18x80 M12 / t <sub>fix</sub>	FZA 22x100 M16 / t <sub>fix</sub>	FZA 22x125 M16 / t <sub>lix</sub>
Steel failure FZA										
Characteristic resistance	NRK,S	[kN]	16,1	29,3	46,4	29,3	46,4	67,4	126	126
Partial safety factor	YMs (	H				1	1,5			
Steel failure FZA A4										
Characteristic resistance	NRK,s	[kN]	14,1	25,6	40,6	25,6	40,6	29,0	110	110
Partial safety factor	1) YMs	Ξ				1,	1,87			
Steel failure FZA C										
Characteristic resistance	NRK,S	[kN]	14,1	25,6	40,6	25,6	40,6	59,0	110	110
Partial safety factor	η γ <sub>Ms</sub>						1,5			
Pullout failure FZA, FZA A4, FZA C										
Character resistance in cracked concrete	i	10,000	9	9	9	6	12	20	40	40
Character, resistance in non-cracked concrete	d concrete [kN]	CZ0/Z5	တ	6	6	12	20	30	40	40
	-	C25/30					1,10			
		C30/37				1,	1,22			
Increasing factors for NRk,p		C35/45				1,	1,34			
lot cracked allo non-cracked concrete	o	C40/20				1,	1,41			
		C45/55				1,	1,48			
		C50/60				<u>_</u>	1,55			
Partial safety factor	7Mp	$[\cdot]$		1,8 <sup>2)</sup>				$1,5^{2}$		
Concrete cone and splitting failure FZA,	FZA A4, FZA	၁								
Effective anchorage depth	h <sub>ef</sub>	[mm]	40	40	40	20	09	80	100	125
Spacing	Scr,N = Scr,sp	[mm]	120	120	120	150	180	240	300	375
Edge distance	C <sub>cr,N</sub> = C <sub>cr,sp</sub>	[mm]	90	9	90	75	90	120	150	190
Partial safety factor	$\gamma_{Mc} = \gamma_{M,Sp}^{1)}$	[-]		1,8 <sup>2)</sup>				$1,5^{2}$		
Minimum thickness of concrete member, minimum spacings and minimum edge distances of anchors FZA,	ber, minimum sp	acings ar	nd minimur	n edge dista	inces of and		FZA A4, FZA	4 C		
Minimum spacing	Smin	[mm]	40	40	70	50	09	80	100	125
Minimum edge distance	Gmin	[mm]	35	40	70	45	55	70	100	125
Minimum thickness of concrete member	nber h <sub>min</sub>	[mm]	100	100	100	110	130	160	200	250
Table 8: Displacements of anchors	que	to tension load	n load							
Tension load in cracked concrete		[kN]	2,0	2,0	2,0	3,5	5,0	8,0	16,0	16,0
	SNo	[mm]				0	8,0			
Displacement	δN∞	[mm]				_	1,1			
Tension load in non-cracked concrete		[kN]		3,3		4,8	7,5	12,7	17,9	17,9
Oice Company	SNO	[mm]				0	8'0			
Displacement	o	[]					7			

Bolt projecting anchor

Characteristic values to tension loads

Design method A according to ETAG 001, Annex C

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Anchor type, - size			FZA 10x40 M6 / t <sub>fix</sub>	FZA 12x40 M8 / t <sub>fix</sub>	FZA 14x40 M10 / t <sub>fix</sub>	FZA 12x50 M8 / t <sub>fix</sub>	FZA 14x60 M10 / t <sub>fix</sub>	FZA 18x80 M12 / t <sub>fix</sub>	FZA 22x100 M16 / t <sub>fix</sub>	FZA 22x125 M16 / t <sub>fix</sub>
Steel failure without lever arm FZA										
Characteristic resistance V <sub>Rk,s</sub>		[kN]	8,0	14,7	23,2	14,7	23,2	33,8	62,8	62,8
Partial safety factor	(1) [-]					1,	1,25			
Steel failure with lever arm FZA										
Characteristic bending resistance M <sup>0</sup> R <sub>K</sub>	S	[Nm]	12,2	30,0	59,8	30,0	29,8	105	566	566
Partial safety factor	$\overline{}$					1,	1,25			
ever arm FZA A4										
Characteristic resistance		[kN]	7,0	12,8	20,3	12,8	20,3	5,62	25,0	92'0
Partial safety factor	() [-]					1,	1,56			
er arm FZA A4										
Characteristic bending resistance M <sup>0</sup> Rk	s	[Nm]	10,7	26,2	52,3	26,2	52,3	91,6	232	232
Partial safety factor						1,	1,56			
Steel failure without lever arm FZA C										
Characteristic resistance		[kN]	7,0	12,8	20,3	12,8	20,3	29,5	25,0	92'0
Partial safety factor	(1) [-]					1,	1,25			
Steel failure with lever arm FZA C										
Characteristic bending resistance M <sup>0</sup>	M <sup>o</sup> rk,s	[Nm]	10,7	26,2	52,3	26,2	52,3	91,6	232	232
	,1) [-]					1,	1,25			
A4, FZA										
Factor in equation (5.6) of ETAG k Annex C. 5.2.3.3	Ξ		1,3	1,3	4,	2,1	2,0	2,0	2,0	2,0
Or YMC	() ()						1,5 <sup>2)</sup>			
FZA, FZA A4, FZA C										
Effective length of anchor in shear loading		[mm]	40	40	40	20	09	80	100	125
Effective diameter of anchor	d <sub>nom</sub> [rr	[mm]	10	12	14	12	14	18	22	22
Partial safety factor	<sub>УМс</sub> <sup>1)</sup> [-]					,	1,5 <sup>2)</sup>			
Table 10: Displacements of anchor	ors under shear load	shear l	oad							
Shear load in cracked and non-cracked concrete		[kN]	4,0	2,0	0'6	2,0	12,5	19,0	30,0	30'0
Similar Superior Supe		[mm]	2,0	7'0	1,9	7,0	1,9	2,1	2,1	2,1
Displacement S√∞		[mm]	3,0	1,0	2,8	1,0	2,8	3,1	3,1	3,1

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

**Bolt projecting anchor** 

Annex 9

Electronic copy of the ETA by DIBt: ETA-98/0004

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English translation prepared by DIBt

			)						•	
Anchor type, - size (tootnote see Annex 11)	nnex 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	NRK,s	[kN]	29,3	29,3	29,3	46,4	46,4	67,4	67,4	126
Partial safety factor	7Ms	[-]				1	1,5			
Steel failure FZA A4										
Characteristic resistance	NRK,s	[kN]	25,6	25,6	25,6	40,6	40,6	59,0	59,0	110
Partial safety factor	7 (1)	$\Box$				1,	,87			
Steel failure FZA C										
Characteristic resistance	NRK,s	[kN]	25,6	25,6	25,6	9'04	9'07	29,0	29,0	110
Partial safety factor	γ <sub>Ms</sub>	Ξ				<u></u>	25			
Pullout failure FZA, FZA A4, FZA C										
Character resistance in cracked concrete		1	9	6	6	12	12	20	20	40
Character. resistance in non-cracked concret	d concrete [kN]	CZ0/Z5	6	12	12	20	20	30	30	40
		C25/30				,	1,10			
		C30/37				1,	1,22			
Increasing factors for N <sub>RK,p</sub>		C35/45				1,	1,34			
tor cracked and	ψc	C40/20					1,41			
Holl-clacked colloiete		C45/55					1.48			
		C50/60					1,55			
Partial safety factor	7Mp	Ξ	1,8 <sup>2)</sup>				1,52)			
Concrete cone and splitting failure FZA, FZA	A4,	ပ					-			
Effective anchorage depth		[mm]	40	50	50	09	09	8	80	100
Spacing	Scr.N = Scr.sp	[mm]	120	150	150	180	180	240	240	300
Edge distance	Ccr.N = Ccr.sp	[mm]	09	75	75	06	06	120	120	150
Partial safety factor	$\gamma_{Mc} = \gamma_{M,Sp}$	Ξ	1,8 <sup>2)</sup>				$1,5^{2}$			
Minimum thickness of concrete member, minimum spacings	nber, minimum sp	acings ar	and minimum	n edge distances of	nces of and	anchors FZA,	FZA A4, FZA	1 C		
Minimum spacing	Smin	[mm]	40	20	50	09	09	80	80	100
Minimum edge distance	Gmin	[mm]	32	45	45	55	22	70	70	100
Minimum thickness of concrete member		[mm]	100	110	110	130	130	160	160	200
Table 12: Displacements of anchors	que	to tension load	on load							
Tension load in cracked concrete		[kN]	2,0	3,5	3,5	5,0	2,0	8,0	8,0	16,0
Oice Constant	δNο	[mm]				0	8,0			
Displacement	δN∞	[mm]				1	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	δNO	[mm]				0	8,0			
	$\delta_{N_\infty}$	[mm]				1	1,1			

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

Design method A according to ETAG 001, Annex C

Characteristic values to tension loads **Through bolt anchor** 

English translation prepared by DIBt

Institut für Bautechnik



14x100	FZA	, , ; , , , , , , , , , , , , , , , , ,			
KN   14,7   1,25   1,	ks [KN] 14,7 14,7 14,7 14,7 14,7 14,7 14,7 14,7			FZA 18x130 M12D/50	FZA 22x125 M16D/25
FNJ   14,7   14,7   14,7   14,7   14,7   14,7   14,7   14,7   14,7   14,7   14,7   14,7   14,7   14,7   14,7   14,7   14,5   1,25   105	Fig.   Fig.   14,7   12,8	l			
Fig.	ks [Nm] 30,0 30,0 30,0 30,0 30,0 30,0 30,0 30,			33,8	62,8
ks [Nmj] 30,0 30,0 30,0 59,8 59,8 105 105 105 1.25 1.25 1.25 1.25 1.25 1.25 1.25 1.2	F.     30,0   30,0   30,0	1,25			
Fig.   Nm    30,0   30,0   30,0   59,8   59,8   105	ks [Nm] 30,0 30,0 30,0 30,0 30,0 30,0 30,0 30,				
F-1   12,8   12,8   20,3   20,3   29,5   2	ks [Nm] 26,2 26,2 26,2   26,2			105	266
FKN   12.8   12.8   20.3   20.3   29.5   29.5	Fig.   12,8	1,25			
FKN   12,8   12,8   12,8   20,3   20,5   29,5   29,5   20,5   2	ks [kN] 12,8 12,8 12,8 12,8				
F-1   1,56   1	ks [Nm] 26,2 26,2 26,2   26,2			29,5	55,0
ks [Nm] 26,2 26,2 52,3 52,3 91,6 91,6   91,6	ks [Nm] 26,2 26,2 26,2   26,2	1,56			
ks [Nm] 26,2 26,2 26,2 126,3 52,3 91,6 91,6 12,6 12,1	ks [Nm] 26,2 26,2 26,2   26,2				
F-1   12,8   12,8   12,3   20,3   29,5   2	F-1   12,8   13,8   13,9   14,9   14,0   1			91,6	232
Figure   F	k,s [Nm] 26,2 26,2 26,2 [Nm] 26,2 26,2 [Nm] 40 50 50 50 50 50 50 50 50 50 50 50 50 50	1,56			
Fig.   Fig.   12,8   12,8   20,3   20,3   20,3   29,5   20,5	Fig.   12,8   12,8   12,8				
F.]   1,25   1,25   26,2   26,2   52,3   52,3   91,6   91,6   91,6	F-1   26,2   26,2   26,2			29,5	55,0
Fig.   Nm    26,2   26,2   52,3   52,3   91,6   91,6	F.S. [Nm] 26,2 26,2 26,2   26,	1,25			
Fig.   [Nm]   26,2   26,2   26,2   52,3   52,3   91,6   91,6	Fig. [Nm] 26,2 26,2 26,2 [Nm] [Fig. 26,2 26,2 26,2 26,2 26,2 26,2 26,2 26,	:			
F.] 1,3 1,3 2,0 2,0 2,0 2,0 2,0 2,0 2,0 2,0 2,0 2,0	F.]  [-]  [-]  [-]  [-]  [-]  [-]  [-]  [	_	_	91,6	232
[-] 1,3 1,3 2,0 2,0 2,0 2,0 2,0 2,0 2,0 2,0 2,0 2,0	F.] 1,3 1,3 1,3 1,3 1,3 1,3 1,3 1,3 1,3 1,3	1,25			
F.] 1,3 1,3 2,0 2,0 2,0 2,0 2,0 2,0 2,0 [-1] 1,5	[-] 1,3 1,3 1,3 1,3 1,3 [-] [-] [mm] 40 50 50 50 50 [-] [mm] 12 12 12 12 [-] [mm] 5,0 5,0 [mm] 0,7 0,7 [mm] 1,0 1,0 1,0 1,0				
Figure   F	Fig. [mm] 40 50 50 50 40 40 50 40 40 40 40 40 40 40 40 40 40 40 40 40			2,0	2,0
Find   40   50   60   60   80   80   80   80   80   8	dom [mm] 40 50 50 50 50 70 70 70 70 70 70 70 70 70 70 70 70 70	1,52	-		
He [mm] 40 50 60 60 80 80 80 80 40 40 40 40 40 40 40 40 40 40 40 40 40	Annual [mm] 40 50 50 50 40 50 50 40 50 40 40 40 40 40 40 40 40 40 40 40 40 40				
How [mm] 12 12 14 14 18 18 18 18 18 18 18 18 18 18 18 18 18	The man			80	100
rwe <sup>1</sup> [-]     1,5 <sup>2</sup> s under shear load       [kN]     5,0     5,0     12,5     12,5     19,0     19,0       [mm]     0,7     0,7     1,9     1,9     2,1     2,1       [mm]     1,0     1,0     1,0     2,8     2,8     3,1     3,1	rwe <sup>1)</sup> [-]  s under shear load  [kN] 5,0 5,0 5,0 [mm] 0,7 0,7 0,7 [mm] 1,0 1,0 1,0			18	22
s under shear load         [kN]       5,0       5,0       12,5       12,5       19,0       19,0         [mm]       0,7       0,7       1,9       1,9       2,1       2,1       2,1         [mm]       1,0       1,0       1,0       2,8       2,8       3,1       3,1	s under shear load [kN] 5,0 5,0 5,0 [mm] 0,7 0,7 0,7 [mm] 1,0 1,0 1,0	1,52)			
[kN]         5,0         5,0         5,0         12,5         12,5         19,0         19,0           [mm]         0,7         0,7         0,7         1,9         1,9         2,1         2,1           [mm]         1,0         1,0         1,0         2,8         2,8         3,1         3,1	[mm] 5,0 5,0 5,0 [mm] 0,7 0,7 0,7 [mm] 1,0 1,0				
[mm] 0,7 0,7 0,7 1,9 1,9 2,1 2,1 [mm] 1,0 1,0 1,0 2,8 2,8 3,1 3,1	[mm] 0,7 0,7 [mm] 1,0 1,0			19,0	30,0
$\delta_{V_{\infty}}$ [mm] 1,0 1,0 2,8 2,8 3,1 3,1	δ <sub>V∞</sub> [mm] 1,0 1,0			2,1	2,1
	$^{1}$ In absent of other national regulations. $^{2}$ The partial safety factor $\gamma_{2}$ is included.			3,1	3,1

