Deutsches Institut für Bautechnik

Zulassungsstelle für Bauprodukte und Bauarten

Bautechnisches Prüfamt

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

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Mitglied der EOTA

Member of EOTA

European Technical Approval ETA-13/0364

English translation prepared by DIBt - Original version in German language

Handelsbezeichnung Trade name

Zulassungsinhaber Holder of approval

Zulassungsgegenstand und Verwendungszweck

Generic type and use of construction product

Geltungsdauer: Validity: vom from bis

to

Herstellwerk

Manufacturing plant

JCP Option 1 Throughbolt und Option 1 Throughbolt ITS JCP Option 1 Throughbolt and Option 1 Throughbolt ITS

JCP Construction Products
Unit 14 Teddington Business Park
Station Road

TEDDINGTON, MIDDLESEX TW11 9BQ GROSSBRITANNIEN

Kraftkontrolliert spreizender Dübel zur Verankerung im Beton

Torque controlled expansion anchor for use in concrete

30 May 2013

15 May 2018

Plant2, Germany

Diese Zulassung umfasst This Approval contains

41 Seiten einschließlich 33 Anhänge

41 pages including 33 annexes





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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.
- Deutsches Institut für Bautechnik is authorized to check whether the provisions of this European technical approval are met. Checking may take place in the manufacturing plant. Nevertheless, the responsibility for the conformity of the products to the European technical approval and for their fitness for the intended use remains with the holder of the European technical approval.
- This European technical approval is not to be transferred to manufacturers or agents of manufacturers other than those indicated on page 1, or manufacturing plants other than those indicated on page 1 of this European technical approval.
- This European technical approval may be withdrawn by Deutsches Institut für Bautechnik, in particular pursuant to information by the Commission according to Article 5(1) of Council Directive 89/106/EEC.
- Reproduction of this European technical approval including transmission by electronic means shall be in full. However, partial reproduction can be made with the written consent of Deutsches Institut für Bautechnik. In this case partial reproduction has to be designated as such. Texts and drawings of advertising brochures shall not contradict or misuse the European technical approval.
- The European technical approval is issued by the approval body in its official language. This version corresponds fully to the version circulated within EOTA. Translations into other languages have to be designated as such.

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

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

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

Bundesgesetzblatt Teil I 1998, p. 812

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 JCP Option 1 Throughbolt and Option 1 Throughbolt ITS 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 Option 1 Throughbolt with external thread, washer and hexagon nut, sizes M8 to M27.
- Anchor type Option 1 Throughbolt ITS S with internal thread, hexagon head nut and washer S-IG, sizes M6 to M12,
- Anchor type Option 1 Throughbolt ITS SK with internal thread, countersunk head screw and countersunk washer SK-IG, sizes M6 to M12,
- Anchor type Option 1 Throughbolt ITS 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 JCP Option 1 Throughbolt is marked in accordance with Annex 3. Each JCP Option 1 Throughbolt ITS 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.

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.

See section 3.2.2.

Z36806.13

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.



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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 Option 1 Throughbolt ITS 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).

