Deutsches Institut für Bautechnik

DIBt

Public-law institution jointly founded by the federal states and the Federation

Technical authority granting approvals and permits for construction products and construction techniques

General construction technique permit

Date: 16 April 2025

Reference number: I 29-1.21.1-17/25

Number:
Z-21.1-2008

Validity
from: **15 April 2025**
to: **15 April 2030**

Applicant:
fischerwerke GmbH & Co. KG
Klaus-Fischer-Straße 1
72178 Waldachtal, Germany

Subject of decision:
fischer ZYKON undercut anchors FZA and FZA-I
for fastenings in nuclear power plants and other nuclear facilities

The subject named above is herewith granted a general construction technique permit (*allgemeine Bauartgenehmigung*).
This decision contains six pages and twelve annexes.
The subject concerned was granted the first national technical approval on 11 July 2024.

Translation authorised by DIBt

I GENERAL PROVISIONS

1 The general construction technique permit confirms the fitness for application of the subject concerned within the meaning of the Building Codes of the federal states (*Landesbauordnungen*).

2 This decision does not replace the permits, approvals and certificates required by law for carrying out construction projects.

3 This decision is granted without prejudice to the rights of third parties, in particular private property rights.

4 Notwithstanding further provisions in the 'Special Provisions', copies of this decision shall be made available to the installer of the subject concerned. Furthermore, the installer of the subject concerned shall be made aware of the fact that this decision must be made available at the place of application. Upon request, copies of the decision shall be provided to the authorities involved.

5 This decision shall be reproduced in full only. Partial publication requires the consent of DIBt. Texts and drawings in promotional material shall not contradict this decision. In the event of a discrepancy between the German original and this authorised translation, the German version shall prevail.

6 This decision may be revoked. The provisions contained herein may subsequently be supplemented and amended, in particular if this is required by new technical findings.

7 This decision is based on the information and documents provided by the applicant on the subject concerned during the permit procedure. Alterations to the information on which this general construction technique permit was based are not covered by this decision and shall be notified to DIBt without delay.

II SPECIAL PROVISIONS

1 Subject concerned and field of application

1.1 Subject concerned

This general construction technique permit covers the planning, design and execution of anchorages using the fischer ZYKON anchor FZA (hereinafter called 'fastener') in the sizes FZA 10 x 40 M6 and FZA 12 x 40 M8 and the fischer ZYKON anchor FZA-I in the size FZA 12 x 40 M6 I in accordance with the ETA-98/0004 of 16 June 2021 used in concrete for fastenings in nuclear power plants (NPP) and other nuclear facilities[1].

The fastener is anchored by impact acting on the expansion sleeve over the cone bolt in the undercut of the drill hole.

The installed fastener is shown in Annex 1.

1.2 Field of application

The fasteners may be used for anchorages subject to static and quasi-static loads for Requirement Categories A1, A2 and A3 as stated in the Guideline for fastenings with anchors in nuclear power plants and nuclear facilities[1] in reinforced and unreinforced normal weight concrete with a minimum strength class of C20/25 and a maximum strength class of C50/60 in accordance with DIN EN 206-1:2001-07 Concrete - Part 1: Specification, performance, production and conformity. They may also be used in concrete with a minimum strength class of B 25 and a maximum strength class of B 55 in accordance with DIN 1045:1988-07 Structural use of concrete - Design and construction.

The fastener may be used in cracked and uncracked concrete. Under accidental actions (Requirement Category A2 and A3), the fastener may be used up to a crack width of w_k = 1.0 mm.

The fasteners shall not be used for fastenings in critical structure areas where the concrete could spall or large cracks could occur under accidental actions, for example, in the area of plastic hinges (critical areas) of concrete structures.

Under use conditions, the temperature in the base material shall not exceed 80°C in the long-term.

The steel elements of the fastener made of galvanised steel shall only be used in concrete subject to dry internal conditions.

Steel elements made of stainless steel (1.4401, 1.4404, 1.4578, 1.4571, 1.4062, 1.4362) may be used in accordance with corrosion resistance class CRC III in accordance with DIN EN 1993-1-4:2015-10 in conjunction with DIN EN 1993-1-4/NA:2020-11. Steel elements made of stainless steel (1.4439) may be used in accordance with corrosion resistance class CRC IV in accordance with DIN EN 1993-1-4:2015-10 in conjunction with DIN EN 1993-1-4/NA:2020-11.

Steel elements made of high corrosion-resistant steel (1.4529, 1.4565) may be used in accordance with corrosion resistance class CRC V in accordance with DIN EN 1993-1-4:2015-10 in conjunction with DIN EN 1993-1-4/NA:2020-11.

[1] Deutsches Institut für Bautechnik: Guideline for fastenings with anchors in nuclear power plants and nuclear facilities (*Leitfaden für Dübelbefestigungen in Kernkraftwerken und anderen kerntechnischen Anlagen*), issued June 2010

2 Provisions for planning, design and execution

2.1 Planning

For the Requirement Categories A2 and A3 the Guideline for fastenings with anchors in nuclear power plants and nuclear facilities[1] shall be observed. The evaluation regarding the crack width of w_k = 1.0 mm shall consider the collective extreme cases so that a separate verification of the expected crack width in the anchoring area is not necessary when minimal reinforcement is present.

The anchorages shall be planned in line with good engineering practice. Verifiable calculation notes and design drawings shall be prepared taking into account the loads to be anchored. The position of the fastener shall be indicated on the design drawings.

Fastenings in areas of dense reinforcement (bar spacing of reinforcement ≤ 3 d_s), for example close to columns, corbels, undersides of joists, shall not be permitted due to the risk of concrete spalling.

2.2 Design

The anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete work in accordance with ETAG 001 'Guideline for European Technical Approval of Metal Anchors for Use in Concrete', Annex C (August 2010), design method A (for Requirement Category A1) and design method B (for Requirement Categories A2 and A3).

In deviation of or in addition to the design methods mentioned above, the provisions of Sections 4.2 to 4.9 of the Guideline[1] shall be observed for the Requirement Categories A2 and A3.

Partial safety factors and load combination factors of actions of the Requirement Categories A2 and A3 shall be taken from DIN 25499:2022-07.

