

English translation prepared by DIBt - Original version in German language

European Technical Approval ETA-99/0011

Handelsbezeichnung Würth Fixanker W-FAZ/S, W-FAZ/A4, W-FAZ/HCR Trade name Würth Fixanker W-FAZ-IG/S, W-FAZ-IG/A4, W-FAZ-IG/HCR Würth Fixanchor W-FAZ/S, W-FAZ/A4, W-FAZ/HCR Würth Fixanchor W-FAZ-IG/S, W-FAZ-IG/A4, W-FAZ-IG/HCR Adolf Würth GmbH & Co. KG Zulassungsinhaber Holder of approval Reinhold-Würth-Straße 12 -17 74653 Künzelsau DEUTSCHLAND Zulassungsgegenstand Kraftkontrolliert spreizender Dübel zur Verankerung im Beton und Verwendungszweck Generic type and use Torque controlled expansion anchor for use in concrete of construction product Geltungsdauer: vom 30 May 2013 Validity: from bis 15 May 2018 to Herstellwerk W1, Deutschland Herstellwerk Manufacturing plant

This Approval contains41 pages including 33 annexesDiese Zulassung ersetztETA-99/0011 mit Geltungsda

Diese Zulassung umfasst

This Approval replaces

ETA-99/0011 mit Geltungsdauer vom 08.03.2011 bis 30.01.2014 ETA-99/0011 with validity from 08.03.2011 to 30.01.2014

41 Seiten einschließlich 33 Anhänge



Europäische Organisation für Technische Zulassungen European Organisation for Technical Approvals



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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 products¹, modified by Council Directive 93/68/EEC² and Regulation (EC) N° 1882/2003 of the European Parliament and of the Council³;
 - 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 1998⁴, as amended by Article 2 of the law of 8 November 2011⁵;
 - Common Procedural Rules for Requesting, Preparing and the Granting of European technical approvals set out in the Annex to Commission Decision 94/23/EC⁶;
 - Guideline for European technical approval of "Metal anchors for use in concrete Part 2: Torque controlled expansion anchors ", ETAG 001-02.
- 2 Deutsches Institut für Bautechnik is authorized to check whether the provisions of this European technical approval are met. Checking may take place in the manufacturing plant. Nevertheless, the responsibility for the conformity of the products to the European technical approval and for their fitness for the intended use remains with the holder of the European technical approval.
- 3 This European technical approval is not to be transferred to manufacturers or agents of manufacturers other than those indicated on page 1, or manufacturing plants other than those indicated on page 1 of this European technical approval.
- 4 This European technical approval may be withdrawn by Deutsches Institut für Bautechnik, in particular pursuant to information by the Commission according to Article 5(1) of Council Directive 89/106/EEC.
- 5 Reproduction of this European technical approval including transmission by electronic means shall be in full. However, partial reproduction can be made with the written consent of Deutsches Institut für Bautechnik. In this case partial reproduction has to be designated as such. Texts and drawings of advertising brochures shall not contradict or misuse the European technical approval.
- 6 The European technical approval is issued by the approval body in its official language. This version corresponds fully to the version circulated within EOTA. Translations into other languages have to be designated as such.

¹ Official Journal of the European Communities L 40, 11 February 1989, p. 12

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

³ Official Journal of the European Union L 284, 31 October 2003, p. 25

Bundesgesetzblatt Teil I 1998, p. 812

⁵ 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 the construction product

The Würth Fixanchor W-FAZ/S, W-FAZ/A4, W-FAZ/HCR and W-FAZ-IG/S, W-FAZ-IG/A4, W-FAZ-IG/HCR is an anchor made of galvanised steel or made of stainless steel or high corrosions resistant steel which is placed into a drilled hole and anchored by torque-controlled expansion. This European technical approval comprises the following anchor types:

- Anchor type W-FAZ with external thread, washer and hexagon nut, sizes M8 to M27,
- Anchor type W-FAZ-IG S with internal thread, hexagon head nut and washer S-IG, sizes M6 to M12,
- Anchor type W-FAZ-IG SK with internal thread, countersunk head screw and countersunk washer SK-IG, sizes M6 to M12,
- Anchor type W-FAZ-IG B with internal thread, hexagon nut and washer MU-IG, sizes M6 to M12.

An illustration of the product and intended use is given in Annexes 1, 2 and 20.

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 may be used for anchorages with requirements related to resistance to fire.

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 C20/25 at least and C50/60 at most according to EN 206:2000-12. It may be anchored in cracked and non-cracked concrete.

Anchor made of galvanised steel:

The anchor made of galvanised steel may only be used in structures subject to dry internal conditions.

Anchor made of stainless steel

The anchor made of stainless steel 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).



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Anchor 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).

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 the product and methods of verification

2.1 Characteristics of the product

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

Regarding the requirements concerning safety in case of fire it is assumed that the anchor meets the requirements of class A1 in relation to reaction to fire in accordance with the stipulations of the Commission decision 96/603/EC, amended by 2000/605/EC.

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

Each Würth Fixanchor W-FAZ is marked in accordance with Annex 3. Each Würth Fixanchor W-FAZ-IG is marked in accordance with Annex 21.

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 2 "Torque-controlled expansion anchors", on the basis of Option 1.

The assessment of the anchor for the intended use in relation to the requirements for resistance to fire has been made in accordance with the technical Report TR 020 "Evaluation of anchorages in concrete concerning resistance to fire".

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.

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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.



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3 Evaluation and attestation of conformity and CE marking

3.1 System of attestation of conformity

According to the decision 96/582/EG of the European Commission⁸ the system 2(i) (referred to as system 1) of attestation of conformity applies.

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 control 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 Bautechnik⁹.

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 for the 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.

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

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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3.2.2 Tasks for the 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.

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 holder of the approval (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 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 Deutsches Institut für Bautechnik before the changes are introduced. Deutsches Institut für Bautechnik will decide whether or not such changes affect the European technical approval and consequently the validity of the CE marking on the basis of the European technical approval and if so whether further assessment or alterations to the European technical approval shall be necessary.



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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

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

or in accordance with

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 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).

The design of anchorages under fire exposure has to consider the conditions given in the technical Report TR 020 "Evaluation of anchorages in concrete concerning resistance to fire". The relevant characteristic anchor values are given in Annexes. The design method covers anchors with a fire attack from one side only. If the fire attack is from more than one side, the design method may be taken only, if the edge distance of the anchor is $c \ge 300$ mm.

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 W-FAZ-IG B according to Annex 20 the commercial standard rod may only be used if the following requirements are fulfilled:
 - Material, Dimensions and mechanical properties according to Annex 22, Table 22,
 - 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,
 - Use of the hexagon nut and washer with special coating as supplied by the holder of the approval.
- Anchor installation in accordance with the manufacturer's specifications and drawings and using the appropriate tools,
- 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,
- Edge distances and spacing not less than 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,



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- Cleaning of the hole of drilling dust,
- Anchor installation such that the effective anchorage depth is complied with. This compliance is ensured when the embedment mark of the anchor does no more exceed the concrete surface,
- Application of the torque moment given in the Annexes using a calibrated torque wrench.

5 Indications to the manufacturer

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

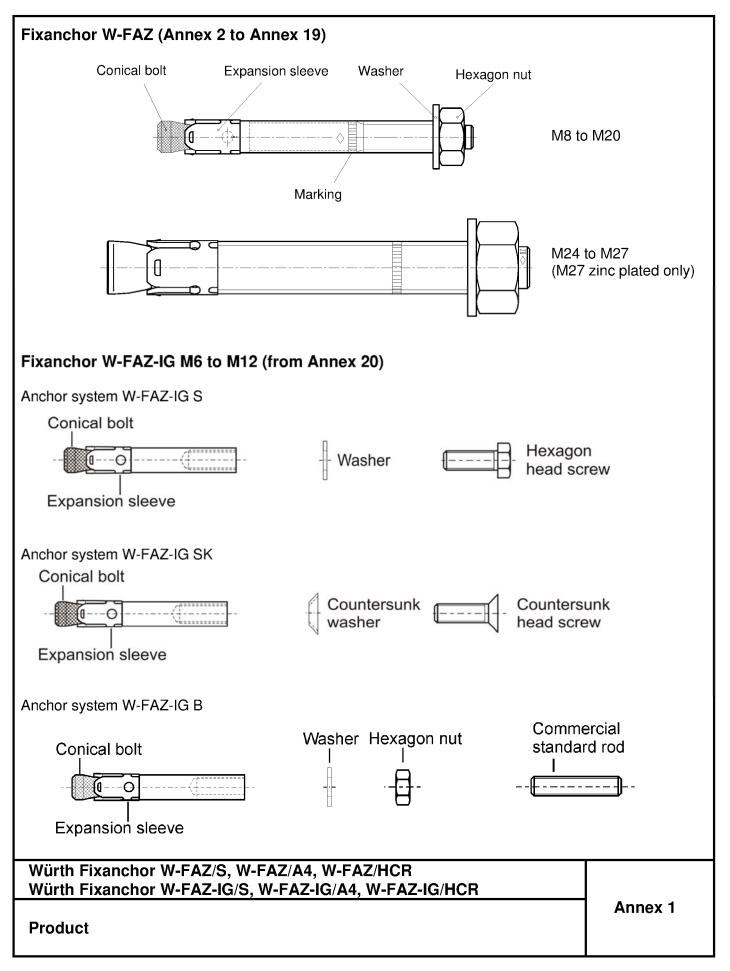
The minimum data required are:

- Diameter of drill bit,
- Thread diameter,
- Maximum diameter of clearance hole in the fixture,
- Maximum thickness of the fixture,
- Minimum effective anchorage depth,
- Minimum hole depth,
- Torque moment,
- Information on the installation procedure, including cleaning of the hole, preferably by means of an illustration,
- Reference to any special installation equipment needed,
- Identification of the manufacturing batch.

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

Uwe Bender Head of Department *beglaubigt:* Baderschneider

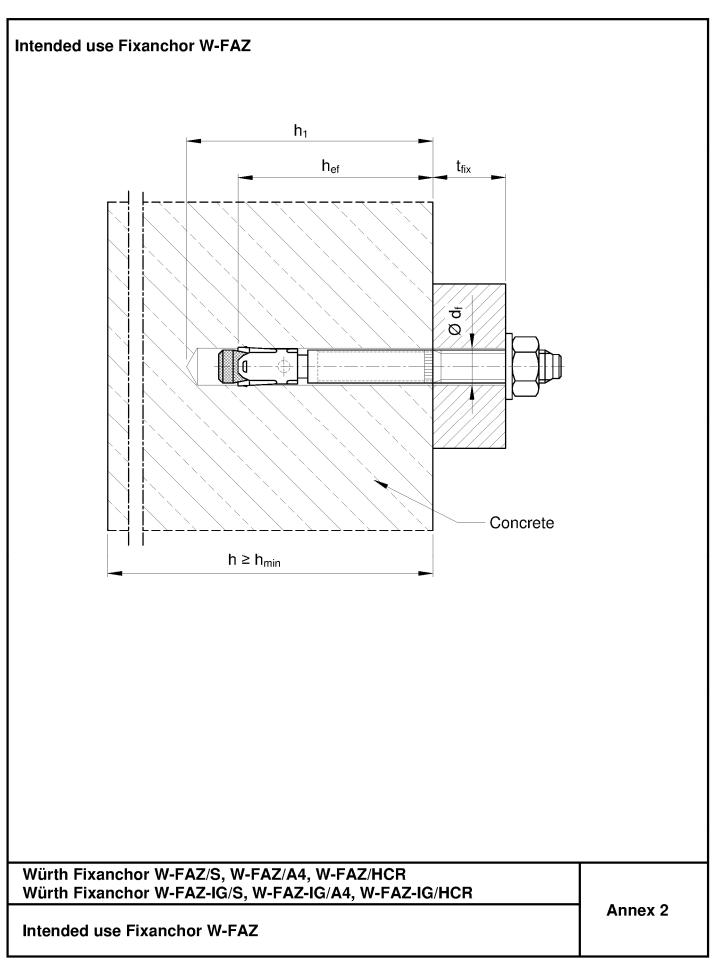




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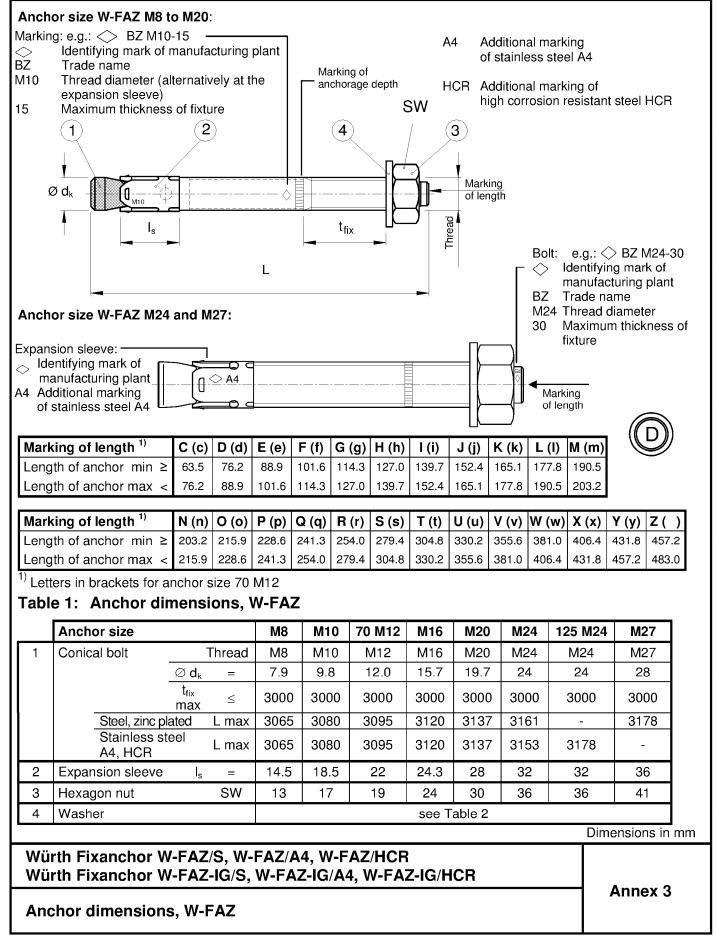




