Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

Designated according to Article 29 of Regulation (EU) No 305/2011 and member of EOTA (European Organisation for Technical Assessment)

European Technical Assessment

ETA-20/0229 of 26 January 2022

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	Würth Fixanchor W-FAZ PRO
Product family to which the construction product belongs	Mechanical fasteners for use in concrete
Manufacturer	Adolf Würth GmbH & Co. KG Reinhold-Würth-Straße 12-17 74653 Künzelsau DEUTSCHLAND
Manufacturing plant	Werk W1
This European Technical Assessment contains	23 pages including 3 annexes which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	EAD 330232-01-0601, Edition 05/2021
This version replaces	ETA-20/0229 issued on 3 April 2020

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Specific Part

1 Technical description of the product

The Würth Fixanchor W-FAZ PRO is a fastener made of zinc plated steel, stainless steel or high corrosion resistant steel which is placed into a drilled hole and anchored by torque-controlled expansion.

The product description is given in Annex A.

2 Specification of the intended use in accordance with the applicable European Assessment Document

The performances given in Section 3 are only valid if the fastener is used in compliance with the specifications and conditions given in Annex B.

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the fastener of at least 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

3 Performance of the product and references to the methods used for its assessment

3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic resistance to tension load (static and quasi-static loading) Method A	see Annex B3, C1, C2
Characteristic resistance to shear load (static and quasi-static loading)	see Annex C3
Displacements	see Annex C8 and C9
Characteristic resistance and displacements for seismic performance categories C1 and C2	see Annex C4, C5, C8 and C9

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire	see Annex C6 and C7

3.3 Aspects of durability linked with the Basic Works Requirements

Essential characteristic	Performance
Durability	See Annex B1

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

In accordance with the European Assessment Document EAD 330232-01-0601 the applicable European legal act is: 1996/582/EC.

The system to be applied is: 1

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable European Assessment Document

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with Deutsches Institut für Bautechnik.

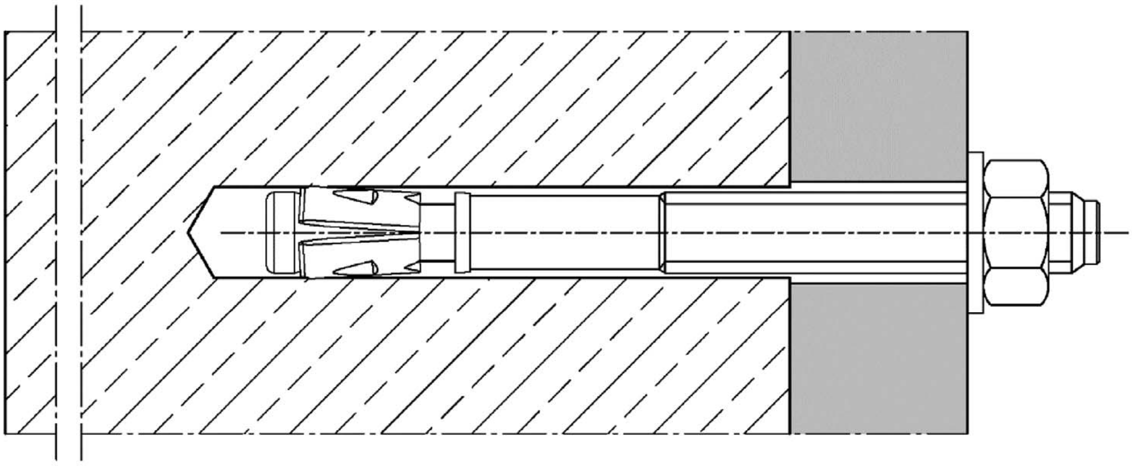
Issued in Berlin on 26 January 2022 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock
Head of Section