Design method A according to ETAG 001, Annex C

Characteristic values to shear loads

Through bolt anchor



Anchor type, - size (footnote see Annex 13)	nnex 13)		FZA 12x40 M6 I	FZA 12x50 M6 I	FZA 14x60 M8 I	FZA 18x80 M10 I	FZA 22x100 M12.1	FZA 22x125 M12 I
Steel failure FZA <sup>1)</sup>								
Characteristic resistance	NRK,s	[kN]	17,2	17,2	22,9	26,9	0,59	63,0
Partial safety factor	$\gamma_{MS}^{2)}$	Ξ	1,75	1,75	1,75	2,0	2,0	2,0
Steel failure FZA A4 <sup>1)</sup>								
Characteristic resistance	NRK,s	[kN]	13,5	13,5	17,9	22,7	53,1	53,1
Partial safety factor	γ <sub>Ms</sub> 2)					1,8		
Steel failure FZA C								
Characteristic resistance	NRKS	[KN]	13,5	13,5	17,9	22,7	53,1	53,1
Partial safety factor	7Ms	· :			1	1,8		
Pullout failure FZA, FZA A4, FZA C								
Character resistance in cracked concrete		1	9	6	12	20	40	40
Character resistance in non-cracked concrete	d concrete [kN]	CZ0/Z2	6	12	20	30	40	40
		C25/30			1,	1,10		
		C30/37			1,	1,22		
Increasing factors for NRK,p		C35/45				1,34		
lot cracked allu non-cracked concrete	√c	C40/20				1,41		
		C45/55			1,	1,48		
		C20/60			1,	1,55		
Partial safety factor	YMp (	E	1,8 <sup>3)</sup>			1,5 <sup>3)</sup>		
Concrete cone and splitting failure FZA,	FZA A4,	၁						
Effective anchorage depth	h <sub>ef</sub>	[mm]	40	50	09	80	100	125
Spacing	Scr,N = Scr,sp	[mm]	120	150	180	240	300	375
Edge distance	Cor,N = Cor,sp	[mm]	09	52	06	120	150	190
Partial safety factor	$\gamma_{Mc} = \gamma_{M,Sp}$	Ξ	1,8 <sup>3)</sup>			1,53)		
Minimum thickness of concrete member, minimum spacings and minimum edge distances of anchors FZA,	nber, minimum sp	acings and	d minimum ed	ge distances of		FZA A4, FZA C		
Minimum spacing	Smin	[mm]	40	09	09	80	100	125
Minimum edge distance	Cmin	[mm]	35	45	22	70	100	125
Minimum thickness of concrete member		[mm]	100	110	130	160	200	250
Table 16: Displacements of anchor	s due	to tension load	n load					
Tension load in cracked concrete		[kN]	2,0	3,5	5,0	8,0	16,0	16,0
-taomooolaoiG	δNο	[mm]			0	8,0		
Displacement	δN∞	[mm]				1,1		
Tension load in non-cracked concrete		[kN]	3,3	4,8	7,5	12,7	17,9	17,9
Displacement	SNO	[mm]			0	0,8		
	c					, ,		

Design method A according to ETAG 001, Annex C

Characteristic values to tension loads **Internal thread anchor** 

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lable 17. Chalacteristic values of te					,		
Anchor type, - size		FZA 12x40 M6 I	FZA 12x50 M6 I	FZA 14x60 M8 I	FZA 18x80 M10 I	FZA 22x100 M121	FZA 22x125 M12 I
Steel failure without lever arm FZA 1)							
Characteristic resistance V <sub>Rk,s</sub>	[kN]	9,8	9'8	11,4	13,4	31,5	31,5
Partial safety factor	Ξ	1,5	1,5	1,5	1,7	1,7	1,7
Steel failure with lever arm FZA <sup>1)</sup>							
Characteristic bending resistance M <sup>0</sup> R <sub>K.s</sub>	[Nm]	12,2	12,2	30,0	59,8	105	105
γMs	[-]			1,	,25		
Steel failure without lever arm FZA A41)	•						
Characteristic resistance V <sub>RK,S</sub>	[kN]	6,7	6,7	0,6	11,3	26,6	26,6
	Ξ			~	5,		
<u>-</u>							
Characteristic bending resistance M <sup>RK,S</sup>	[Nm]	10,7	10,7	26,2	52,3	91,6	91,6
Partial safety factor	[-]			1,	1,56		
Steel failure without lever arm FZA C <sup>1)</sup>							
Characteristic resistance V <sub>Rk,s</sub>	[kN]	6,7	6,7	0'6	11,3	26,6	26,6
	Ξ				5.		
Steel failure with lever arm FZA C <sup>1)</sup>							
<sub>o</sub> ⊠	[NM]	10,7	10,7	26,2	52,3	91,6	91,6
Partial safety factor				1,	1,56		
re FZA, FZA A4, FZA							
Factor in equation (5.6) of ETAG k	Ξ	1,3	1,3	2,0	2,0	2,0	2,0
Partial safety factor	Ξ				1,5 <sup>3)</sup>		
FZA. FZA A4. FZA C							
	[mm]	40	20	09	80	100	125
ļ		12	12	14	18	22	22
Partial safety factor $\gamma_{ m Mc}^{(2)}$	c <sup>2)</sup> [-]			1,	,5 <sup>3)</sup>		
Table 18: Displacements of anchors under shear load	under shear	load					
Shear load in cracked and non-cracked concrete	[kN]	5,0	5,0	12,5	19,0	30,0	30,0
Svo Svo	[mm]	2'0	2'0	1,9	2,1	2,1	2,1
Displacement δ√∞	[mm]	1,0	1,0	2,8	3,1	3,1	3,1

Design method A according to ETAG 001, Annex C

Characteristic values to shear loads

Internal thread anchor



FZA         FZA         FZA         FZA         FZA           14x40         12x50         14x60         18x80         22x100           M10 / t <sub>fix</sub> M8 / t <sub>fix</sub> M10 / t <sub>fix</sub> M16 / t <sub>fix</sub>		46,4 29,3 46,4 67,4 126	1,5		40,6 25,6 40,6 59,0 110	1,87		40,6 25,6 40,6 59,0 110	1,5		6 9 72 20 40	9   12   20   30   40	1,10	1,22	1,34	1,41	1,48	1,55	$1,5^2$		40   50   60   80   100	10,1	7,2	120 150 180 240 300	60 75 90 120 150	$1,5^2$	edge distances of anchors FZA, FZA A4, FZA C	50 60 80	70 45 55 70 100	100 110 130 160 200
FZA         FZA         F           10x40         12x40         1           M6 / tix         M8 / tix         M1		16,1 29,3 4			14,1 25,6 4			14,1 25,6 4			9 9	6 6							1,8 <sup>2)</sup>		40 40			120 120	09 09	1,8 <sup>2)</sup>	nimum edge distance:	40 40	35 40	100 100
		N <sub>Rk,s</sub> [kN] 16	$\gamma_{Ms}^{-1}$ [-]		N <sub>RK,S</sub> [KN] 14	<sup>1</sup> ) [-]		N <sub>Rk,s</sub> [kN] 14	$\gamma_{Ms}^{-1}$ [-]		NRK,P C30/3E	[kN] 020/23	C25/30	C30/37		ψc C40/50	C45/55	C20/60	γмρ <sup>1)</sup> [-]	ᄣ	h <sub>ef</sub> [mm] 4	K <sub>ucr</sub> [-]	k <sub>or</sub> [-]	[mm]	[mm]	$\gamma_{Mc} = \gamma_{M,Sp}^{-1}$ [-]	nber, minimum spacings and mir	[mm]	C <sub>min</sub> [mm]	h <sub>min</sub> [mm]
Anchor type, - size (footnote see Annex 15)	Steel failure FZA	Characteristic resistance	Partial safety factor	Steel failure FZA A4	Characteristic resistance	Partial safety factor	Steel failure FZA C	Characteristic resistance	Partial safety factor	Pullout failure FZA, FZA A4, FZA C	Character resistance in cracked concrete	Character, resistance in non-cracked concrete			Increasing factors for INR.p	non-cracked concrete			Partial safety factor	Concrete cone and splitting failure FZA,	Effective anchorage depth	Factor for uncracked concrete	Factor for cracked concrete	Spacing	Edge distance	Partial safety factor	Minimum thickness of concrete member, minimum spacings and minimum	Minimum spacing	Minimum edge distance	Minimum thickness of concrete member

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Design method A according to CEN/TS 1992-4: 2009

Characteristic values to tension loads

**Bolt projecting anchor** 



T-ZA	
VRKS       [KN]       8,0       14,7       23,2       13,8       33,8         M <sup>O</sup> RLS       [Nm]       12,2       30,0       59,8       30,0       59,8       105         YMS 1)       [-]       1,25       1,25       1,25         A4       VRKS       [KN]       7,0       12,8       20,3       12,8       20,3       29,5         YMS 1)       [-]       10,7       26,2       52,3       26,2       52,3       91,6         C       VRKS       [KN]       7,0       12,8       20,3       12,8       20,3       91,6         C       VRKS       [KN]       7,0       12,8       20,3       12,8       20,3       91,6         M <sup>O</sup> RKS       [KN]       7,0       12,8       20,3       12,8       20,3       91,6         M <sup>O</sup> RKS       [KN]       7,0       12,8       20,3       12,8       20,3       91,6         M <sup>O</sup> RKS       [KN]       10,7       26,2       52,3       26,2       52,3       91,6         M <sup>O</sup> R       [MS       [MS       [MS       [MS       10,7       26,2       52,3       26,2       52,3       91,6         M <sup>O</sup> R	1 dash
VRR,S         [KN]         8,0         14,7         23,2         14,7         23,2         33,8         33,8           M <sup>0</sup> R,S         [Nm]         12,2         30,0         59,8         30,0         59,8         105         105           7/Ms <sup>-1</sup> [-]         A4         12,2         30,0         59,8         10,6         105         105           7/Ms <sup>-1</sup> [-]         1,26         20,3         12,8         20,3         29,5         1           M <sup>0</sup> R,S         [Nm]         10,7         26,2         52,3         26,2         52,3         91,6         1           C         V <sub>R,k</sub> S         [KN]         7,0         12,8         20,3         12,8         20,3         29,5         1           M <sup>0</sup> R,L,S         [Nm]         10,7         26,2         52,3         26,2         52,3         91,6         1           M <sup>0</sup> R,L,S         [Nm]         7,0         12,8         20,3         12,8         20,3         29,5         1           M <sup>0</sup> R,L,S         [Nm]         -1         26,2         52,3         26,2         52,3         91,6         1           M <sup>0</sup> R,L,S         [Nm]         10,7 <td< td=""><td><math>\vdash</math> <math>\mid</math> <math>\mid</math> <math>\mid</math> <math>\mid</math> <math>\mid</math> <math>\mid</math> <math>\mid</math> <math>\mid</math> <math>\mid</math> <math>\mid</math></td></td<>	$\vdash$ $\mid$
M <sup>0</sup> <sub>Rks</sub> [Nm]       12,2       30,0       59,8       30,0       59,8       105         A4       A4       A4       A4       A4       A4       A4       A4       A4         M <sup>0</sup> <sub>Rks</sub> [kN]       7,0       12,8       20,3       12,8       20,3       29,5       A         M <sup>0</sup> <sub>Rks</sub> [Nm]       10,7       26,2       52,3       26,2       52,3       91,6       A         C       V <sub>Rks</sub> [kN]       7,0       12,8       20,3       12,8       20,3       29,5       A         V <sub>Rks</sub> [kN]       7,0       12,8       20,3       20,3       20,5       A         V <sub>Rks</sub> [kN]       7,0       12,8       20,3       20,3       20,5       A         V <sub>Rks</sub> [kN]       7,0       12,8       20,3       20,3       20,5       A         V <sub>Rks</sub> [kN]       7,0       12,8       20,3       52,3       91,6       A         Y <sub>Ms</sub> <sup>1</sup> [-]       1,25       22,3       26,2       52,3       91,6       A         Y <sub>Ms</sub> 1,1,0       1,25       1,25       1,25       A       A       A	$ \hspace{.06cm}  .$
M <sup>0</sup> <sub>Rk,s</sub> [Nm]         12,2         30,0         59,8         30,0         59,8         105           A4         A4           W <sub>Rk,s</sub> [kN]         7,0         12,8         20,3         12,8         20,3         29,5           γ <sub>Ms</sub> <sup>1</sup> )         [-]         A         A         A         A         A         A         A         A         A         A         A         B <t< td=""><td></td></t<>	
MGRKS       [Nm]       12,2       30,0       59,8       30,0       59,8       105       105         A4       VRKS       [KN]       7,0       12,8       20,3       12,8       20,3       29,5       1         MGRKS       [Nm]       10,7       26,2       52,3       26,2       52,3       91,6       1         C       VRKS       [KN]       7,0       12,8       20,3       12,8       20,3       29,5       1         MGRKS       [KN]       7,0       12,8       20,3       12,8       20,3       29,5       1         MGRKS       [Nm]       10,7       26,2       52,3       26,2       52,3       91,6       1         MGRKS       [Nm]       10,7       26,2       52,3       26,2       52,3       91,6       1         MGRKS       [Nm]       10,7       26,2       52,3       26,2       52,3       91,6       1         MGRKS       [Nm]       10,7       26,2       52,3       26,2       52,3       91,6       1         K2       1,10       1,25       1,26       1,26       1,26       1,26       1,26       1,10	$\vdash$
A44       1.25       1.25         VRk,s       [KN]       7,0       12,8       20,3       29,5                 YMs 1)       [-]       10,7       26,2       52,3       26,2       52,3       91,6                 C       VRk,s       [KN]       7,0       12,8       20,3       12,8       20,3       29,5                 YMs 1)       [-]       10,7       26,2       52,3       26,2       52,3       91,6                 M <sup>0</sup> Rk,s       [Nm]       10,7       26,2       52,3       20,3       29,5                 YMs 1)       [-]       10,7       26,2       52,3       91,6                 K2       [-]       1,25       20,3       1,25                         A2       [-]       1,0       1,26   K2       [-]       1,0       1,0	
A4           V <sub>Rk,S</sub> [kN]         7,0         12,8         20,3         12,8         20,3         29,5           ½MS (NS)         [Nm]         10,7         26,2         52,3         26,2         52,3         91,6           C         M <sup>O</sup> Rk,S         [kN]         7,0         12,8         20,3         12,8         20,3         29,5           YMS (NM)         [-]         10,7         26,2         52,3         26,2         52,3         91,6           K2         [-]         10,7         26,2         52,3         26,2         52,3         91,6	$oxed{ } oxed{ } $
V <sub>Rk,S</sub> [KN]         7,0         12,8         20,3         12,8         20,3         29,5           M <sup>0</sup> <sub>Rk,S</sub> [Nm]         10,7         26,2         52,3         26,2         52,3         91,6           C         V <sub>Rk,S</sub> [KN]         7,0         12,8         20,3         12,8         20,3         29,5           M <sup>0</sup> <sub>Rk,S</sub> [Nm]         10,7         26,2         52,3         26,2         52,3         91,6           M <sup>0</sup> <sub>Rk,S</sub> [Nm]         10,7         26,2         52,3         26,2         52,3         91,6           Y <sub>MS</sub> <sup>1</sup> [-]         10,7         26,2         52,3         91,6         1,25           K <sub>2</sub> [-]         1,25         1,25         1,25	$\vdash \mid \mid \vdash \mid \mid \vdash \mid \mid \mid \vdash \mid \mid \mid \vdash \mid \mid \mid \vdash \mid \vdash \mid \mid \vdash \mid \mid \vdash \mid \vdash \mid \vdash \mid \vdash \mid \vdash \mid \mid \vdash \mid \vdash \mid \vdash \mid \vdash \mid \mid \mid \vdash \mid \mid \mid \vdash \mid \mid$
YMS <sup>1</sup> )       [-]       1,56         M <sup>0</sup> Rk.s       [Nm]       10,7       26,2       52,3       26,2       52,3       91,6         C       VRk.s       [KN]       7,0       12,8       20,3       12,8       20,3       29,5         M <sup>0</sup> Rk.s       [Nm]       10,7       26,2       52,3       91,6                 YMS <sup>1</sup> )       [-]       10,7       26,2       52,3       91,6                 K2       [-]       1,25       1,25                         TA       1,2       1,2       1,2                 1,0       1,0       1,0       1,0       1,0       1,0       1,0	$\left\{ \left[ $
M <sup>0</sup> Rk.s [Nm] 10,7 26,2 52,3 26,2 52,3 91,6 C  C  VRk.s [KN] 7,0 12,8 20,3 12,8 20,3 29,5    M <sup>0</sup> Rk.s [Nm] 10,7 26,2 52,3 26,2 52,3 91,6    W <sup>0</sup> Rk.s [Nm] 10,7 26,2 52,3 26,2 52,3 91,6    K2 [-]	$oxed{ } oxed{ } $
M° <sub>Rk,s</sub> [Nm]         10,7         26,2         52,3         26,2         52,3         91,6           C         N <sub>Rk,s</sub> [kN]         7,0         12,8         20,3         12,8         20,3         29,5           M° <sub>Rk,s</sub> [Nm]         10,7         26,2         52,3         26,2         52,3         91,6           NMs <sup>1</sup> )         [-]         10,7         26,2         52,3         26,2         52,3         91,6           Y <sub>Ms</sub> <sup>1</sup> )         [-]         1,25         1,25         1,25         1,25           k <sub>2</sub> [-]         1,0         1,0         1,0         1,0	$H \mid H \mid H \mid H \mid H \mid H$
C V <sub>Rk,S</sub> [kN] 7,0 12,8 20,3 12,8 20,3 29,5   M <sup>0</sup> <sub>Rk,S</sub> [Nm] 10,7 26,2 52,3 26,2 52,3 91,6   M <sup>1</sup> <sub>KS</sub> [-]	
C V <sub>Rk,S</sub> [kN] 7,0 12,8 20,3 12,8 20,3 29,5   Ms <sup>1</sup> ) [-] 1,25	+ + + ++++++++++++++++++++++++++++++
V <sub>Rk,s</sub> [kN]         7,0         12,8         20,3         29,5                     'Ms <sup>1</sup> [-]         1,25         1,25         91,6                     M <sup>0</sup> <sub>Rk,s</sub> [Nm]         10,7         26,2         52,3         26,2         52,3         91,6           Y <sub>Ms</sub> <sup>1</sup> [-]         1,25         1,25         1,0	$H \mid H \mid H \mid H \mid H$
7Ms 1 [-] 10,7 26,2 52,3 26,2 52,3 91,6 k2 [-] 1,25	$  \hspace{.04cm}   .04cm$
M <sup>0</sup> <sub>Rk,s</sub> [Nm] 10,7 26,2 52,3 26,2 52,3 91,6 7	$  \vdash \mid \mid \mid \vdash \mid \mid \mid \vdash \mid$
M <sup>0</sup> <sub>Rk,S</sub> [Nm] 10,7 26,2 52,3 26,2 52,3 91,6 7 7 1,25 7 1,0	$H \sqcup H$
$\gamma_{MS}^{(1)}$ [-] 1,25 $K_2$ [-] 1,0	$  \cdot   \cdot   \cdot   \cdot  $
k2 [-]	
Concrete pryout failure FZA, FZA A4, FZA C	
2,0 2,0	
Partial safety factor 1,5 <sup>2)</sup>	
Concrete edge failure FZA, FZA A4, FZA C	
shear loading I <sub>f</sub> [mm] 40 40 50 60 80	
of anchor d <sub>nom</sub> [mm] 10   12   14   12	77 77
Partial safety factor $\gamma_{ m Mc}^{1)}$ [-]	
national regulations. factor γ <sub>inst</sub> is included.	