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Tabl	e 2: Materials,	W-FAZ			
Part	Anchor size	Steel, zinc plated M8 to M20	Steel, zinc plated M24 and M27	Stainless steel A4	High corrosion resistant steel (HCR)
1	Conical bolt	Cold formed or machined steel, Cone plastic coated (M8 to M20)	Threaded bolt, steel property class 8.8, EN ISO 898-1 Threaded cone, steel, property class 8, EN ISO 898-2	Stainless steel 1.4401, 1.4404, 1.4571 or 1.4578, EN 10088 Cone plastic coated	High corrosion resistant steel 1.4529 or 1.4565, EN 10088 Cone plastic coated
2	Expansion sleeve	Steel acc. to EN 100 1.4301 or 1.4401 for Steel EN 10139 for	r M8-M20;	Stainless steel 1.4401 or 1.4571, EN 10088	Stainless steel 1.4401 or 1.4571, EN 10088
3	Hexagon nut	Property class 8 acc galvanised, coated	o. to EN ISO 898-2,	ISO 3506, property class 70, stainless steel 1.4401 or 1.4571, EN 10088, coated	ISO 3506, property class 70, high corrosion resistant steel 1.4529 or 1.4565, EN 10088, coated
4	Washer acc. to EN ISO 7089, or EN ISO 7093, or EN ISO 7094	Steel, galvanised		Stainless steel 1.4401 or 1.4571, EN 10088	High corrosion resistant steel 1.4529 or 1.4565, EN 10088

Würth Fixanchor W-FAZ/S, W-FAZ/A4, W-FAZ/HCR Würth Fixanchor W-FAZ-IG/S, W-FAZ-IG/A4, W-FAZ-IG/HCR

Annex 4

Materials, W-FAZ

Deutsches Institut für Bautechnik

Anchor siz	ze			М8	M10	70 M12	M16	M20	M24	125 M24	M27
Nominal dri	ill hole diameter	d_0	[mm]	8	10	12	16	20	24	24	28
Cutting diar	meter of drill bit	$d_{\text{cut}} \leq$	[mm]	8.45	10.45	12.5	16.5	20.55	24.55	24.55	28.55
Depth of	Steel, zinc plated	$h_1 \geq$	[mm]	60	75	90	110	125	145	-	160
drill hole	Stainless steel A4, HCR	$h_1 \ge$	[mm]	60	75	90	110	125	130	160	-
Effective	Steel, zinc plated	h _{ef}	[mm]	46	60	70	85	100	115	-	125
Steel zinc plated Time [Nm]		[mm]	46	60	70	85	100	100	125	-	
Installation	stallation Stainless steel T. [Nm]					45	90	160	200	-	300
torque	Stainless steel A4, HCR	T _{inst}	[Nm]	20	35	50	110	200	200	290	-
Diameter of in the fixture	f clearance hole e	$d_{\rm f} \leq$	[mm]	9	12	14	18	22	26	26	30
h et ¹⁾ t fix ³⁾ t fix ³⁾ t fix ³⁾ t fix ¹⁾ Effective anchorage depth hef ²⁾ Minimum thickness of concrete member h _{min} ³⁾ Thickness of fixture t _{fix}											
							³⁾ Thi	ective anch nimum thic ckness of	horage deg kness of c fixture t _{fix}	oth h _{ef} oncrete me	ember h₁

Würth Fixanchor W-FAZ/S, W-FAZ/A4, W-FAZ/HCR Würth Fixanchor W-FAZ-IG/S, W-FAZ-IG/A4, W-FAZ-IG/HCR

Installation parameters, W-FAZ



Installa	tion instructions, W-FAZ	
1	90°	Drill hole perpendicular to concrete surface.
2		Blow out dust.
3		Drive in anchor.
4		Max. tightening torque T _{inst} shall be applied by using torque wrench.

Würth Fixanchor W-FAZ/S, W-FAZ/A4, W-FAZ/HCR Würth Fixanchor W-FAZ-IG/S, W-FAZ-IG/A4, W-FAZ-IG/HCR

Installation instructions, W-FAZ



Table 4: Standard thickness of concrete member and respective minimum spacing and edge distance, W-FAZ

Anchor size			M8	M10	70 M12	M16	M20	M24	125 M24	M27
Steel zinc plated					<u>. </u>					
Minimum thickness of member	h _{std}	[mm]	100	120	140	170	200	230	-	250
Cracked concrete										
Minimum spacing	S _{min}	[mm]	40	45	60	60	95	100	-	125
	for $c \ge$	[mm]	70	70	100	100	150	180	-	300
Minimum edge distance	C _{min}	[mm]	40	45	60	60	95	100	-	180
	for $s \ge$	[mm]	80	90	140	180	200	220	-	540
Non-cracked concrete										
Minimum spacing	S _{min}	[mm]	40	45	60	65	90	100	-	125
	for c ≥	[mm]	80	70	120	120	180	180	-	300
Minimum edge distance	C _{min}	[mm]	50	50	75	80	130	100	-	180
	for $s \ge$	[mm]	100	100	150	150	240	220	-	540
Stainless steel A4, HCR										
Minimum thickness of member	h _{std}	[mm]	100	120	140	160	200	200	250	-
Cracked concrete										
Minimum spacing	S _{min}	[mm]	40	50	60	60	95	180	125	-
	für c ≥	[mm]	70	75	100	100	150	180	125	-
Minimum edge distance	C _{min}	[mm]	40	55	60	60	95	180	125	-
	für s≥	[mm]	80	90	140	180	200	180	125	-
Non-cracked concrete										
Minimum spacing	S _{min}	[mm]	40	50	60	65	90	180	125	-
	für c ≥	[mm]	80	75	120	120	180	180	125	-
Minimum edge distance	C _{min}	[mm]	50	60	75	80	130	180	125	-
	für s ≥	[mm]	100	120	150	150	240	180	125	-

Intermediate values by linear interpolation.

Table 5: Minimum thickness of concrete of member and respective minimum spacing and edge distance, W-FAZ

Anchor size			M8	M10	70 M12	M16	M20	M24	125 M24	M27
Steel zinc plated and Stainles	s steel A	4, HCR								
Minimum thickness of member	h _{min}	[mm]	80	100	120	140	-	-	-	-
Cracked concrete										
Minimum spacing	S _{min}	[mm]	40	45	60	70	-	-	-	-
	for $c \ge$	[mm]	70	90	100	160	-	-	-	-
Minimum edge distance	C _{min}	[mm]	40	50	60	80	-	-	-	-
	for $s \ge$	[mm]	80	115	140	180	-	-	-	-
Non-cracked concrete										
Minimum spacing	S _{min}	[mm]	40	60	60	80	-	-	-	-
	für c ≥	[mm]	80	140	120	180	-	-	-	-
Minimum edge distance	C _{min}	[mm]	50	90	75	90	-	-	-	-
	für s ≥	[mm]	100	140	150	200	-	-	-	-
ntermediate values by linear interpo	lation.									
Würth Fixanchor W-FAZ						R				
	ürth Fixanchor W-FAZ-IG/S, W-FAZ-IG/A4, W-FAZ-IG/HCR inimum thickness of member, inimum spacing and edge distance, W-FAZ									ex 7



Table 6: Characteristic values for tension loads, ETAG 001, Annex C, W-FAZ, steel zinc plated

Anchor size			M8	M10	70 M12	M16	M20	M24	M27
Steel failure									
Characteristic resistance	N _{Rk,s}	[kN]	16	27	40	60	86	126	196
Partial safety factor	γ̈́Ms	[-]	1.	.53	1.	5	1.6	1.	5
Pullout									
Characteristic resistance in cracked concrete C20/25	N _{Rk,p}	[kN]	5	9	16	25	3)	3)	3)
Characteristic resistance in non-cracked concrete C20/25	N _{Rk,p}	[kN]	12	16	25	35	3)	3)	3)
Splitting for standard thickness of	i concrete n	nember	·(The high	her resista	nce of Cas	e 1 and C	ase 2 may	be applie	d.)
Standard thickness of concrete	h _{std} ≥	[mm]	100	120	140	170	200	230	250
Case 1									
Characteristic resistance in concrete C20/25	$N^0_{Rk,sp}$	[kN]	9 ¹⁾	12 ¹⁾	20 ¹⁾	30 ¹⁾	40 ¹⁾	3)	50 ¹⁾
Respective spacing	S _{cr,sp}	[mm]				3 h _{ef}			
Respective edge distance	C _{cr,sp}	[mm]				1.5 h _{ef}			
Case 2									
Characteristic resistance in concrete C20/25	${\sf N}^0_{\sf Rk,sp}$	[kN]	12 ¹⁾	16 ¹⁾	25 ¹⁾	35 ¹⁾	3)	3)	3)
Respective spacing	S _{cr,sp} ²⁾	[mm]		4	↓ h _{ef}		4.4 h _{ef}	3 h _{ef}	5 h _{ef}
Respective edge distance	C _{cr,sp} ²⁾	[mm]		2	2 h _{ef}		2.2 h _{ef}	1.5 h _{ef}	2.5 h _{ef}
Splitting for minimum thickness o			r						
Minimum thickness of concrete	h _{min} ≥	[mm]	80	100	120	140	-	-	-
Characteristic resistance in concrete C20/25	$N^0_{Rk,sp}$	[kN]	12 ¹⁾	16 ¹⁾	25 ¹⁾	35 ¹⁾	-	-	-
Respective spacing	S _{cr,sp} ²⁾	[mm]		5	h _{ef}		-	-	-
Respective edge distance	C _{cr,sp} ²⁾	[mm]		2.5	5 h _{ef}		-	-	-
Increasing factors	C30/37	[-]				1.22			
for $N_{Rk,p}$ and $N^0_{Rk,sp}$ ψ_C	C40/50	[-]				1.41			
	C50/60	[-]				1.55			
Concrete cone failure									
Effective anchorage depth	h _{ef}	[mm]	46	60	70	85	100	115	125
Spacing	S _{cr,N}	[mm]				3 h _{ef}			
Edge distance	C _{cr,N}	[mm]				1.5 h _{ef}			
Partial safety factor YM	o= γ _{Msp} =γ _{Mc}	[-]				1.5			

¹⁾ For the proof against splitting failure according to ETAG 001, Annex C, $N_{Rk,c}^0$ in equation (5.3) has to be replaced by $N_{Rk,sp}^0$ with consideration of the member thickness ($\psi_{ucr,N} = 1.0$).

²⁾ The values $s_{cr,sp}$ and $c_{cr,sp}$ may be linearly interpolated for the member thickness $h_{min} < h < h_{std}$ (Case 2) ($\psi_{h,sp}$ = 1.0).

³⁾ Pullout is not decisive

Würth Fixanchor W-FAZ/S, W-FAZ/A4, W-FAZ/HCR Würth Fixanchor W-FAZ-IG/S, W-FAZ-IG/A4, W-FAZ-IG/HCR	
Characteristic values for tension loads, ETAG 001, Annex C, W-FAZ, steel zinc plated	Annex 8



Characteristic values for tension loads, ETAG 001, Annex C, W-FAZ, Table 7: stainless steel A4, HCR

Anchor size			M8	M10	70 M12	M16	M20	M24	125 M24
Steel failure									
Characteristic resistance	N _{Rk,s}	[kN]	16	27	40	64	108	11	0
Partial safety factor	γMs	[-]		1	.5		1.68	1.	5
Pullout									
Characteristic resistance in cracked concrete C20/25	N _{Rk,p}	[kN]	5	9	16	25	3)	3)	40
Characteristic resistance in non-cracked concrete C20/25	N _{Rk,p}	[kN]	12	16	25	35	3)	3)	3)
Splitting for standard thickness of	concrete n	nember	(The high	ner resista	nce of Cas	e 1 and C	ase 2 may	be applied	d.)
Standard thickness of concrete	h _{std} ≥	[mm]	100	120	140	160	200	200	250
Case 1									
Characteristic resistance in concrete C20/25	N ⁰ Rk,sp	[kN]	9 ¹⁾	12 ¹⁾	20 ¹⁾	30 ¹⁾	40 ¹⁾	-	-
Respective spacing	S _{cr,sp}	[mm]			3 h _{ef}			-	-
Respective edge distance	C _{cr,sp}	[mm]			1.5 h _{ef}			-	-
Case 2									
Characteristic resistance in concrete C20/25	${\sf N}^0_{\sf Rk,sp}$	[kN]	12 ¹⁾	16 ¹⁾	25 ¹⁾	35 ¹⁾	3)	3)	3)
Respective spacing	S _{cr,sp} ²⁾	[mm]	230	250	280	400	440	600	500
Respective edge distance	C _{cr,sp} ²⁾	[mm]	115	125	140	200	220	300	250
Splitting for minimum thickness o	f concrete r	nembei	r						
Minimum thickness of concrete	h _{min} ≥	[mm]	80	100	120	140	-	-	-
Characteristic resistance in concrete C20/25	N ⁰ _{Rk,sp}	[kN]	12 ¹⁾	16 ¹⁾	25 ¹⁾	35 ¹⁾	-	-	-
Respective spacing	S _{cr,sp} ²⁾	[mm]		5	h _{ef}		-	-	-
Respective edge distance	C _{cr,sp} ²⁾	[mm]		2.5	h _{ef}		-	-	-
Increasing factors	C30/37	[-]				1.22			
for $N_{Rk,p}$ and $N_{Rk,sp}^0$ ψ_C	C40/50	[-]				1.41			
	C50/60	[-]				1.55			
Concrete cone failure									
Effective anchorage depth	h _{ef}	[mm]	46	60	70	85	100	100	125
Spacing	S _{cr,N}	[mm]				3 h _{ef}	•		•
Edge distance	C _{cr,N}	[mm]				1.5 h _{ef}			
	= γ _{Msp} =γ _{Mc}	[-]				1.5			

1) For the proof against splitting failure according to ETAG 001, Annex C, N⁰_{Rk,c} in equation (5.3) has to be replaced by N⁰_{Rk,sp} with consideration of the member thickness ($\psi_{ucr,N} = 1.0$).