The characteristic anchor values for the design of the anchorage in accordance with ETAG 001, Annex C, are given in Annexes 8 to 10 (Requirement Categories A1, A2 and A3).

It shall be ensured that the strength class of the concrete in which the fastener is to be placed is not lower than that of the concrete to which the characteristic loads apply. The concrete strength class shall not be lower than B 25 or C20/25 and shall not exceed B 55 or C50/60.

For the design of anchorages in normal weight concrete in accordance with DIN 1045:1988-07, the value for $f_{ck,cube}$ shall be replaced by 0.97 x β_{WN}.

The fixture shall be made of metal and be anchored against the concrete either without an intermediate layer or with a mortar levelling layer (thickness ≤ 3 mm, compressive strength ≥ 30 N/mm²).

The verification of the immediate local force transmission into the concrete member has been provided. The transfer of the loads to be anchored in the member shall be verified separately.

The fastening screw for the internal threaded anchor FZA-I shall be in accordance with the details of Annex 2, Table 1. The fastening screw shall be specified by the designer depending on the field of application (corrosion resistance class), the length of the screw taking into account the thickness of the fixture, the required minimum screw-in depth and the possible tolerances unless it is supplied by the manufacturer for the respective application.

2.2 Execution

2.2.1 General

The fastener shall only be used as a mass-produced fastening unit. Individual parts shall not be exchanged. It may only be installed by appropriately qualified personnel under the supervision of the site manager.

For installation, Section 5.3 of the Guideline[1] shall be considered.

Before the fastener is installed, the quality of the base material shall be checked. The concrete shall be well compacted, e.g. without significant voids.

The fastener shall be installed in accordance with the design drawings as stated in Section 2.1. It shall be installed as stated in the manufacturer's installation instruction (see Annex 11) by using the appropriate specified tools (see Annexes 4 and 5).

The required distances to edges, openings, steps in ceiling slabs or built-in components as well as the required spacing to other fastenings (e.g. anchor plates with headed fasteners) shall be observed.

2.2.2 Drilling of the holes

In order to reduce the risk of incorrect drill holes or damage of the reinforcement, the position of the reinforcement shall be located. The drill hole, including the undercut, shall be positioned taking into account the position of the reinforcement to ensure that the existing reinforcement remains undamaged.

The drill hole, including the undercut, shall be drilled perpendicular to the surface of the base material using a hammer drill equipped with the appropriate ZYKON drill bit FZUB as shown in Annex 4 in accordance with the installation instructions (Annex 11). The required drill hole depth shall be reached when the stop on the drill bit hits the concrete. Inclinations from 85° to 95° relative to the existing surface shall be considered perpendicular.

The drill diameter and the drill bit cutting diameter shall comply with Annex 4. The drill bit cutting diameter shall be checked (Annex 11). The drilling dust shall be removed from the drill hole.

Incorrect drill holes shall be completely closed with high strength mortar. An incorrect drill hole also exists if a fastener is removed which has not been installed in compliance with the specifications. If the incorrect drill hole has a depth greater than $h_{ef}/4$, the spacing to a new drill hole shall be at least twice the drill hole diameter. Pre-stressing or loading of the fastener after closing of the incorrect drill hole with high-strength mortar shall only be permitted if the strength of the mortar is at least equal to the concrete strength. If the strength development of the mortar is not known, the fastener shall be pre-stressed or loaded after 24 hours at the earliest.

2.2.3 Installation of the fastener

The surface of the concrete in the area of the steel fixture shall be such that the fixture rests fully against the concrete after the fastener has been installed. In order to achieve a full contact surface, a mortar levelling layer (thickness ≤ 3 mm, compressive strength ≥ 30 N/mm^2) may be applied. Torque moments shall only be applied after the mortar has cured.

After the fastener has been set in the drill hole, the expansion sleeve shall be driven in by means of the appropriate setting tool as described in Annex 5 using a hand hammer (weight as specified in Annex 11).

The fastener has been properly installed and shall only be loaded if all control conditions in accordance with Annex 11 are fulfilled.

The fixture shall be installed with a torque wrench that has been tested. The fastener shall not be loaded if the torque moment specified in Annex 6 or 7 cannot be applied.

When welding fixtures subsequently on site, restraints on the fasteners caused by heat input shall be avoided.

The fastener shall only be installed once.

After installation and during service life, the nut or screw may be removed and tightened again by applying the torque moment specified in Annex 6 or Annex 7.

2.2.4 Inspection of execution

The quality assurance measures in accordance with Section 5.4 of the Guideline[1] shall be considered.

During installation of the fasteners, the contractor commissioned to install the fasteners or the site manager assigned by the contractor or a competent representative of the site manager shall be present at the construction site. They shall ensure that the work is carried out properly.

During installation of the fasteners, records on the proper installation of the fasteners shall be maintained by the site manager or the site manager's representative. The setting and installation protocols shall contain at least the information provided in Annex 12.

The records shall be available at the construction site during the construction period and shall be submitted to the inspection supervisor upon request. Like the delivery notes, they shall be kept by the contractor for a minimum of 5 years after completion of the project.

When using the fasteners in nuclear power plants and nuclear facilities, consideration of additional requirements of the supervisory authorities can be required.