Design method A according to CEN/TS 1992-4: 2009

Characteristic values to shear loads

**Bolt projecting anchor** 



FZA   FZA
M8D/10
-
[KN] 29,3
ILVII 25.6
-
$\left  \right $
[kN] 25,6
ď
C20/25
C25/30
C30/37
C35/45
C40/50
C45/55
C50/60
1 8 <sup>2</sup> )
<u>-</u>
[mm] 40
[mm] 120
-
  -
4
Minimum thickness of concrete member, minimum spacings and minimum
[mm] 40
[mm] 35
<u> </u>

Design method A according to CEN/TS 1992-4: 2009

Characteristic values to tension loads

Through bolt anchor



FZA 22x125 M16D/25		62,8			266			55,0		232			55,0			232				2,0			100	22			
FZA 18x130 M12D/50		33,8			105			29,5		916			29,5			91,6				2,0			80	18			
FZA 18x100 M12D/20		33,8			105			29,5		9,16			29,5			91,6				2,0			80	18			
FZA 14x100 M10D/40		23,2	25		59,8	25		20,3	99	523	1		20,3	25		52,3	25	0		2,0	,5 <sup>2)</sup>		90	14	,5 <sup>2)</sup>		
FZA 14x80 M10D/20		23,2	1,25		59,8	1,25		20,3	1,56	523	1,56		20,3	1,25		52,3	1,25	1,0		2,0	1,5		90	14	1,5		
FZA 12x80 M8D/30	,	14,7			30,0			12,8		26.2			12,8			26,2				1,3			50	12			
FZA 12x60 M8D/10	,	14,7			30,0			12,8		28.2			12,8			26,2				1,3			50	12			
FZA 12x50 M8D/10	;	14,7			30,0			12,8		26.2			12,8			26,2				1,3			40	12			
	:	Z Z	Ξ		[Nm]	Ξ		[ <u>K</u> ]	Ξ	[N]			[KN]	Ξ		[NM]	Ξ	Η		[-]	Ы		[mm]	[mm]	Ξ		
		VRK,S	YMs )	4	M <sup>0</sup> Rk,s	(Ms		VRK,S	YMs'	M	7/Ms 1)		V <sub>Rk,s</sub>	η (γ γMs	÷	M <sup>0</sup> Rk,s	/Ms /	<b>k</b> 2	FZA C	k <sub>3</sub>	/Mc	S		d <sub>nom</sub>	η γ <sub>Mc</sub>	. <del>c</del> i	
Anchor type, - size	Steel failure without lever arm FZA	Characteristic resistance	Partial safety factor	Steel failure with lever arm FZA	Characteristic bending resistance	Partial safety factor	Steel failure without lever arm FZA A4	Characteristic resistance	Partial safety factor	Characteristic bending resistance	Partial safety factor	Steel failure without lever arm FZA C	Characteristic resistance	Partial safety factor	Steel failure with lever arm FZA C	Characteristic bending resistance	Partial safety factor	Ductility factor	4,	Factor in equation (16) of the CEN/TS 1992-4-4, Section 6.2.2.3	Partial safety factor	Concrete edge failure FZA, FZA A4, FZA C	Effective length of anchor in shear loading	Effective diameter of anchor	Partial safety factor	$^{1)}$ In absent of other national regulations. $^{2)}$ The partial safety factor $\gamma_{\mathrm{mst}}$ is included.	

Design method A according to CEN/TS 1992-4: 2009

Characteristic values to shear loads

Through bolt anchor



Anchor type, - size (footnote see Annex 19)	(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 <sup>1)</sup>								
Characteristic resistance	N <sub>Rk,s</sub>	[KN]	17,2	17,2	22,9	26,9	63,0	63,0
Partial safety factor	γ <sub>Ms</sub> 2)	Ξ	1,75	1,75	1,75	2,0	2,0	2,0
Steel failure FZA A4 <sup>1)</sup>								
Characteristic resistance	NRK,s	[kN]	13,5	13,5	17,9	22,7	53,1	53,1
Partial safety factor	γMs (					1,8		
Steel failure FZA C 1)								
Characteristic resistance	N <sub>RK.S</sub>	[kN]	13,5	13,5	17,9	22,7	53,1	53,1
Partial safety factor	γMs					1,8		
Pullout failure FZA, FZA A4, FZA C								
Character, resistance in cracked concrete		1	9	6	12	20	40	40
Character, resistance in non-cracked concrete	ncrete [kN]	CZ//\Z0	6	12	20	30	40	40
		C25/30				1,10		
		C30/37			_	1,22		
Increasing factors for NRk,p	;	C35/45			, T	1,34		
non-cracked concrete	÷	C40/20			1,	1,41		
		C45/55			1,	1,48		
		C20/60			1,	1,55		
Partial safety factor	γ <sub>Mp</sub> 2)	Ξ	1,8 <sup>3)</sup>			1,53)		
Concrete cone and splitting failure FZA,	FZA A4, FZA	၁						
Effective anchorage depth	$h_{ef}$	[mm]	40	20	09	80	100	125
Factor for uncracked concrete	Kucr	Θ			1(	10,1		
Factor for cracked concrete	K <sub>cr</sub>	Ξ			7	7,2		
Spacing	Scr,N = Scr,sp	[mm]	120	150	180	240	300	375
Edge distance	Ccr,N = Ccr,sp	[mm]	09	75	06	120	150	190
Partial safety factor	$\gamma_{Mc} = \gamma_{M,Sp}^{2}$	Ξ	1,8³)			1,53)		
Minimum thickness of concrete member, minimum spacings and minimum edge distances of anchors FZA,	minimum sp	acings and	minimum ed	ge distances of	anchors FZA,	FZA A4, FZA C		
Minimum spacing	Smin	[mm]	40	50	09	80	100	125
Minimum edge distance	Cmin	[mm]	35	45	55	70	100	125
Minimum thickness of concrete member	h <sub>min</sub>	[mm]	100	110	130	160	200	250

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Design method A according to CEN/TS 1992-4: 2009