²⁾ The values $s_{cr,sp}$ and $c_{cr,sp}$ may be linearly interpolated for the member thickness $h_{min} < h < h_{std}$ (Case 2) ($\psi_{h,sp}$ = 1.0). ³⁾ Pullout is not decisive

Würth Fixanchor W-FAZ/S, W-FAZ/A4, W-FAZ/HCR	
Würth Fixanchor W-FAZ-IG/S, W-FAZ-IG/A4, W-FAZ-IG/HCR Characteristic values for tension loads, ETAG 001, Annex C, W-FAZ, stainless steel A4, HCR	Annex 9



Anchor size			M8	M10	70 M12	M16	M20	M24	125 M24	M27
Steel zinc plated										
Tension load in cracked concrete	Ν	[kN]	2.4	4.3	7.6	11.9	17.1	21.1	-	24
Displacement	δ_{N0}	[mm]	0.6	1.0	0.4	1.0	0.9	0.7	-	0.9
	δ_{N^∞}	[mm]	1.4	1.2	1.4	1.3	1.0	1.2	-	1.4
Tension load in non-cracked concrete	Ν	[kN]	5.7	7.6	11.9	16.7	23.8	29.6	-	34
Displacement	δ_{N0}	[mm]	0.4	0.5	0.7	0.3	0.4	0.5	-	0.3
	δ_{N^∞}	[mm]	0.	8	1.4		0.8		-	1.4
Stainless steel A4, HCF	}									
Tension load in cracked concrete	Ν	[kN]	2.4	4.3	7.6	11.9	17.1	17.0	19.0	-
Displacement	δ_{N0}	[mm]	0.7	1.8	0.4	0.7	0.9	0.5	0.5	-
	δ_{N^∞}	[mm]	1.2	1.4	1.4	1.4	1.0	1.6	1.8	-
Tension load in non-cracked concrete	Ν	[kN]	5.8	7.6	11.9	16.7	23.8	24.1	33.5	-
Displacement	δ_{N0}	[mm]	0.6	0.5	0.7	0.2	0.4	1.5	0.5	-
	δ_{N^∞}	[mm]	1.2	1.0	1.4	0.4	0.8	1.1	1.1	_

Würth Fixanchor W-FAZ/S, W-FAZ/A4, W-FAZ/HCR Würth Fixanchor W-FAZ-IG/S, W-FAZ-IG/A4, W-FAZ-IG/HCR

Displacements under tension loads, W-FAZ



Table 9: Characteristic	values	s for s	shear	loads,	ETAG	001, A	nnex(C, W-F	AZ	
Anchor size			M8	M10	70 M12	M16	M20	M24	125 M24	M27
Steel failure without lever arm, S	teel zinc	plated								
Characteristic resistance	$V_{Rk,s}$	[kN]	15	22	30	60	69	114	-	169.4
Partial safety factor	γMs	[-]		1	.25		1.33	1.25	-	1.25
Steel failure without lever arm, S	tainless	steel A	4, HCR							
Characteristic resistance	$V_{Rk,s}$	[kN]	13	20	30	55	86	123	.6	-
Partial safety factor	γ̂Ms	[-]		1	.25		1.4	1.	25	-
Steel failure with lever arm, Steel	zinc pla	ited								
Characteristic bending resistance	M ⁰ _{Rk,s}	[Nm]	23	47	82	209	363	898	-	1331.5
Partial safety factor	γ̃Ms	[-]		. 1	.25		1.33	1.25	-	1.25
Steel failure with lever arm, Stain	less ste	el A4, l	HCR							
Characteristic bending resistance	M ⁰ _{Rk,s}	[Nm]	26	52	92	233	454	785	.4	-
Partial safety factor	γ́Ms	[-]		. 1	.25		1.4	1.	25	-
Concrete pryout failure										
Factor in equation (5.6) ETAG 001, Annex C, 5.2.3.3	k	[-]				2.0				
Partial safety factor	γмср	[-]				1.5				
Concrete edge failure										
Effective length Steel zinc plated	l _f	[mm]	46	60	70	85	100	115	-	125
of anchor in Stainless steel A4, shear loading HCR	l _f	[mm]	46	60	70	85	100	100	125	-
Outside diameter of anchor	d _{nom}	[mm]	8	10	12	16	20	2	4	27
Partial safety factor	γмс	[-]				1.	5			

Table 10: Displacements under shear loads, W-FAZ

Anchor size			M8	M10	70 M12	M16	M20	M24	125 M24	M27
Steel zinc plated										
Shear load in cracked and non-cracked concrete	V	[kN]	8.6	12.6	17.1	34.3	36.8	64.9	-	96.8
Displacement	δ_{V0}	[mm]	2.3	2.2	2.2	4.0	1.8	3.5	-	3.6
	δ_{V^∞}	[mm]	3.5	3.3	3.4	6.0	2.7	5.3	-	5.4
Stainless steel A4, HCR							•			
Shear load in cracked and non-cracked concrete	۷	[kN]	7.3	11.6	16.9	31.3	43.8	70	.6	-
Displacement	δ_{V0}	[mm]	3.2	4.4	5.2	6.5	2.9	2.	8	-
-	δ_{V^∞}	[mm]	4.8	6.6	7.8	9.8	4.3	4.	2	-

Würth Fixanchor W-FAZ/S, W-FAZ/A4, W-FAZ/HCR Würth Fixanchor W-FAZ-IG/S, W-FAZ-IG/A4, W-FAZ-IG/HCR

Characteristic values for shear loads, ETAG 001, Annex C, Displacements under shear loads, W-FAZ

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And the selection of the selection	Table 11: Characteristic value Table 11: Characteristic value Anchor size Ms Fire resistance R Anchor size Ms Fire resistance R Anchor size Ms Fire resistance R Anchor size Ms Anchor size Ms Anchor size Ms Steel failure Ms Steel failure Ms Pullout failure Ms Concrete NNs.p.fi V2. 1.4 1.1 0.8 0.7 Concrete NN Nek.p.fi 7.3 2.9 2.0 1.0 Concrete NN Nek.p.fi 7.3 2.6 2.1 Sconscie KNI Nature 2.6 2.1 2.6 2.1 Bacing and Scr.N.fi 1.3 2.6 2.1 2.6 2.1 Sconscie KNI Nature 2.6 2.1 2.6 2.1 Bacing acting and Scr.N.fi 1.3 2.6 2.1 <t< th=""><th>Stance Stance 120/25 t</th><th>under fire under fire M16 30 60 90 90 6.3 4.4 6.3 10.5 12.0 10.5 4 x he 2 x he 2 x he 10 gt o Anne></th><th>Exposur ETAG00 I20 30 60 7.8 33.5 25.0 5.0 9.0 9.0 9.6 18.0 Annex 7 Annex 7</th><th>e in 20 20 120 120 120 120 120 120 120 120 1</th><th>4 0 - 4 - 4 - 7</th><th>M27 0 60 90 120 7.6 15.3 13.0 11.8 7.6 15.3 13.0 11.8 31.5 25.2</th></t<>	Stance Stance 120/25 t	under fire under fire M16 30 60 90 90 6.3 4.4 6.3 10.5 12.0 10.5 4 x he 2 x he 2 x he 10 gt o Anne>	Exposur ETAG00 I20 30 60 7.8 33.5 25.0 5.0 9.0 9.0 9.6 18.0 Annex 7 Annex 7	e in 20 20 120 120 120 120 120 120 120 120 1	4 0 - 4 - 4 - 7	M27 0 60 90 120 7.6 15.3 13.0 11.8 7.6 15.3 13.0 11.8 31.5 25.2
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18.6 68.0 20 ï ī 69.0 19.0 6 ï ī M27 72.0 19.8 80 i. . 20.6 75.0 30 . ï in cracked and non-cracked concrete C20/25 to C50/60, ETAG001, Annex C, W-FAZ 46.0 55.5 14.0 17.4 20 M24 / 125 M24 A4 23.6 47.0 15.0 75.1 6 48.0 53.5 114.3 15.0 35.9 60 50.0 16.0 48.2 30 In Equation (5.6) of ETAG 001, Annex C, 5.2.3.3 the k-factor 2.0 and the relevant values of N⁰ ek.c.f of Table 11 have to be considered. 10.0 26.0 20 2 32.1 The initial value V⁰_{Pkcfi} of the characteristic resistance in concrete C20/25 to C50/60 under fire exposure may be determined by: 10.0 27.0 43.4 6.4 6 M20 11.0 25.0 28.0 66.1 80 $V^{0}_{Rk,c,fi} = 0.20 \times V^{0}_{Rk,c} (R120)$ In absence of other national regulations the partial factor for resistance under fire exposure $\gamma_{M,ii} = 1.0$ recommended. 33.5 88.8 11.0 29.0 30 with $V_0^{R_{k,c}}$ initial value of the characteristic resistance in cracked concrete C20/25 under normal temperature. 16.4 7.8 13.0 20 6.4 10.5 22.2 6.5 14.0 Characteristic shear resistance under fire exposure 60 M16 16.0 14.0 33.9 6.8 60 21.5 7.0 45.5 15.0 30 4.2 6.5 20 3.4 5.3 3.5 5.6 8.8 70 M12 5.4 6 13.3 3.6 8.6 5.6 V⁰_{Rkc.fl} = 0.25 x V⁰_{Rk.c} (R30, R60, R90) 60 11.5 17.9 3.8 30 5.9 3.4 2.0 20 2.7 2.5 9.0 6.8 4.5 M10 8 6.9 5.2 3.5 3.3 3.2 2.7 2.6 2.5 2.1 60 30 1.6 20 1.0 1.6 1.2 2.0 4 N 2.1 6 81 1.5 1.6 2.9 2.9 60 9.1 3.8 1.7 3.8 8 Steel failure without lever arm A4 / HCR A4 / HCR arm ۲Ż. ۲Z. concrete pryout failure: M⁰_{Rk,s,fi}_ Steel failure with lever Concrete edge failure: V_{Rk,s,fi} [kN] R... [min] Fire resistance Anchor size Characteristic Characteristic **Fable 12:** resistance esistance duration Würth Fixanchor W-FAZ/S, W-FAZ/A4, W-FAZ/HCR Würth Fixanchor W-FAZ-IG/S, W-FAZ-IG/A4, W-FAZ-IG/HCR

English translation prepared by DIBt





Characteristic values for tension loads, CEN/TS 1992-4, W-FAZ, steel zinc Table 13: plated

•					1				
Anchor size			M8	M10	70 M12	M16	M20	M24	M27
Steel failure		1		1	· · · ·		T	r	.
Characteristic resistance	N _{Rk,s}	[kN]	16	27	40	60	86	126	196
Partial safety factor	γMs	[-]	1.	.53	1.	5	1.6	1.	.5
Pullout									
Characteristic resistance in cracked concrete C20/25	N _{Rk,p}	[kN]	5	9	16	25	3)	3)	3)
Characteristic resistance in non-cracked concrete C20/25	N _{Rk,p}	[kN]	12	16	25	35	3)	3)	3)
Splitting for standard thickness of	of concrete n	nembei	r (The high	ner resista	ince of Cas	e 1 and C	ase 2 may	be applie	d.)
Standard thickness of concrete	h _{std} ≥	[mm]	100	120	14	170	200	230	250
Case 1									
Characteristic resistance in concrete C20/25	N ⁰ Rk,sp	[kN]	9 ¹⁾	12 ¹⁾	20 ¹⁾	30 ¹⁾	40 ¹⁾	3)	50 ¹⁾
Respective spacing	S _{cr,sp}	[mm]				3 h _{ef}			
Respective edge distance	C _{cr,sp}	[mm]				1.5 h _{ef}			
Case 2	·								
Characteristic resistance in concrete C20/25	$N^0_{Rk,sp}$	[kN]	12 ¹⁾	16 ¹⁾	25 ¹⁾	35 ¹⁾	3)	3)	3)
Respective spacing	S _{cr,sp} ²⁾	[mm]		. 4	⊦ h _{ef}		4.4 h _{ef}	3 h _{ef}	5 h _{ef}
Respective edge distance	C _{cr,sp} ²⁾	[mm]		2	2 h _{ef}		2.2 h _{ef}	1.5 h _{ef}	2.5 h _{ef}
Splitting for minimum thickness of	of concrete r	nembe	r				1	l.	<u> </u>
Minimum thickness of concrete	h _{min} ≥	[mm]	80	100	120	140	-	-	-
Characteristic resistance in concrete C20/25	N ⁰ _{Rk,sp}	[kN]	12 ¹⁾	16 ¹⁾	25 ¹⁾	35 ¹⁾	-	-	-
Respective spacing	S _{cr.sp} ²⁾	[mm]		. 5	5 h _{ef}		-	-	-
Respective edge distance	C _{cr,sp} ²⁾	[m]		2.5	5 h _{ef}		-	-	-
Increa ing factors	C30/37	[-				1.22			<u> </u>
for $N_{Rk,p}$ and $N_{Rk,sp}^{0}$ ψ_{C}	C40/50	[-]				1.41			
τοι τηκ,ρ απο τη τικ,sp το	C50/60	[-]				1.55			
Concrete cone failure									
Effective anchorage depth	h _{ef}	[mm]	46	60	70	85	100	115	125
Spacing	S _{cr.N}	[mm]				3 h _{ef}			<u>_</u>
Edge distance	C _{cr.N}	[mm]				1.5 h _{ef}			
	1p= γ _{Msp} =γ _{Mc}	[-]				1.5			
	$\mu = 100 \text{ sp} = 100 \text{ c}$	LJ				1.0			

¹⁾ For the proof against splitting failure according to CEN/TS 1992-4-4, N⁰_{Rk,c} in equation (12) has to be replaced by N⁰_{Rk,sp} with consideration of the member thickness ($\psi_{ucr,N} = 1.0$).

²⁾ The values $s_{cr,sp}$ and $c_{cr,sp}$ may be linearly interpolated for the member thickness $h_{min} < h < h_{std}$ (Case 2) ($\psi_{h,sp}$ = 1.0). ³⁾ Pullout is not decisive

Würth Fixanchor W-FAZ/S, W-FAZ/A4, W-FAZ/HCR Würth Fixanchor W-FAZ-IG/S, W-FAZ-IG/A4, W-FAZ-IG/HCR	
Characteristic values for tension loads, CEN/TS 1992-4, W-FAZ, steel zinc plated	Annex 14



Characteristic values for tension loads, CEN/TS 1992-4, W-FAZ, stainless Table 14: steel A4, HCR

Anchor size			M8	M10	70 M12	M16	M20	M24	125 M24
Steel failure									
Characteristic resistance	N _{Rk,s}	[kN]	16	27	40	64	108	11	0
Partial safety factor	γMs	[-]		1	.5		1.68	1.	.5
Pullout									
Characteristic resistance in cracked concrete C20/25	N _{Rk,p}	[kN]	5	9	16	25	3)	3)	40
Characteristic resistance in non-cracked concrete C20/25	N _{Rk,p}	[kN]	12	16	25	35	3)	3)	3)
Splitting for standard thickness of c	concrete m	nember	(The high	ner resista	ince of Cas	e 1 and C	ase 2 may	be applie	d.)
Standard thickness of concrete	h _{std} ≥	[mm]	100	120	140	160	200	200	250
Case 1									
Characteristic resistance in concrete C20/25	${\sf N}^0{}_{\sf Rk,sp}$	[kN]	9 ¹⁾	12 ¹⁾	20 ¹⁾	30 ¹⁾	40 ¹⁾	-	-
Respective spacing	S _{cr,sp}	[mm]			3	h _{ef}		-	-
Respective edge distance	C _{cr,sp}	[mm]			1.5	h _{ef}		-	-
Case 2									
Characteristic resistance in concrete C20/25	N ⁰ _{Rk,sp}	[kN]	12 ¹⁾	16 ¹⁾	25 ¹⁾	35 ¹⁾	3)	3)	3)
Respective spacing	S _{cr,sp} ²⁾	[mm]	230	250	280	400	440	600	500
Respective edge distance	C _{cr,sp} ²⁾	[mm]	115	125	140	200	220	300	250
Splitting for minimum thickness of e	concrete n	nember	•						
Minimum thickness of concrete	h _{min} ≥	[mm]	80	100	120	140	-	-	-
Characteristic resistance in concrete C20/25	N ⁰ _{Rk,sp}	[kN]	12 ¹⁾	16 ¹⁾	25 ¹⁾	35 ¹⁾	-	-	-
Respective spacing	S _{cr,sp} ²⁾	[mm]		5	5 h _{ef}		-	-	-
Respective edge distance	C _{cr,sp} ²⁾	[mm]		2.5	5 h _{ef}		-	-	-
Increasing factors	C30/37	[-]				1.22			
for N _{Rk,p} and N ⁰ _{Rk,sp} ψc	C40/50	[-]				1.41			
	C50/60	[-]				1.55			
Concrete cone failure									
Effective anchorage depth	h _{ef}	[mm]	46	60	70	85	100	100	125
Spacing	S _{cr,N}	[mm]				3 h _{ef}			
Edge distance	C _{cr,N}	[mm]				1.5 h _{ef}			
Partial safety factor γ _{Mp} =	γ _{Msp} =γ _{Mc}	[-]				1.5			

¹⁾ For the proof against splitting failure according to CEN/TS 1992-4-4, N⁰_{Rk,c} in equation (12) has to be replaced by N⁰_{Rk,sp} with consideration of the member thickness ($\psi_{ucr,N} = 1.0$).