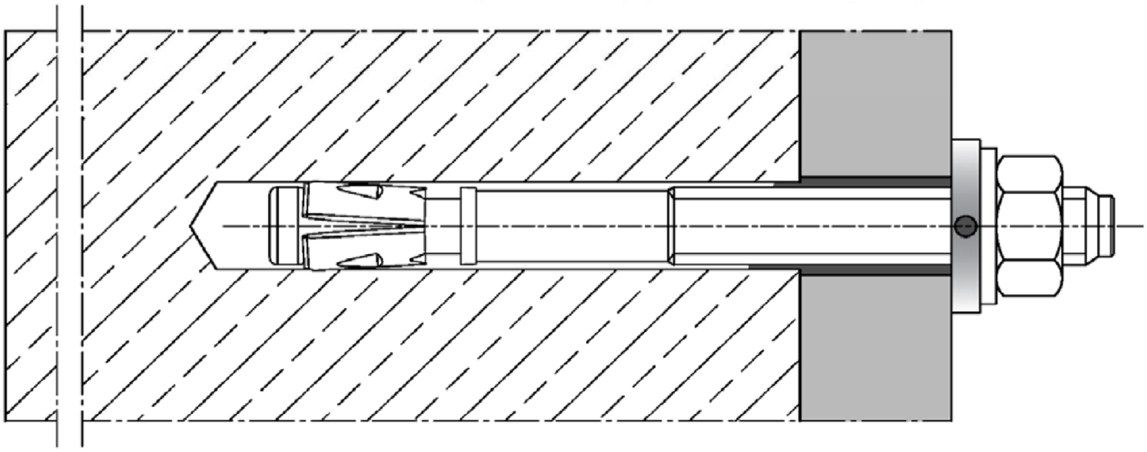
beglaubigt:
Baderschneider

Throughbolt Fixanchor W-FAZ PRO/S, W-FAZ PRO/A4 and W-FAZ PRO/HCR

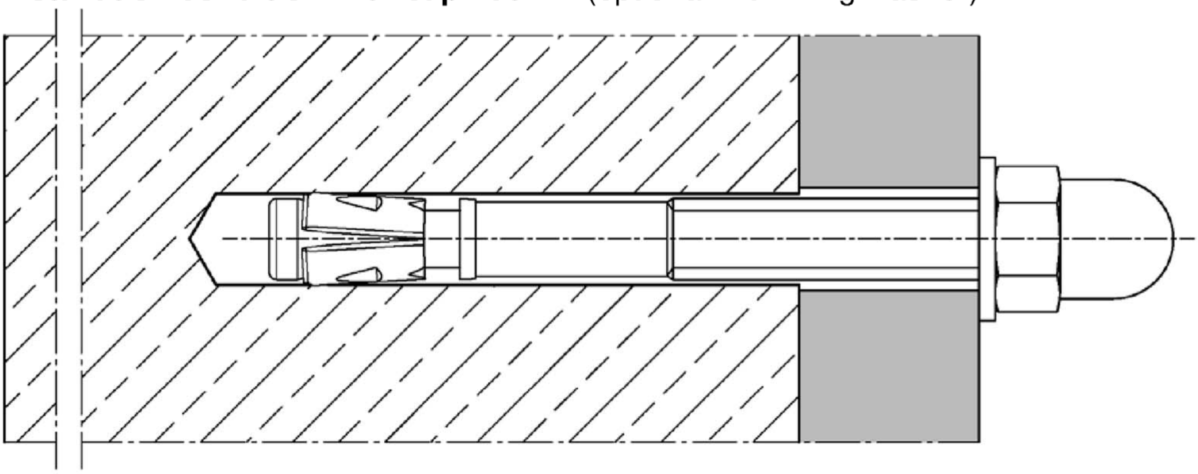
Installation condition



Installation condition with filling washer (optional with cap nut)



Installation condition with cap nut HM (optional with filling washer)

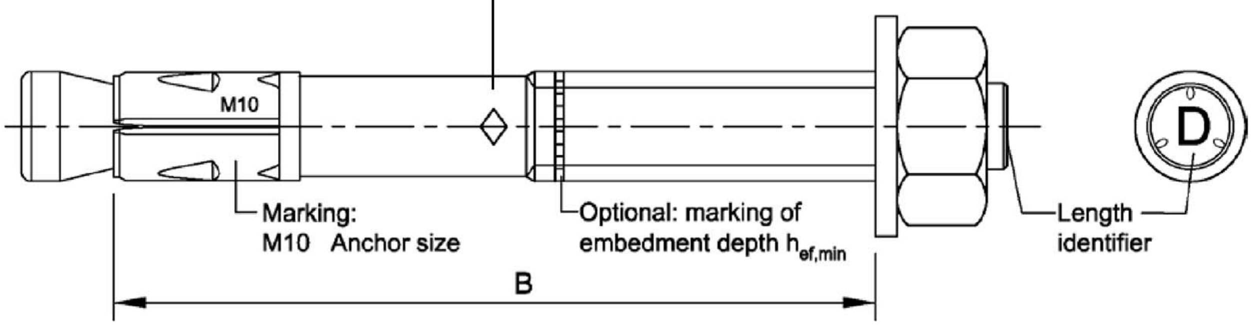


Würth Fixanchor W-FAZ PRO	**Annex A1**
Product description Product types and installation conditions	

Marking

e.g.: ◇ BZ3 15

◇ Identifying mark of manufacturing plant
BZ3 fastener identity
15 max. thickness of fixture $t_{fix,max}$ for $h_{ef,min}$
A4 additional marking for stainless steel
HCR additional marking for high corrosion resistant steel



Usable length: $\mathbf{B = h_{ef} + t_{fix}}$

h_{ef}: (existing) effective anchorage depth

t_{fix}: fixture thickness (including e.g. levelling layers or other non-load-bearing layers or additional filling washer)

Table A1: Length identification

Length identifier	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Usable length B ≥	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105

Length identifier	P	Q	R	S	T	U	V	W	X	Y	Z	AA	BB	CC	DD
Usable length B ≥	110	115	120	125	130	135	140	145	150	160	170	180	190	200	210

Length identifier	EE	FF	GG	HH	II	JJ	KK	LL
Usable length B ≥	220	230	240	250	260	270	280	290

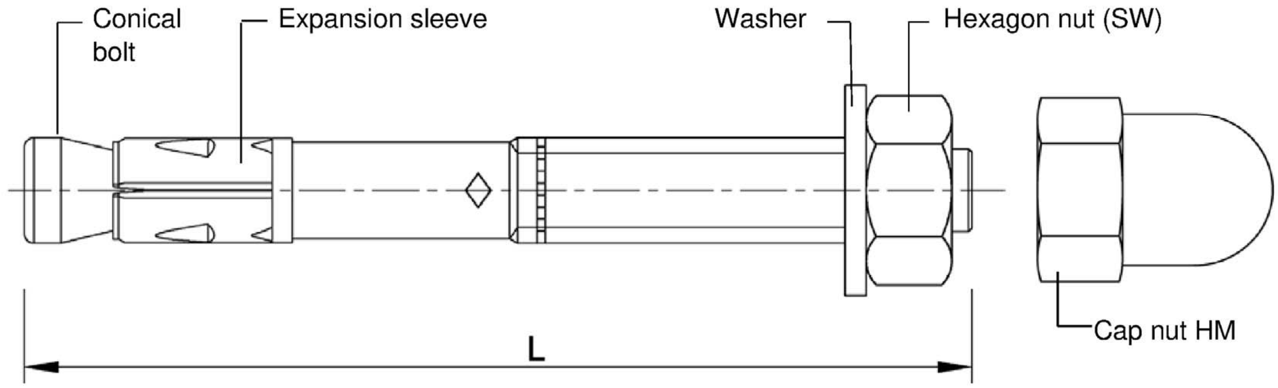
Dimensions in mm

Table A2: Material

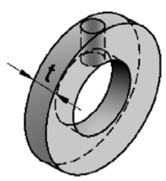
Part	W-FAZ PRO/S	W-FAZ PRO/A4	W-FAZ PRO/HCR
	Steel, zinc plated	**Stainless steel CRC III**	**High corrosion resistant steel CRC V**
Conical bolt	Steel, galvanized ≥ 5 µm, fracture elongation A_5 ≥ 8%	Stainless steel, fracture elongation A_5 ≥ 8%	High corrosion resistant steel, fracture elongation A_5 ≥ 8%
Expansion sleeve	Stainless steel	Stainless steel	Stainless steel
Washer	Steel, galvanized ≥ 5 µm	Stainless steel	High corrosion resistant steel
Filling washer			
Hexagon nut			
Cap nut			