Dipl.-Ing. Beatrix Wittstock
Head of Section

Drawn up by
Baderschneider

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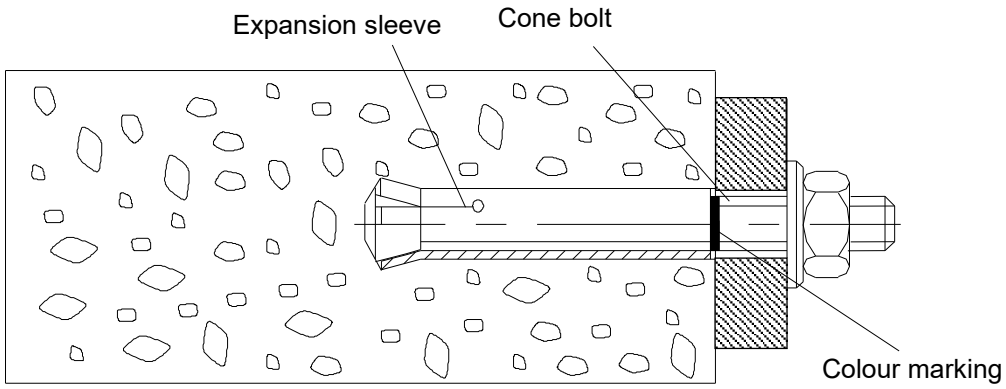
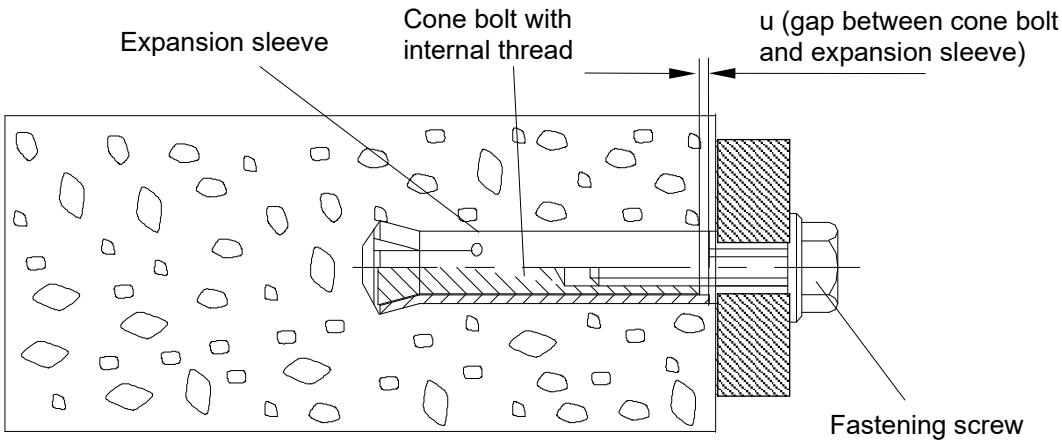
Installed anchor
- Anchorage in concrete -

Bolt anchor FZA:



Internal threaded anchor FZA-I:



(Figures not to scale)

fischer ZYKON undercut anchors FZA and FZA-I for fastenings in NPP	**Annex 1**
Installed condition	

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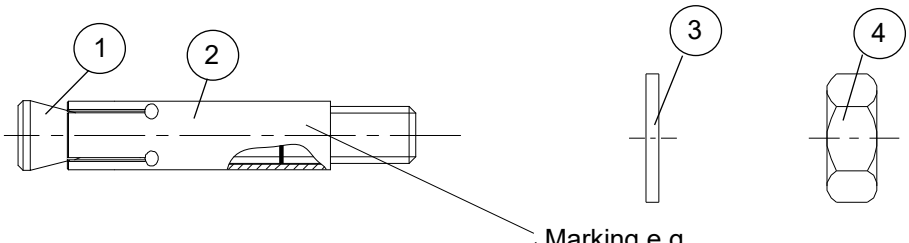
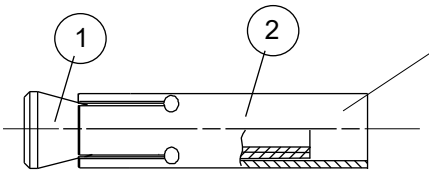
Anchor types

Bolt anchor FZA:

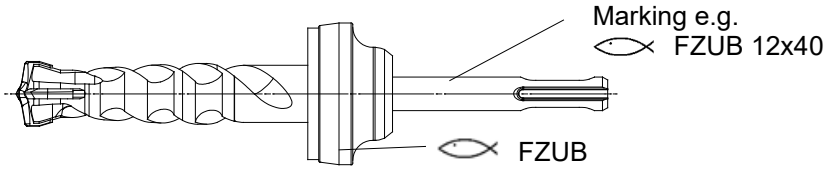


Related fastening screws or threaded rods shall comply with footnotes of Table 2.1

Internal threaded anchor FZA-I:



ZYKON drill bit FZUB:



Setting tool FZE Plus (with centering pin for internal threaded anchor)

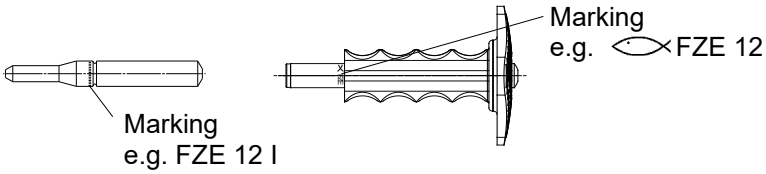


Table 2.1: Designation and Materials

Part	Designation	Material	
		Galvanised [1]	Stainless steel / high corrosion resistant steel
1	Cone bolt with external thread	Steel, $R_m \geq 800$ N/mm²; $R_e \geq 640$ N/mm², $A_5 \geq 8\%$	Steel, DIN EN 10088-1:2024-04 [2) 4)]
	Cone bolt with internal thread	Steel DIN EN ISO 683-7:2025-02 [2) 3)]	
2	Expansion sleeve seamless or rolled	Steel	
3	Washer	Steel DIN EN 10139:2020-06	
4	Hexagon nut	Steel, property class 8 DIN EN ISO 898-2:2023-02	

[1] ≥ 5 µm in accordance with DIN EN ISO 4042:2022-11
[2] Application with a threaded rod shall only be permitted when the torque moment specified in Annex 7, Table 7.1, is applied.
[3] Related fastening screws or threaded rods: Property class 6.8 or 8.8 in accordance with DIN EN ISO 898-1:2013-05; ductility A_5 > 8%; galvanised > 5µm in accordance with DIN EN ISO 4042:2022-11
[4] Related fastenings screws or threaded rods: Property class ≥ 70 in accordance with DIN EN ISO 3506-1:2020-08; ductility A5 > 8%; made of stainless steel 1.4401, 1.4404, 1.4578, 1.4571, 1.4439, 1.4062, 1.4362 or high corrosion resistant steel 1.4529 or 1.4565 in accordance with DIN EN 10088-1:2024-04