Characteristic values to tension loads **Internal thread anchor** 

English translation prepared by DIBt



| Verks         [kN]         8,6         12x40         14x60         18x80         22x100           Verks         [kN]         8,6         8,6         11,4         13,4         31,5           Nuss         [-]         1,5         1,5         1,7         1,7         1,7           Nuss         [Nm]         12,2         1,5         1,7         1,7         1,7           Nuss         [-]         1,5         1,2         30,0         59,8         105         1,7           Nuss         [-]         1,2         2,0         1,25         1,25         1,5         1,7         1,7           Nuss         [-]         1,1         1,2         1,2         30,0         1,5         1,5         1,5         1,5         1,5         1,5         1,5         1,7         1,7         1,7         1,5   | 12x40   12x50   14x60   18x80   22x100  | National Part   National Par   | 12x40   12x50   14x50   14x80   18x80   22x100   18x80   12x410   18x80   12x410   18x80   12x410   18x80   12x410   12x80   1x82   1   | 12x40  | 12x40   | National N  |   |                     |              | FZA           | FZA FZA FZA FZA FZA | FZA           | FZA              | FZA             | FZA             |
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---|---|---------------------|--------------|---------------|---------------------|---------------|------------------|-----------------|-----------------|
| Verse of Fixed Street         RAI (Street Street Stree  | VRes         [KNJ]         8.6         11,4         13,4         31,5           YMs (2)         [-]         1,5         1,5         1,7         1,7  
      1,7         1,2         1,2         1,7         1,2         1,2         1,7         1,7         1,2         1,2         1,7         1,7         1,2         1,2         1,7         1,7         1,2         1,2         1,7         1,2         1,7         1,2         1,2         1,7         1,2 <th< td=""><td>Verss         [KNJ]         8.6         8.6         11.4         13.4         31.5           PMs2         [-]         1,5         1,5         1,7         1,7         1,7           M<sup>0</sup>Rxs         [Nm]         12.2         12.2         30.0         59.8         105           Yes,s         [KN]         6,7         6,7         9.0         11.3         26.6           Yes,s         [KN]         10,7         10,7         26.2         52.3         91.6           Yes,s         [KN]         6,7         10,7         26.2         52.3         91.6           Yes,s         [-]         1,3         1,5         1.5           Ac         1         1,5         2.0         2.0           Ac         1         1,3         2,0         1.5           Ing b         [mm]         10,7         10,7         2,0         2.0           Yes         1         1,3         2,0         2.0         2.0           Ac         1         1,5         1,5         1.6           Yes         1         1         1,5         1.6           Yes         1         1         1,5         1.6</td><td>Verss         [KN]         8.6         8.6         11,4         13,4         31,5           Yoss         [-]         1,5         1,5         1,5         1,7         1,7         1,7           M°exs         [Nm]         12,2         1,5         1,5         1,7         1,7         1,7           Yoss         [-]         1,5         1,2         1,2         1,2         1,2         1,7         1,7           Yoss         [-]         [-]         1,2         1,2         30,0           59,8         105                     Yoss         [-]         [-]         1,2         1,2         20,0           1,3         26,6                     Yoss         [-]         1,1         10,7         10,7         26,2         52,3         91,6                     Yoss         [-]         1,5         1,5         20,0                   1,6                     Yoss         [-]         1,3         1,3         2,0                   20,0                   1,6                     Yoss         [-]         1,3         1,3         2,0                   2,0                   2,0                    </td><td>Vers.s         [KNI]         8.6         8.6         11.4         13.4         31.5           Yoke 2/2         [-]         1,5         1,5         1,7         1,7         1,7         1,7           Weeks 2/2         [Nm]         (12.2         12.2         30.0         5.9/8         105         1           Yoke 2/2         [-]         (1.2)         6,7         6,7         9,0         11.3         26.6         1           Yoke 2/2         [-]         (1.7)         10,7         10,7         26.2         52.3         91.6         1           Yoke 2/2         [-]         4.5         1.3         2.6         1.5         3.0         1.5         3.0         1.5         3.0         1.5         3.0         1.5         3.0         1.5         4.5</td><td>Venus         [KN]         8.6         11.4         11.3.4         31.5           Yokes         [-]         1.5         1.5         1.5         1.7         1.7         1.7           Markes         [-]         1.5         1.5         1.5         1.5         1.7         1.7         1.7           Yokes         [-]         1.5         1.5         1.5         1.5         1.5         1.5         1.5           Wins         [-]         1.1         1.2.2         1.2.2         30.0         1.5         1.5         1.5           Volus         [-]         1.1         1.2.2         2.0         1.1.5         2.6.6         1.5           Winks         [-]         1.0         1.0.7         1.0.7         2.6.2         52.3         91.6         1.6           Minks         [-]         1.1         1.5         2.0         2.0         1.6         1.6           Ac         1.1         1.2         1.0         2.0         2.0         2.0         2.0           Ac         1.2         1.3         2.0         80         1.0         1.5           Ing         4         1.5         1.5         1.5</td><td>VRR.5         [KN]         8.6         8.6         11.4         13.4         31.5           Yoke 2         [-]         1.5         1.5         1.5         1.7         1.7         1.7           Yoke 3         [Nm]         12.2         12.2         30.0         59.8         105           Yoke 3         [-]         1.3         6.7         6.7         9.0         1.1.3         26.6           Yoke 3         [-]         1.0         10.7         10.7         26.2         52.3         91.6           Wiles 2         [-]         1.0         10.7         10.7         26.2         52.3         91.6           Wiles 2         [-]         1.0         1.0         1.5         1.5         2.0         2.0           And 2         [-]         1.3         2.0         2.0         2.0         2.0           And 3         [-]         1.3         2.0         2.0         2.0         2.0           And 3         [-]         1.3         2.0         2.0         2.0         2.0           And 4         1.5         1.5         1.5         1.5         1.5           And 4         1.0         2.0</td><td>Anchor type, - size</td><td></td><td></td><td>12x40<br/>M6 I</td><td>12x50<br/>M6 I</td><td>14x60<br/>M8 I</td><td>18x80<br/>M10 I</td><td>22x100<br/>M12 I</td><td>22x125<br/>M12 I</td></th<>  
  | Verss         [KNJ]         8.6         8.6         11.4         13.4         31.5           PMs2         [-]         1,5         1,5         1,7         1,7         1,7           M <sup>0</sup> Rxs         [Nm]         12.2         12.2         30.0         59.8         105           Yes,s         [KN]         6,7         6,7         9.0         11.3         26.6           Yes,s         [KN]         10,7         10,7         26.2         52.3         91.6           Yes,s         [KN]         6,7         10,7         26.2         52.3         91.6           Yes,s         [-]         1,3         1,5         1.5           Ac         1         1,5         2.0         2.0           Ac         1         1,3         2,0         1.5           Ing b         [mm]         10,7         10,7         2,0         2.0           Yes         1         1,3         2,0         2.0         2.0           Ac         1         1,5         1,5         1.6           Yes         1         1         1,5         1.6           Yes         1         1         1,5         1.6  | Verss         [KN]         8.6         8.6        
11,4         13,4         31,5           Yoss         [-]         1,5         1,5         1,5         1,7         1,7         1,7           M°exs         [Nm]         12,2         1,5         1,5         1,7         1,7         1,7           Yoss         [-]         1,5         1,2         1,2         1,2         1,2         1,7         1,7           Yoss         [-]         [-]         1,2         1,2         30,0           59,8         105                     Yoss         [-]         [-]         1,2         1,2         20,0           1,3         26,6                     Yoss         [-]         1,1         10,7         10,7         26,2         52,3         91,6                     Yoss         [-]         1,5         1,5         20,0                   1,6                     Yoss         [-]         1,3         1,3         2,0                   20,0                   1,6                     Yoss         [-]         1,3         1,3         2,0                   2,0                   2,0   | Vers.s         [KNI]         8.6         8.6         11.4         13.4         31.5           Yoke 2/2         [-]         1,5         1,5         1,7         1,7         1,7         1,7           Weeks 2/2         [Nm]         (12.2         12.2         30.0         5.9/8         105         1           Yoke 2/2         [-]         (1.2)         6,7         6,7         9,0         11.3         26.6         1           Yoke 2/2         [-]         (1.7)         10,7         10,7         26.2         52.3         91.6         1           Yoke 2/2         [-]         4.5         1.3         2.6         1.5         3.0         1.5         3.0         1.5         3.0         1.5         3.0         1.5         3.0         1.5         4.5  
   | Venus         [KN]         8.6         11.4         11.3.4         31.5           Yokes         [-]         1.5         1.5         1.5         1.7         1.7         1.7           Markes         [-]         1.5         1.5         1.5         1.5         1.7         1.7         1.7           Yokes         [-]         1.5         1.5         1.5         1.5         1.5         1.5         1.5           Wins         [-]         1.1         1.2.2         1.2.2         30.0         1.5         1.5         1.5           Volus         [-]         1.1         1.2.2         2.0         1.1.5         2.6.6         1.5           Winks         [-]         1.0         1.0.7         1.0.7         2.6.2         52.3         91.6         1.6           Minks         [-]         1.1         1.5         2.0         2.0         1.6         1.6           Ac         1.1         1.2         1.0         2.0         2.0         2.0         2.0           Ac         1.2         1.3         2.0         80         1.0         1.5           Ing         4         1.5         1.5         1.5   | VRR.5         [KN]         8.6         8.6         11.4         13.4         31.5           Yoke 2         [-]         1.5         1.5         1.5         1.7         1.7         1.7           Yoke 3         [Nm]         12.2         12.2         30.0         59.8         105           Yoke 3         [-]         1.3         6.7         6.7         9.0         1.1.3         26.6           Yoke 3         [-]         1.0         10.7         10.7         26.2         52.3         91.6           Wiles 2         [-]         1.0         10.7         10.7         26.2         52.3         91.6           Wiles 2         [-]         1.0         1.0         1.5         1.5         2.0         2.0           And 2         [-]         1.3         2.0         2.0         2.0         2.0           And 3         [-]         1.3         2.0         2.0         2.0         2.0           And 3         [-]         1.3         2.0         2.0         2.0         2.0           And 4         1.5         1.5         1.5         1.5         1.5           And 4         1.0         2.0   
   | Anchor type, - size   |                     |              | 12x40<br>M6 I | 12x50<br>M6 I       | 14x60<br>M8 I | 18x80<br>M10 I   | 22x100<br>M12 I | 22x125<br>M12 I |
| VRAS         [KN]         8,6         11,4         13,4         31,5         1           YMS         [-]         1,5         1,5         1,7         1,7         1,7         1,7           MRRAS         [Nm]         12,2         12,2         30,0         59,8         105         1           YMS         [-]         1,25         1,25         1,25         10,7         10,7         10,7         10,7         10,7         11,3         26,6         1           YMS         [-]         1,5         11,3         26,6         1,56         1         1,6         1           YMS         [-]         1,7         10,7         26,2         52,3         91,6         1           YMS         [-]         1,5         1,5         1,5         1         1,5         1           YMS         [-]         1,7         10,7         26,2         52,3         91,6         1           YMS         [-]         1,5         1,5         1,5         1         1         1         1           YMS         [-]         1,3         1,3         2,0         2,0         2,0         2         1           YMS   
  | VRAS         [KNJ]         8.6         11,4         13,4         31,5         1.5         1.5         1,5         1,5         1,5         1,5         1,5         1,7         1,2         1,7         1,2         1  
  | VRs.s         [KNI]         8.6         11,4         13,4         31,5           YMs.s         [-1]         1,5         1,5         1,5         1,7         1,7         1,7           M <sup>C</sup> Rs.s         [Nm]         12,2         12,2         30,0         59,8         105         177           Yms.s         [-1]         6,7         6,7         9,0         1,25         105         105           Yms.s         [-1]         6,7         6,7         9,0         1,5         26,6         106           Yms.s         [-1]         10,7         6,7         9,0         1,5         26,6         106           Yms.s         [-1]         6,7         6,7         9,0         1,5         30,6         106           Yms.s         [-1]         6,7         6,7         9,0         1,5         30,6         1           Yms.s         [-1]         6,7         6,7         9,0         1,5         30,6         1           Yms.s         [-1]         1,3         1,5         2,0         2,0         2,0         1           Ac  
   | VRIS.2   (kV)   8 6   8 6   11,4   13,4   31,5   1.5   1.5   1.5   1.7   1.2   1.3   | Very State of Line (No. 1)         R/B (No. 1)         8.6         8.6         11,4         13,4         31,5         1.5         1.5         1.5         1.5         1.5         1.5         1.7         1.5         1.7         1.5         1.7         1.5         1.7         1.5         1.7         1.5         1.5         1.5         1.6  
   | Vigits   KiN   8 6 8 6 11,4   13,4   31,5   1.  | Vers.   (kN)   8.6   8.6   11,4   13,4   31,5   1,5   1,5   1,5   1,7  
1,7     | Steel failure without lever arm FZA 1)                          |                     |              |               |                     |               |                  |                 |                 |
| Mc Res (Nmi)         [-]         1,5         1,5         1,7         1,2         1,7         1,7         1,2         1,2         1,2         1,7         1,2 <t< td=""><td>NMe Res         [Nm]         1.5         1.5         1.5         1.7         1.25         1.25         1.5         1.25         1.1         1.5         <th< td=""><td>Nus. 2 (INm)         (1.5 (1.5)         (1.5 (1.5)         (1.7 (1.7)         (1.7 (1.7)           Material (Inm)         (1.5 (1.2)         (1.2 (1.2)         (30.0 (1.2)         (59.8 (1.05)         (1.05 (1.2)           Nus. 2 (Inm)         (1.1 (1.2)         (1.2 (1.2)         (30.0 (1.2)         (30.0 (1.2)         (10.5 (1.2)           Nus. 2 (Inm)         (1.1 (1.2)         (1.2 (1.2)         (30.0 (1.2)         (11.3 (1.2)         (30.0 (1.2)           Nus. 2 (Inm)         (1.1 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)           Nus. 2 (Inm)         (1.1 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)           Nus. 2 (Inm)         (1.1 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)           Nus. 2 (Inm)         (1.1 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)           Nus. 2 (1.1 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)</td><td>  Null</td><td>  M<sup>0</sup>Rts   F.   1,5   1,5   1,7   1,2   1</td><td>  M<sup>2</sup>Res   [-]   1,5   1,5   1,7   1,7   1,7   1,7    </td><td>Miles         [-]         1,5         1,5         1,7<!--</td--><td>Characteristic resistance</td><td>VRK,s</td><td>[kN]</td><td>9,8</td><td>9,8</td><td>11,4</td><td>13,4</td><td>31,5</td><td>31,5</td></td></th<></td></t<>  
  | NMe Res         [Nm]         1.5         1.5         1.5         1.7         1.25         1.25         1.5         1.25         1.1         1.5 <th< td=""><td>Nus. 2 (INm)         (1.5 (1.5)         (1.5 (1.5)         (1.7 (1.7)         (1.7 (1.7)           Material (Inm)         (1.5 (1.2)         (1.2 (1.2)         (30.0 (1.2)         (59.8 (1.05)         (1.05 (1.2)           Nus. 2 (Inm)         (1.1 (1.2)         (1.2 (1.2)         (30.0 (1.2)         (30.0 (1.2)         (10.5 (1.2)           Nus. 2 (Inm)         (1.1 (1.2)         (1.2 (1.2)         (30.0 (1.2)         (11.3 (1.2)         (30.0 (1.2)           Nus. 2 (Inm)         (1.1 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)           Nus. 2 (Inm)         (1.1 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)           Nus. 2 (Inm)         (1.1 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)           Nus. 2 (Inm)         (1.1 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)           Nus. 2 (1.1 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)</td><td>  Null</td><td>  M<sup>0</sup>Rts   F.   1,5   1,5   1,7   1,2   1</td><td>  M<sup>2</sup>Res   [-]   1,5   1,5   1,7   1,7   1,7   1,7    </td><td>Miles         [-]         1,5         1,5         1,7<!--</td--><td>Characteristic resistance</td><td>VRK,s</td><td>[kN]</td><td>9,8</td><td>9,8</td><td>11,4</td><td>13,4</td><td>31,5</td><td>31,5</td></td></th<>   
  | Nus. 2 (INm)         (1.5 (1.5)         (1.5 (1.5)         (1.7 (1.7)         (1.7 (1.7)           Material (Inm)         (1.5 (1.2)         (1.2 (1.2)         (30.0 (1.2)         (59.8 (1.05)         (1.05 (1.2)           Nus. 2 (Inm)         (1.1 (1.2)         (1.2 (1.2)         (30.0 (1.2)         (30.0 (1.2)         (10.5 (1.2)           Nus. 2 (Inm)         (1.1 (1.2)         (1.2 (1.2)         (30.0 (1.2)         (11.3 (1.2)         (30.0 (1.2)           Nus. 2 (Inm)         (1.1 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)           Nus. 2 (Inm)         (1.1 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)           Nus. 2 (Inm)         (1.1 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)           Nus. 2 (Inm)         (1.1 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)           Nus. 2 (1.1 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)         (1.2 (1.2)   
   | Null   | M <sup>0</sup> Rts   F.   1,5   1,5   1,7   1,2   1  
   | M <sup>2</sup> Res   [-]   1,5   1,5   1,7   1,7   1,7   1,7  | Miles         [-]         1,5         1,5         1,7         1,7         1,7         1,7         1,7         1,7         1,7         1,7         1,7         1,7         1,7         1,7         1,7         1,7         1,7         1,7         1,7        
1,7         1,7 </td <td>Characteristic resistance</td> <td>VRK,s</td> <td>[kN]</td> <td>9,8</td> <td>9,8</td> <td>11,4</td> <td>13,4</td> <td>31,5</td> <td>31,5</td>  | Characteristic resistance                                       | VRK,s               | [kN]         | 9,8           | 9,8                 | 11,4          | 13,4             | 31,5            | 31,5            |
| WP, Reks         [NIM]         12,2         30,0         59,8         105           YRR,S         [KN]         6,7         6,7         6,7         9,0         11,3         26,6         1           YRR,S         [KN]         10,7         10,7         26,2         52,3         91,6         1           WR,Rs         [KN]         6,7         9,0         11,3         26,6         1           YMS,2         [-]         10,7         10,7         26,2         52,3         91,6         1           WR,ss         [MM] R,ss         [MM] R,ss         [-]         4,5         1,5         1,5         1,5           YMS,2         [-]         1,7         10,7         26,2         52,3         91,6         1           YMS,2         [-]         1,5         1,5         1,5         1,5         1,6         1           YMS,2         [-]         1,1         26,2         52,3         91,6         1         1           Ks         [-]         1,3         1,3         2,0         2,0         2,0         2,0         1           YMS,2         [-]         1,3         2,0         2,0         2,0         2,0   
  | Winstantal Marks         [Nm]         12,2         12,2         30,0         59,8         105  
  | MP Rs.s   [Nm]   12,2   12,2   30,0   59,8   105   105   105   108   1   
   | Nature   N   | M <sup>0</sup> Firs.   Nm    12,2   12,2   30,0   59,8   105   105   108 <sup>2</sup>   1,25   1,   
   | M <sup>0</sup> Rts, a   Nm    12.2   12.2   30.0   59,8   105   105   106   105   106   105   | Wifels   Family   12.2   12.2   30.0   59.8   105   105   108.2   1.25  
   | Partial safety factor   | γ <sub>Ms</sub> 2)  | 三            | 1,5           | 1,5                 | 1,5           | 1,7              | 1,7             | 1,7             |
| Mf Reks         [Nm]         12,2         12,2         30,0         59,8         105         105           Yorks         [-1]         6,7         6,7         9,0         11,3         26,6         1           Yorks         [Nm]         10,7         10,7         26,2         52,3         91,6         1           Yorks         [Nm]         6,7         6,7         9,0         11,3         26,6         1           Yorks         [Nm]         6,7         6,7         9,0         11,3         26,6         1           Yorks         [-]         6,7         6,7         9,0         11,3         26,6         1           Yorks         [-]         6,7         6,7         9,0         11,3         26,6         1           Yorks         [-]         10,7         26,2         52,3         91,6         1           Yorks         [-]         1,3         1,3         1,5         2,0         2,0         1           Yorks         [-]         1,3         2,0         2,0         2,0         2,0         2         1           Yorks         [-]         1,3         1,3         2,0         2,0  
  | MfRs.s         [NII]         12.2         12.2         30.0         59.8         105         105           Yas.s         [-]         1.2.2         1.2.5         1.2.5         1.2.5         1.2.5         1.2.6         1.2.5   
  | M <sup>R<sub>RAS</sub></sup> [Nm]         12,2         30,0         59,8         105         105           Y <sub>RAS</sub> [N]         6,7         6,7         6,7         9,0         11,3         26,6         1           W <sub>RAS</sub> [KM]         6,7         6,7         9,0         11,3         26,6         1           W <sub>RAS</sub> [KM]         6,7         6,7         9,0         11,3         26,6         1           Y <sub>MS</sub> [-]         10,7         26,2         52,3         91,6         1           Y <sub>MS</sub> [-]         1,5         2,0         1,5         2,0         2,0           Y <sub>MS</sub> [-]         1,3         2,0         2,0         2,0         2,0           Y <sub>MS</sub> [-]         1,3         2,0         2,0         2,0         2,0           AC         1,5         1,5         1,5         1,5         1,5         1,6           Ac         1,1         2,0         2,0         2,0         2,0         2,0         2,0           Ac         1,2         1,5         2,0         2,0         2,0         2,0         2,0           Ac         1,5         1,   
   | MPRiss         [NIM]         12,2         12,2         30,0         59,8         105         105           Verse         [-1]         6,7         6,7         9,0         1,13         26,6         105           Yes,s         [-1]         10,7         6,7         9,0         1,5         11,3         26,6         10,6           Yes,s         [-1]         10,7         10,7         26,2         52,3         91,6         10,7         10,7         10,5         11,5         11,5         11,6   | M <sup>0</sup> <sub>Res</sub> [Nm]         12.2         12.2         30.0         59.8         105           Yes         [-]         1.25   
   | M <sup>6</sup> R <sub>18</sub>   [Nm]   12,2   12,2   30,0   59,8   105   105   108   | M <sup>0</sup> <sub>04s.s</sub>   Nmj   12.2   12.2   30.0   59.8   105  
105     | Steel failure with lever arm FZA1)                              |                     |              |               |                     |               |                  |                 |                 |