Table A3: Fastener dimensions

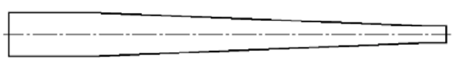
Fastener size			M8	M10	M12	M16
			W-FAZ PRO/S, W-FAZ PRO/A4, W-FAZ PRO/HCR			
Width across hexagon nut / cap nut	SW	[mm]	13	17	19	24
Length of fastener	L	[mm]	h_{ef} + t_{fix} + 18,0	h_{ef} + t_{fix} + 21,5	h_{ef} + t_{fix} + 26,0	h_{ef} + t_{fix} + 33,0
Thickness of filling washer	t	[mm]	5			



Filling washer WIT-SHB



Reducing adapter



Würth Fixanchor W-FAZ PRO

Product description
Material and dimensions

Annex A3

Specifications of intended use

Fixanchor	W-FAZ PRO/S, W-FAZ PRO/A4, W-FAZ PRO/HCR			
	M8	M10	M12	M16
Static or quasi-static action	✓			
Seismic performance categories C1 and C2	✓			
Fire exposure	R30 / R60 / R90 / R120			
Variable, effective anchorage depth	35 mm to 90 mm	40 mm to 100 mm	50 mm to 125 mm	65 mm to 160 mm

Base materials:

- Cracked or uncracked concrete
- Reinforced or unreinforced normal weight concrete without fibers according to EN 206:2013 + A1:2016
- Strength classes C20/25 to C50/60 according to EN 206:2013 + A1:2016

Use conditions (Environmental conditions):

- Structures subject to dry internal conditions: all materials
- For all other conditions according to EN 1993-1-2006 + A1:2015-10, corresponding to corrosion resistance classes CRC according to Annex A3, Table A2:

Design:

- Anchorages are designed 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 fastener is indicated on the design drawings (e.g. position of the fastener relative to reinforcement or to supports, etc.).
- Design method EN 1992-4:2018 and Technical Report TR 055:2018

Installation:

- Fastener installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site
- Hole drilling by hammer drill bit or vacuum drill bit
- Use of the fastener only as supplied by the manufacturer without exchanging the components of the fastener (exception: when using the cap nut HM)
- The anchor can be set in pre- or through-setting installation.
- Optionally, the annular gap between fixture and stud of W-FAZ PRO can be filled to reduce the hole clearance. For this purpose, the filling washer (Annex A3) must be used in addition to the supplied washer. For filling use Würth Injection Adhesive WIT-UM 300, WIT-VM 250, WIT-PE 1000, WIT-VIZ or other high-strength injection mortar with compressive strength ≥ 40N/mm².

Table B1: Installation parameters

Anchor size			W-FAZ PRO/S, W-FAZ PRO/A4, W-FAZ PRO/HCR			
			M8	**M10**	**M12**	**M16**
Nominal drill hole diameter	d_0	[mm]	8	10	12	16
Cutting diameter of drill bit	$d_{cut} \leq$	[mm]	8,45	10,45	12,5	16,5
Minimum effective anchorage depth	$h_{ef,min}$	[mm]	35	40	50	65
Maximum effective anchorage depth	$h_{ef,max}$	[mm]	90	100	125	160
Depth of drill hole	$h_0 \geq$	[mm]	h_{ef} + 8	h_{ef} + 9	h_{ef} + 10	h_{ef} + 14
	$h_1 \geq$	[mm]	h_{ef} + 10	h_{ef} + 11	h_{ef} + 13	h_{ef} + 17
Diameter of clearance hole in the fixture [1)]	$d_f \leq$	[mm]	9	12	14	18
Projection after anchor has been inserted for installing with cap nut HM (according to Annex B6, Figure 3)	C	[mm]	10,5	12,5	16,0	19,5
Installation torque W-FAZ PRO/S	T_{inst}	[Nm]	15	40	60	110
Installation torque W-FAZ PRO/A4 W-FAZ PRO/HCR	T_{inst}	[Nm]	15	40	55	100

[1)] For larger diameters of clearance hole in the fixture, see EN 1992-4:2018, chapter 6.2.2.2

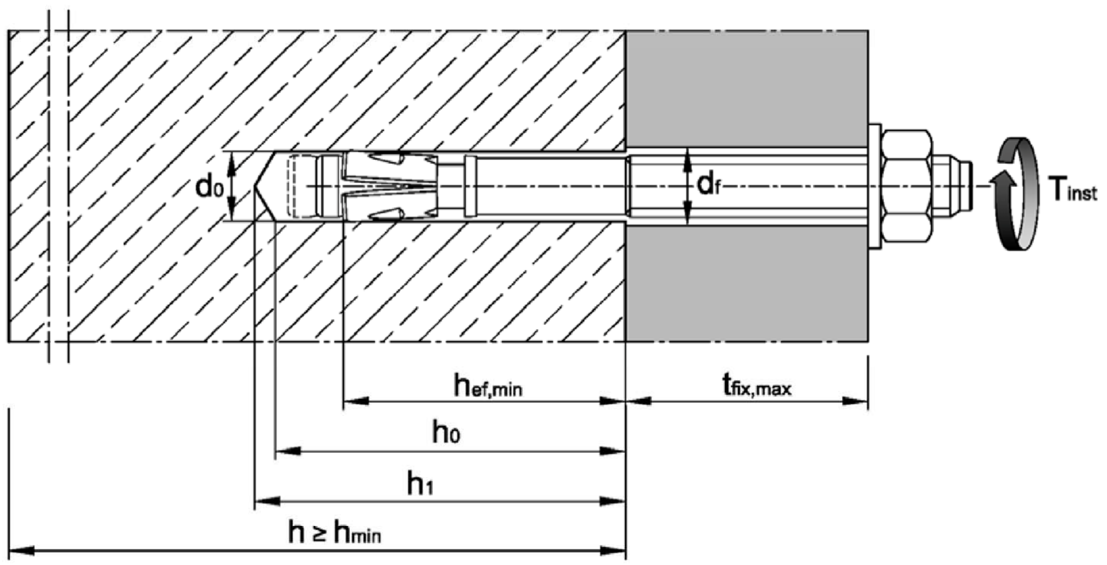


Table B2: Minimum thickness of concrete member, minimum spacings, edge distances

Anchor size			**W-FAZ PRO/S, W-FAZ PRO/A4, W-FAZ PRO/HCR**			
			M8	**M10**	**M12**	**M16**
Minimum member thickness depending on h_{ef}	$h_{min} \geq$	[mm]	max $(1{,}5 \cdot h_{ef}\,; 80)$		max $(1{,}5 \cdot h_{ef}\,;100)$	max $(1{,}5 \cdot h_{ef}\,;120)$
Minimum edge distances and spacings						
Minimum edge distance	c_{min}	[mm]	40	45	55	65
	for $s \geq$	[mm]	see Table B4			
Minimum spacings	s_{min}	[mm]	35	40	50	65
	for $c \geq$	[mm]	see Table B4			