(Figures not to scale)

fischer ZYKON undercut anchors FZA and FZA-I for fastenings in NPP	**Annex 2**
Anchor types and materials	

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FZA:

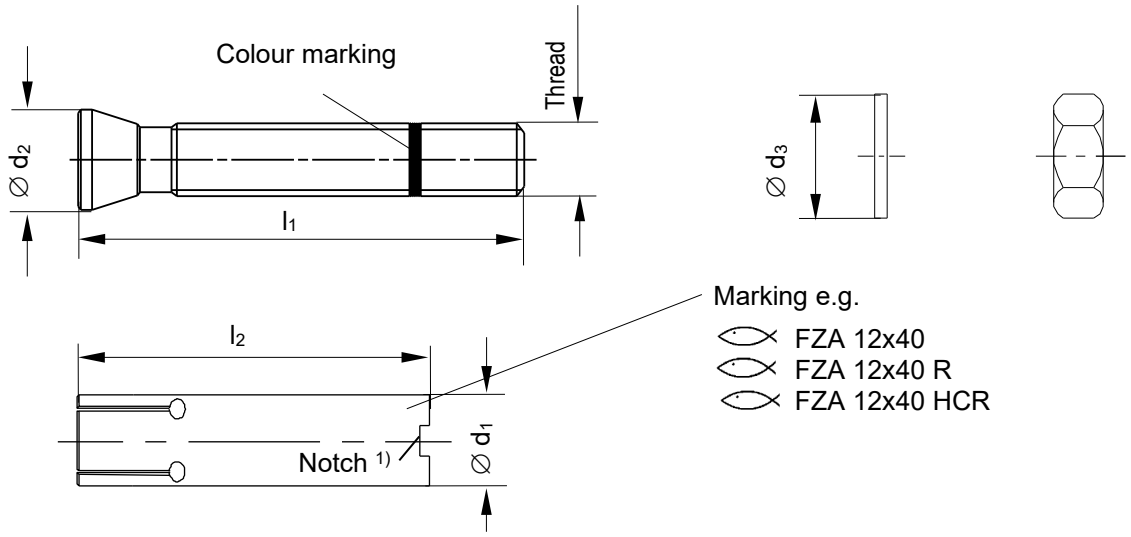

Table 3.1: Dimensions for bolt anchor FZA

Anchor types	Thread	$l_1 \geq$	l_1 max	l_2	∅ d_1	∅ d_2	∅ d_3
FZA 10 x 40 M6 1)	M6	50	100	40	10	10	≥ 11
FZA 12 x 40 M8 1)	M8	52	154	40	12	12	≥ 15

1) Expansion sleeve with notch (identifying feature for h_{ef} = 40mm)

Dimensions in [mm]

FZA-I:

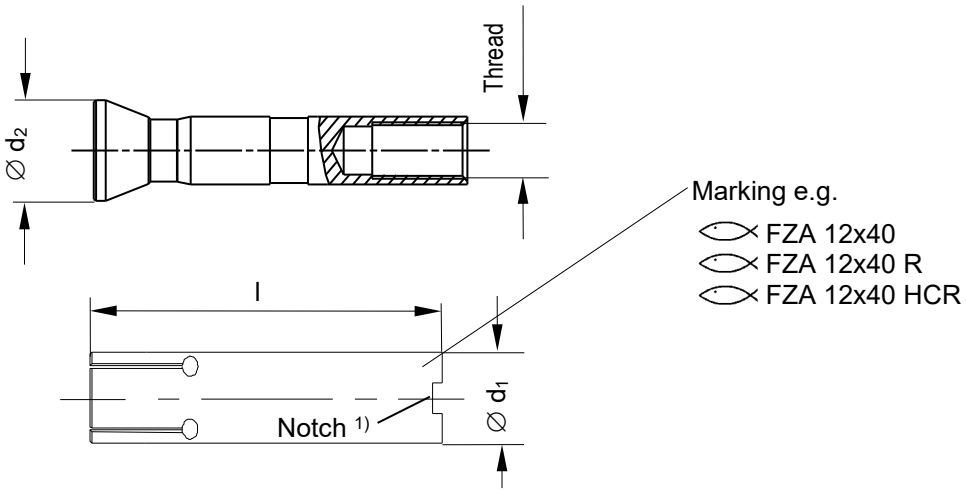

Table 3.2: Dimensions for internal threaded anchor FZA-I

Anchor types	Thread	∅ d_1	∅ d_2	l
FZA 12 x 40 M6 I 1)	M6	12	12	40

1) Expansion sleeve with notch (identifying feature for h_{ef} = 40mm)

(Figures not to scale)

fischer ZYKON undercut anchors FZA and FZA-I for fastenings in NPP	**Annex 3**
Dimensions and anchor types	

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FZUB:

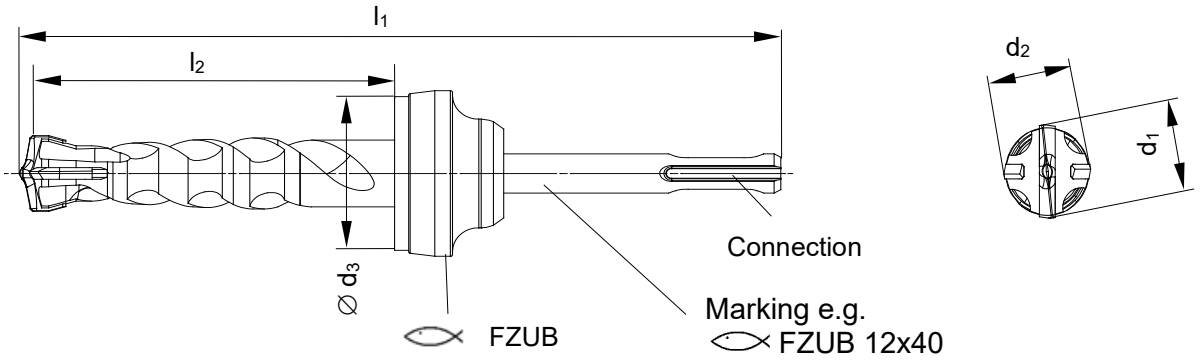

Table 4.1: Dimensions for ZYKON drill bit FZUB

Drill type	Connection	l_1	l_2	d_1 [1)]	d_2	∅ d_3
FZUB 10 x 40	SDS plus	126	≥ 40	≤ 10.80	$d_2 \le d_1$	≤ 39.5
FZUB 12 x 40		127	≥ 40	≤ 12.82		