²⁾ The values $s_{cr,sp}$ and $c_{cr,sp}$ may be linearly interpolated for the member thickness $h_{min} < h < h_{std}$ (Case 2) ($\psi_{h,sp}$ = 1.0). ³⁾ Pullout is not decisive

Würth Fixanchor W-FAZ/S, W-FAZ/A4, W-FAZ/HCR Würth Fixanchor W-FAZ-IG/S, W-FAZ-IG/A4, W-FAZ-IG/HCR	
Characteristic values for tension loads, CEN/TS 1992-4, W-FAZ, stainless steel A4, HCR	Annex 15



Anchor size			M8	M10	70 M12	M16	M20	M24	125 M24	M27
Steel zinc plated										
Tension load in cracked concrete	Ν	[kN]	2.4	4.3	7.6	11.9	17.1	21.1	-	24
Displacement	δ_{N0}	[mm]	0.6	1.0	0.4	1.0	0.9	0.7	-	0.9
	δ_{N^∞}	[mm]	1.4	1.2	1.4	1.3	1.0	1.2	-	1.4
Tension load in non-cracked concrete	Ν	[kN]	5.7	7.6	11.9	16.7	23.8	29.6	-	34
Displacement	δ _{N0}	[mm]	0.4	0.5	0.7	0.3	0.4	0.5	-	0.3
	δ_{N^∞}	[mm]	0.	.8	1.4		0.8		-	1.4
Stainless steel A4, HCR	l									
Tension load in cracked concrete	Ν	[kN]	2.4	4.3	7.6	11.9	17.1	17.0	19.0	-
Displacement	δ_{N0}	[mm]	0.7	1.8	0.4	0.7	0.9	0.5	0.5	-
	δ_{N^∞}	[mm]	1.2	1.4	1.4	1.4	1.0	1.6	1.8	-
Tension load in non-cracked concrete	Ν	[kN]	5.8	7.6	11.9	16.7	23.8	24.1	33.5	-
Displacement	δ _{N0}	[mm]	0.6	0.5	0.7	0.2	0.4	1.5	0.5	-
	$\delta_{N^{\infty}}$	[mm]	1.2	1.0	1.4	0.4	0.8	1.1	1.1	-

Würth Fixanchor W-FAZ/S, W-FAZ/A4, W-FAZ/HCR Würth Fixanchor W-FAZ-IG/S, W-FAZ-IG/A4, W-FAZ-IG/HCR

Displacements under tension loads, W-FAZ



Anchor size				M8	M10	70 M12	M16	M20	M24	125 M24	M27
Steel failure witho	ut lever arm, Ste	el zinc	plated			·					
Characteristic resist	tance	$V_{Rk,s}$	[kN]	15	22	30	60	69	114	-	169.4
Factor of ductility		k ₂	[-]			1.0	0			-	1.0
Partial safety factor		γ_{Ms}	[-]		1	.25		1.33	1.25	-	1.25
Steel failure witho	ut lever arm, Sta	linless :	steel A4	I, HCR							
Characteristic resist	tance	$V_{Rk,s}$	[kN]	13	20	30	55	86	123	.6	-
Factor of ductility		k ₂	[-]				1.0				-
Partial safety factor		γ_{Ms}	[-]		1	.25		1.4	1.	.25	-
Steel failure with l	ever arm, Steel z	-									
Characteristic bend	ing resistance	${\sf M}^0{}_{\sf Rk,s}$		23	47	82	209	363	898	-	1331.5
Partial safety factor		γ _{Ms}	[-]		1	.25		1.33	1.25	-	1.25
Steel failure with l	ever arm, Stainle	∋ss ste €	୬I A4, H0	CR							
Characteristic bend	ing resistance	M ⁰ _{Rk,s}	[Nm]	26	52	92	233	454	785	.4	-
Partial safety factor		γ́Ms	[-]		1	.25		1.4	1.	.25	-
Concrete pryout fa											
Factor in equation (CEN/TS 1992-4-4,		k ₃	[-]				2.	0			
Partial safety factor		γмср	[-]				1.	5			
Concrete edge fail	lure										
Effective length of	Steel zinc plated	۱ _f	[mm]	46	60	70	85	100	115	-	125
anchor in shear loading	Stainless steel A4, HCR	۱ _f	[mm]	46	60	70	85	100	100	125	-
Outside diameter of	f anchor	\mathbf{d}_{nom}	[mm]	8	10	12	16	20	2	4	27
Partial safety factor	,	ŶMc	[-]				1.	5			

Table 17: Displacements under shear loads, W-FAZ

Anchor size			M8	M10	70 M12	M16	M20	M24	125 M24	M27
Steel zinc plated										
Shear load in cracked and non-cracked concrete	V	[kN]	8.6	12.6	17.1	34.3	36.8	64.9	-	96.8
Displacement	δ_{V0}	[mm]	2.3	2.2	2.2	4.0	1.8	3.5	-	3.6
	$\delta_{V^{\infty}}$	[mm]	3.5	3.3	3.4	6.0	2.7	5.3	-	5.4
Stainless steel A4, HCR				•						
Shear load in cracked and non-cracked concrete	V	[kN]	7.3	11.6	16.9	31.3	43.8	70	.6	-
Displacement	δ _{vo}	[mm]	3.2	4.4	5.2	6.5	2.9	2.	.8	-
	δ _{V∞}	[mm]	4.8	6.6	7.8	9.8	4.3	4.	.2	-

Würth Fixanchor W-FAZ/S, W-FAZ/A4, W-FAZ/HCR Würth Fixanchor W-FAZ-IG/S, W-FAZ-IG/A4, W-FAZ-IG/HCR

Characteristic values for shear loads, CEN/TS 1992-4, Displacements under shear loads, W-FAZ

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English translation prepared by DIBt