The following equation must be fulfilled for the calculation of the minimum spacing and edge distance during installation in combination with variable anchorage depth and member thickness:

$$\mathbf{A_{sp,req} \leq A_{sp,ef}}$$

Required splitting area $A_{sp,req}$ and idealized splitting area $A_{sp,ef}$ according to Table B4.

Table B3: Applicable concrete thickness h_{sp} and area A_{sp} to determine characteristic edge distance $c_{cr,sp}$

Anchor size				**M8**	**M10**	**M12**	**M16**
Applicable concrete thickness	W-FAZ PRO/S W-FAZ PRO/A4 W-FAZ PRO/ HCR	h_{sp}	[mm]	$\min(h\,;\ h_{ef} + 1{,}5 \cdot c \cdot \sqrt{2})$			
Area to determine $c_{cr,sp}$ [1)]	W-FAZ PRO/S	A_{sp}	[mm²]	$\frac{N^0_{Rk,sp} - 2{,}573}{0{,}000436}$	$\frac{N^0_{Rk,sp} + 2{,}040}{0{,}000693}$	$\frac{N^0_{Rk,sp} + 3{,}685}{0{,}000692}$	$\frac{N^0_{Rk,sp} + 3{,}738}{0{,}000875}$
	W-FAZ PRO/A4 W-FAZ PRO/HCR	A_{sp}	[mm²]	$\frac{N^0_{Rk,sp} + 4{,}177}{0{,}000862}$	$\frac{N^0_{Rk,sp} + 7{,}235}{0{,}000967}$	$\frac{N^0_{Rk,sp} + 7{,}847}{0{,}000951}$	$\frac{N^0_{Rk,sp} + 11{,}415}{0{,}000742}$

1) with $N^0_{Rk,sp}$ in kN

Würth Fixanchor W-FAZ PRO	**Annex B3**
Intended use Minimum spacings and edge distances Required area and applicable concrete thickness	

Table B4: Areas to determine spacings and edge distances for installation

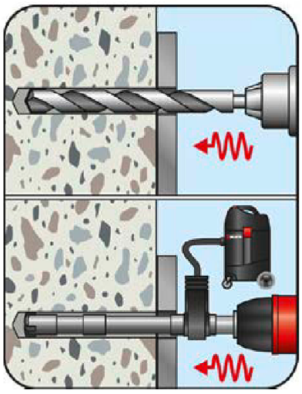
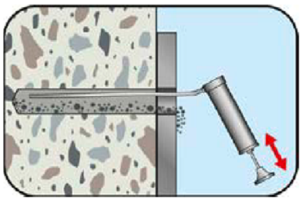
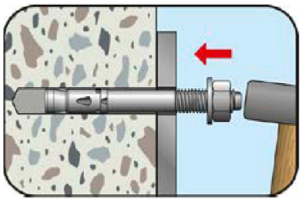
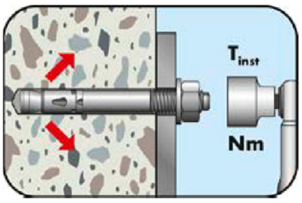
Anchor size				**W-FAZ PRO/S, W-FAZ PRO/A4, W-FAZ PRO/HCR**			
				M8	**M10**	**M12**	**M16**
The following equation must be fulfilled for the calculation of the minimum spacing and edge distance during installation in combination with variable anchorage depth and member thickness: $A_{sp,req} \leq A_{sp,ef}$							
Idealized splitting area $A_{sp,ef}$ The edge distances and spacings shall be selected or rounded in steps of 5 mm.							
Member thickness: $h > h_{ef} + 1{,}5 \cdot c$							
Single anchor or anchor group with $s \geq 3 \cdot c$							
Effective anchorage depth	$h_{ef} < 1{,}5 \cdot c$			$A_{sp,ef} = (6 \cdot c) \cdot (1{,}5 \cdot c + h_{ef})$			[mm²]
Effective anchorage depth	$h_{ef} \geq 1{,}5 \cdot c$			$A_{sp,ef} = (6 \cdot c) \cdot (3 \cdot c)$			[mm²]
Anchor group ($s < 3 \cdot c$)							
Effective anchorage depth	$h_{ef} < 1{,}5 \cdot c$			$A_{sp,ef} = (3 \cdot c + s) \cdot (1{,}5 \cdot c + h_{ef})$			[mm²]
Effective anchorage depth	$h_{ef} \geq 1{,}5 \cdot c$			$A_{sp,ef} = (3 \cdot c + s) \cdot (3 \cdot c)$			[mm²]
Member thickness: $h \leq h_{ef} + 1{,}5 \cdot c$							
Single anchor or anchor group with $s \geq 3 \cdot c$							
Effective anchorage depth	$h_{ef} < 1{,}5 \cdot c$			$A_{sp,ef} = (6 \cdot c) \cdot h$			[mm²]
Effective anchorage depth	$h_{ef} \geq 1{,}5 \cdot c$			$A_{sp,ef} = (6 \cdot c) \cdot (h - h_{ef} + 1{,}5 \cdot c)$			[mm²]
Anchor group ($s < 3 \cdot c$)							
Effective anchorage depth	$h_{ef} < 1{,}5 \cdot c$			$A_{sp,ef} = (3 \cdot c + s) \cdot h$			[mm²]
Effective anchorage depth	$h_{ef} \geq 1{,}5 \cdot c$			$A_{sp,ef} = (3 \cdot c + s) \cdot (h - h_{ef} + 1{,}5 \cdot c)$			[mm²]
Required splitting area $A_{sp,req}$							
W-FAZ PRO/S	cracked concrete	$A_{sp,req}$	[mm²]	13 900	23 700	31 500	42 300
	uncracked concrete	$A_{sp,req}$	[mm²]	22 500	34 700	41 300	50 200
W-FAZ PRO/A4 W-FAZ PRO/HCR	cracked concrete	$A_{sp,req}$	[mm²]	16 900	25 900	29 800	44 300
	uncracked concrete	$A_{sp,req}$	[mm²]	19 700	35 700	35 300	54 800