[1)] $d_{cut,min}$ see Annex 11

Dimensions in [mm]

(Figures not to scale)

fischer ZYKON undercut anchors FZA and FZA-I for fastenings in NPP	**Annex 4**
Dimensions for ZYKON drill bit FZUB	

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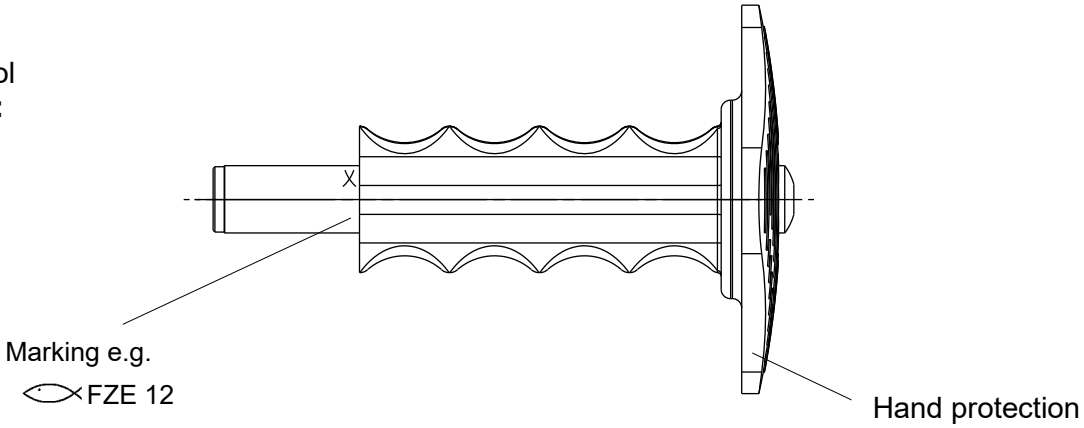
Setting tool
FZE Plus:



Centering pin for setting tool FZE Plus:

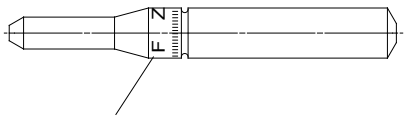


Table 5.1: Setting tools to be used

Anchor types	FZE Plus	Centering pin for FZE Plus
FZA 10 x 40 M6	FZE 10	-
FZA 12 x 40 M8	FZE 12	-
FZA 12 x 40 M6 I	FZE 12	FZE 12 I

(Figures not to scale)

fischer ZYKON undercut anchors FZA and FZA-I for fastenings in NPP	**Annex 5**
Setting tool FZE Plus	

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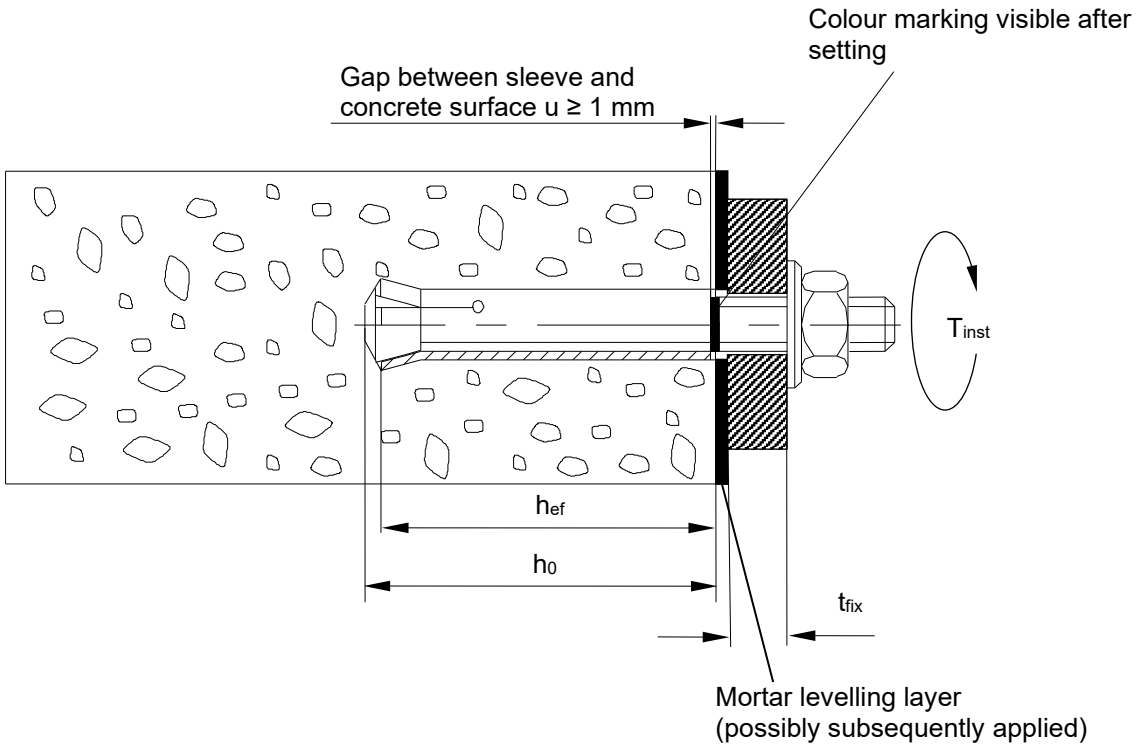
Table 6.1: Anchor and installation parameters for the bolt anchor

Anchor types	Drill hole depth h_0 [mm]	Drill bit to be used FZUB [-]	Clearance hole [2] [mm]	Mortar levelling layer [1] [mm]	Installation torque T_{inst} [Nm]	Thickness of fixture t_{fix} [mm]	Embedment depth h_{ef} [mm]
FZA 10 x 40 M6	≥ 43	10 x 40	≤ 7	≤ 3	8.5	≤ 50	≥ 40
FZA 12 x 40 M8	≥ 43	12 x 40	≤ 9	≤ 3	20	≤ 100	≥ 40