Table 18: Characteristic Naksif Ville 18: Characteristic Anchor size Fire resistance R Anchor size Erectode Anchor size Fire resistance R Anchor size Erectode Anchor size Fire resistance R.N. Maksif Ville Steel failure Steel failure Naksif Ville Characteristic Naksif Ville Ville Characteristic Naksif Ville Ville Characteristic Naksif Ville Ville Concrete C20/25 [kN] Anchor size Maksif Ville Concrete C20/25 [kN] Anchor size Ville Ville Concrete C20/26 [kN] Anchor size Ville Ville Concrete C20/26 [kN] Anchor size Ville Ville Spacing Ser.N.fi Ser.N.fi H Anchor size No Ville Ville Ville Minimum spacing and siztance under fine Minimum spacing and siztance under fine Ville Ville Partial safety YM, fine Factor	Characteristic values of tension resistance under fire exposure in cracked and non-cracked concrete C20/25 to C 50/60, CENTS 1992-4, W-FAZ R:::::::::::::::::::::::::::::::::::	Stic v3 MB nd non 60 90 60 90 60 90 2:6	Aalue 120 2.1 2.1	30 30 4 0 4 0 4 0 4 0 4 0 4 0 4 0 4 0 4	If tens ed cc ed cc 5.0 5.0	Sion 120 4.0	Image: Solution resistance under fire exposure in racked concrete C20/25 to C 50/60, CEN/TS 199 MIO TO MI2 MIE MIE MIO TO M12 MIE MIE TO M12 MIE MIE MEE TO M12 MIE MIE MIE TO M12 MIE MIE MEE TO M12 MIE MIE <th colspa<="" th=""><th>sistanc 2.8 2.4 2 3. 4.0 3 3. 4.0 3 3. 4.0 3 5.6 4 2.8 2.4 2 7.4 5 7.4 7 7.4 7 7.5 7 7.5</th><th>25 to C 25 to C 2.2 6.0 30 4.2 21.5 5.9 5.9 Ac</th><th>6.3 6.3 6.3 Mi Mi</th><th>tance under fire exposure in 20/25 to C 50/60, CEN/TS 1995 M12 M16 M20 90 120 30 60 90 91 20 30 60 90 90 21.5 16.0 10.5 7.8 33.5 25.0 16.4 2.9 6.3 5.0 9.0 9.0 9.0 9.0 3.2 6.3 5.0 9.0 9.0 9.0 9.0 3.2 6.3 5.0 9.0 9.0 9.0 9.0 3.2 5.9 12.0 9.6 9.0 9.0 9.0 3.2 5.9 12.0 9.6 9.0 9.0 5.9 12.0 9.6 9.0 9.0 9.0 5.9 12.0 9.6 9.0 9.0 9.0 5.9 12.0 9.6 9.0 9.0 9.0 5.9 12.0 9.0 9.0 9.0 9.0 5.9 12.0 9.0 9.0 9.0 9.0 5.0 12.0<!--</th--><th>CEED CEED CEED CEED CEED CEED CEED</th><th>Possu 33.522 33.522 anim 1</th><th>Urre ii M20 9:0 9:0 9:0 9:0 18:0 18:0</th><th>e in 300 - 4, 12.1 16.4 12.1 14.4 11.4 12.1 14.4 11.4 11.4 11</th><th>1 1 1 1 1 1 1 1 1 1</th><th>M24/125 M24 A4 M24/125 M24 A4 30 60 90 120 31.5¹ 11.0 8.8 11.0 8.8 17.4 11.0 8.8 17.4 11.0 11.0 14.4 11.1 25.5 20.4 11.1 11.4 11.4 11.1 25.5 20.4 25.5 20.4 25.5 20.4</th><th></th><th></th><th>MI 30 60 31.5 31.5</th><th>M27 5: 6: 6: 7: 7:</th><th>25.2</th></th></th>	<th>sistanc 2.8 2.4 2 3. 4.0 3 3. 4.0 3 3. 4.0 3 5.6 4 2.8 2.4 2 7.4 5 7.4 7 7.4 7 7.5 7 7.5</th> <th>25 to C 25 to C 2.2 6.0 30 4.2 21.5 5.9 5.9 Ac</th> <th>6.3 6.3 6.3 Mi Mi</th> <th>tance under fire exposure in 20/25 to C 50/60, CEN/TS 1995 M12 M16 M20 90 120 30 60 90 91 20 30 60 90 90 21.5 16.0 10.5 7.8 33.5 25.0 16.4 2.9 6.3 5.0 9.0 9.0 9.0 9.0 3.2 6.3 5.0 9.0 9.0 9.0 9.0 3.2 6.3 5.0 9.0 9.0 9.0 9.0 3.2 5.9 12.0 9.6 9.0 9.0 9.0 3.2 5.9 12.0 9.6 9.0 9.0 5.9 12.0 9.6 9.0 9.0 9.0 5.9 12.0 9.6 9.0 9.0 9.0 5.9 12.0 9.6 9.0 9.0 9.0 5.9 12.0 9.0 9.0 9.0 9.0 5.9 12.0 9.0 9.0 9.0 9.0 5.0 12.0<!--</th--><th>CEED CEED CEED CEED CEED CEED CEED</th><th>Possu 33.522 33.522 anim 1</th><th>Urre ii M20 9:0 9:0 9:0 9:0 18:0 18:0</th><th>e in 300 - 4, 12.1 16.4 12.1 14.4 11.4 12.1 14.4 11.4 11.4 11</th><th>1 1 1 1 1 1 1 1 1 1</th><th>M24/125 M24 A4 M24/125 M24 A4 30 60 90 120 31.5¹ 11.0 8.8 11.0 8.8 17.4 11.0 8.8 17.4 11.0 11.0 14.4 11.1 25.5 20.4 11.1 11.4 11.4 11.1 25.5 20.4 25.5 20.4 25.5 20.4</th><th></th><th></th><th>MI 30 60 31.5 31.5</th><th>M27 5: 6: 6: 7: 7:</th><th>25.2</th></th>	sistanc 2.8 2.4 2 3. 4.0 3 3. 4.0 3 3. 4.0 3 5.6 4 2.8 2.4 2 7.4 5 7.4 7 7.4 7 7.5	25 to C 25 to C 2.2 6.0 30 4.2 21.5 5.9 5.9 Ac	6.3 6.3 6.3 Mi	tance under fire exposure in 20/25 to C 50/60, CEN/TS 1995 M12 M16 M20 90 120 30 60 90 91 20 30 60 90 90 21.5 16.0 10.5 7.8 33.5 25.0 16.4 2.9 6.3 5.0 9.0 9.0 9.0 9.0 3.2 6.3 5.0 9.0 9.0 9.0 9.0 3.2 6.3 5.0 9.0 9.0 9.0 9.0 3.2 5.9 12.0 9.6 9.0 9.0 9.0 3.2 5.9 12.0 9.6 9.0 9.0 5.9 12.0 9.6 9.0 9.0 9.0 5.9 12.0 9.6 9.0 9.0 9.0 5.9 12.0 9.6 9.0 9.0 9.0 5.9 12.0 9.0 9.0 9.0 9.0 5.9 12.0 9.0 9.0 9.0 9.0 5.0 12.0 </th <th>CEED CEED CEED CEED CEED CEED CEED</th> <th>Possu 33.522 33.522 anim 1</th> <th>Urre ii M20 9:0 9:0 9:0 9:0 18:0 18:0</th> <th>e in 300 - 4, 12.1 16.4 12.1 14.4 11.4 12.1 14.4 11.4 11.4 11</th> <th>1 1 1 1 1 1 1 1 1 1</th> <th>M24/125 M24 A4 M24/125 M24 A4 30 60 90 120 31.5¹ 11.0 8.8 11.0 8.8 17.4 11.0 8.8 17.4 11.0 11.0 14.4 11.1 25.5 20.4 11.1 11.4 11.4 11.1 25.5 20.4 25.5 20.4 25.5 20.4</th> <th></th> <th></th> <th>MI 30 60 31.5 31.5</th> <th>M27 5: 6: 6: 7: 7:</th> <th>25.2</th>	CEED CEED CEED CEED CEED CEED CEED	Possu 33.522 33.522 anim 1	Urre ii M20 9:0 9:0 9:0 9:0 18:0 18:0	e in 300 - 4, 12.1 16.4 12.1 14.4 11.4 12.1 14.4 11.4 11.4 11	1 1 1 1 1 1 1 1 1 1	M24/125 M24 A4 M24/125 M24 A4 30 60 90 120 31.5 ¹ 11.0 8.8 11.0 8.8 17.4 11.0 8.8 17.4 11.0 11.0 14.4 11.1 25.5 20.4 11.1 11.4 11.4 11.1 25.5 20.4 25.5 20.4 25.5 20.4			MI 30 60 31.5 31.5	M27 5: 6: 6: 7: 7:	25.2
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Fire resistance T 30 60 90 120 30 60 90 120 30 60 90 120 30 60 90 120 30 60 90 120 30 60 90 120 30 60 90 120 30 60 90 120 30 60 90 120 30 60 90 120 30 60 90 120 30 60 90 120 30 60 90 120 30 60 90 120 30 60 90 120 30 60 90 120 30 60 30 120 30 120 30 120 30 120 30 120 30 120 30 120 30 120 30 120 30 120 30 120 30 120 30 120 30 120 30 120 30	Fire resistance R 30 60 30 120 30 60 30 120 30 60 30 120 30 60 30 120 30 60 30 120 30 60 30 120 30 60 30 120 30 60 30 120 30 60 30 120 30 60 30 120 30 60 30 120 30 60 120 120 30 60 120 120 120 120 30 60 120 120 30 60 120		Table 19: Anchor size			in cracked and		1001-Cracked Concrete CZU/25 to C2U/60, CEN/15 1992-4, W-FAZ M10 70 M12 M16 M20 M24 / 125 M24 /	Σ	M10			70 M12	12	; H		M16			ז	M20		F	M24 / 125 M24 A4	1251	M24	A4		Ë	M27
without lever arm without lever arm $V_{Rks,sh}$ vz 1.6 1.5 1.2 1.0 2.6 2.5 2.4 7.0 6.8 6.5 6.4 110 100 160 150 140 206 198 190 $V_{Rks,sh}$ $Adr/$ 3.8 2.9 2.0 1.5 11.5 8.6 5.6 4.2 21.5 160 100 160 160 150 140 206 198 190 with lever M_{CR} 3.8 2.9 2.7 11.5 8.6 5.6 5.6 5.6 5.6 5.6 5.6 5.6 5.8 5.6 5.6 5.6 5.8 5.6	Steel failure without lever arm Characteristic Verse, in Hout lever arm Value without lever arm Characteristic Verse, in Hout AA/ 3.8 2.9 2.0 1.6 1.5 1.2 1.0 2.0 3.8 3.4 7.0 6.8 6.5 6.4 11.0 11.0 100 100 160 15 Steel failure with lever arm Advise in Market, In	without lever arm without lever arm Vertices.In MON vz 16 1.5 1.2 1.0 2.6 3.5 3.4 7.0 6.8 6.5 6.4 11.0 100 100 160 150 140 206 198 190 VR _{Ns.51} MO vz 1.6 1.5 1.2 1.0 2.6 3.5 3.5 3.4 7.0 6.8 6.5 6.4 11.0 11.0 100 100 160 150 14.0 205 198 190 With lever arm Mo mo mo 25.5 15.5 15.5 15.5 15.6 14.0 13.0 22.0 28.0 27.0 28.0 27.0 28.0 27.0 28.0 27.0 28.0 27.0 28.0 27.0 28.0 27.0 28.0 27.0 28.0 27.0 28.0 27.1 27.1 25.5 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	Fire resistance duration		30	_		20 30		06	120			90											00	06	120	30	60	06
$ \frac{V_{Rk_3, fi}}{MO} \frac{Vz}{KNJ} \frac{Vz}{HCK} \frac{1.6}{3} 1.2 1.0 2.6 2.5 2.1 2.0 3.8 3.6 3.5 3.4 7.0 6.8 6.5 6.4 110 110 100 160 160 150 150 140 206 198 190 100 160 150 150 150 150 150 150 150 150 150 15$	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	$ \frac{V_{Rk_{24},11}}{MV_{MK_{24},1}} \frac{v_{2}}{MV_{MK_{24},11}} \frac{1.6}{1.5} \frac{1.2}{1.2} \frac{1.0}{1.6} \frac{2.6}{2.5} \frac{2.1}{2.7} \frac{2.0}{11.5} \frac{3.8}{8.5} \frac{3.5}{2.5} \frac{3.4}{2.1} \frac{7.0}{2.6} \frac{6.8}{5.6} \frac{6.5}{4.2} \frac{6.5}{2.15} \frac{16.0}{10.5} \frac{10.5}{7.8} \frac{10.0}{33.5} \frac{10.0}{25.0} \frac{16.4}{12.1} \frac{12.0}{48.2} \frac{10.0}{35.9} \frac{10.0}{23.6} \frac{17.4}{17.4} \frac{20.6}{2} \frac{13.0}{2} \frac{10.0}{10.5} \frac{10.0}{10.5$	Steel failure v	without leve	r arm			•]	1	1		1	1		1		1		1									
[KN] $\frac{4}{HCN}$ $\frac{4}{HCN}$ $\frac{4}{RS}$	resistance $[KN]$ $A4/$ 38 2.9 2.0 1.6 6.9 5.2 3.5 2.7 11.5 8.6 5.6 4.2 21.5 16.0 10.5 7.8 33.5 25.0 16.4 12.1 48.2 35.5 21.5 55.5 55.6	$ \begin{bmatrix} KNJ & At/\\ HCR & 38 & 29 & 2.0 & 1.6 & 6.9 & 5.2 & 3.5 & 2.7 & 11.5 & 8.6 & 5.6 & 4.2 & 21.5 & 16.0 & 10.5 & 7.8 & 33.5 & 25.0 & 16.4 & 12.1 & 48.2 & 35.9 & 23.6 & 17.4 & - & - & - & - & - & - & - & - & - & $	Characteristic			1.5 1	-		3 2.5	2.1 2.1			9								1.0 1()1 O.C					14.0	20.6	19.8	19.0
with lever arm vz. 1.7 1.6 1.2 1.1 3.3 3.2 2.7 2.5 5.9 5.6 5.4 5.3 15.0 14.0 13.0 29.0 28.0 27.0 26.0 48.0 47.0 46.0 75.0 72.0 69.0 M ⁰ Rkshf M4/ 3.8 2.9 2.1 1.6 9.0 6.8 4.5 3.4 13.8 8.8 66.1 43.4 32.1 153.5 114.3 75.1 55.5 -	Steel failure with lever arm Steel failure with lever arm Characteristic M ⁰ _{nkss,fi} vz. 1.7 1.6 1.2 1.1 3.3 3.2 2.5 5.6 5.4 5.3 15.0 14.0 13.0 29.0 28.0 27.0 28.0 38.0 31.4 resistance [Nm] A4/ 3.8 2.9 2.1 1.6 9.0 6.8 4.5 3.4 17.9 3 8.8 6.5 45.5 33.9 22.2 16.4 88.8 66.1 43.4 32.1 153.5 114 resistance [Nm] A4/ 3.8 2.9 2.1 1.6 9.0 6.8 4.5 3.4 17.9 3 8.8 6.5 45.5 33.9 22.2 16.4 88.8 66.1 43.4 32.1 153.5.5 114 resistance [Nm] A4/ 3.8 6.5 45.5 33.9 22.2 16.4 88.8 66.1 43.4 32.1 153.5.5 114 171.4 173.3	with lever arm with lever arm $M_0^0 \frac{Vz}{Rk_{\rm Stiff}}$ 1.7 1.6 1.2 1.1 3.3 3.2 2.7 2.5 5.9 5.6 5.4 5.3 15.0 14.0 13.0 28.0 28.0 50.0 48.0 47.0 46.0 75.0 72.0 69.0 N^m M_1^0 M_1^0 3.8 2.9 2.1 1.6 9.0 6.8 4.5 3.3 2.2 16.4 88.8 66.1 43.4 32.1 15.3 114.3 75.1 55.5 - - - count failure: V ^{mk.c.1} of the characteristic resistance in concrete C20/25 to C50/60 under fire exposure may be determined by: V ^{mk.c.1} = 0.25 x V ⁰ _{nk.c.1} = 0.25 x V ⁰ _{nk.c.1} = 0.20 x V ⁰ _{nk.c.1}	resistance		3.8	<u>െ</u>	- 0	9.9		3.5	2.7			5.6 4		1.5 14	6.0 1				5.0 16						17.4	ı.		
$ \frac{M_{\text{Rks,h}}^{0}}{\text{INm}} \frac{\text{vz.}}{\text{HCR}} \frac{1.7}{3.8} \frac{1.6}{2.9} \frac{1.1}{2.1} \frac{3.3}{2.2} \frac{3.2}{2.7} \frac{2.5}{2.5} \frac{5.6}{5.9} \frac{5.6}{5.4} \frac{5.3}{5.3} \frac{15.0}{14.0} \frac{14.0}{14.0} \frac{14.0}{13.0} \frac{13.0}{29.0} \frac{28.0}{28.0} \frac{26.0}{20.0} \frac{48.0}{48.0} \frac{47.0}{47.0} \frac{46.0}{46.0} \frac{75.0}{75.0} \frac{72.0}{69.0} \frac{69.0}{69.0} \frac{3.8}{10.0} \frac{3.8}{2.9} \frac{2.9}{2.1} \frac{1.5}{1.6} \frac{3.8}{2.9} \frac{2.9}{2.1} \frac{1.5}{1.6} \frac{3.8}{2.9} \frac{2.9}{2.1} \frac{1.5}{1.6} \frac{3.8}{2.9} \frac{3.8}{2.5} \frac{3.4}{3.8} \frac{17.9}{3} \frac{3.8}{3.8} \frac{6.5}{6.5} \frac{45.5}{3.3} \frac{32.2}{2.2} \frac{16.4}{16.4} \frac{88.8}{88.8} \frac{66.1}{66.1} \frac{43.4}{43.4} \frac{32.1}{153.5} \frac{15.3}{114.3} \frac{75.1}{75.1} \frac{55.5}{55.5} \frac{-}{-} \frac{-}{-} \frac{1.5}{2.6} \frac{5.6}{1.6} \frac{5.6}{1.6} \frac{5.6}{1.6} \frac{5.6}{1.6} \frac{5.6}{1.6} \frac{5.6}{1.5} \frac{5.6}{1.5} \frac{5.5}{1.5} \frac{-}{1.5} \frac{-}{-} \frac{1.5}{1.5} \frac{1.5}{1.5}$	Characteristic M ⁰ _{Ms,s,fi} vz. 1.7 1.6 1.1 3.3 3.2 2.7 2.5 5.9 5.4 5.3 15.0 14.0 13.0 28.0 28.0 50.0 48 resistance [Nm] A4/ 3.8 2.1 1.6 9.0 6.8 4.5 3.4 17.9 13 8.8 6.5 45.5 33.9 22.2 16.4 88.8 66.1 43.4 32.1 153.5 114 concrete pryout failure: In Equations (D.6 and D.7) of CEN/TS 1992-4-1, Annex D,D.3.3.2 the k-factor is similar to the k ₃ -factor for normal temperature and the 18 have to be considered. Concrete edge failure: The initial value V ⁰ ,, of the characteristic resistance in concrete C20/25 to C50/60 under fire exposure may be determined by:	$ \frac{M_{Pks,h}^{0}}{Nm^{1}} \frac{vz.}{A4/} \frac{1.7}{3.8} \frac{1.7}{2.9} \frac{1.6}{2.1} \frac{1.3}{2.5} \frac{3.2}{2.7} \frac{2.5}{2.5} \frac{5.6}{5.4} \frac{5.3}{5.3} \frac{15.0}{3.3} \frac{14.0}{14.0} \frac{14.0}{13.0} \frac{13.0}{280} \frac{28.0}{27.0} \frac{26.0}{26.0} \frac{26.0}{48.0} \frac{48.0}{47.0} \frac{47.0}{46.0} \frac{46.0}{75.0} \frac{75.0}{22.0} \frac{72.0}{69.0} \frac{69.0}{69.0} \frac{10.0}{Nm} $	Steel failure v	with lever ar	Ξ	1	-		-]		1	1	1		-	1	-	•	1	-	-		-	1					
INMI A4/ 3.8 2.0 1.6 9.0 6.8 17.9 13. 8.8 66.1 43.4 32.1 153.5 114.3 75.1 55.5 - <t< td=""><td>resistance $[Nm]_{HCR}^{M}$ $A4/{}$ 3.8 2.9 2.1 1.6 9.0 6.8 4.5 3.3 6.5 45.5 33.9 22.2 16.4 88.8 66.1 43.4 32.1 153.5 11.4 concrete pryout failure: In Equations (D.6 and D.7) of CEN/TS 1992-4-1, Annex D,D.3.3.2 the k-factor is similar to the k_3-factor for normal temperature and the 18 have to be considered. Concrete edge failure: The initial value V^{0} and D.7) of CEN/TS 1992-4-1, Annex D,D.3.3.2 the k-factor is similar to the k_3-factor for normal temperature and the 18 have to be considered. Concrete edge failure:</td><td>$\begin{bmatrix} Nm_{M,GM}^{m} & A4' \\ HCR \end{bmatrix} 3.8 \begin{bmatrix} 2.9 \\ 2.1 \end{bmatrix} 1.6 \begin{bmatrix} 9.0 \\ 6.8 \\ 4.5 \end{bmatrix} 3.4 \begin{bmatrix} 17.9 \\ 3.8 \\ 17.9 \end{bmatrix} \frac{3}{3} \begin{bmatrix} 8.5 \\ 45.5 \\ 33.9 \\ 22 \end{bmatrix} 16.4 \\ \begin{bmatrix} 888 \\ 66.1 \\ 43.4 \\ 32.1 \\ 153.5 \end{bmatrix} 114.3 \\ \hline 75.1 \\ 55.5 \\ - \frac{1}{2} \end{bmatrix} \frac{1}{2} \begin{bmatrix} -1 \\ - \frac{1}{2} \end{bmatrix} \frac{1}{2} \end{bmatrix} \frac{1}{2} \begin{bmatrix} -1 \\ - \frac{1}{2} \end{bmatrix} \frac{1}{2} \begin{bmatrix} -1 \\ - \frac{1}{2} \end{bmatrix} \frac{1}{2} \end{bmatrix} \frac{1}{2} \begin{bmatrix} -1 \\ - \frac{1}{2} \end{bmatrix} \frac{1}{2} \end{bmatrix} \frac{1}{2} \begin{bmatrix} -1 \\ - \frac{1}{2} \end{bmatrix} \frac{1}{2} \begin{bmatrix} -1 \\ - \frac{1}{2} \end{bmatrix} \frac{1}{2} \begin{bmatrix} -1 \\ - \frac{1}{2} \end{bmatrix} \frac{1}{2} \end{bmatrix} \frac{1}{2} \begin{bmatrix} -1 \\ - \frac{1}{2} \end{bmatrix} \frac{1}{2} \end{bmatrix} \frac{1}{2} \begin{bmatrix} -1 \\ - \frac{1}{2} \end{bmatrix} \frac{1}{2} \end{bmatrix} \frac{1}{2} \begin{bmatrix} -1 \\ - \frac{1}{2} \end{bmatrix} \frac{1}{2} \end{bmatrix} \frac{1}{2} \begin{bmatrix} -1 \\ - \frac{1}{2} \end{bmatrix} \frac{1}{2} \end{bmatrix} \frac{1}{2} \begin{bmatrix} -1 \\ - \frac{1}{2} \end{bmatrix} \frac{1}{2} \end{bmatrix} \frac{1}{2} \begin{bmatrix} -1 \\ - \frac{1}{2} \end{bmatrix} \frac{1}{2} \end{bmatrix} \frac{1}{2} \begin{bmatrix} -1 \\ - \frac{1}{2} \end{bmatrix} \frac{1}{2} \end{bmatrix} \frac{1}{2} \begin{bmatrix} -1 \\ - \frac{1}{2} \end{bmatrix} \frac{1}{2} \end{bmatrix} \frac{1}{2} \begin{bmatrix} -1 \\ - \frac{1}{2} \end{bmatrix} \frac{1}{2} \end{bmatrix} \frac{1}{2} \end{bmatrix} \frac{1}{2} \begin{bmatrix} -1 \\ - \frac{1}{2} \end{bmatrix} \frac{1}{2} \end{bmatrix} \frac{1}{2$</td><td>Characteristic</td><td></td><td></td><td>1.6 1</td><td>-</td><td></td><td>3 3.2</td><td>2.7</td><td></td><td></td><td></td><td></td><td></td><td>5.0 1</td><td>4.0</td><td>4.0 1;</td><td></td><td>9.0</td><td>3.0 27</td><td>7.0 24</td><td></td><td></td><td></td><td>47.0</td><td>46.0</td><td>75.0</td><td>72.0</td><td>69.0</td></t<>	resistance $[Nm]_{HCR}^{M}$ $A4/{}$ 3.8 2.9 2.1 1.6 9.0 6.8 4.5 3.3 6.5 45.5 33.9 22.2 16.4 88.8 66.1 43.4 32.1 153.5 11.4 concrete pryout failure: In Equations (D.6 and D.7) of CEN/TS 1992-4-1, Annex D,D.3.3.2 the k-factor is similar to the k_3 -factor for normal temperature and the 18 have to be considered. Concrete edge failure: The initial value V^{0} and D.7) of CEN/TS 1992-4-1, Annex D,D.3.3.2 the k-factor is similar to the k_3 -factor for normal temperature and the 18 have to be considered. Concrete edge failure:	$ \begin{bmatrix} Nm_{M,GM}^{m} & A4' \\ HCR \end{bmatrix} 3.8 \begin{bmatrix} 2.9 \\ 2.1 \end{bmatrix} 1.6 \begin{bmatrix} 9.0 \\ 6.8 \\ 4.5 \end{bmatrix} 3.4 \begin{bmatrix} 17.9 \\ 3.8 \\ 17.9 \end{bmatrix} \frac{3}{3} \begin{bmatrix} 8.5 \\ 45.5 \\ 33.9 \\ 22 \end{bmatrix} 16.4 \\ \begin{bmatrix} 888 \\ 66.1 \\ 43.4 \\ 32.1 \\ 153.5 \end{bmatrix} 114.3 \\ \hline 75.1 \\ 55.5 \\ - \frac{1}{2} \end{bmatrix} \frac{1}{2} \begin{bmatrix} -1 \\ - \frac{1}{2} \end{bmatrix} \frac{1}{2} \end{bmatrix} \frac{1}{2} \begin{bmatrix} -1 \\ - \frac{1}{2} \end{bmatrix} \frac{1}{2} \begin{bmatrix} -1 \\ - \frac{1}{2} \end{bmatrix} \frac{1}{2} \end{bmatrix} \frac{1}{2} \begin{bmatrix} -1 \\ - \frac{1}{2} \end{bmatrix} \frac{1}{2} \end{bmatrix} \frac{1}{2} \begin{bmatrix} -1 \\ - \frac{1}{2} \end{bmatrix} \frac{1}{2} \begin{bmatrix} -1 \\ - \frac{1}{2} \end{bmatrix} \frac{1}{2} \begin{bmatrix} -1 \\ - \frac{1}{2} \end{bmatrix} \frac{1}{2} \end{bmatrix} \frac{1}{2} \begin{bmatrix} -1 \\ - \frac{1}{2} \end{bmatrix} \frac{1}{2} \end{bmatrix} \frac{1}{2} \begin{bmatrix} -1 \\ - \frac{1}{2} \end{bmatrix} \frac{1}{2} \end{bmatrix} \frac{1}{2} \begin{bmatrix} -1 \\ - \frac{1}{2} \end{bmatrix} \frac{1}{2} \end{bmatrix} \frac{1}{2} \begin{bmatrix} -1 \\ - \frac{1}{2} \end{bmatrix} \frac{1}{2} \end{bmatrix} \frac{1}{2} \begin{bmatrix} -1 \\ - \frac{1}{2} \end{bmatrix} \frac{1}{2} \end{bmatrix} \frac{1}{2} \begin{bmatrix} -1 \\ - \frac{1}{2} \end{bmatrix} \frac{1}{2} \end{bmatrix} \frac{1}{2} \begin{bmatrix} -1 \\ - \frac{1}{2} \end{bmatrix} \frac{1}{2} \end{bmatrix} \frac{1}{2} \begin{bmatrix} -1 \\ - \frac{1}{2} \end{bmatrix} \frac{1}{2} \end{bmatrix} \frac{1}{2} \begin{bmatrix} -1 \\ - \frac{1}{2} \end{bmatrix} \frac{1}{2} \end{bmatrix} \frac{1}{2} \end{bmatrix} \frac{1}{2} \begin{bmatrix} -1 \\ - \frac{1}{2} \end{bmatrix} \frac{1}{2} \end{bmatrix} \frac{1}{2$	Characteristic			1.6 1	-		3 3.2	2.7						5.0 1	4.0	4.0 1;		9.0	3.0 27	7.0 24				47.0	46.0	75.0	72.0	69.0
concrete pryout failure: In Equations (D.6 and D.7) of CEN/TS 1992-4-1, Annex D,D.3.3.2 the k-factor is similar to the k ₃ -factor for normal temperature and the relevant values of N ⁰ _{Rko4} of Table 18 have to be considered.	concrete pryout failure: In Equations (D.6 and D.7) of CEN/TS 1992-4-1, Annex D,D.3.3.2 the k-factor is similar to the k ₃ -factor for normal temperature and the 1 18 have to be considered. Concrete edge failure: The initial value V ⁰ ,, of the characteristic resistance in concrete C20/25 to C50/60 under fire exposure may be determined by:	concrete pryout failure: In Equations (D.6 and D.7) of CEN/TS 1992-4-1, Annex D,D.3.3.2 the k-factor is similar to the k ₃ -factor for normal temperature and the relevant values of N ⁰ _{Rkc,fi} of Table 18 have to be considered. If have to be considered. Concrete edge failure: The initial value V ⁰ _{Rkc,fi} of the characteristic resistance in concrete C20/25 to C50/60 under fire exposure may be determined by: V ⁰ _{Rkc,fi} = 0.25 x V ⁰ _{Rkc} (R30, R60, R90) V ⁰ _{Rkc,fi} = 0.20 x V ⁰ _{Rkc} (R120)	resistance	[Nm] A4/ HCF	3.8	6	-	9.6	6.8	4.5					3.5 4	5.5 3	3.9 2	2.2 1(6.4		5.1 4:	3.4 32	11	33.5 1-	14.3	75.1	55.5		1	
In Equations (D.6 and D.7) of CEN/TS 1992-4-1, Annex D,D.3.3.2 the k-factor is similar to the k ₃ -factor for normal temperature and the relevant values of N ⁰ _{Rkoft} of Table 18 have to be considered.	In Equations (D.6 and D.7) of CEN/TS 1992-4-1, Annex D,D.3.3.2 the k-factor is similar to the k ₃ -factor for normal temperature and the 1 18 have to be considered. Concrete edge failure: The initial value V ⁰ ,, of the characteristic resistance in concrete C20/25 to C50/60 under fire exposure may be determined by:	In Equations (D.6 and D.7) of CEN/TS 1992-4-1, Annex D, D.3.3.2 the k-factor is similar to the k ₃ -factor for normal temperature and the relevant values of N ⁰ _{Rk,c,f} of Table 18 have to be considered. Concrete edge failure: The initial value V ⁰ _{Rk,c,f} of the characteristic resistance in concrete C20/25 to C50/60 under fire exposure may be determined by: V ⁰ _{Rk,c,f} = 0.25 x V ⁰ _{Rk,c,f} = 0.25 x V ⁰ _{Rk,c,f} = 0.25 x V ⁰ _{Rk,c,f} = 0.20 x V ⁰ _{Rk,c,f} (R120)	concrete pryc	out failure:																										
	Concrete edge failure: The initial value V ⁰	Concrete edge failure: The initial value V ⁰ _{Rkeń} of the characteristic resistance in concrete C20/25 to C50/60 under fire exposure may be determined by: V ⁰ _{Rkeň} = 0.25 x V ⁰ _{Rke} (R30, R60, R90) V ⁰ _{Rkeň} = 0.20 x V ⁰ _{Rke} (R120)	In Equations (D. 18 have to be co	.6 and D.7) of onsidered.	CEN/	TS 1:	992-7	4-1, A	nnex	D,D	.3.3.2	the l	k-fact	tor is	simil	ar to 1	the k _e	1-facto	or for	norm	al ter	ıpera	ture 6	and the	e relev	vant v	/alue	s of N	0 Rk,c,fi	of Ta
		= 0.25 x V ⁰ _{Rk.c} (R30, R60, R90)	The initial value	$V^{0}_{Rk,c,fi}$ of the c	charac	terist	tic res	sistan	ce in	conc	rete	C20/2	25 to	C50/I	60 un	der fi	re ex _l	posur	e ma	y be (letern	ninea	by:							
The initial value V ⁰ Rkc.ii of the characteristic resistance in concrete C20/25 to C50/60 under fire exposure may be determined by:	= 0.25 x V ⁰ _{RkC} (R30, R60, R90)					>	Rk,c,fi =	= 0.25	i x V ^c	Rkc (R30,	R60,	(06H	_		$<_{\rm R}^{0}$	k,c,fi =	0.20	× V ⁰ _{RI}	_{ره} (R1	20)									