Würth Fixanchor W-FAZ PRO

Intended use
Projected effective area to determine spacings and edge distances

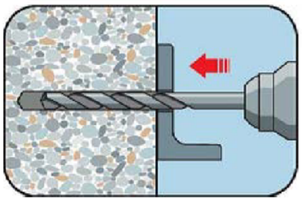
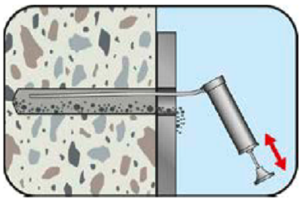
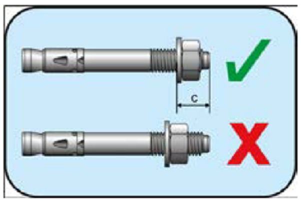
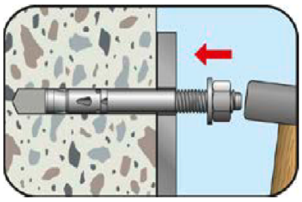
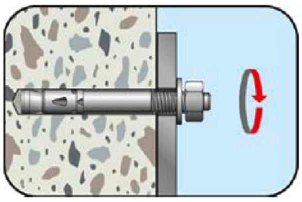
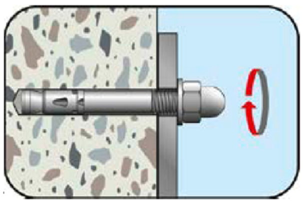
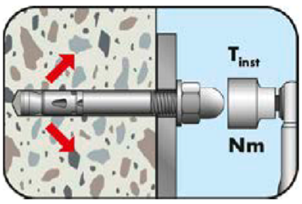
Annex B4

Installation instructions

1		Drill hole perpendicular to concrete surface. If using a vacuum drill bit, proceed with step 3.
2		Blow out dust. Alternatively vacuum clean down to the bottom of the hole.
3		Drive in fastener.
4		Apply installation torque T_{inst}.

Würth Fixanchor W-FAZ PRO	**Annex B5**
Intended use Installation instructions	

Installation with cap nut HM

1		Drill hole perpendicular to concrete surface. If using a vacuum drill bit, proceed with step 3.
2		Blow out dust. Alternatively vacuum clean down to the bottom of the hole.
3		Check position of nut. Projection C after anchor has been inserted see Annex B2, Table B1.
4		Drive in fastener.
5		Remove nut.
6		Screw on cap nut
7		Apply installation torque T_{inst}.

Würth Fixanchor W-FAZ PRO	**Annex B6**
Intended use Installation instructions with cap nut	

Installation instructions with filling of annular gap

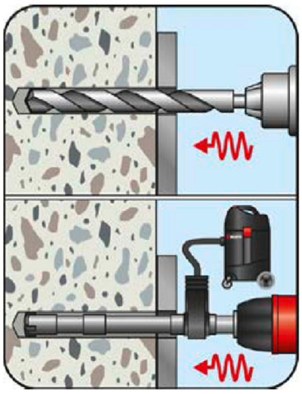
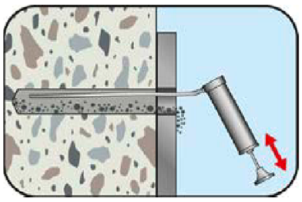
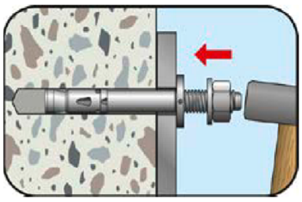
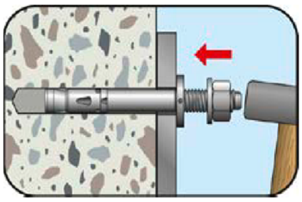
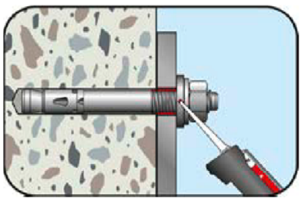
1		Drill hole perpendicular to concrete surface. If using a vacuum drill bit, proceed with step 3.
2		Blow out dust. Alternatively vacuum clean down to the bottom of the hole.
3		Drive in fastener with additionally mounted filling washer.
4		Apply installation torque T_{inst}.
5		Fill the annular gap between anchor and fixture with injection adhesive (see Annex B1). Use enclosed reducing adapter. The annular gap is completely filled, when excess mortar seeps out.

Table C1: Characteristic values for **tension loads** under static and quasi-static action, **W-FAZ PRO/S** (steel, zinc plated)