[1] The mortar levelling layer may be applied before or after setting the fastener / drilling the hole.
[2] Clearance hole in the fixture



Key:
T_{inst} = Installation torque
h_{ef} = Effective embedment depth
h_0 = Drill hole depth
t_{fix} = Thickness of fixture

(Figures not to scale)

fischer ZYKON undercut anchors FZA and FZA-I for fastenings in NPP

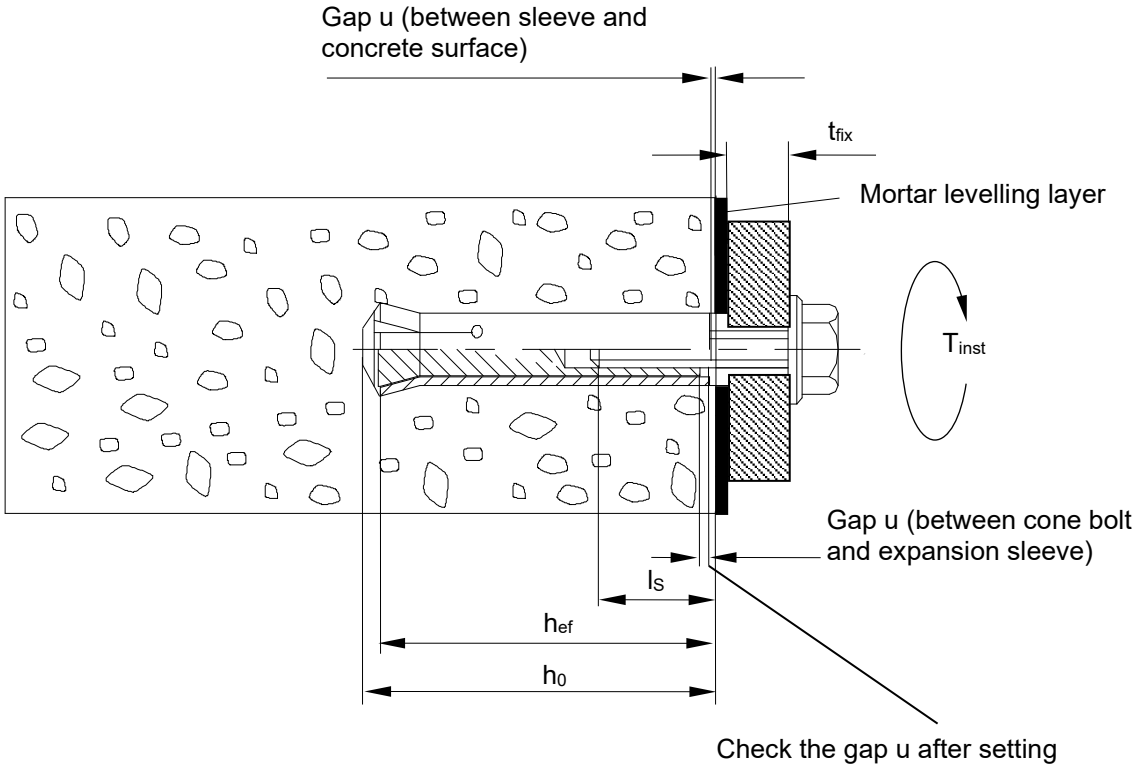
Installation parameters of bolt anchor FZA

Annex 6

Table 7.1: Anchor and installation parameters of the internal threaded anchor

Anchor types	Drill hole depth h_0 [mm]	Drill bit to be used FZUB [-]	Clearance hole [2] [mm]	Mortar levelling layer [1) 3)] [mm]	Installation torque T_{inst} [Nm]	Screw-in depth [3] l_s [mm] min	Screw-in depth [3] l_s [mm] max	Embedment depth h_{ef} [mm]	Gap u [mm]
FZA 12 x 40 M6 I	≥ 43	12 x 40	≤ 7	≤ 3	8.5	10	15	≥ 40	0 to 4

[1] The mortar levelling layer may be applied before or after setting the fastener / drilling the hole.
[2] Clearance hole in the fixture
[3] If the mortar levelling layer is applied after the fastener has been installed / the hole has been drilled, the thickness of the layer shall be taken into account regarding the screw-in depth (reach of the screw)



Key:
T_{inst} = Installation torque
u = Gap between cone bolt and expansion sleeve
l_s = Screw-in depth
h_{ef} = Effective embedment depth
h_0 = Drill hole depth
t_{fix} = Thickness of fixture

fischer ZYKON undercut anchors FZA and FZA-I for fastenings in NPP

Installation parameters for the internal threaded anchor FZA-I

Annex 7

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Table 8.1: **Design method A:** Characteristic values of resistance of **bolt anchors and internal threaded anchors** under tension load
- Requirement Category A1

Anchor type				FZA 10x40 M6	FZA 12x40 M8	FZA 12x40 M6 I
Steel failure FZA, FZA-I[1]						
Characteristic resistance under tension load		$N_{Rk,s}$	[kN]	16.1	29.3	12.1
Partial safety factor		γ_{Ms}	[-]	1.5		1.75
Steel failure FZA R, FZA-I R[1]						
Characteristic resistance under tension load		$N_{Rk,s}$	[kN]	14.1	25.6	13.5
Partial safety factor		γ_{Ms}	[-]	1.87		1.8
Steel failure FZA HCR, FZA-I HCR[1]						
Characteristic resistance under tension load		$N_{Rk,s}$	[kN]	14.1	25.6	13.5
Partial safety factor		γ_{Ms}	[-]	1.5		1.8
Pull-out failure FZA, FZA R, FZA HCR, FZA-I, FZA-I R, FZA-I HCR						
Characteristic resistance in concrete C20/25	cracked	$N_{Rk,p}$	[kN]	6		
	uncracked			9		
Increasing factors for characteristic tension resistance $N_{Rk,p}$ in cracked and uncracked concrete		ψ_c [-]	C25/30	1.10		
			C30/37	1.22		
			C35/45	1.34		
			C40/50	1.41		
			C45/55	1.48		
			C50/60	1.55		
Partial safety factor		γ_{Mp}	[-]	1.8 [2]		
Concrete cone failure and splitting failure FZA, FZA R, FZA HCR, FZA-I, FZA-I R, FZA-I HCR						
Effective embedment depth		h_{ef}	[mm]	40	40	40
Factor for uncracked concrete		$k_{ucr,N}$	[-]	10.1		
Factor for cracked concrete		$k_{cr,N}$		7.2		
Spacing		$s_{cr,N} = s_{cr,sp}$	[mm]	120	120	120
Edge distance		$c_{cr,N} = c_{cr,sp}$		60	60	60
Partial safety factor		$\gamma_{Mc} = \gamma_{M,Sp}$	[-]	1.8 [2]		
Minimum thickness of concrete member, minimum spacing and minimum edge distances of the fasteners FZA, FZA R, FZA HCR, FZA-I, FZA-I R, FZA-I HCR						
Minimum spacing		s_{min}	[mm]	40		
Minimum edge distance		c_{min}		35	40	35
Minimum member thickness		h_{min}		100		