| YMRS         [KN]         6,7         6,7         9,0         11,3         26,6           YMRS         [KN]         6,7         6,7         9,0         11,3         26,6           YMRS         [KN]         10,7         10,7         26,2         52,3         91,6           YMRS         [KN]         6,7         6,7         9,0         11,3         26,6           YMS         [-]   
  | 1,125  
  | YMAS         [-]         (-) <td>Yuks         [-]         1,25           Verks         [kN]         6,7         6,7         9,0         11,3         26,6         1           Yuks         [-]         1,1         26,6         1         1,5         26,6         1           Yuks         [-]         1         10,7         10,7         26,2         52,3         91,6         1           Yuks         [-]         1         26,7         6,7         9,0         11,5         26,6         1           Yuks         [-]         1         26,7         6,7         9,0         11,5         26,6         1           Kg         [-]         1         1         1         1         1         1         1           A C         1         1         1         1         2         1         1         1           Inglish         I         1         1         2         2         2         1</td> <td>YMes         [FN]         6,7         9,0         11,3         26,6         1           YMes         [FN]         6,7         6,7         9,0         11,3         26,6         1           YMes         [FN]         10,7         10,7         26,2         52,3         91,6         1           YMes         [FN]         6,7         6,7         9,0         11,3         26,6         1           YMes         [F]         1,1         26,2         52,3         91,6         1           YMes         [F]         1,5         1,5         1,5         1,5         1,6           YMes         [F]         1,3         2,0         2,0         2,0         2,0           Ke         [F]         1,3         2,0         2,0         2,0         2,0           Ing         [Img         [Img         [Img         1,5         1,5         1,5         1,5           Yme         [Img         [Img         1,2         1,5         1,5         1,5         1,5           Ing         [Img         [Img         [Img         1,5         1,5         1,5         1,5</td> <td>West of Manual Countries of Manual Countrie</td> <td>YMes         [-]         1,25           YMes         [-]         1,25           YMes         [-]         1,1,3         26,6           YMes         [-]         1,5         26,6           YMes         [-]         10,7         10,7         26,2         52,3         91,6           YMes         [-]         1,5         22,3         91,6         7           YMes         [-]         1,3         2,0         1,5         1,5           AC         [-]         1,3         2,0         1,5           YMes         [-]         1,3         2,0         2,0         2,0           AC         1         1,5         2         2         0           Ac         1,5         1,5         1,5         1,5           Ac         1         1,5         1,5         1,5           Ac         1         1,5         1,5         1,5     <td>Characteristic bending resistance</td><td><math>M^{0}_{Rk,s}</math></td><td>[Nm]</td><td>12,2</td><td>12,2</td><td>30,0</td><td>59,8</td><td>105</td><td>105</td></td>   | Yuks         [-]         1,25           Verks         [kN]         6,7         6,7         9,0         11,3         26,6         1           Yuks         [-]         1,1         26,6         1         1,5         26,6         1           Yuks         [-]         1         10,7         10,7   
     26,2         52,3         91,6         1           Yuks         [-]         1         26,7         6,7         9,0         11,5         26,6         1           Yuks         [-]         1         26,7         6,7         9,0         11,5         26,6         1           Kg         [-]         1         1         1         1         1         1         1           A C         1         1         1         1         2         1         1         1           Inglish         I         1         1         2         2         2         1   | YMes         [FN]         6,7         9,0         11,3         26,6         1           YMes         [FN]         6,7         6,7         9,0         11,3         26,6         1           YMes         [FN]         10,7         10,7         26,2         52,3         91,6         1           YMes         [FN]         6,7         6,7         9,0         11,3         26,6         1           YMes         [F]         1,1         26,2         52,3         91,6         1           YMes         [F]         1,5         1,5         1,5         1,5         1,6           YMes         [F]         1,3         2,0         2,0         2,0         2,0           Ke         [F]         1,3         2,0         2,0         2,0         2,0           Ing         [Img         [Img         [Img         1,5         1,5         1,5         1,5           Yme         [Img         [Img         1,2         1,5         1,5         1,5         1,5           Ing         [Img         [Img         [Img         1,5         1,5         1,5         1,5   
  | West of Manual Countries of Manual Countrie   | YMes         [-]         1,25           YMes         [-]         1,25           YMes         [-]         1,1,3         26,6           YMes         [-]         1,5         26,6           YMes         [-]         10,7         10,7         26,2         52,3         91,6           YMes         [-]         1,5         22,3         91,6         7           YMes         [-]         1,3         2,0         1,5         1,5           AC         [-]         1,3         2,0         1,5           YMes         [-]         1,3         2,0         2,0         2,0           AC         1         1,5         2         2         0           Ac         1,5         1,5         1,5         1,5           Ac         1         1,5         1,5         1,5           Ac         1         1,5         1,5         1,5 <td>Characteristic bending resistance</td> <td><math>M^{0}_{Rk,s}</math></td> <td>[Nm]</td> <td>12,2</td> <td>12,2</td> <td>30,0</td> <td>59,8</td> <td>105</td> <td>105</td>  
   | Characteristic bending resistance                               | $M^{0}_{Rk,s}$      | [Nm]         | 12,2          | 12,2                | 30,0          | 59,8             | 105             | 105             |
| VRRs.s         [KNI]         6,7         6,7         9,0         11,3         26,6           YMs.2         [-]         10,7         10,7         26,2         52,3         91,6           YMs.2         [-]         40,7         10,7         26,2         52,3         91,6           YMs.2         [-]         1,56         11,3         26,6         14,6           YMs.2         [-]         1,3         1,3         2,0         2,0         2,0           Ks.2         [-]         1,3         1,3         2,0         2,0         2,0           Ks.2         [-]         1,3         1,3         2,0         2,0         2,0           A C         40         50         60         80         100         100           A C         1,3         1,3         2,0         2,0         2,0         2,0           A C         40         60         80         100         100         100           A C         1,5%         1,5%         1,5%         1,5%         1,5%         1,0         1,0   
  | VRN,S         [KNJ]         6,7         9,0         11,3         26,6           WR,S         [-]         10,7         10,7         26,2         52,3         91,6           WR,Rs         [Nm]         10,7         10,7         26,2         52,3         91,6           WR,S         [-]         40         11,3         26,6         16           WR,S         [-]         10,7         26,2         52,3         91,6           WR,S         [-]         10,7         26,2         52,3         91,6           Nus.S         [-]         10,7         26,2         52,3         91,6           Ks         [-]         1,3         1,5         1,6           AC         1,5         2,0         2,0         2,0           Implementation         [mm]         40         50         60         80         100           AC         1,3         1,3         1,5         1,5         1,5         2,0         100           AC         100m         100         80         100         100         100           Ac         1,4         18         22         1,5         1,5         1,5  
  | Verses         [KNJ]         6,7         6,7         9,0         11,3         26,6           Nuss 2/2         [-]         10,7         10,7         26,2         52,3         91,6           Nms 2/2         [-]         40,7         10,7         26,2         52,3         91,6           Nms 2/2         [-]         40,0         11,3         26,6         156           Nms 2/2         [-]         40,7         10,7         26,2         52,3         91,6           Nms 2/2         [-]         1,3         1,5         1,5         1,5           Nms 2/2         [-]         1,3         2,0         2,0         2,0           Nms 2/2         [-]         1,3         2,0         2,0         2,0           Nms 2/2         [-]         1,3         2,0         2,0         2,0           Nmc 2/2         [-]         1,5         1,5         2,0         2,0           A C         1,3         2,0         60         80         100           Imp 4 mem         Imm 3         40         60         80         100           Imp 4 mem         1,1         1,5         1,5         1,5   
   | Naks   [KN]   6,7   6,7   9,0   11,3   26,6  | Verse of Means         [KNJ]         6,7         6,7         9,0         11,3         26,6           Material         [-]         1,5         1,5         1,5         1,6  
   | VRKs.s. [KNI]         (k.7)   | Verse (kM)         (k)  
   | Partial safety factor   | YMs 2)              | Ξ            |               |                     | 1             | ,25              |                 |                 |
| VRR,s         [kN]         6,7         6,7         9,0         11,3         26,6         8           YMs <sup>2</sup> [-]         10,7         10,7         26,2         52,3         91,6         8           YMs <sup>2</sup> [-]         10,7         10,7         26,2         52,3         91,6         8           YMs <sup>2</sup> [-]         40         1,56         26,6         26,6         8         8           YMs <sup>2</sup> [-]         10,7         10,7         26,2         52,3         91,6         8           YMs <sup>2</sup> [-]         1,3         1,3         1,5         2,0         2,0         2,0           K <sub>2</sub> [-]         1,3         1,3         2,0         2,0         2,0         2,0           K <sub>3</sub> [-]         1,3         1,3         2,0         2,0         2,0         2,0           K <sub>3</sub> [-]         1,3         1,3         2,0         2,0         2,0         2,0           K <sub>3</sub> [-]         1,3         2,0         2,0         2,0         2,0         2,0           K <sub>3</sub> [-]         1,3         1,3         1,4         1,5         <  
  | VRR,S         [KNJ]         6,7         6,7         9,0         11,3         26,6         C           YMs2         [-]         10,7         10,7         26,2         52,3         91,6         1           YMs2         [-]         10,7         10,7         26,2         15,6         1         1           YMs2         [-]         6,7         9,0         11,3         26,6         1           YMs2         [-]         10,7         10,7         26,2         52,3         91,6         1           YMs2         [-]         11,3         26,2         26,2         26,6         1         1           AC         1         1         1         1         1         1         1         1         1           K2         [-]         1   
  | VRR,s (kN)   
  | VRR,S         [kN]         6,7         6,7         9,0         11,3         26,6         R           YMs (2)         [-]         1,5         26,2         26,2         26,2         91,6         R           YMs (2)         [-]         1         10,7         10,7         26,2         26,2         91,6         R           YMs (2)         [-]         4         6,7         6,7         9,0         11,3         26,6         8           WR (2)         [-]         1         1         1         2         1   | Vers. s (kN)         (k)         <  
  | Very 2 (KNJ)         (6.7)  | Wakes         [KNJ]         6,7         6,7         9,0         11,3         26,6         8           TWRs <sup>2</sup> [-]         10,7         10,7         26,2         52,3         91,6         1           TWRs <sup>2</sup> [-]         10,7         6,7         6,7         9,0         11,3         26,6         1           WRss         [-]         10,7         6,7         6,7         9,0         11,3         26,6         1           WRss         [-]         10,7         10,7         26,2         52,3         91,6         1           MRss         [-]         1,3         1,3         2,0         2,0         2,0         1           A C         1,1         1,3         1,3         2,0         2,0         2,0         1           MRss         [-]         1,3         1,3         2,0         2,0         2,0         2           MRss         [-]         1,2         1,4         18         22         1           MRss         [-]         1,5         1,5         1,5         1         1           MRss         [-]         1,5         2,0         2,0         2         2   
  | Steel failure without lever arm FZA A41                         |                     |              |               |                     |               |                  |                 |                 |
| YMs         [-]         1,5           M <sup>RR,S</sup> [Nm]         10,7         10,7         26,2         52,3         91,6           YMs         [-]         40,7         10,7         26,2         52,3         91,6         1           VRks         [KN]         6,7         6,7         9,0         11,5         26,6         1           YMs         [-]         10,7         10,7         26,2         52,3         91,6         1           Ks         [-]         1,3         2,0         26,2         52,3         91,6         1           A C         A C         1,56         1,0         1,56         1,0         1,56         1,0           Ks         [-]         1,3         2,0         2,0         2,0         2,0         2,0           Nsc         [-]         1,3         2,0         2,0         2,0         2,0         2,0           Nsc         [-]         1,3         2,0         80         100         100           Nsc         [-]         1,5         1,5         1,5         1,5         1,5           Nsc         1,1         1,5         1,5         1,5         1,5  | YMS 2/N [Nm]         [Nm]         10,7         10,7         26,2         52,3         91,6                     YMS 2/N [KN]         [F.]         AC         6,7         9,0         11,3         26,6                     YMS 2/N [KN]         [F.]         6,7         9,0         11,3         26,6                     YMS 2/N [F.]         [F.]         10,7         10,7         26,2         52,3         91,6                     AC         YMS 2/N [F.]         [F.]         1,5         2,0         2,0         2,0                     K2         [F.]         1,3         2,0         2,0         2,0                   1,6                     AC         TMS         T,5         2,0         2,0         2,0                   1,6                     Mom         F         1,3         2,0         2,0         2,0                   1,5                     Mom         Imml         40         50         60         80         100                     Qom         Imml         40         50         60         80         100                     YMs <sup>2</sup> / <sub>2</sub> F         1         1 <th< td=""><td>Wike St. S.         [-] Indicated rods must correspond to Annex St.         [Indicate St.]         10,7 Indicate In</td><td>WR Rk s (kNJ)         (L) T (kNS)         10,7 (kNS)         26,2 (kNS)         52,3 (kNS)         91,6 (kNS)         10,7 (kNS)         10,7 (kNS)         10,7 (kNS)         10,7 (kNS)         10,7 (kNS)         10,7 (kNS)         11,3 (kNS)         11,3 (kNS)         11,3 (kNS)         11,3 (kNS)         11,5 (kNS)         11,6 (kNS)         11,</td><td>  M<sup>R<sub>KS</sub></sup>   F.                                  </td><td>  No. 2</td><td>  1,5   1,5</td><td>Characteristic resistance</td><td>V<sub>Rk,s</sub></td><td>[kN]</td><td>6,7</td><td>6,7</td><td>0'6</td><td>11,3</td><td>26,6</td><td>26,6</td></th<>  | Wike St. S.         [-] Indicated rods must correspond to Annex St.         [Indicate St.]         10,7 Indicate In   | WR Rk s (kNJ)         (L) T (kNS)         10,7 (kNS)         26,2 (kNS)         52,3 (kNS)         91,6 (kNS)         10,7 (kNS)         10,7 (kNS)         10,7 (kNS)         10,7 (kNS)         10,7 (kNS)         10,7 (kNS)         11,3 (kNS)         11,3 (kNS)         11,3 (kNS)         11,3 (kNS)         11,5 (kNS)         11,6 (kNS)         11,  | M <sup>R<sub>KS</sub></sup>   F.   | No. 2   | 1,5     | Characteristic resistance                                       | V <sub>Rk,s</sub>   | [kN]         | 6,7           | 6,7                 | 0'6           | 11,3             | 26,6            | 26,6            |
| M <sup>R<sub>K,S</sub></sup> [Nm]         10,7         10,7         26,2         52,3         91,6           γ <sub>MS</sub> <sup>2</sup> [-]         1,56         1,56         91,6         1,56           γ <sub>MS</sub> <sup>2</sup> [-]         10,7         10,7         26,2         52,3         91,6           γ <sub>MS</sub> <sup>2</sup> [-]         1,56         1,56         1,6         1,6           κ <sub>2</sub> [-]         1,3         1,0         2,0         2,0           κ <sub>2</sub> [-]         1,3         2,0         2,0         2,0           κ <sub>3</sub> [-]         1,3         1,5 <sup>3</sup> 1,5 <sup>3</sup> σ <sub>nom</sub> [mm]         40         50         60         80         100           η <sub>c</sub> [-]         12         14         18         22         10  
  | MFRAS         [Nm]         10,7         10,7         26,2         52,3         91,6           YMS2         [-]         1,56         1,56         11,3         26,6         26,6         15           YMS2         [-]         10,7         10,7         26,2         52,3         91,6         16           Ks         [-]         10,7         10,7         26,2         52,3         91,6         16           Ks         [-]         1,3         2,0         2,0         2,0         2,0         2,0           Ks         [-]         1,3         2,0         2,0         2,0         2,0         2,0         2,0           Ig         k         [mm]         40         50         60         80         100         100         100           Ig         k         [mm]         12         12         14         18         22         100  
  | M <sup>R<sub>kLS</sub></sup> [Nm]         10,7         10,7         26,2         52,3         91,6           Y <sub>MSS</sub> [-]         1         1,56         91,6 <t< td=""><td>MP RLS         [NIM]         10,7         10,7         26,2         52,3         91,6           YARLS         [-]         1,56         <td< td=""><td>MP (R,s) (Nm)         (Nm)         10,7         10,7         26,2         52,3         91,6         10,6           YMs (S) (KN)         (-1)         6,7         6,7         9,0         11,3         26,6         1           YMs (S) (F) (F) (Miss)         (-1)         10,7         10,7         26,2         52,3         91,6         1           YMs (S) (F) (Miss)         (-1)         10,7         10,7         26,2         52,3         91,6         1           Ka (S) (F) (Miss)         (-1)         10,7         10,7         26,2         52,3         91,6         1           Ka (S) (F) (Miss)         (-1)         1,3         2,0         <td< td=""><td>MP Rxs         [Nm]         10,7         10,7         26,2         52,3         91,6                     YAR,5         [-]         1.5         1,56         1,56         1,56                   1,6                   1,56                             1,6                   1,6                   1,6                             1,6                   1,6                             1,6                             1,6                             1,6                             1,6                             1,6                             1,6                                       1,6   1,6   1,6  </td><td>WPRIST         [NIM]         10,7         10,7         26,2         52,3         91,6           YMRS         [-]         1.5         1.56         91,6         1.56           YMRS         [-]         1.5         1.5         26,6         1.5           YMRS         [-]         1.0,7         1.0,7         26,2         52,3         91,6         1.6           MPRRS         [-]         1.0,7         1.0,7         26,2         52,3         91,6         1.6</td><td>Partial safety factor</td><td>YMs 2)</td><td>Ξ</td><td></td><td></td><td>7</td><td>1,5</td><td></td><td></td></td<></td></td<></td></t<>  
   | MP RLS         [NIM]         10,7         10,7         26,2         52,3         91,6           YARLS         [-]         1,56 <td< td=""><td>MP (R,s) (Nm)         (Nm)         10,7         10,7         26,2         52,3         91,6         10,6           YMs (S) (KN)         (-1)         6,7         6,7         9,0         11,3         26,6         1           YMs (S) (F) (F) (Miss)         (-1)         10,7         10,7         26,2         52,3         91,6         1           YMs (S) (F) (Miss)         (-1)         10,7         10,7         26,2         52,3         91,6         1           Ka (S) (F) (Miss)         (-1)         10,7         10,7         26,2         52,3         91,6         1           Ka (S) (F) (Miss)         (-1)         1,3         2,0         <td< td=""><td>MP Rxs         [Nm]         10,7         10,7         26,2         52,3         91,6                     YAR,5         [-]         1.5         1,56         1,56         1,56                   1,6                   1,56                             1,6                   1,6                   1,6                             1,6                   1,6                             1,6                             1,6                             1,6                             1,6                             1,6                             1,6                                       1,6   1,6   1,6  </td><td>WPRIST         [NIM]         10,7         10,7         26,2         52,3         91,6           YMRS         [-]         1.5         1.56         91,6         1.56           YMRS         [-]         1.5         1.5         26,6         1.5           YMRS         [-]         1.0,7         1.0,7         26,2         52,3         91,6         1.6           MPRRS         [-]         1.0,7         1.0,7         26,2         52,3         91,6         1.6</td><td>Partial safety factor</td><td>YMs 2)</td><td>Ξ</td><td></td><td></td><td>7</td><td>1,5</td><td></td><td></td></td<></td></td<>   | MP (R,s) (Nm)         (Nm)         10,7         10,7         26,2         52,3         91,6         10,6           YMs (S) (KN)         (-1)         6,7         6,7         9,0         11,3         26,6         1           YMs (S) (F) (F) (Miss)         (-1)         10,7         10,7         26,2         52,3         91,6         1           YMs (S) (F) (Miss)         (-1)         10,7         10,7         26,2         52,3         91,6         1           Ka (S) (F) (Miss)         (-1)         10,7         10,7         26,2         52,3         91,6         1           Ka (S) (F) (Miss)         (-1)         1,3         2,0 <td< td=""><td>MP Rxs         [Nm]         10,7         10,7         26,2         52,3         91,6                     YAR,5         [-]         1.5         1,56         1,56         1,56                   1,6                   1,56                             1,6                   1,6                   1,6                             1,6                   1,6                             1,6                             1,6                             1,6                             1,6                             1,6                             1,6                                       1,6   1,6   1,6  </td><td>WPRIST         [NIM]         10,7         10,7         26,2         52,3         91,6           YMRS         [-]         1.5         1.56         91,6         1.56           YMRS         [-]         1.5         1.5         26,6         1.5           YMRS         [-]         1.0,7         1.0,7         26,2         52,3         91,6         1.6           MPRRS         [-]         1.0,7         1.0,7         26,2         52,3         91,6         1.6 
       1.6         1.6         1.6         1.6         1.6         1.6         1.6         1.6</td><td>Partial safety factor</td><td>YMs 2)</td><td>Ξ</td><td></td><td></td><td>7</td><td>1,5</td><td></td><td></td></td<>   | MP Rxs         [Nm]         10,7         10,7         26,2         52,3         91,6                     YAR,5         [-]         1.5         1,56         1,56         1,56                   1,6                   1,56                             1,6                   1,6                   1,6                             1,6                   1,6                             1,6                             1,6                             1,6                             1,6                             1,6                             1,6                                       1,6   1,6   1,6  | WPRIST         [NIM]         10,7         10,7         26,2         52,3         91,6           YMRS         [-]         1.5         1.56         91,6         1.56           YMRS         [-]         1.5         1.5         26,6         1.5           YMRS