Fastener size			**W-FAZ PRO/S**			
			M8	**M10**	**M12**	**M16**
Installation factor	γ_{inst}	[-]	1,0			
Steel failure						
Characteristic resistance	$N_{Rk,s}$	[kN]	19,8	30,4	44,9	79,3
Partial factor [4)]	γ_{Ms}	[-]	1,5			
Pull-out						
Characteristic resistance in cracked concrete C20/25	$N_{Rk,p,cr}$	[kN]	9,5	15	22	30
Increasing factor $N_{Rk,p,cr} = \psi_C \cdot N_{Rk,p,cr}$ (C20/25)	ψ_C	[-]	$\left(\frac{f_{ck}}{20}\right)^{0,439}$	$\left(\frac{f_{ck}}{20}\right)^{0,265}$	$\left(\frac{f_{ck}}{20}\right)^{0,5}$	$\left(\frac{f_{ck}}{20}\right)^{0,339}$
Characteristic resistance in uncracked concrete C20/25	$N_{Rk,p,ucr}$	[kN]	14	24	30	50
Increasing factor $N_{Rk,p,ucr} = \psi_C \cdot N_{Rk,p,ucr}$ (C20/25)	ψ_C	[-]	$\left(\frac{f_{ck}}{20}\right)^{0,489}$	$\left(\frac{f_{ck}}{20}\right)^{0,448}$	$\left(\frac{f_{ck}}{20}\right)^{0,5}$	$\left(\frac{f_{ck}}{20}\right)^{0,203}$
Splitting						
Characteristic resistance	$N^0_{Rk,sp}$	[kN]	min ($N_{Rk,p}$; $N^0_{Rk,c}$ [3)])			
Characteristic edge distance [2)]	$c_{cr,sp}$	[mm]	$\frac{A_{sp} + 0{,}8 \cdot (h_{sp} - h_{ef})^2}{(3{,}41 \cdot h_{sp} - 0{,}59 \cdot h_{ef})}$			
Characteristic spacing	$s_{cr,sp}$	[mm]	$2 \cdot c_{cr,sp}$			
Concrete cone failure						
Minimum, effective anchorage depth	$h_{ef,min}$	[mm]	35 [1)]	40	50	65
Maximum, effective anchorage depth	$h_{ef,max}$	[mm]	90	100	125	160
Characteristic edge distance	$c_{cr,N}$	[mm]	$1{,}5 \cdot h_{ef}$			
Characteristic spacing	$s_{cr,N}$	[mm]	$2 \cdot c_{cr,N}$			
Factor – cracked concrete	$k_{cr,N}$	[-]	7,7			
Factor – uncracked concrete	$k_{ucr,N}$	[-]	11,0			

[1)] Fastenings with anchorage depth h_{ef} < 40mm are restricted to the use of structural components which are statically indeterminate and subject to internal exposure conditions only.

[2)] Applicable concrete thickness h_{sp} and area A_{sp} to determine characteristic edge distance $c_{cr,sp}$ according to Table B3

[3)] $N^0_{Rk,c}$ according to EN 1992-4:2018

[4)] In absence of other national regulations

Table C2: Characteristic values for **tension loads** under static or quasi-static action, **W-FAZ PRO/A4** and **W-FAZ PRO/HCR**

Fastener size			**W-FAZ PRO/A4, W-FAZ PRO/HCR**			
			M8	**M10**	**M12**	**M16**
Installation factor	γ_{inst}	[-]	1,0			
Steel failure						
Characteristic resistance	$N_{Rk,s}$	[kN]	19,8	30,4	44,9	74,6
Partial factor [4]	γ_{Ms}	[-]	1,5			
Pull-out						
Characteristic resistance in cracked concrete C20/25	$N_{Rk,p,cr}$	[kN]	9,5	17	22	35
Increasing factor $N_{Rk,p,cr} = \psi_C \cdot N_{Rk,p,cr}$ (C20/25)	ψ_C	[-]	$\left(\frac{f_{ck}}{20}\right)^{0,488}$	$\left(\frac{f_{ck}}{20}\right)^{0,5}$	$\left(\frac{f_{ck}}{20}\right)^{0,435}$	$\left(\frac{f_{ck}}{20}\right)^{0,350}$
Characteristic resistance in uncracked concrete C20/25	$N_{Rk,p,ucr}$	[kN]	20	25	42	50
Increasing factor $N_{Rk,p,ucr} = \psi_C \cdot N_{Rk,p,ucr}$ (C20/25)	ψ_C	[-]	$\left(\frac{f_{ck}}{20}\right)^{0,240}$	$\left(\frac{f_{ck}}{20}\right)^{0,364}$	$\left(\frac{f_{ck}}{20}\right)^{0,213}$	$\left(\frac{f_{ck}}{20}\right)^{0,196}$
Splitting						
Characteristic resistance	$N^0_{Rk,sp}$	[kN]	min ($N_{Rk,p}$; $N^0_{Rk,c}$ [3])			
Characteristic edge distance [2]	$c_{cr,sp}$	[mm]	$\frac{A_{sp} + 0,8 \cdot (h_{sp} - h_{ef})^2}{(3,41 \cdot h_{sp} - 0,59 \cdot h_{ef})}$			
Characteristic spacing	$s_{cr,sp}$	[mm]	$2 \cdot c_{cr,sp}$			
Concrete cone failure						
Minimum, effective anchorage depth	$h_{ef,min}$	[mm]	35 [1]	40	50	65
Maximum, effective anchorage depth	$h_{ef,max}$	[mm]	90	100	125	160
Characteristic edge distance	$c_{cr,N}$	[mm]	$1,5 \cdot h_{ef}$			
Characteristic spacing	$s_{cr,N}$	[mm]	$2 \cdot c_{cr,N}$			
Factor — cracked concrete	$k_{cr,N}$	[-]	7,7			
Factor — uncracked concrete	$k_{ucr,N}$	[-]	11,0			

[1] Fastenings with anchorage depth h_{ef} < 40 mm are restricted to the use of structural components which are statically indeterminate and subject to internal exposure conditions only

[2] Applicable concrete thickness h_{sp} and area A_{sp} according to Table B3 to determine characteristic edge distance $c_{cr,sp}$

[3] $N^0_{Rk,c}$ according to EN 1992-4:2018

[4] In absence of other national regulations

Würth Fixanchor W-FAZ PRO	**Annex C2**
Performance Characteristic values for **tension loads, W-FAZ PRO/A4** and **W-FAZ PRO/HCR**	

Table C3: Characteristic values for **shear loads** under static and quasi-static action

Fastener size				**W-FAZ PRO/S, W-FAZ PRO/A4, W-FAZ PRO/HCR**			
				M8	**M10**	**M12**	**M16**
Installation factor		γ_{inst}	[-]	1,0			
Steel failure without lever arm							
Characteristic resistance	W-FAZ PRO/S	$V^0_{Rk,s}$	[kN]	15,7	26,8	38,3	60,0
	W-FAZ PRO/A4 W-FAZ PRO/HCR	$V^0_{Rk,s}$	[kN]	16,8	27,8	39,8	69,5
Partial factor [2)]		γ_{Ms}	[-]	1,25			
Ductility factor		k_7	[-]	1,0			
Steel failure with lever arm							
Characteristic bending resistance	W-FAZ PRO/S	$M^0_{Rk,s}$	[Nm]	30	60	105	240
	W-FAZ PRO/A4 W-FAZ PRO/HCR	$M^0_{Rk,s}$	[Nm]	27	55	99	223
Partial factor [2)]		γ_{Ms}	[-]	1,25			
Concrete pry-out failure							
Pry-out factor	W-FAZ PRO/S	k_8	[-]	2,8	3,1	3,0	3,6
	W-FAZ PRO/A4 W-FAZ PRO/HCR	k_8	[-]	2,7	2,8	3,3	3,4
Concrete edge failure							
Effective length of fastener in shear loading		l_f	[mm]	h_{ef} [1)]			
Outside diameter of fastener		d_{nom}	[mm]	8	10	12	16

[1)] Fastenings with anchorage depth $h_{ef} < 40$ mm are restricted to the use of structural components which are statically indeterminate and subject to internal exposure conditions only.