18.6

68.0

English translation prepared by DIBt



1.0

YM,fi [-]

Partial safety factor



Characteristic shear resistance

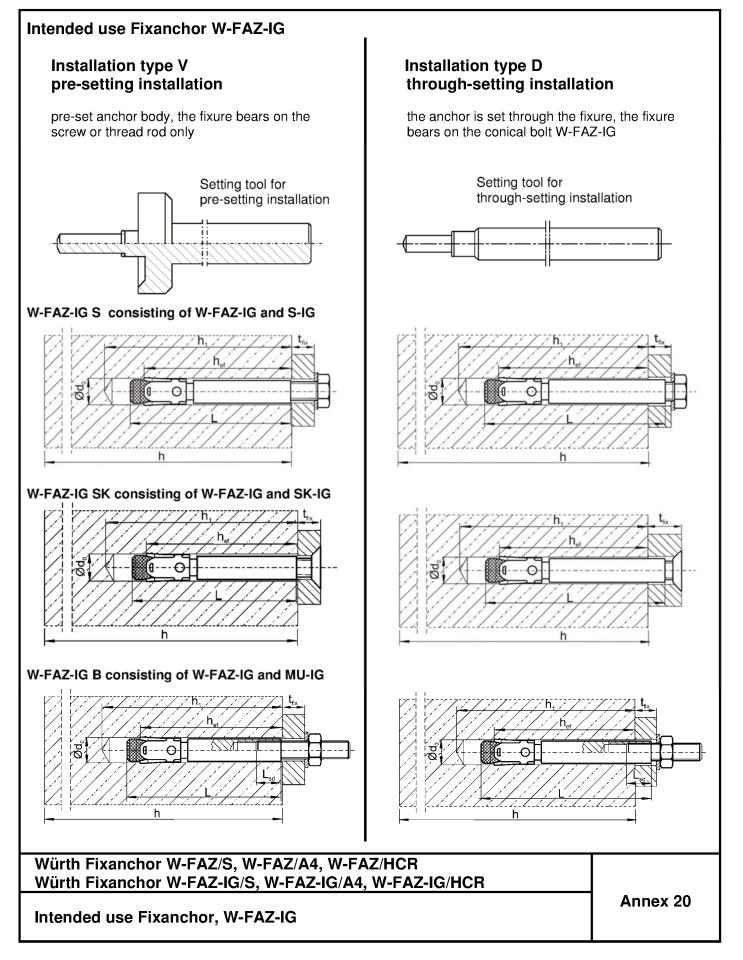
under fire exposure, CEN/TS 1992-4, W-FAZ

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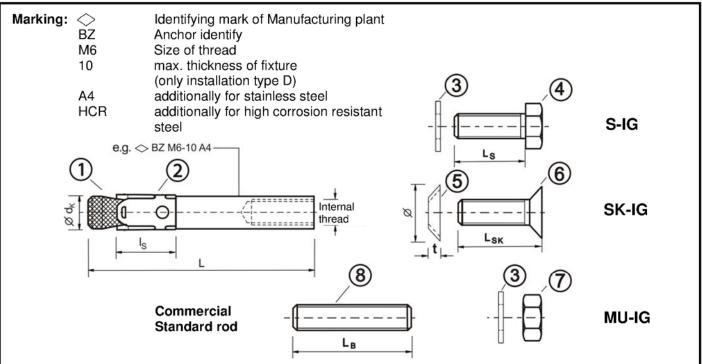


Table 20: Anchor dimensions, W-FAZ-IG

Γ	No.	Anchor size		M6	M8	M10	M12
ŀ		Conical bolt with Internal thread	$\oslash \mathbf{d}_{\mathbf{k}}$	7.9	9.8	11.8	15.7
L	1	Installation type V	L	50	62	70	86
		Installation type D	L	50 + t _{fix}	62 + t _{fix}	70 + t _{fix}	86 + t _{fix}
	2	Expansion sleeve	l _s	14.5	18.5	22.0	24.3
L	3	Washer			see ta	ible 21	
	4	Hexagon head screw	width accross flats	10	13	17	19
	4	Installation type V	Ls	t _{fix} + (13 to 21)	t _{fix} + (17 to 23)	t _{fix} + (21 to 25)	t _{fix} + (24 to 29)
		Installation type D	Ls	14 to 20	18 to 22	20 to 22	25 to 28
	5		ð countersink	17.3	21.5	25.9	30.9
	5	washer	t	3.9	5.0	5.7	6.7
	6	Countersunk head screw	bit size	Torx T30	Torx T45 (Steel. zinc plated) T40 (Stainless steel A4. HCR)	Hexagon socket 6 mm	Hexagon socket 8 mm
L							
	7	Hexagon nut widt	h accross flats	10	13	17	19
Г	8		be V $L_B \ge$	t _{fix} + 21	t _{fix} + 28	t _{fix} + 34	t _{fix} + 41
	0	Standard rod ¹⁾ typ	be D L _B ≥	21	28	34	41
) a	icc. to	specifications (Table 2	21)			Di	mensions in mm
		h Fixanchor W-FA h Fixanchor W-FA	-				Annex 21
A	hch	or dimensions, W	-FAZ-IG				AIIIICX 21