Table 8.2: Displacements under tension load

Anchor type			FZA 10x40 M6	FZA 12x40 M8	FZA 12x40 M6 I
Tension load in cracked concrete		[kN]	2.0		
Displacement	δ_{N0}	[mm]	0.8		
	$\delta_{N\infty}$		1.1		
Tension load in uncracked concrete		[kN]	3.3		
Displacement	δ_{N0}	[mm]	0.8		
	$\delta_{N\infty}$		1.1		

[1] Related fastening screws or threaded rods shall comply with Annex 2.
[2] This value includes the installation safety factor $\gamma_2 = 1.2$.

fischer ZYKON undercut anchors FZA and FZA-I for fastenings in NPP

Design method A: Characteristic values of resistance of bolt anchors and internal threaded anchors under tension load - Requirement Category A1

Annex 8

Table 9.1: **Design method A:** Characteristic values of resistance of **bolt anchors and internal threaded anchors** under shear load
- **Requirement category A1**

Anchor type			FZA 10x40 M6	FZA 12x40 M8	FZA 12x40 M6 I
Steel failure without lever arm FZA, FZA-I[1)]					
Characteristic resistance under shear load	$V_{Rk,s}$	[kN]	8.0	14.7	6.0
Partial safety factor	γ_{Ms}	[-]	1.25		1.5
Steel failure without lever arm FZA R, FZA-I R[1)]					
Characteristic resistance under shear load	$V_{Rk,s}$	[kN]	7.0	12.8	6.7
Partial safety factor	γ_{Ms}	[-]	1.56		1.5
Steel failure without lever arm FZA HCR, FZA-I HCR[1)]					
Characteristic resistance under shear load	$V_{Rk,s}$	[kN]	7.0	12.8	6.7
Partial safety factor	γ_{Ms}	[-]	1.25		1.5
Concrete pry-out failure FZA, FZA R, FZA HCR, FZA-I, FZA-I R, FZA-I HCR					
Factor in Equation (5.6) of ETAG Annex C, 5.2.3.3	k	[-]	1.3		
Partial safety factor	γ_{Mc}		1.5[2)]		
Concrete edge failure FZA, FZA R, FZA HCR, FZA-I, FZA-I R, FZA-I HCR					
Effective embedment length	l_f	[mm]	40		
Diameter of fastener	d_{nom}		10	12	12
Partial safety factor	γ_{Mc}	[-]	1.5[2)]		

Table 9.2 Displacements under shear load

Anchor type			FZA 10x40 M6	FZA 12x40 M8	FZA 12x40 M6 I
Shear load in cracked and uncracked concrete		[kN]	4.0	5.0	5.0
Displacement	δ_{V0}	[mm]	2.0	0.7	0.7
	$\delta_{V\infty}$		3.0	1.0	1.0

1) Related fastening screws or threaded rods shall comply with Annex 2.
2) This value includes the installation safety factor γ_2 = 1.0.

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Table 10.1: **Design method B:** Characteristic resistance for tension, shear and combined tension and shear load at any angle of bolt anchors and internal threaded anchors - **Requirement Categories A2 and A3**

Anchor type			FZA 10x40 M6	FZA 12x40 M8	FZA 12x40 M6 I
Resistance for tension, shear and combined tension and shear load at any angle					
Characteristic resistance F^0_{Rk} for cracked and uncracked concrete C20/25		[kN]	0.40		
Partial safety factor	γ_{Mp}	[-]	1.5[1)]		1.8[2)]
Effective embedment depth	h_{ef}	[mm]	40		
Increasing factors for characteristic resistance in cracked and uncracked concrete	ψ_c [-]	C25/30	1.10		
		C30/37	1.22		
		C35/45	1.34		
		C40/50	1.41		
		C45/55	1.48		
		C50/60	1.55		
Minimum thickness of concrete member and minimum or characteristic spacing and edge distances of the fasteners FZA, FZA R, FZA HCR, FZA-I, FZA-I R, FZA-I HCR					
Minimum spacing	$s_{min} = s_{cr}$	[mm]	40		
Minimum edge distance	$c_{min} = c_{cr}$		35	40	35
Minimum member thickness	h_{min}		100		

Table 10.2: Displacements under tension and shear load

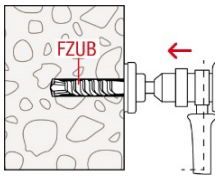
Anchor type			FZA 10x40 M6	FZA 12x40 M8	FZA 12x40 M6 I
Load	F	[kN]	0.27		0.22
Displacement under tension load	δ_N	[mm]	0.5		
Displacement under shear load	δ_V		1.6[3)]		

[1)] This value includes the installation safety factor γ_2 = 1.0.
[2)] This value includes the installation safety factor γ_2 = 1.2.
[3)] The hole tolerance in the fixture shall be additionally taken into account.