[2)] In absence of other national regulations

Würth Fixanchor W-FAZ PRO

Performance
Characteristic values for **shear loads**

Annex C3

Table C4: Characteristic values for **seismic loading,** performance category **C1**

Fastener size				**W-FAZ PRO/S, W-FAZ PRO/A4, W-FAZ PRO/HCR**							
				M8		**M10**		**M12**		**M16**	
Effective anchorage depth		$h_{ef} \geq$	[mm]	40	45	40	60	50	70	65	85
Tension load											
Installation factor		γ_{inst}	[-]	1,0							
Steel failure											
Characteris-tic resistance	W-FAZ PRO/S	$N_{Rk,s,C1}$	[kN]	19,8		30,4		44,9		79,3	
	W-FAZ PRO/A4 W-FAZ PRO/HCR	$N_{Rk,s,C1}$	[kN]	19,8		30,4		44,9		74,6	
Pull-out											
Characteris-tic resistance	W-FAZ PRO/S	$N_{Rk,p,C1}$	[kN]	9,1		15,0		22,0		30,0	
	W-FAZ PRO/A4 W-FAZ PRO/HCR	$N_{Rk,p,C1}$	[kN]	9,0		17,0		22,0		35,0	
Shear load											
Steel failure without lever arm											
Characteris-tic resistance	W-FAZ PRO/S	$V_{Rk,s,C1}$	[kN]	11,7	13,4	22,5	24,4	30,0	33,8	48,8	52,3
	W-FAZ PRO/A4 W-FAZ PRO/HCR	$V_{Rk,s,C1}$	[kN]	11,0	12,7	20,6	22,2	33,2	33,2	61,1	64,3
Factor for anchorages	**with** annular gap	α_{gap}	[-]	0,5							
	without annular gap	α_{gap}	[-]	1,0							

Table C5: Characteristic values for **seismic loading,** performance category **C2**

Fastener size				**W-FAZ PRO/S, W-FAZ PRO/A4, W-FAZ PRO/HCR**							
				M8		**M10**		**M12**		**M16**	
Effective anchorage depth		$h_{ef} \geq$	[mm]	40	45	40	60	50	70	65	85
Tension load											
Installation factor		γ_{inst}	[-]	1,0							
Steel failure											
Characteristic resistance	W-FAZ PRO/S	$N_{Rk,s,C2}$	[kN]	19,8		30,4		44,9		79,3	
	W-FAZ PRO/A4 W-FAZ PRO/HCR	$N_{Rk,s,C2}$	[kN]	19,8		30,4		44,9		74,6	
Pull-out											
Characteristic resistance	W-FAZ PRO/S	$N_{Rk,p,C2}$	[kN]	2,8	3,6	7,3	12,5	10,7	19,0	19,8	35,2
	W-FAZ PRO/A4 W-FAZ PRO/HCR	$N_{Rk,p,C2}$	[kN]	2,3	3,2	5,0	7,7	8,0	13,8	19,0	29,4
Shear load											
Steel failure without lever arm											
Characteristic resistance	W-FAZ PRO/S	$V_{Rk,s,C2}$	[kN]	7,3	11,3	15,4	19,0	18,3	28,0	39,4	43,3
	W-FAZ PRO/A4 W-FAZ PRO/HCR	$V_{Rk,s,C2}$	[kN]	7,5	8,6	12,5	15,9	22,4	25,6	42,7	46,1
Factor for anchorages	**with** annular gap	α_{gap}	[-]	0,5							
	without annular gap	α_{gap}	[-]	1,0							

Table C6: Characteristic values **for tension and shear load** under **fire exposure, W-FAZ PRO/S** (steel, zinc plated)

Fastener size				**W-FAZ PRO/S**			
				M8	**M10**	**M12**	**M16**
Tension load							
Steel failure							
Characteristic resistance	R30	$N_{Rk,s,fi}$	[kN]	1,2	2,6	4,6	7,7
	R60			1,0	1,9	3,3	5,6
	R90			0,7	1,3	2,1	3,5
	R120			0,6	1,0	1,5	2,5
Shear load							
Steel failure <u>without</u> lever arm							
Characteristic resistance	R30	$V_{Rk,s,fi}$	[kN]	4,0	7,5	12,3	20,7
	R60			2,7	5,1	8,5	14,2
	R90			1,4	2,7	4,6	7,7
	R120			0,8	1,6	2,7	4,5
Steel failure <u>with</u> lever arm							
Characteristic resistance	R30	$M^0_{Rk,s,fi}$	[Nm]	4,1	9,6	19,1	43,8
	R60			2,8	6,6	13,1	30,1
	R90			1,5	3,5	7,2	16,4
	R120			0,8	2,0	4,2	9,6

$N_{Rk,p,fi}$ and $N_{Rk,c,fi}$ according to EN 1992-4:2018

Table C7: Characteristic values **for tension and shear load** under **fire exposure, W-FAZ PRO/A4** and **W-FAZ PRO/HCR**

Fastener size				**W-FAZ PRO/A4, W-FAZ PRO/HCR**			
				M8	**M10**	**M12**	**M16**
Tension load							
Steel failure							
Characteristic resistance	R30	$N_{Rk,s,fi}$	[kN]	4,0	6,9	11,0	18,1
	R60			2,9	5,0	8,0	13,1
	R90			1,8	3,1	4,9	8,1
	R120			1,2	2,1	3,4	5,6
Shear load							
Steel failure without lever arm							
Characteristic resistance	R30	$V_{Rk,s,fi}$	[kN]	8,5	17,6	32,0	52,6
	R60			6,2	12,6	22,6	37,1
	R90			3,9	7,5	13,1	21,5
	R120			2,8	5,0	8,4	13,8
Steel failure with lever arm							
Characteristic resistance	R30	$M^0_{Rk,s,fi}$	[Nm]	8,7	22,7	49,8	111,5
	R60			6,3	16,2	35,1	78,6
	R90			4,0	9,7	20,4	45,6
	R120			2,8	6,5	13,0	29,2