        [-]         1.0,7         1.0,7         26,2         52,3         91,6         1.6           MPRRS         [-]         1.0,7         1.0,7         26,2         52,3         91,6         1.6  | Partial safety factor   | YMs 2)              | Ξ            |               |                     | 7             | 1,5              |                 |                 |
| M <sup>0</sup> <sub>Rk,s</sub> [Nm]         10,7         10,7         26,2         52,3         91,6         156           γ <sub>Ms</sub> <sup>2</sup> [-]         1,56         11,3         26,6         16,7         9,0         11,3         26,6         16,6         16,7         16,7         16,7         16,6         17,5         16,6         17,6  
  | MPRAS         [Nm]         10,7         10,7         26,2         52,3         91,6                     'Ms2         [-]         1,56         11,3         26,6  
  | MFRAS [Nm]         [Nm]         10,7         10,7         26,2         52,3         91,6         10,6         91,6  
   | M <sup>R<sub>RLS</sub></sup> [Nm]         10,7         10,7         26,2         52,3         91,6           YMs <sup>2</sup> [-]         1,56         91,6         11,3         26,6         91,6           VRRs         [KM]         6,7         6,7         9,0         11,3         26,6         86           YMs <sup>2</sup> [-]         1         10,7         10,7         26,2         52,3         91,6         80           A C         A C         A C         1,5         2,0   | M <sup>0</sup> <sub>Rks</sub> [Nm]         10,7         10,7         26,2         52,3         91,6                     Y <sub>Rks</sub> [-1]         10,7         6,7         9,0         11,3         26,6                     Y <sub>Rks</sub> [-1]         10,7         10,7         26,2         52,3         91,6                     W <sub>0</sub> ks, 2         [-1]         10,7         10,7         26,2         52,3         91,6                     Ks         [-1]         10,7         26,2         52,3         91,6                               Ks         [-1]         1,3         1,3         2,0         2,0                               Ks         [-1]         1,3         2,0         2,0         2,0                               Goal         [-1]         40         50         60         80         100                     Goal         [-1]         12         12         14         18         22                     Y <sub>Me</sub> <sup>2</sup> [-1]         12         12         1,5%   Y <sub>Me</sub> <sup>2</sup> [-1]         12         12         14         15%  
   | M <sup>Rks</sup> (kN)         (N)         10,7         10,7         26,2         52,3         91,6                     7ks         [-]         1,56         1   | MF <sub>Rks</sub> [Nm]         10,7         10,7         26,2         52,3         91,6                     Yes,s         [-]   
   | Steel failure with lever arm FZA A41)                           |                     |              |               |                     |               |                  |                 |                 |
|  
  | YMs.2         [-]         H,56           VRks         [KNJ]         6,7         6,7         9,0         11,3         26,6         26,6           YMs.2         [-]         10,7         10,7         26,2         52,3         91,6         91,6           YMs.2         [-]         1,3         2,0         2,0         2,0         2,0         2,0           Ks         [-]         1,3         2,0         2,0         2,0         2,0         2,0           Ms.2         [-]         1,3         2,0         2,0         2,0         2,0           Ms.2         [-]         1,3         1,3         2,0         2,0         2,0           Ms.2         [-]         1,3         2,0         2,0         2,0         2,0           Ms.2         [-]         1,5         1,5         1,5         2,0         2,0           Ms.2         1,1         1,5         1,5         1,5         1,5         1,5           Ms.2         1,1         1,5         1,5         1,5         1,5         1,5  
  | YMRS         [-]         1,56           VRRS         [kN]         6,7         6,7         9,0         11,3         26,6         26,6           YMRS         [-]         10,7         10,7         26,2         52,3         91,6         10,7           YMRS         [-]         1,3         1,3         2,0         2,0         2,0         2,0           Ks         [-]         1,3         1,3         2,0         2,0         2,0         2,0           Mosc         [-]         1,3         1,3         2,0         80         100         100           Golombia         [mm]         40         50         60         80         100         100           quonn         [mm]         12         12         14         18         22         10           quonn         [mm]         40         50         60         80         100         100           quonn         [mm]         12         12         14         18         22         10           quonn         1,5%         1,5%         1,5%         1,5%         1,5%         1,5%         1,5%  
   | YMRS         [-]         1,56           VRRAS         [kN]         6,7         6,7         9,0         11,3         26,6           YMRS         [-]         10,7         10,7         26,2         52,3         91,6           MRS         [-]         1,3         2,0         91,6         1           A C         1,3         2,0         2,0         2,0         2,0           Ks         [-]         1,3         2,0         2,0         2,0           Nucl         [-]         40         50         60         80         100           C         C         12         12         14         18         22           YMc         [-]         12         12         14         18         22           YMc         [-]         12         14         15         15  | 1,56   1   
   | 1,56   1  | 1,56   1  
   | Characteristic bending resistance                               | M <sup>0</sup> Rk,s | [Nm]         | 10,7          | 10,7                | 26,2          | 52,3             | 91,6            | 91,6            |
| VRks         [kN]         6,7         6,7         9,0         11,3         26,6           ↑Ms²         [-]         10,7         10,7         26,2         52,3         91,6           ↑Ms²         [-]         1,3         1,56         1,0           k²         [-]         1,3         2,0         2,0         2,0           k³         [-]         1,3         2,0         2,0         2,0           ywe²         [-]         1,3         1,5³         2,0         2,0           c         c         60         80         100         100           ng lr         [mm]         12         12         14         18         22           n, 2,0         1,5³         22         100         100         100         100   
  | VRks         [kN]         6,7         6,7         9,0         11,3         26,6         26,0         2   
  | VRKs         [kN]         6,7         6,7         9,0         11,3         26,6         1           M <sup>0</sup> Rk,s         [Nm]         10,7         10,7         26,2         52,3         91,6         1           k <sub>2</sub> [-]         1         10,7         10,7         26,2         52,3         91,6         1           AC         4         1         1         1         1         1         1         1           AC         C         1         2         2         2         2         0         2         0           k <sub>3</sub> [-]         1,3         1,3         2,0         2,0         2,0         2         0           r <sub>3</sub> [-]         1,3         2,0         2,0         2,0         2         0           r <sub>3</sub> f <sub>1</sub> 1         1         1         1         3         1         3         1         3           r <sub>4</sub> 1         1         1         1         3         1         3         1         3         3         3         3         3         3         3         3         3         3         3         3         3   
   | VRR.s         [KN]         6,7         6,7         9,0         11,3         26,6           YMs2/2         [-]         1,5         26,2         52,3         91,6         15           M <sup>Rex.s</sup> [Nm]         10,7         10,7         26,2         52,3         91,6         16           Nms2/2         [-]         1,3         2,0         2,0         2,0         2,0         2,0           Ks         [-]         1,3         2,0  | VRR,S         [kN]         6,7         6,7         9,0         11,3         26,6           YMs 2/2         [-]         1,5         1,5         26,6         80           MR, ks         [Nm]         10,7         10,7         26,2         52,3         91,6           YMs 2/2         [-]         1,3         1,3         2,0         2,0         2,0           Ks         [-]         1,3         1,3         2,0         2,0         2,0           G 4chan         [mm]         40         50         60         80         100           I g lift         [mm]         12         12         14         18         22           Ame 2         [-]         1,5 <sup>3</sup> 1         1,5 <sup>3</sup> readed rods must correspond to Annex 3.   
   | VRR,S         [KN]         6,7         6,7         9,0         11,3         26,6           YMs 2/2         [-]         1-         1,5         1,5         1,6         1   | Votes   [KN]   6,7   6,7   9,0   11,3   26,6  
   | Partial safety factor   | YMs 2)              | Θ            |               |                     | 1             | ,56              |                 |                 |
| VRks         [kN]         6,7         6,7         9,0         11,3         26,6         R           γMs <sup>2</sup> [-]         10,7         10,7         26,2         52,3         91,6         80           γMs s <sup>2</sup> [-]         1,5         1,56         2,0         80         1,6         80           κ2         [-]         1,3         1,3         2,0  
  | VRRs         [kN]         6,7         6,7         9,0         11,3         26,6         1           M <sup>C</sup> Rs         [L]         10,7         10,7         26,2         52,3         91,6         1           M <sup>C</sup> Rs         [L]         10,7         26,2         52,3         91,6         1           MS         [-]         1,5         1,0         1,0         1,0         1,0         1,0           A C         K <sub>2</sub> [-]         1,3         2,0         2,0         2,0         2,0           K <sub>3</sub> [-]         1,3         2,0         2,0         2,0         2,0         2,0           K <sub>3</sub> [-]         1,3         2,0         2,0         2,0         2,0         2,0           M <sub>c</sub> [-]         1,5 <sup>3</sup> 2         1,5 <sup>3</sup> 2         1,5 <sup>3</sup> 2           I of bin         I min         40         50         60         80         100         100           I min         I min         12         12         14         18         22         22           I min  
  | V <sub>Rks</sub> (kN)         (6,7)         (6,7)         (6,7)         (6,7)         (6,7)         (6,7)         (6,7)         (6,7)         (6,7)         (6,7)         (6,7)         (6,6)  
   | VRR.s         [KN]         6,7         6,7         9,0         11,3         26,6           YMs.2         [-]         10,7         26,2         52,3         91,6         16           Rs.s         [-]         10,7         10,7         26,2         52,3         91,6         16           Rs.s         [-]         1         1,5         1,0         1,0         1,6 <td< td=""><td>VRR.s         [KN]         6,7         6,7         9,0         11,3         26,6           YMs2/2         [-]         10,7         10,7         26,2         52,3         91,6           M RR.s         [Nm]         10,7         10,7         26,2         52,3         91,6           Ms2/2         [-]         1,3         1,3         2,0         2,0         2,0           Rs         [-]         1,3         2,0         2,0         2,0         2,0           Nwc2         [-]         40         50         60         80         100         100           Indom         [mm]         40         50         60         80         100         100           YMc2         [-]         1         1         1         1         15.3         1.5.3         1.5.3</td><td>VRRss         [kN]         6,7         6,7         9,0         11,3         26,6         8           MSRs         [Nm]         10,7         10,7         26,2         52,3         91,6         8           1/MSRs         [-]         10,7         26,2         52,3         91,6         8           1/MSRs         [-]         1,3         1,3         2,0         2,0         2,0           1/MSRs         [-]         1,3         2,0         2,0         2,0         2,0           1/MSRs         [-]         1,3         2,0         80         100         100           1/MSRs         [-]         1         1         1         1         1           1/MSRs         [-]         1</td><td>VRRss         [KN]         6,7         6,7         9,0         11,3         26,6                     MBsks         [-]         10,7         10,7         26,2         52,3         91,6                     MBsks         [-]         10,7         10,7         26,2         52,3         91,6                     MBsks         [-]         1,3         2,0         1,56                   1,0                     Mc         [-]         1,3         2,0         2,0         2,0                               Mc         [-]         1,3         2,0         2,0         2,0  </td><td>Steel failure without lever arm FZA C<sup>1)</sup></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>   | VRR.s         [KN]         6,7         6,7         9,0         11,3         26,6           YMs2/2         [-]         10,7         10,7         26,2         52,3         91,6           M RR.s         [Nm]         10,7         10,7         26,2         52,3         91,6           Ms2/2         [-]         1,3         1,3         2,0         2,0         2,0           Rs         [-]         1,3         2,0         2,0         2,0         2,0           Nwc2         [-]         40         50         60         80         100         100           Indom         [mm]         40         50         60         80         100         100           YMc2         [-]         1         1         1         1         15.3         1.5.3         1.5.3   
   | VRRss         [kN]         6,7         6,7         9,0         11,3         26,6         8           MSRs         [Nm]         10,7         10,7         26,2         52,3         91,6         8           1/MSRs         [-]         10,7         26,2         52,3         91,6         8           1/MSRs         [-]         1,3         1,3         2,0         2,0         2,0           1/MSRs         [-]         1,3         2,0         2,0         2,0         2,0           1/MSRs         [-]         1,3         2,0         80         100         100           1/MSRs         [-]         1         1         1         1         1           1/MSRs         [-]         1  | VRRss         [KN]         6,7         6,7         9,0         11,3         26,6                     MBsks         [-]         10,7         10,7         26,2         52,3         91,6                     MBsks         [-]         10,7         10,7         26,2         52,3         91,6                     MBsks         [-]         1,3  
      2,0         1,56                   1,0                     Mc         [-]         1,3         2,0         2,0         2,0                               Mc         [-]         1,3         2,0         2,0         2,0   | Steel failure without lever arm FZA C <sup>1)</sup>             |                     |              |               |                     |               |                  |                 |                 |
| Msks         [Nm]         10,7         10,7         26,2         52,3         91,6           Msks         [Nm]         10,7         10,7         26,2         52,3         91,6           kz         [-]         1,56         1,56           A C         1,0         1,0         1,0           ks         [-]         1,3         2,0         2,0         2,0           msc         [-]         1,3         2,0         2,0         2,0         2,0           c         C         1,5 <sup>3</sup> 2,0         1,5 <sup>3</sup> 2,0         2,0         2,0           ng         lf         [mm]         40         50         60         80         100           ng         lf         mm]         12         14         18         22           nc, 2,2         1,5 <sup>3</sup> 1,5 <sup>3</sup> 22         22   
  | M0 Rks         [1]         10,7         26,2         52,3         91,6           γMs <sup>2</sup> [-]         1,3         2,0         2,0         2,0           K3         [-]         1,3         2,0         2,0         2,0           Mc <sup>2</sup> [-]         1,3         2,0         2,0         2,0           γmc <sup>2</sup> [-]         40         50         60         80         100           O         Immil         40         50         60         80         100           γmc <sup>2</sup> [-]         12         12         14         18         22           readed rods must correspond to Annex 3.         1,5 <sup>3</sup> 1,5 <sup>3</sup> 1,5 <sup>3</sup> 1,5 <sup>3</sup>  
  | MoRes         [·]         10,7         26,2         52,3         91,6           γMs <sup>2</sup> [·]         10,7         10,7         26,2         52,3         91,6           A C         A C         1,0         1,0         1,0         1,0         1,0           K <sub>2</sub> [·]         1,3         2,0         2,0         2,0         2,0           K <sub>3</sub> [·]         1,3         2,0         2,0         2,0         2,0           N <sub>c</sub> <sup>2</sup> [·]         40         50         60         80         100           Q Inn         1         1         1         1         1           Ane         [·]         1         1         1         1           Y <sub>Mor</sub> [·]         1         1         1         1           Y <sub>Mor</sub> [·]         1         1         1         1         1           Y <sub>Mor</sub> [·]         1         1         1         1         3         1           Y <sub>Mor</sub> [·]         1         1         1         3         1         1           Y <sub>Mor</sub> [·]         1         1         1   
   | YMS         [-]         1,5         1,56           MGRLS         [Nm]         10,7         10,7         26,2         52,3         91,6                     YMS         [-]         1,3         1,3         2,0<  | 1,5    
   | We start at State 1         1,5         1,5           Mf exts at State 2         [Nm]         10,7         10,7         26,2         52,3         91,6         10,7         10,7         10,7         10,6         <  | Marks   Fig.   Fig.   Marks   Miles   
   | Characteristic resistance                                       | VRK,s               | [ <u>K</u> ] | 6,7           | 6,7                 | 0'6           | 11,3             | 26,6            | 26,6            |
| M <sup>0</sup> <sub>Rk,s</sub> [Nm]         10,7         10,7         26,2         52,3         91,6           k <sub>2</sub> [-]         1,56         1,56         91,6         91,6           A C         A C         1,0         1,0         1,0         1,0           A C         k <sub>3</sub> [-]         1,3         2,0         2,0         2,0           k <sub>3</sub> [-]         1,3         1,3         2,0         2,0         2,0           r <sub>Me</sub> [-]         1,5 <sup>3</sup> 2,0         1,5 <sup>3</sup> 2,0           C         60         80         100         100           q <sub>nom</sub> [mm]         12         12         14         18         22           c, 1,2         1,5 <sup>3</sup> 1,5 <sup>3</sup> 22         22  
  | M <sup>0</sup> <sub>Rk,s</sub> [Nm]         10,7         10,7         26,2         52,3         91,6           γ <sub>Ms</sub> <sup>2</sup> [-]         1,56         91,6         91,6           A C         A C         1,0         1,0         1,0           K <sub>3</sub> [-]         1,3         2,0         2,0         2,0           γ <sub>Mc</sub> <sup>2</sup> [-]         1,3         2,0         2,0         2,0           Og Ir [mm]         40         50         60         80         100           C and Imm         12         12         14         18         22           γ <sub>Mc</sub> <sup>2</sup> [-]         1,5 <sup>3</sup> 1,5 <sup>3</sup> 1,5 <sup>3</sup>   
  | M <sup>0</sup> <sub>Rk,s</sub> [Nm]         10,7         10,7         26,2         52,3         91,6           γ <sub>Ms</sub> <sup>2</sup> [-]         1,56         91,6         91,6           A C         A C         1,0         1,0         1,0           A C         A C         1,3         2,0         2,0         2,0           K <sub>3</sub> [-]         1,3         2,0         2,0         2,0           γ <sub>Mc</sub> <sup>2</sup> [-]         1,5 <sup>3</sup> 1,5 <sup>3</sup> C         60         80         100         100           C         40         50         60         80         100           γ <sub>Mc</sub> <sup>2</sup> [-]         1,5 <sup>3</sup> 1,5 <sup>3</sup> 22           readed rods must correspond to Annex 3.         1,5 <sup>3</sup> 1,5 <sup>3</sup> 1,5 <sup>3</sup>  
   | M <sup>0</sup> <sub>Rk,s</sub> [Nm]         10,7         10,7         26,2         52,3         91,6           γ <sub>Ms</sub> <sup>2</sup> / <sub>2</sub> [-]         1,56         1,56         91,6   | M <sup>R<sub>RLS</sub></sup> [Nm]         10,7         10,7         26,2         52,3         91,6           Nashs         [-]         1,56         1,56         1,0         1,0           AC         AC         1,0         2,0         2,0         2,0         2,0           k <sub>3</sub> [-]         1,3         2,0         2,0         2,0         2,0           Nwc         C         1,5%         1,5%         1         2           cg l <sub>r</sub> [mm]         40         50         60         80         100         100           q <sub>nom</sub> [mm]         12         12         14         18         22         2           Y <sub>Mc</sub> <sup>2</sup> [-]         1         1         1         1         2         1           q <sub>nom</sub> [mm]         40         50         60         80         100         1           Y <sub>Mc</sub> <sup>2</sup> [-]         12         14         18         22         1           Y <sub>Mc</sub> <sup>2</sup> [-]         1         1         5%         1         1         5%   
   | M <sup>RNS</sup> [Nm]         (Nm]         10,7         10,7         26,2         52,3         91,6           Nss <sup>2</sup> / <sub>2</sub> [-]         1,3         2,0         2,0         2,0         2,0           A C         R <sub>3</sub> [-]         1,3         2,0         2,0         2,0         2,0           R <sub>3</sub> [-]         1,3         2,0         2,0         2,0         2,0           N <sub>Mc</sub> <sup>2</sup> [-]         40         50         60         80         100           of Indian         Imml         40         50         60         80         100           q Indian         Imml         12         12         14         18         22           y <sub>Mc</sub> <sup>2</sup> [-]         1,5 <sup>3</sup> 1,5 <sup>3</sup> 1,5 <sup>3</sup> 1,5 <sup>3</sup> Fragment of smust correspond to Annex 3.  | Moreous         [Nm]         10,7         10,7         26,2         52,3         91,6           Nuss         [-]         1,56         91,6         91,6         91,6         91,6         91,6         91,6         91,6         91,6         91,6        
91,6            | Partial safety factor   | γMs 2)              | Ξ            |               |                     | -             | 1,5              |                 |                 |
| $M_{Rks}$ $[Nmj]$ $10,7$ $10,7$ $26,2$ $52,3$ $91,6$ $\gamma_{Ms}^{2}$ $[-]$ $1,56$ $1,56$ AC $A$ C $A$ C $k_3$ $[-]$ $1,3$ $1,3$ $2,0$ $2,0$ $2,0$ $\gamma_{Me}$ $[-]$ $1,3$ $1,3$ $2,0$ $2,0$ $2,0$ $M_{\odot}$ $[-]$ $[-]$ $[-]$ $[-]$ $[-]$ $[-]$ $M_{\odot}$ $[-]$  
  | M <sup>R,k.s</sup> [Nm]         [Nm]         10,7         10,7         26,2         52,3         91,6                     k <sub>2</sub> [-]         1,56         1,56   <td>M<sup>R,k.s</sup> [Nm]         [Nm]         10,7         10,7         26,2         52,3         91,6           K<sub>2</sub>         [-]         1,56         1,56         2,0         1,56           A C         A C         A C         2,0</td> <td>M<sup>0</sup><sub>Rk,S</sub>         [Nm]         10,7         10,7         26,2         52,3         91,6         10,6           γ<sub>MS</sub><sup>2</sup>         [-]         1,56         1,56         1,56         1,0         1,56           A C         A C         1,3         1,3         2,0</td> <td>  M<sup>0</sup><sub>Rx,S</sub>   [Nm]   10,7   10,7   26,2   52,3   91,6                                      </td> <td>M<sup>R<sub>RLS</sub></sup>         [Nm]         10,7         10,7         26,2         52,3         91,6           Nows<sup>2</sup>         [-]         1,56         1,00         1,00           Ks         [-]         1,3         2,0         2,0         2,0           Nows<sup>2</sup>         [-]         1,3         2,0         2,0         2,0           Nows<sup>2</sup>         [-]         1,3         2,0         80         100           Og Ir         Imml         40         50         60         80         100           Og Ir         Imml         12         12         14         18         22           YMe<sup>2</sup>         [-]         1,5<sup>3</sup>         1         1,5<sup>3</sup>   readed rods must correspond to Annex 3.</td> <td>M<sup>R<sub>RLS</sub></sup>         [Nm]         10,7         10,7         26,2         52,3         91,6           Nsss         [-]         1,56         1,56         1,56         1,56           A C         A C         1,50         2,0         2,0         2,0         2,0           Ks         [-]         1,3         2,0         2,0         2,0         2,0           inch         Imml         40         50         60         80         100           ight         Imml         12         12         14         18         22           ywe.<sup>2</sup>         [-]         1,5<sup>3</sup>         1,5<sup>3</sup>         1,5<sup>3</sup>   readed rods must correspond to Annex 3.</td> <td>Steel failure with lever arm FZA C<sup>1)</sup></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>   