Table 21: Materials, W-FAZ-IG

No.	Part	Steel, zinc plated ≥ 5 µm acc. to EN ISO 4042	Stainless steel A4	High corrosion resistant steel HCR
1	Conical bolt W-FAZ-IG With internal thread	Machined steel, Cone plastic coated	Stainless steel, 1.4401, 1.4404, 1.4571, 1.4362, EN 10088, Cone plastic coated	Stainless steel, 1.4529, 1.4565, EN 10088, Cone plastic coated
2	Expansion sleeve W-FAZ-IG	Stainless steel, 1.4301, 1.4303, EN 10088	Stainless steel, 1.4401, 1.4571, EN 10088	Stainless steel, 1.4401, 1.4571, EN 10088
3	Washer S-IG / MU-IG acc. to DIN EN 7089 or DIN EN 7093 or DIN EN 7094	Steel, EN 10025-2	Stainless steel, 1.4401, 1.4571, EN 10088	Stainless steel, 1.4529, 1.4565, EN 10088
4	Hexagon head screw S-IG	Steel, Property class 8.8, EN ISO 898-1, coated	Stainless steel, 1.4401, 1.4571, EN 10088, Property class 70, EN ISO 3506, coated	Stainless steel, 1.4529, 1.4565, EN 10088, Property class 70, EN ISO 3506, coated
5	Countersunk washer SK-IG	Steel, EN 10083-2	Stainless steel, 1.4401, 1.4404, 1.4571, EN 10088, zinc plated, coated	Stainless steel, 1.4529, 1.4565, EN 10088, zinc plated, coated
6	Countersunk head screw SK-IG	Steel, Property class 8.8, acc. to EN ISO 898-1, coated	Stainless steel, 1.4401, 1.4571, EN 10088, Property class 70, EN ISO 3506, coated	Stainless steel, 1.4529, 1.4565, EN 10088, Property class 70, EN ISO 3506, coated
7	Hexagon nut MU-IG	Steel, Property class 8, acc. to EN ISO 898-2, coated	Stainless steel, 1.4401, 1.4571, EN 10088, Property class 70, EN ISO 3506, coated	Stainless steel, 1.4529, 1.4565, EN 10088, Property class 70, EN ISO 3506, coated
8	Commercial standard rod	Property class 8.8, acc. to EN ISO 898-1 A ₅ > 8 % ductile	Stainless steel, 1.4401, 1.4571, EN 10088, Property class 70, EN ISO 3506	Stainless steel, 1.4529, 1.4565, EN 10088, Property class 70, EN ISO 3506

Würth Fixanchor W-FAZ/S, W-FAZ/A4, W-FAZ/HCR Würth Fixanchor W-FAZ-IG/S, W-FAZ-IG/A4, W-FAZ-IG/HCR

Materials, W-FAZ-IG

Deutsches Institut für Bautechnik

Anchor size				M6	М8	M10	M12
Effective anchorage depth		h _{ef}	[mm]	45	58	65	80
Drill hole diameter		d ₀	[mm]	8	10	12	16
Cutting diameter of drill bit		$d_{\text{cut}} \leq$	[mm]	8.45	10.45	12.5	16.5
Depth of drill hole		$h_1 \geq$	[mm]	60	75	90	105
Screwing depth of thread rod		${L_{sd}}^{2)} \geq$	[mm]	9	12	15	18
	T _{inst}	S	[Nm]	10	30	30	55
Installation moment, zinc plated steel		SK	[Nm]	10	25	40	50
		В	[Nm]	8	25	30	45
Installation moment,	T _{inst}	S	[Nm]	15	40	50	100
stainless steel A4 and high		SK	[Nm]	12	25	45	60
corrosion resistant steel HCR		В	[Nm]	8	25	40	80
Installation type V							
Diameter of clearance hole in the	fixture	$d_{\rm f} \leq$	[mm]	7	9	12	14
		S	[mm]	1	1	1	1
Minimum thickness of fixture	$t_{fix} \ge$	SK	[mm]	5	7	8	9
		В	[mm]	1	1	1	1
Installation type D							
Diameter of clearance hole in the	fixture	$d_{\rm f} \leq$	[mm]	9	12	14	18
		S	[mm]	5	7	8	9
Minimum thickness of fixture 1)	t _{fix} ≥	SK	[mm]	9	12	14	16
		В	[mm]	5	7	8	9

¹⁾ The minimum thickness of fixture can be reduced to the value of installation type V, if the shear load at steel failure is designed with lever arm according to equation (5.5) of ETAG 001, Annex C. Marking

²⁾ see Annex 21

Setting check for Installation type V:

The anchor is placed correctly in the drill hole if the setting tool leaves a visible marking on the concrete surface.

Drill hole Table 23: Minimum thickness of concrete member, minimum spacing and minimum edge distance, W-FAZ-IG

Anchor size			M6	M8	M10	M12		
Minimum thickness of concrete member	h _{min}	[mm]	100	120	130	160		
Cracked concrete								
Minimum spacing	S _{min}	[mm]	50	60	70	80		
	für c ≥	[mm]	60	80	100	120		
Minimum edge distance	C _{min}	[mm]	50	60	70	80		
	für s≥	[mm]	75	100	100	120		
Non-cracked concrete								
Minimum spacing	S _{min}	[mm]	50	60	65	80		
	für c ≥	[mm]	80	100	120	160		
Minimum edge distance	C _{min}	[mm]	50	60	70	100		
	für s≥	[mm]	115	155	170	210		
Vürth Fixanchor W-FAZ/S, W-FAZ/A4, W-FAZ/HCR Vürth Fixanchor W-FAZ-IG/S, W-FAZ-IG/A4, W-FAZ-IG/HCR								
nstallation parameters, Minimum	memb	er thick	ness, M	inimum s	pacing	Annex		

and edge distance, W-FAZ-IG



Installation instructions pre-setting installation, W-FAZ-IG										
1	90° 	Drill hole perpendicular to concrete surface.								
2		Blow out dust.								
3		Setting tool insert in anchor.								
4		Drive in anchor with setting tool.								
5		Check screwing depth by the excess length (K) of the screw.								
6	Tinst	Max. tightening torque T _{inst} may be applied by using torque wrench.								

Würth Fixanchor W-FAZ/S, W-FAZ/A4, W-FAZ/HCR Würth Fixanchor W-FAZ-IG/S, W-FAZ-IG/A4, W-FAZ-IG/HCR

Installation instructions, W-FAZ-IG



Installation	instructions through-settin	g installation, W-FAZ-IG						
1	90° 	Drill hole perpendicular to concrete surfa	ICE.					
2		Blow out dust.						
3	BZ-IGS	Setting tool insert in anchor.						
4	BZ-IGS	Drive in anchor with setting tool.						
5		Drive in screw.						
6	T _{INST}	Max. tightening torque T _{inst} may be appli by using torque wrench.	ed					
	hor W-FAZ/S, W-FAZ/A4, W							
	hor W-FAZ-IG/S, W-FAZ-IG	A4, W-FAZ-IG/HCK	Annex 25					

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Table 24: Characteristic values for tension loads, ETAG 001, Annex C, W-FAZ-IG

Anchor size			M6	M8	M10	M12	
Steel failure				•		·	
Characteristic resistance, steel zinc plated	N _{Rk,s}	[kN]	16.1	22.6	26.0	56.6	
Partial safety factor	γ_{Ms}	[-]		1	.5		
Characteristic resistance, stainless steel A4 and high corrosic resistant steel HCR	on N _{Rk,s}	[kN]	14.1	25.6	35.8	59.0	
Partial safety factor	γ_{Ms}	[-]		1.	87		
Pullout failure							
Characteristic resistance in cracked concrete C20/25	N _{Rk,p}	[kN]	5	9	12	20	
Pullout and splitting (Choice of	f minimum spa	icing and	l edge distar	ice)			
Characteristic resistance in non-cracked concrete C20/25	N _{Rk,p}	[kN]	9	12	16	25	
Respective spacing	S _{cr,sp}	[mm]	3 h _{ef}				
Respective edge distance	C _{cr,sp}	[mm]		1.5	i h _{ef}		
Pullout and splitting (Choice of	f maximum res	sistance)		-			
Characteristic resistance in non-cracked concrete C20/25	N _{Rk,p}	[kN]	12	16	20	30	
Respective spacing	S _{cr,sp}	[mm]		5	h _{ef}		
Respective edge distance	C _{cr,sp}	[mm]		2.5	i h _{ef}		
Increasing factors for $N_{Rk,p}$ for	C30/37	[-]		1.	22		
cracked and non-cracked	ψ _C C40/50	[-]			41		
concrete	C50/60	[-]		1.	55		
Concrete cone failure					1	1	
Effective anchoring depth	h _{ef}	[mm]	45	58	65	80	
Spacing	S _{cr,N}	[mm]	3 h _{ef}				
Edge distance	C _{cr,N}	[mm]	-				
Partial safety factor γ	$M_{Mp} = \gamma_{Msp} = \gamma_{Mc}$	[-]		1	.8		

Table 25: Displacements under tension loads

Anchor size			М6	M8	M10	M12
Tension load in cracked concrete	Ν	[kN]	2.0	3.6	4.8	8.0
Displacement -	δ_{N0}	[mm]	0.6	0.6	0.8	1.0
	δ_{N^∞}	[mm]	0.8	0.8	1.2	1.4
Tension load in non-cracked concrete	Ν	[kN]	4.8	6.4	8.0	12.0
Displacement -	δ_{N0}	[mm]	0.4	0.5	0.7	0.8
Displacement	δ_{N^∞}	[mm]	0.8	0.8	1.2	1.4

Würth Fixanchor W-FAZ/S, W-FAZ/A4, W-FAZ/HCR Würth Fixanchor W-FAZ-IG/S, W-FAZ-IG/A4, W-FAZ-IG/HCR

Characteristic values for tension loads, ETAG 001, Annex C Displacements under tension loads, W-FAZ-IG



Table 26: Characteristic values for shear loads, ETAG 001, Annex C, W-FAZ-IG

Anchor size			M6	M8	M10	M12	
W-FAZ-IG zinc plated		<u>'</u>					
Steel failure without lever arm, Install	ation typ	e V					
Characteristic resistance	V _{Rk,s}	[kN]	5.8	6.9	10.4	25.8	
Steel failure without lever arm, Install		e D					
Characteristic resistance	V _{Rk,s}	[kN]	5.1	7.6	10.8	24.3	
Steel failure with lever arm, Installatio							
Characteristic bending resistance	M ⁰ _{Rk,s}	[Nm]	12.2	30.0	59.8	104.6	
Steel failure with lever arm, Installation	on type D						
Characteristic bending resistance	M ⁰ _{Rk,s}	[Nm]	36.0	53.2	76.0	207	
Partial safety factor for $V_{Rk,s}$ (type V, D) and $M^0_{Rk,s}$ (type V, D)	γ_{Ms}	[-]	1.25				
W-FAZ-IG stainless steel A4 and high	corrosio	n resist	ant steel H	CR			
Steel failure without lever arm, Install	ation typ	e V					
Characteristic resistance	V _{Rk,s}	[kN]	5.7	9.2	10.6	23.6	
Partial safety factor							
Steel failure without lever arm, Install		e D					
Characteristic resistance	V _{Rk.s}	[kN]	7.3	7.6	9.7	29.6	
Partial safety factor	γ _{Ms}	[-]		1.	25		
Steel failure with lever arm, Installation							
Characteristic bending resistance	M ⁰ _{Rk,s}	[Nm]	10.7	26.2	52.3	91.6	
Partial safety factor	Ϋ́Ms	[-]		1.	56		
Steel failure with lever arm, Installatio							
Characteristic bending resistance	M ⁰ _{Rk,s}	[Nm]	28.2	44.3	69.9	191.2	
Partial safety factor	γ_{Ms}	[-]		1.	25		
Concrete pryout failure		L					
Factor in equation (5.6) ETAG 001, Annex C, 5.2.3.3	k	[-]	1.5	1.5	2.0	2.0	
Partial safety factor	γМср	[-]		1	.5	I	
Concrete edge failure	,						
Effective length of anchor in shear loading	۱ _f	[mm]	45	58	65	80	
Effective diameter of anchor	d _{nom}	[mm]	8	10	12	16	
Partial safety factor	γ _{Mc}	[-]		1	.5		

Table 27: Displacements under shear loads, W-FAZ-IG

Anchor size			M6	M8	M10	M12
Shear load in cracked and non-cracked concrete	V	[kN]	4.2	5.3	6.2	16.9
Displacements	δ _{vo}	[mm]	2.8	2.9	2.5	3.6
	δγ∞	[mm]	4.2	4.4	3.8	5.3

Würth Fixanchor W-FAZ/S, W-FAZ/A4, W-FAZ/HCR Würth Fixanchor W-FAZ-IG/S, W-FAZ-IG/A4, W-FAZ-IG/HCR

Characteristic values for shear loads, ETAG 001, Annex C, Displacements under shear loads, W-FAZ-IG

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		120		1.8	4.0		4.0		8.2					
	M 12	06		2.2	5.7									
<u>5</u>	Μ	60		2.9	9.2		5.0		10.3					Ъ.
-FAZ		30		3.7	12.6								mende	
ک ک		120		1.3	2.7		2.4		4.9				Ë	ecom
nex	M 10	06		1.5	3.9								300 n	.0 is r
l, An	Σ	60		2.0	6.3		3.0		6.1			ix 23	C _{min} IV	^{v,fi} = 1
001		30		2.5	8.7					h _{ef}	h _{ef}	o Anne	ex 23;	ure _%
s to tension loads under fire exposure cracked concrete C20/25 to C50/60, ETAG 001, Annex C, W-FAZ-IG		120		0.8	1.3		1.8		3.7	4 x h _{ef}	2 x h _{ef}	according to Annex 23	s _{min} according to Annex 23; c _{min} ≥ 300 mm.	expos
nso(1,60, F	M 8	06		0.9	2.1							accol	ding t	er fire
∍ exp C50/	2	60		1.2	3.8		2.3		4.6				accor	pun e
st fire 5 to		30		1.4	5.4								S _{min}	stance
unde 220/2		120		0.4	0.5		1.0		2.0				sr fire shift according to Annex 23; $c_{min} \ge 300 \text{ mm}$. It partial safety factor for resistance under fire exposure $\gamma_{M,fi} = 1.0$ is recommended	or resi
ads ⊧ ete C	M 6	06		0.5	1.0									ctor fc
on lo	Σ	60		0.6	1.9		1.3		2.4					ety fa
ensic ed co		30		0.7	2.9									ial saf
value. non-		R [min]		Steel zinc plated	Stainless steel A4 / HCR		N _{Rk,p,fi} [kN]		N ⁰ _{Rk,c,fi} [kN]	S _{cr,N,fi}	C _{or,} N,fi	stance under fire	stance under fire size	gulations the part
Table 28: Characteristic v in cracked and	Anchor size	Fire resistance duration	Steel failure:	Characteristic N _{Rk s fi}	resistance [kN]	Pullout failure:	Characteristic resistance in concrete C20/25 to C50/60	Concrete cone failure:	Characteristic resistance in concrete C20/25 to C50/60	Spacing	Edge Distance	Minimum spacing and edge distance under fire exposure from one side	Minimum spacing and edge distance under fire exposure from more than one size	In absence of other national regulations the
Würth Fixanchor W-FAZ/S, W-FAZ/A4, W-FAZ/HCR Würth Fixanchor W-FAZ-IG/S, W-FAZ-IG/A4, W-FAZ-IG/HCR Characteristic values of tension resistance under fire exposure, ETAG001, Annex C, W-FAZ-IG								- Ar	nnex 28					