$N_{Rk,p,fi}$ and $N_{Rk,c,fi}$ according to EN 1992-4:2018

Table C8: Displacements under **tension load, W-FAZ PRO/S** (steel, zinc plated)

Fastener size			W-FAZ PRO/S							
			M8		M10		M12		M16	
Displacements under static or quasi-static action $\delta_{N0} = \delta_{N0\text{-factor}} \cdot N$ N: acting tension load $\delta_{N\infty} = \delta_{N\infty\text{-factor}} \cdot N$										
Effective anchorage depth	$h_{ef} \geq$	[mm]	35		40		50		65	
Cracked concrete										
Factor for displacement	$\delta_{N0\text{-factor}}$	[mm/kN]	0,13		0,05		0,04		0,03	
	$\delta_{N\infty\text{-factor}}$	[mm/kN]	0,29		0,20		0,15		0,11	
Uncracked concrete										
Factor for displacement	$\delta_{N0\text{- factor}}$	[mm/kN]	0,03		0,01		0,004		0,005	
	$\delta_{N\infty\text{- factor}}$	[mm/kN]	0,03		0,03		0,03		0,03	
Displacement under seismic action C2										
Effective anchorage depth	$h_{ef} \geq$	[mm]	40	45	40	60	50	70	65	85
Displacements for DLS	$\delta_{N,\,C2(DLS)}$	[mm]	3,9	4,9	2,8	4,7	2,4	4,2	2,5	4,5
Displacements for ULS	$\delta_{N,\,C2(ULS)}$	[mm]	11,3	14,3	9,4	16,1	7,3	12,9	7,2	12,8

Table C9: Displacements under **tension load, W-FAZ PRO/A4** and **W-FAZ PRO/HCR**

Fastener size			W-FAZ PRO/A4, W-FAZ PRO/HCR							
			M8		M10		M12		M16	
Displacements under static or quasi-static action $\delta_{N0} = \delta_{N0\text{-factor}} \cdot N$ N: acting tension load $\delta_{N\infty} = \delta_{N\infty\text{-factor}} \cdot N$										
Effective anchorage depth	$h_{ef} \geq$	[mm]	35		40		50		65	
Cracked concrete										
Factor for displacement	$\delta_{N0\text{-factor}}$	[mm/kN]	0,11		0,06		0,05		0,02	
	$\delta_{N\infty\text{-factor}}$	[mm/kN]	0,27		0,17		0,16		0,08	
Uncracked concrete										
Factor for displacement	$\delta_{N0\text{- factor}}$	[mm/kN]	0,02		0,00		0,001		0,00	
	$\delta_{N\infty\text{- factor}}$	[mm/kN]	0,05		0,05		0,05		0,05	
Displacement under seismic action C2										
Effective anchorage depth	$h_{ef} \geq$	[mm]	40	45	40	60	50	70	65	85
Displacements for DLS	$\delta_{N,\,C2(DLS)}$	[mm]	2,0	2,9	2,6	4,1	3,3	5,7	3,3	5,1
Displacements for ULS	$\delta_{N,\,C2(ULS)}$	[mm]	7,7	11,1	10,8	16,8	10,4	18,0	9,0	13,9

Würth Fixanchor W-FAZ PRO

Performance
Displacements under tension load

Annex C8

Table C10: Displacements under **shear load,** W-FAZ PRO/S (steel, zinc plated)

Fastener size			**W-FAZ PRO/S**							
			M8		**M10**		**M12**		**M16**	
Displacements under static or quasi-static action $\delta_{V0} = \delta_{V0\text{-factor}} \cdot V$ V: acting shear load $\delta_{V\infty} = \delta_{V\infty\text{-factor}} \cdot V$										
Effective anchorage depth	$h_{ef} \geq$	[mm]	35		40		50		65	
Factor for displacement	$\delta_{V0\text{- factor}}$	[mm/kN]	0,15		0,09		0,09		0,07	
	$\delta_{V\infty\text{- factor}}$	[mm/kN]	0,22		0,13		0,14		0,11	
Displacement under seismic action C2 [1)]										
Effective anchorage depth	$h_{ef} \geq$	[mm]	40	45	40	60	50	70	65	85
Displacements for DLS	$\delta_{V,C2(DLS)}$	[mm]	2,8	2,7	3,0	3,1	3,4	3,7	3,4	3,8
Displacements for ULS	$\delta_{V,C2(ULS)}$	[mm]	5,1	5,0	5,0	5,5	6,3	9,9	6,0	9,6

[1)] For anchorages with clearance in the fixture the annular gap must also be considered.

Table C11: Displacements under **shear load,** W-FAZ PRO/A4 and W-FAZ PRO/HCR

Fastener size			**W-FAZ PRO/ A4 / W-FAZ PRO/ HCR**							
			M8		**M10**		**M12**		**M16**	
Displacements under static or quasi-static action $\delta_{V0} = \delta_{V0\text{-factor}} \cdot V$ V: acting shear load $\delta_{V\infty} = \delta_{V\infty\text{-factor}} \cdot V$										
Effective anchorage depth	$h_{ef} \geq$	[mm]	35		40		50		65	
Factor for displacement	$\delta_{V0\text{- factor}}$	[mm/kN]	0,26		0,14		0,12		0,09	
	$\delta_{V\infty\text{- factor}}$	[mm/kN]	0,39		0,20		0,17		0,14	
Displacement under seismic action C2 [1)]										
Effective anchorage depth	$h_{ef} \geq$	[mm]	40	45	40	60	50	70	65	85
Displacements for DLS	$\delta_{V,C2(DLS)}$	[mm]	2,8	3,0	3,4	3,5	3,5	4,2	3,8	4,4
Displacements for ULS	$\delta_{V,C2(ULS)}$	[mm]	5,2	5,1	7,0	8,4	7,5	11,8	7,8	11,1

[1)] For anchorages with clearance in the fixture the annular gap must also be considered.