  | M <sup>R,k.s</sup> [Nm]         [Nm]         10,7         10,7         26,2         52,3         91,6           K <sub>2</sub> [-]         1,56         1,56         2,0         1,56           A C         A C         A C         2,0  
   | M <sup>0</sup> <sub>Rk,S</sub> [Nm]         10,7         10,7         26,2         52,3         91,6         10,6           γ <sub>MS</sub> <sup>2</sup> [-]         1,56         1,56         1,56         1,0         1,56           A C         A C         1,3         1,3         2,0   | M <sup>0</sup> <sub>Rx,S</sub>   [Nm]   10,7   10,7   26,2   52,3   91,6   
   | M <sup>R<sub>RLS</sub></sup> [Nm]         10,7         10,7         26,2         52,3         91,6           Nows <sup>2</sup> [-]         1,56         1,00         1,00           Ks         [-]         1,3         2,0         2,0         2,0           Nows <sup>2</sup> [-]         1,3         2,0         2,0         2,0           Nows <sup>2</sup> [-]         1,3         2,0         80         100           Og Ir         Imml         40         50         60         80         100           Og Ir         Imml         12         12         14         18         22           YMe <sup>2</sup> [-]         1,5 <sup>3</sup> 1         1,5 <sup>3</sup> readed rods must correspond to Annex 3.   | M <sup>R<sub>RLS</sub></sup> [Nm]         10,7         10,7         26,2         52,3         91,6           Nsss         [-]         1,56         1,56         1,56         1,56           A C         A C         1,50         2,0         2,0         2,0  
      2,0           Ks         [-]         1,3         2,0         2,0         2,0         2,0           inch         Imml         40         50         60         80         100           ight         Imml         12         12         14         18         22           ywe. <sup>2</sup> [-]         1,5 <sup>3</sup> 1,5 <sup>3</sup> 1,5 <sup>3</sup> readed rods must correspond to Annex 3.   | Steel failure with lever arm FZA C <sup>1)</sup>                |                     |              |               |                     |               |                  |                 |                 |
| k <sub>2</sub> [-]         1,56           A C         1,0         1,0           A C         1,3         2,0         2,0         2,0           γ <sub>Mc</sub> <sup>2</sup> [-]         1,3         2,0         2,0         2,0           γ <sub>Mc</sub> <sup>2</sup> [-]         1,5 <sup>3</sup> 1,5 <sup>3</sup> 1,5 <sup>3</sup> C         C         60         80         100           Igh         Imm         40         50         60         80         100           Imm         In         12         14         18         22           Annex         In         15         15         15  
  | γ <sub>Ms</sub> <sup>2</sup> [-]         1,56           k <sub>2</sub> [-]         1,3         2,0         2,0         2,0           AC         γ <sub>Mc</sub> <sup>2</sup> [-]         1,3         2,0         2,0         2,0           γ <sub>Mc</sub> <sup>2</sup> [-]         1,3         2,0         2,0         2,0         2,0           Q         γ <sub>Mc</sub> <sup>2</sup> [-]         1,5 <sup>3</sup> 2,0         2,0         2,0           ig l <sub>f</sub> [mm]         40         50         60         80         100         7           q <sub>nom</sub> [mm]         12         12         14         18         22         22           γ <sub>Mc</sub> <sup>2</sup> [-]         1,5 <sup>3</sup> 1,5 <sup>3</sup> 1,5 <sup>3</sup> 22         22   
  | γ <sub>Ms</sub> <sup>2</sup> / <sub>1</sub> [-]         1,56         1.56           A C         A C         1,0         1,0           κ3         [-]         1,3         2,0         2,0         2,0           γ <sub>Mc</sub> <sup>2</sup> / <sub>3</sub> [-]         1,5 <sup>3</sup> / <sub>3</sub> 2,0         2,0         2,0           G         G         60         80         100         100           ig l <sub>f</sub> [mm]         40         50         60         80         100         22           γ <sub>Mc</sub> <sup>2</sup> / <sub>2</sub> [-]         12         14         18         22         22           readed rods must correspond to Annex 3.         readed rods must correspond to Annex 3.  
   | k <sub>2</sub> /k <sub>2</sub> [-]         1,56           AC         1,0         1,0           κ <sub>2</sub> [-]         1,3         2,0         2,0         2,0           γ <sub>Mc</sub> <sup>2</sup> [-]         1,5 <sup>3</sup> 2,0         2,0         2,0         2,0           σ         r  | 1,56   
   | 1,56  | 1,56  
   | Characteristic bending resistance                               | M <sup>0</sup> Rk,s | [Nm]         | 10,7          | 10,7                | 26,2          | 52,3             | 91,6            | 91,6            |
| k2         [-]         1,0           AC         2,0         2,0         2,0         2,0           γ <sub>Mc</sub> <sup>2</sup> [-]         1,3         2,0         2,0         2,0         2,0           C         C         C         C         C         C         C         C           og l <sub>f</sub> [mm]         40         50         60         80         100 </td <td>AC         1,0           k<sub>3</sub>         [-]         1,3         2,0</td> <td>AC         1,0         1,0           k<sub>3</sub>         [-]         1,3         2,0         2,0         2,0           y<sub>Mc</sub><sup>2</sup>         [-]         40         50         60         80         100           Igh         [mm]         40         50         60         80         100         100           y<sub>Mc</sub><sup>2</sup>         [-]         12         12         14         18         22         10           readed rods must correspond to Annex 3.         readed rods must correspond to Annex 3.</td> <td>AC         1,0         1,0           k3         [-]         1,3         2,0</td> <td>κ2         [-]         1,3         2,0<td>AC         1,0           k3         1,3         2,0         2,0         2,0           γ<sub>Me</sub><sup>2</sup>         [-]         1,3         2,0         2,0         2,0           change         [mm]         40         50         60         80         100           q ls         [mm]         12         12         14         18         22           γ<sub>Me</sub><sup>2</sup>         [-]         1,5°         1         1,5°         1           readed rods must correspond to Annex 3.         1,5°         1,5°         1</td><td>k2         [-]         1,0           A C           k3         [-]         1,3         2,0         2,0         2,0           γMc<sup>2</sup>         [-]         1,3         2,0         2,0         2,0         2,0           γMc<sup>2</sup>         [-]         40         50         60         80         100         100           qoon         [mm]         40         50         60         80         100         100           γMc<sup>2</sup>         [-]         12         12         14         18         22         22           γMc<sup>2</sup>         [-]         1,5<sup>3</sup>         1         1,5<sup>3</sup>         1   readed rods must correspond to Annex 3.</td><td>Partial safety factor</td><td>γ<sub>Ms</sub> 2)</td><td>Θ</td><td></td><td></td><td>1</td><td>,56</td><td></td><td></td></td>  
  | AC         1,0           k <sub>3</sub> [-]         1,3         2,0  
  | AC         1,0         1,0           k <sub>3</sub> [-]         1,3         2,0         2,0         2,0           y <sub>Mc</sub> <sup>2</sup> [-]         40         50         60         80         100           Igh         [mm]         40         50         60         80         100         100           y <sub>Mc</sub> <sup>2</sup> [-]         12         12         14         18         22         10           readed rods must correspond to Annex 3.         readed rods must correspond to Annex 3.   
   | AC         1,0         1,0           k3         [-]         1,3         2,0  | κ2         [-]         1,3         2,0 <td>AC         1,0           k3         1,3         2,0         2,0         2,0           γ<sub>Me</sub><sup>2</sup>         [-]         1,3         2,0         2,0         2,0           change         [mm]         40         50         60         80         100           q ls         [mm]         12         12         14         18         22           γ<sub>Me</sub><sup>2</sup>         [-]         1,5°         1         1,5°         1           readed rods must correspond to Annex 3.         1,5°         1,5°         1</td> <td>k2         [-]         1,0           A C           k3         [-]         1,3         2,0         2,0         2,0           γMc<sup>2</sup>         [-]         1,3         2,0         2,0         2,0         2,0           γMc<sup>2</sup>         [-]         40         50         60         80         100         100           qoon         [mm]         40         50         60         80         100         100           γMc<sup>2</sup>         [-]         12         12         14         18         22         22           γMc<sup>2</sup>         [-]         1,5<sup>3</sup>         1         1,5<sup>3</sup>         1   readed rods must correspond to Annex 3.</td> <td>Partial safety factor</td> <td>γ<sub>Ms</sub> 2)</td> <td>Θ</td> <td></td> <td></td> <td>1</td> <td>,56</td> <td></td> <td></td>   
   | AC         1,0           k3         1,3         2,0         2,0         2,0           γ <sub>Me</sub> <sup>2</sup> [-]         1,3         2,0         2,0         2,0           change         [mm]         40         50         60         80         100           q ls         [mm]         12         12         14         18         22           γ <sub>Me</sub> <sup>2</sup> [-]         1,5°         1         1,5°         1           readed rods must correspond to Annex 3.         1,5°         1,5°         1  | k2         [-]         1,0           A C           k3         [-]         1,3         2,0         2,0         2,0           γMc <sup>2</sup> [-]         1,3         2,0         2,0         2,0         2,0           γMc <sup>2</sup> [-]         40        
50         60         80         100         100           qoon         [mm]         40         50         60         80         100         100           γMc <sup>2</sup> [-]         12         12         14         18         22         22           γMc <sup>2</sup> [-]         1,5 <sup>3</sup> 1         1,5 <sup>3</sup> 1   readed rods must correspond to Annex 3.   | Partial safety factor   | γ <sub>Ms</sub> 2)  | Θ            |               |                     | 1             | ,56              |                 |                 |
| K3         [-]         1,3         2,0   
  | κ <sub>3</sub> [-]         1,3         2,0 </td <td>κ<sub>3</sub>         [-]         1,3         2,0<!--</td--><td>K<sub>3</sub>         [-]         1,3         2,0<td>K<sub>3</sub>         [-]         1,3         2,0<td>K<sub>3</sub>         [-]         1,3         2,0<td>K<sub>3</sub>         [-]         1,3         2,0<td>Ductility factor</td><td><b>k</b>2</td><td>Ξ</td><td></td><td></td><td>7</td><td>0,1</td><td></td><td></td></td></td></td></td></td>   
  | κ <sub>3</sub> [-]         1,3         2,0 </td <td>K<sub>3</sub>         [-]         1,3         2,0<td>K<sub>3</sub>         [-]         1,3         2,0<td>K<sub>3</sub>         [-]         1,3         2,0<td>K<sub>3</sub>         [-]         1,3         2,0<td>Ductility factor</td><td><b>k</b>2</td><td>Ξ</td><td></td><td></td><td>7</td><td>0,1</td><td></td><td></td></td></td></td></td>  
   | K <sub>3</sub> [-]         1,3         2,0 <td>K<sub>3</sub>         [-]         1,3         2,0<td>K<sub>3</sub>         [-]         1,3         2,0<td>K<sub>3</sub>         [-]         1,3         2,0<td>Ductility factor</td><td><b>k</b>2</td><td>Ξ</td><td></td><td></td><td>7</td><td>0,1</td><td></td><td></td></td></td></td> | K <sub>3</sub> [-]         1,3         2,0 <td>K<sub>3</sub>         [-]         1,3         2,0<td>K<sub>3</sub>         [-]         1,3         2,0      
  2,0         2,0         2,0         2,0         2,0         2,0         2,0         2,0         2,0         2,0         2,0         2,0         2,0         2,0         2,0         2,0         2,0<td>Ductility factor</td><td><b>k</b>2</td><td>Ξ</td><td></td><td></td><td>7</td><td>0,1</td><td></td><td></td></td></td>   | K <sub>3</sub> [-]         1,3         2,0 <td>K<sub>3</sub>         [-]         1,3         2,0<td>Ductility factor</td><td><b>k</b>2</td><td>Ξ</td><td></td><td></td><td>7</td><td>0,1</td><td></td><td></td></td>  | K <sub>3</sub> [-]         1,3         2,0         2,0         2,0         2,0         2,0         2,0         2,0         2,0         2,0         2,0         2,0         2,0         2,0         2,0         2,0         2,0         2,0         2,0        
2,0         2,0 <td>Ductility factor</td> <td><b>k</b>2</td> <td>Ξ</td> <td></td> <td></td> <td>7</td> <td>0,1</td> <td></td> <td></td>  | Ductility factor  | <b>k</b> 2          | Ξ            |               |                     | 7             | 0,1              |                 |                 |
| k <sub>3</sub> [-]         1,3         2,0 <td>k<sub>3</sub>         [-]         1,3         2,0<td>k<sub>3</sub>         [-]         1,3         2,0<td>K<sub>3</sub>         [-]         1,3         2,0         3,0         2,0         3,0         1,00         1,00         1,00         1,00         1,00</td><td>K<sub>3</sub>         [-]         1,3         2,0<td>k<sub>3</sub>         [-]         1,3         1,3         2,0         3,0<td>  F<sub>3</sub>   F<sub>1</sub>   F<sub>2</sub>   F<sub>3</sub>   F<sub>2</sub>   F<sub>3</sub>   F<sub>3</sub>  </td><td>A4,</td><td>ZAC</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td></td></td></td> | k <sub>3</sub> [-]         1,3         2,0 <td>k<sub>3</sub>         [-]         1,3         2,0<td>K<sub>3</sub>         [-]         1,3         2,0         3,0         2,0         3,0         1,00         1,00         1,00         1,00         1,00</td><td>K<sub>3</sub>         [-]         1,3         2,0<td>k<sub>3</sub>         [-]         1,3         1,3         2,0         3,0<td>  F<sub>3</sub>   F<sub>1</sub>   F<sub>2</sub>   F<sub>3</sub>   F<sub>2</sub>   F<sub>3</sub>   F<sub>3</sub>  </td><td>A4,</td><td>ZAC</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td></td></td> | k <sub>3</sub> [-]         1,3         2,0 <td>K<sub>3</sub>         [-]         1,3         2,0         3,0         2,0         3,0         1,00         1,00         1,00         1,00         1,00</td> <td>K<sub>3</sub>         [-]         1,3         2,0<td>k<sub>3</sub>         [-]         1,3         1,3         2,0         3,0<td>  F<sub>3</sub>   F<sub>1</sub>   F<sub>2</sub>   F<sub>3</sub>   F<sub>2</sub>   F<sub>3</sub>   F<sub>3</sub>  </td><td>A4,</td><td>ZAC</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td></td> | K <sub>3</sub> [-]         1,3         2,0         3,0         2,0         3,0         1,00         1,00         1,00         1,00         1,00  | K <sub>3</sub> [-]         1,3         2,0 <td>k<sub>3</sub>         [-]         1,3         1,3         2,0         3,0<td>  F<sub>3</sub>   F<sub>1</sub>   F<sub>2</sub>   F<sub>3</sub>   F<sub>2</sub>   F<sub>3</sub>   F<sub>3</sub>  </td><td>A4,</td><td>ZAC</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td> | k <sub>3</sub> [-]         1,3         1,3         2,0         3,0 <td>  F<sub>3</sub>   F<sub>1</sub>   F<sub>2</sub>   F<sub>3</sub>   F<sub>2</sub>   F<sub>3</sub>   F<sub>3</sub>  </td> <td>A4,</td> <td>ZAC</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> | F <sub>3</sub>   F <sub>1</sub>   F <sub>2</sub>   F <sub>3</sub>   F <sub>2</sub>   F <sub>3</sub>   F <sub>3</sub> | A4,   | ZAC                 |              |               |                     |               |                  |                 |                 |
| Tync 2) [-] 1,53) C 2  Ig I <sub>f</sub> [mm] 40 50 60 80 100 100 100 100 100 100 100 100 100  
  | γ <sub>Mc</sub> <sup>2</sup> [-]         1,5 <sup>3</sup> C         C         100           Ig Ir         [mm]         40         50         60         80         100           γ <sub>Mc</sub> [mm]         12         12         14         18         22           γ <sub>Mc</sub> [-]         1,5 <sup>3</sup> 1,5 <sup>3</sup> 1,5 <sup>3</sup>  
  | γMc         (-)         1,5 <sup>3</sup> tC         C         100           Ig Ir         [mm]         40         50         60         80         100           γMc         γMc         (-)         12         14         18         22           readed rods must correspond to Annex 3.   
   | YMc <sup>2</sup> [-]         1,5 <sup>3</sup> C         G         80         100           Ig Ir         [mm]         40         50         60         80         100           YMc <sup>2</sup> [-]         12         14         18         22           YMc <sup>2</sup> [-]         1,5 <sup>3</sup> 1,5 <sup>3</sup> readed rods must correspond to Annex 3.  | γMc         (-j)         1,5 <sup>3</sup> C         C         100           Ight         40         50         60         80         100           d <sub>nom</sub> [mm]         12         12         14         18         22           γ <sub>Mc</sub> <sup>2)</sup> (-j)         1         1         30         100         100           readed rods must correspond to Annex 3.  
   | γ <sub>Mc</sub> c <sup>2</sup> (-]         1,5 <sup>3</sup> C         N         100         100           1g l <sub>f</sub> [mm] [mm]   12   12   14   18   22         18   22         22   15   15   15   15   15   15   15  | 'Moc <sup>2</sup> [-]     1,5³       10     10     100       10     10     10       10     10     10       10     10     10       10     10     10       10     10     10       10     10     10       10     10     10       10     10     10       10     10
    10       10     10     10       10 </td <td>Factor in equation (16) of the CEN/TS 1992-4-4, Section 6.2.2.3</td> <td>જૂ</td> <td>Ξ</td> <td>1,3</td> <td>6,1</td> <td></td> <td></td> <td>2,0</td> <td>2,0</td>  | Factor in equation (16) of the CEN/TS 1992-4-4, Section 6.2.2.3 | જૂ                  | Ξ            | 1,3           | 6,1                 |               |                  | 2,0             | 2,0             |
| C         G         F         [mm]         40         50         60         80         100           dhom [mm]         12         12         14         18         22  
  | Og l <sub>f</sub> [mm]         40         50         60         80         100           η <sub>mon</sub> [mm]         12         12         14         18         22           γ <sub>Mc</sub> <sup>2</sup> [-]         1,5 <sup>3</sup> 1,5 <sup>3</sup>   
  | Og l <sub>f</sub> [mm]         40         50         60         80         100           η <sub>nom</sub> [mm]         12         12         14         18         22           γ <sub>Me</sub> <sup>2</sup> [-]         1,5 <sup>3</sup> 1,5 <sup>3</sup>   
   | Og     If     [mm]     40     50     60     80     100       dhom     [mm]     12     12     14     18     22       \gamma_{ho}^{2}     [-]     1,5³     1,5³   readed rods must correspond to Annex 3.  | Ig Ir     [mm]     40     50     60     80     100       dnom     [mm]     12     12     14     18     22       \text{yme}^2     [-]     1,5³)     1,5³)   readed rods must correspond to Annex 3.   
   | Og     If     [mm]     40     50     60     80     100       dnom     [mm]     12     12     14     18     22       \gamma_{mon}^{2} [-]     -1     1,5³     1,5³   readed rods must correspond to Annex 3.   | Og     If     [mm]     40     50     60     80     100       A dhom     [mm]     12     12     14     18     22       YMc     [-]     1,53   readed rods must correspond to Annex 3.  
   | Partial safety factor   | χω <sub>2</sub> )   | 三            |               |                     | 1             | ,5 <sub>3)</sub> |                 |                 |
| If         [mm]         40         50         60         80         100           dnom         [mm]         12         12         14         18         22   
  | ding Ir         [mm]         40         50         60         80         100           dnom         [mm]         12         12         14         18         22           YMc <sup>2</sup> / <sub>2</sub> [-]         1,5 <sup>3</sup> 1,5 <sup>3</sup>  
  | ding lf         [mm]         40         50         60         80         100           dnom         [mm]         12         14         18         22           YMc <sup>2</sup> [-]         1,5 <sup>3</sup> threaded rods must correspond to Annex 3.   
   | ding Ir         [mm]         40         50         60         80         100           dnom         [mm]         12         12         14         18         22           Threaded rods must correspond to Annex 3.  | ding Ir         [mm]         40         50         60         80         100           dhom         [mm]         12         12         14         18         22           Y <sub>Mc</sub> <sup>2</sup> [-]         1,5°         1,5°   threaded rods must correspond to Annex 3.   
   | ding Ir         [mm]         40         50         60         80         100           dnom         [mm]         12         12         14         18         22           Threaded rods must correspond to Annex 3.   1.  | ding Ir         [mm]         40         50         60         80         100           dhom         [mm]         12         12         14         18         22           Threaded rods must correspond to Annex 3.   
   | Concrete edge failure FZA, FZA A4, FZA                          | O                   |              |               |                     |               |                  |                 |                 |
| d <sub>nom</sub> [mm] 12   14   18   22  
  | dnom [mm] 12   12   14   18   22   $\gamma_{Me}^{2}  [-1] \qquad \qquad 1,5^{3}$ threaded rods must correspond to Annex 3.   
  | dnom [mm] 12   12   14   18   22   $\gamma_{Mc}^{2}$ [-] $1,5^{3}$ threaded rods must correspond to Annex 3.   
   | dnom [mm] 12 12 14 18 22 1   | dnom [mm] 12 12 14 18 22 1   
   | dnom [mm] 12 12 14 18 22 1  | dnom [mm] 12   12   14   18   22   10   10   11   11   11   12   11   11  
   | Effective length of anchor in shear load                        | Jing k              | [mm]         | 40            | 50                  | 09            | 80               | 100             | 125             |
|  
  | γ <sub>Mc</sub> <sup>2)</sup> [-] 1 1<br>threaded rods must correspond to Annex 3.   
  | γ <sub>Mc</sub> <sup>2)</sup> [-] 1<br>threaded rods must correspond to Annex 3.   
   | threaded rods must correspond to Annex 3.  | threaded rods must correspond to Annex 3.  
   | threaded rods must correspond to Annex 3.   | threaded rods must correspond to Annex 3.   
   | Effective diameter of anchor                                    | d <sub>nom</sub>    | [mm]         | 12            | 12                  |               |                  | 22              | 22              |
| / Mic L J  
  | <sup>1)</sup> Related fastening screws respectively threaded rods must correspond to Annex 3.  
  | <sup>1)</sup> Related fastening screws respectively threaded rods must correspond to Annex 3. <sup>2)</sup> In absent of other national regulations.   
   | Related fastening screws respectively threaded rods must correspond to Annex 3. $^{2)}$ In absent of other national regulations. $^{3)}$ The partial safety factor $\gamma_{\text{inst}}$ is included.   | Related fastening screws respectively threaded rods must correspond to Annex 3. $^{2}$ In absent of other national regulations. $^{3}$ The partial safety factor $\gamma_{\rm nst}$ is included.   
   | Related fastening screws respectively threaded rods must correspond to Annex 3. $^{2)}$ In absent of other national regulations. $^{3)}$ The partial safety factor $\gamma_{\rm inst}$ is included.   | <sup>1)</sup> Related fastening screws respectively threaded rods must correspond to Annex 3. <sup>2)</sup> In absent of other national regulations. <sup>3)</sup> The partial safety factor γ <sub>inst</sub> is included.                                   
   | Partial safety factor   | 2)<br>YMc           | Ξ            |               |                     | 1             | ,5 <sub>3)</sub> |                 |                 |
| <sup>2</sup> The partial safety factor γ <sub>inst</sub> is included.  
  |  
  |  
   |  |  
   |   |   
   |   |                     |              |               |                     |               |                  |                 |                 |