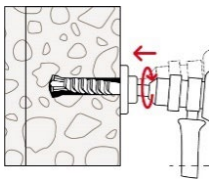
fischer ZYKON undercut anchors FZA and FZA-I for fastenings in NPP

Design method B: Characteristic resistance for all load directions of bolt anchors and internal threaded anchors - **Requirement Categories A2 and A3**

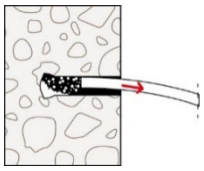
Annex 10



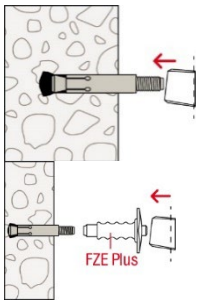
1. The hole is drilled perpendicular to the surface of the base material with a hammer drill using the corresponding ZYKON universal drill bit FZUB. The required drill depth is reached when the FZUB depth stop hits the concrete.



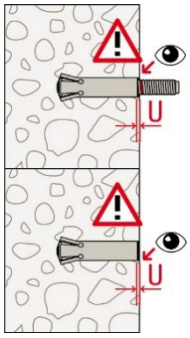
2. Once the FZUB depth stop hits the concrete, the drill hole undercut is created by making circular swivelling movements with the hammer drill while the hammer mechanism is engaged. The hammer drill is firmly pressed against the base material: It is sufficient to make 1-2 swivelling movements.



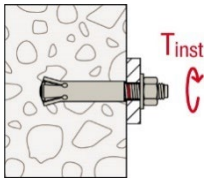
3. The drill hole is cleaned.



4. The fastener is inserted into the drill hole. Then the expansion sleeve is driven in with the setting tool FZE Plus using a manual hammer. The sleeve is set at least 1 mm behind the surface of the concrete (see figure in point 5). When installing the internal threaded anchor FZA-I, the centering pin FZE-I shall additionally be used.



5. The anchor is correctly expanded once the colour marking on the thread of the bolt (FZA) is visible or when the gap u (in accordance with Annex 7, Table 7.1) has been implemented (FZA-I).



6. The installation object (e.g. anchor plate), washer and nut or screw (for FZA-I) or threaded rod with washer and nut (for FZA-I) are mounted. Then the installation torque is applied with the torque wrench.

Control conditions and installation recommendations for the application of accidental actions:

The drill bit cutting diameter of the FZUB drill bit shall not exceed the values given in Annex 4, Table 4.1, and shall not fall below the following values:
FZUB 10: $d_{cut,min}$ = 10.35 mm
FZUB 12: $d_{cut,min}$ = 12.45 mm

A hammer drill with a nominal power of 700 W to 1200 W (3J to 5J impact energy) is recommended for drilling the hole.

A hammer with a weight of 1 kg to 1.5 kg should be used for installing the fastener.

The surface of the concrete in the area of the fixture must be flat to ensure that the fixture rests fully against the concrete after the fastener has been installed. If the concrete surface is uneven, a mortar levelling layer of max. 3 mm may be applied before or after the fastener is installed in order to achieve a flat surface.

If the required installation torque T_{inst} has not been be applied, the fastener shall not be loaded.

Control conditions:

FZA-I: The reach of the fastening screw shall comply with the values given in Annex 7, Table 7.1.

fischer ZYKON undercut anchors FZA and FZA-I for fastenings in NPP

Installation instructions FZA and FZA-I

Annex 11

Example: Setting and installation protocol (to be completed according to plant-specific conditions)

Installation protocol FZA / FZA-I

Change request: _____ **Installation date:** _____
Object: _____ **Number of permit:** Z-21.1-2008
Building/room: _____ **Description of part:** _____
General drawing: _____ **Workshop drawing:** _____

Anchor type:

Description of anchor _____ Number of batch: _____
Material: zinc plated ☐ stainless steel R ☐ high corrosion-resistant steel HCR ☐

Installation tools used:

Type of drill bit: FZUB _____ Hammer drill:_____
Type of setting tool: FZE _____

Check of the drill holes in the concrete:

Drill bit cutting diameter d_{cut}:	d_{cut} = ____mm		
Drill hole depth h_o:	h_0 = ____mm		
Swivelling movements a (1-2 swivelling movements):	a = ____		
Holes free of dust	☐ yes	☐ no	
Perpendicularity of drill holes (±5°):	☐ yes	☐ no	
Incorrect drill holes:	☐ yes	☐ no	

Check of the environment:

Grade of concrete (C../.. or B..):	C___/____		B_____
Corrosive environment (permanently damp / outside / pH / etc.):	☐ yes	☐ no	type:_____
Distances to neighbouring fastenings in acc. with structural design:	☐ yes	☐ no	
Distances to component edges in acc. with structural design:	☐ yes	☐ no	
Mortar levelling layer ($d_M \leq 3$mm, after or before) exists:	☐ yes	☐ no	d_M = _____mm
Damage (reinforcement / cracks / other):	☐ yes	☐ no	

Check of the fasteners:

Gap between sleeve and concrete surface v ≥ 1mm:	☐ yes	☐ no	v = _____mm
Bolt anchor - colour marking is visible:	☐ yes	☐ no	
Internal threaded anchor 0 ≤ u ≤ 4 (gap between cone bolt and expansion sleeve)		u = ____mm	
Installation torque T_{inst} applied:	☐ yes	☐ no	T_{inst} = _____Nm

Check of the fixture:

Execution in acc. with workshop drawing:	☐ yes	☐ no	
Thickness of fixture t_{fix} (max. t_{fix} : Annex 6) complied with:	☐ yes	☐ no	t_{fix} =_____mm
Clearance hole d_f (max d_f : Annex 6 and 7) complied with:	☐ yes	☐ no	d_f =_____mm
Screw-in depth l_s (Annex 7) complied with:	☐ yes	☐ no	l_s =_____mm

Mechanic certification:

Technician training certificate from _____ is available: ☐ yes ☐ no

	Installation company drew up protocol	Inspection and acceptance through site manager	Inspection /acceptance / knowledge through building inspector	Builder's representative / operator
Date:				
Name:				
Signature:				
Distributor:	Original:	Copies:	-Building inspector -Installation company	

Comments: _____

fischer ZYKON undercut anchors FZA and FZA-I for fastenings in NPP

Setting and installation protocol

Annex 12