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120 1.8 4.0 2.8 6.2 In Equation (5.6) of ETAG 001, Annex C, 5.2.3.3 the k-factor of Table 26 and the relevant values of N⁰ Rkcfi of Table 28 have to be The initial value V⁰_{Rkoff} of the characteristic resistance in concrete C20/25 to C50/60 under fire exposure may be determined by In absence of other national regulations the partial safety factor for resistance under fire exposure $\gamma_{M,fi}$ = 1.0 is recommended. 2.2 3.4 8.9 5.7 6 M12 14.3 4.6 0.2 9.2 60 in cracked and non-cracked concrete C20/25 to C50/60, ETAG 001, Annex C, W-FAZ-IG 12.6 19.6 3.7 5.7 8 with $V^0_{
m Rk,c}$ initial value if the characteristic resistance in cracked concrete C20/25 under normal temperature. 1.6 3.5 120 1.3 2.7 1.5 3.9 2.0 5.1 6 M10 2.0 6.3 2.6 8.1 60 $V^{0}_{Rk,c,fi} = 0.20 \times V^{0}_{Rk,c}$ (R120) Characteristic values to tension loads under fire exposure 11.2 2.5 3.3 8.7 30 1.3 1.3 120 0.8 0.8 2.2 0.9 0.9 8 2.1 **M8** 3.9 . N 3.8 4 Z 60 5.5 4. -4 5.4 30 120 0.4 0.5 0.3 0.4 0.5 0.7 1.0 0.4 6 M6 0.6 <u>ი</u> 0.4 <u>ب</u> 60 $V^{0}_{Rk,c,fi} = 0.25 \times V^{0}_{Rk,c}$ (R30, R60, R90) 2.9 0.5 2.2 0.7 30 Stainless steel Zinc plated A4 / HCR A4 / HCR Steel failure without lever arm: Steel Steel R... [min] Steel failure with lever arm: [Nm] Concrete pryout failure: Fire resistance duration Concrete edge failure: V_{Rk,s,fi} resistance Characteristic Characteristic Anchor size: Resistance Table 29: considered M⁰_{Rk,s,fi} ξN] Würth Fixanchor W-FAZ/S, W-FAZ/A4, W-FAZ/HCR Würth Fixanchor W-FAZ-IG/S, W-FAZ-IG/A4, W-FAZ-IG/HCR Annex 29 Characteristic values of shear resistance under fire exposure, ETAG 001, Annex C, W-FAZ-IG





Anchor size			M6	M8	M10	M12		
Steel failure		·						
Characteristic resistance, steel zinc plated	N _{Rk,s}	[kN]	16.1	22.6	26.0	56.6		
Partial safety factor	γ _{Ms}	[-]	1.5					
Characteristic resistance, stainless steel A4 and high corrosion resistant steel HCR	N _{Rk,s}	[kN]	14.1	25.6	35.8	59.0		
Partial safety factor	γ_{Ms}	[-]	[-] 1.87					
Pullout failure								
Characteristic resistance in cracked concrete C20/25	N _{Rk,p}	[kN]	5	9	12	20		
Pullout and splitting (Choice of mi	nimum spa	icing and	edge distar	ice)				
Characteristic resistance in non-cracked concrete C20/25	N _{Rk,p}	[kN]	9	12	16	25		
Respective spacing	S _{cr,sp}	[mm]	3 h _{ef}					
Respective edge distance	C _{cr,sp}	[mm]	1.5 h _{ef}					
Pullout and splitting (Choice of ma	aximum res	sistance)						
Characteristic resistance in non-cracked concrete C20/25	$N_{Rk,p}$	[kN]	12	16	20	30		
Respective spacing	S _{cr,sp}	[mm]			h _{ef}			
Respective edge distance	C _{cr,sp}	[mm]		2.5	i h _{ef}			
Increasing factors for N _{Rk,p} for	C30/37	[-]		1.	22			
cracked and non-cracked ψ_{C}		[-]			41			
concrete	C50/60	[-]		1.	55			
Concrete cone failure				I	1			
Effective anchoring depth	h _{ef}	[mm]	45	58	65	80		
Factor for cracked concrete	k _{cr}	[-]		7.				
Factor for non-cracked concrete	k _{ucr}	[-]		10				
Spacing	S _{cr,N}	[mm]			h _{ef}			
Edge distance	C _{cr,N}	[mm]			i h _{ef}			
Partial safety factor $\gamma_{Mp} =$	$\gamma_{Msp} = \gamma_{Mc}$	[-]		1	.8			

Table 31: Displacements under tension loads

Anchor size			М6	M8	M10	M12
Tension load in cracked concrete	Ν	[kN]	2.0	3.6	4.8	8.0
Displacement	δ_{N0}	[mm]	0.6	0.6	0.8	1.0
Displacement	δ_{N^∞}	[mm]	0.8	0.8	1.2	1.4
Tension load in non-cracked concrete	Ν	[kN]	4.8	6.4	8.0	12.0
Displacement	δ_{N0}	[mm]	0.4	0.5	0.7	0.8
Displacement -	$\delta_{N\infty}$	[mm]	0.8	0.8	1.2	1.4

Würth Fixanchor W-FAZ/S, W-FAZ/A4, W-FAZ/HCR Würth Fixanchor W-FAZ-IG/S, W-FAZ-IG/A4, W-FAZ-IG/HCR

Characteristic values for tension loads, CEN/TS 1992-4, Displacements under tension loads, W-FAZ-IG



Table 32: Characteristic values for shear loads, CEN/TS 1992-4, W-FAZ-IG

Anchor size			M6	M8	M10	M12
W-FAZ-IG zinc plated						
Steel failure without lever arm, Install	ation typ	e V				
Characteristic resistance	V _{Rk,s}	[kN]	5.8	6.9	10.4	25.8
Steel failure without lever arm, Install	ation typ	e D				
Characteristic resistance	$V_{Rk,s}$	[kN]	5.1	7.6	10.8	24.3
Steel failure with lever arm, Installation						
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	12.2	30.0	59.8	104.6
Steel failure with lever arm, Installation	n type D					
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	36.0	53.2	76.0	207
Partial safety factor for $V_{Rk,s}$ (type V, D) and $M^0_{Rk,s}$ (type V, D)	γ_{Ms}	[-]		1.2	25	
Factor of ductility	k ₂	[-]		1.	0	
W-FAZ-IG stainless steel A4 and high	_		nt ataal H		0	
v				UN		
Steel failure without lever arm, Install Characteristic resistance	<u></u>	ev [kN]	5.7	9.2	10.6	00.6
	V _{Rk,s}		D.7	<u>9.2</u>		23.6
Partial safety factor	Ϋ́Ms	[-]		، ا	20	
Steel failure without lever arm, Install					07	
Characteristic resistance	V _{Rk,s}	[kN]	7.3	7.6	9.7	29.6
Partial safety factor	γ _{Ms}	[-]		1.2	25	
Steel failure with lever arm, Installatio						
Characteristic bending resistance	M ⁰ _{Rk,s}	[Nm]	10.7	26.2	52.3	91.6
Partial safety factor	γ_{Ms}	[-]		1.	56	
Steel failure with lever arm, Installation				T	1	1
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	28.2	44.3	69.9	191.2
Partial safety factor	γ_{Ms}	[-]		1.2		
Factor of ductility	k ₂	[-]		1.	0	
Concrete pryout failure				1		
Factor in equation (16) CEN/TS 1992-4-4, 5.2.2.3	k_3	[-]	1.5	1.5	2.0	2.0
Partial safety factor	γмср	[-]		1.	5	•
Concrete edge failure						
Effective length of anchor in shear loading	۱ _۴	[mm]	45	58	65	80
Effective diameter of anchor	d _{nom}	[mm]	8	10	12	16
Partial safety factor	γмс	[-]		1.	5	

Table 33: Displacements under shear loads, W-FAZ-IG

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English translation prepared by DIBt



		120		1.8	4.0		4.0		8.2						
	M 12	06		2.2	5.7										
	Σ	60		2.9	9.2		5.0		10.3						
5-IG		30		3.7	12.6										
V-FA		120		- 3	2.7		2.4		4.9	-		according to Annex 23	s _{min} according to Annex 23; c _{min} ≥ 300 mm.		
1992-4, M	M 10	06		1.5	3.9		3.0								
	Σ	60		2.0	6.3				6.1						
I/TS		30		2.5	8.7					lef	lef			1.0	
CEN		120		0.8	1.3		1.8		3.7	4 x h _{ef}	2 x h _{ef}				
Characteristic values to tension loads under fire exposure in cracked and non-cracked concrete C20/25 to C50/60, CEN/TS 1992-4, W-FAZ-IG	8	6		0.9	2.1		2.3		4.6						
	Σ	60		1.2	3.8 .2			_							
		30		1.4	5.4										
		120		0.4	0.5		1.0		2.0						
	M 6	06		0.5	1.0		1.3								
		60		0.6	1.9			2.4							
		30		0.7	2.9										
		R [min]		Steel zinc plated	Stainless steel A4 / HCR		N _{Rk,p,fi} [kN]		N ⁰ Rk,c,fi [KN]	S _{cr,N,} fi	C _{cr} , N, fi	Minimum spacing and edge distance under fire exposure from one side	distance under τ one size	ΥΜ,fi [-]	
Table 34: Characteristic vall in cracked and no	Anchor size	Fire resistance duration	Steel failure:	Characteristic N _{Rk 5.6}	resistance [kN]	Pullout failure:	Characteristic resistance in concrete C20/25 to C50/60	Concrete cone failure:	Characteristic resistance in concrete C20/25 to C50/60	Spacing	Edge Distance		Minimum spacing and edge distance under fire exposure from more than one size	Partial safety factor	
Vürth Fix Vürth Fix Characte	xanc eristio	hor W c value	-FAZ	Z-IG/S f tens	ion re	AZ-I sist	G/A4, [°] ance	W-F		(HC)	R			Anne	ex 32

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	under fire exposure, CEN/TS 1992-4, W-FAZ-IG											8.06.01-283/12			
Würth	Würth Fixanchor W-FAZ/S, W-FAZ/A4, W-FAZ/HCR Würth Fixanchor W-FAZ-IG/S, W-FAZ-IG/A4, W-FAZ-IG/HCR Characteristic values of shear resistance												Annex 33		
Table 35:	Anchor size:	Fire resistance duration	Steel failure without lever anSteel failure without lever anCharacteristic $V_{Rk,s,fi}$ Characteristic $V_{Rk,s,fi}$ resistance $[KN]$ Steel failure with lever arm:Steel failure with lever arm:Characteristic $M_{0}^{0}_{Rk,s,fi}$ Besistance $[Nm]$ AdConcrete pryout failure:In Equations (D.6 snd D.7) of the relevant values of $N_{0}^{0}_{Rk,c,fi}$ of the value value of $N_{0}^{0}_{Rk,c,fi}$ of the of with $V_{0}^{0}_{Rk,c,fi} = 0.25 \times V_{0}^{0}_{Rk}$										Partial safety factor		
Character in cracked		e duration	without leve		[kN]	with lever a	M ⁰ _{Rk.s.f}		out failure: D.6 snd D.7 alues of N ⁰ _{Rk}	edge failure: value $V^{0}_{Rk,c,fi}$ of th $V^{0}_{Rk,c,fi} = 0.25 \times V^{0}$ initial value if the	ial value if th	γ _{M,fi} [-]			
eristic values t d and non-crac		R [min]	er arm:	Steel zinc plated	Stainless steel A4 / HCR		Steel	A4 / HCR	Jre: D.7) of CEN/TS 1992-4-1, Annex D,D.3.3.2 the k-factor is similar to the k ₃ -factor for normal temperature an N ⁰ _{Rk.c.fi} of Table 34 have to be considered.	Concrete edge failure: The initial value V ⁰ _{Rkc.fl} of the characteristic resistance in concrete C20/25 to C50/60 under fire exposure may be determined by:	V ⁰ _{Rk,c} (R30, R60, R90)	e characteristic resistance in cracked concrete C20/25 under normal temperature.			
o tei ked (30		0.7	2.9		0.5	2.2	-4-1, /e to	esista	(06)	sistan			
Characteristic values to tension loads under fire exposur in cracked and non-cracked concrete C20/25 to C50/60, CEN/TS 1992-4, W-FAZ-IG	MG	60		0.6	1.9		0.4	1.5	Anne be co	ance i		ce In			
		90 12		0.5 0.	1.0 0.		0.4 0.	0.7 0.4	x D,D. 1sider	u conc	-	cracke			
		120 30		0.4 1.4	0.5 5.4		0.3 1.4	4 5.5	3.3.2 † ed.	trete C	>	ad con			
	M8	60		1.2	1 3.8		1.2	3.9	he k-f	:20/25	0 Rk,c,fi =	crete			
		06		0.9	2.1		0.9	2.2	actor i	to C5	$V^{0}_{Rk,c,fi} = 0.20 \times V^{0}_{Rk,c}$ (R120)	270/22			
		120		0.8	1.3		0.8	1.3	s simil	0/60 u	× V ⁰ _{Rk}	o unde	1.0		
ur I/TS -		30		2.5	8.7		3.3	11.2	ar to t	nder f	_د (R12	ir norn			
992-4	M10	60		2.0	6.3		2.6	8.1	Je k ₃₋₁	te exp	(O)	al ter			
4, W-I	0	06		1.5	3.9		2.0	5.1	actor	posure	-	nperat			
FAZ-		120		1.3	2.7		1.6	3.5	for no	e may		ure.			
ß		30		3.7	12.6		5.7	19.6	rmal t	be de					
	M12	60		2.9	9.2		4.6	14.3	emper	termin					
		06		2.2	5.7		3.4	8.9	ature	ed by					
		12			4.		~i	<u>ن</u>	an						

2.8

6.2

r normal temperature and

120

1.8

4.0