Internal thread anchor

Design method A according to CEN/TS 1992-4: 2009

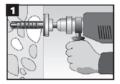
Characteristic values to shear loads



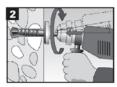
# Installation instructions bolt projecting anchor FZA, FZA-D and FZA-I:

## Pre-positioned anchorage





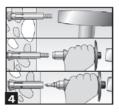
Create a drill hole at right angles to the surface of the anchor base with a hammer drill, using the corresponding Zykon universal drill bit FZUB. The required drill depth is reached once the FZUB depth stop meets the concrete.



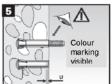
Once the FZUB depth stop meets the concrete, create the drill hole undercut by making circular swivelling movements with the hammer drill while the hammer mechanism is engaged. Press the hammer drill firmly against the anchor base; 1–2 swivelling movements is sufficient for Ø 14 mm, with 3–5 movements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



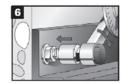
Clean drill hole; blow or brush out.



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



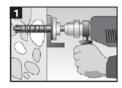
The anchor is correctly expanded if the green colour on the thread of the tapered bolt is visible or the gap u is fulfilled.



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**





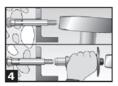
Create a drill hole through the installation object at right angles to the surface of the anchor base with a hammer drill, using the corresponding Zykon universal drill bit FZUB. The required drill depth is reached once the FZUB depth stop meets the concrete.



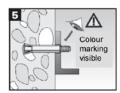
Once the FZUB depth stop meets the fixture, create the drill hole undercut by making circular swivelling movements with the hammer drill while the hammer mechanism is engaged. Press the hammer drill firmly against the anchor base; 1–2 swivelling movements is sufficient for  $\emptyset$  14 mm, with 3–5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



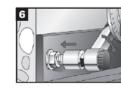
Clean drill hole; blow or brush out.



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

Installation instructions

Annex 20