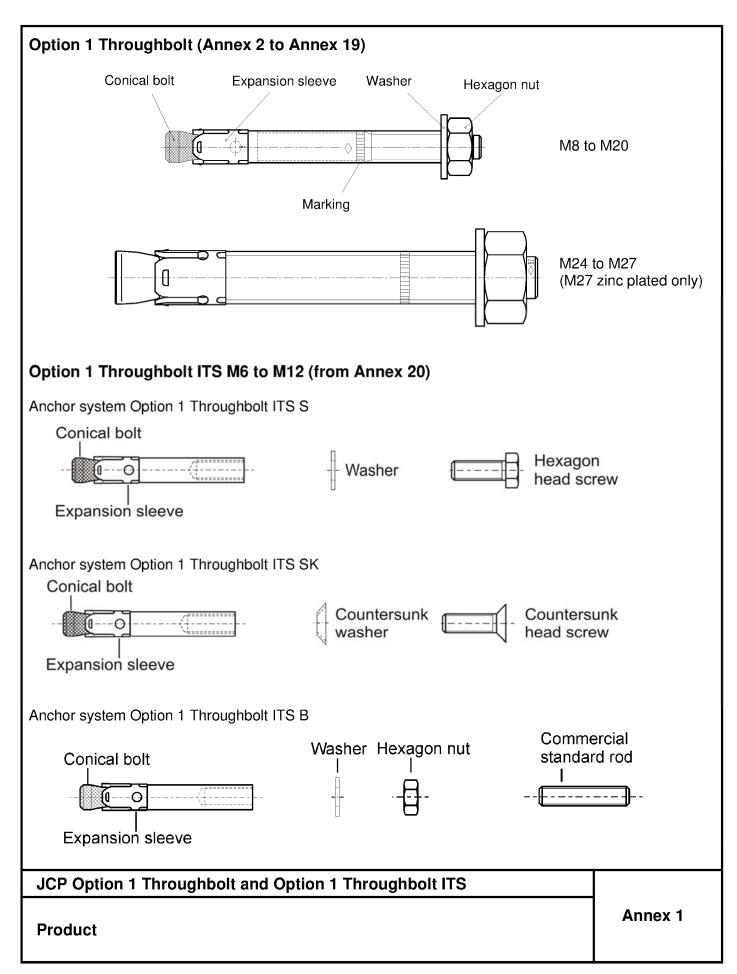
The minimum data required are:

- 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.

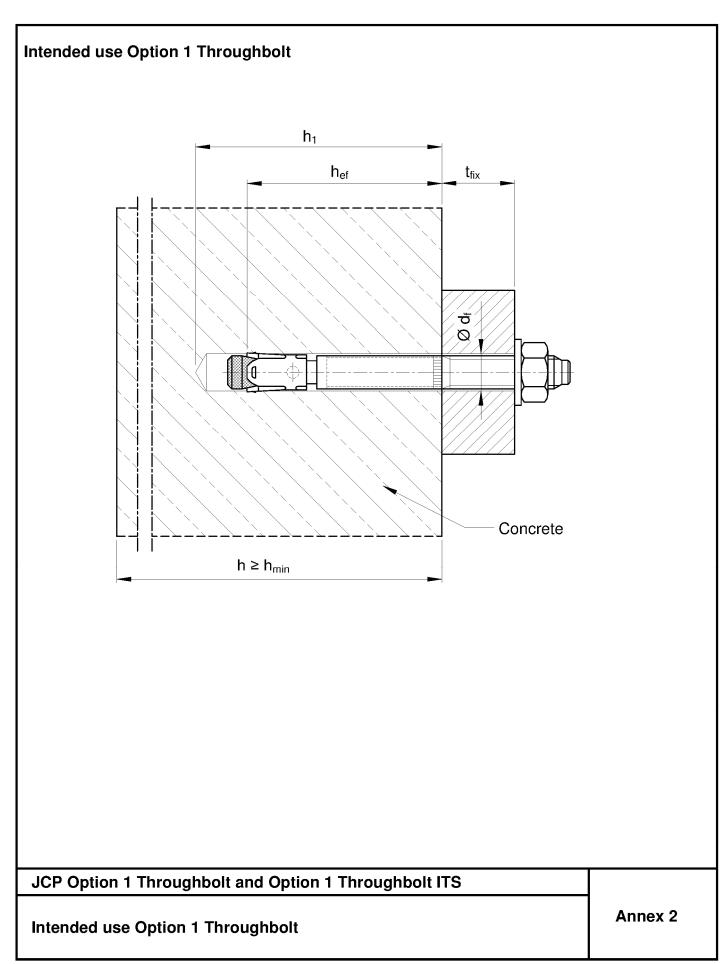
All data shall be presented in a clear and explicit form.

Uwe Bender Head of Department beglaubigt: Baderschneider











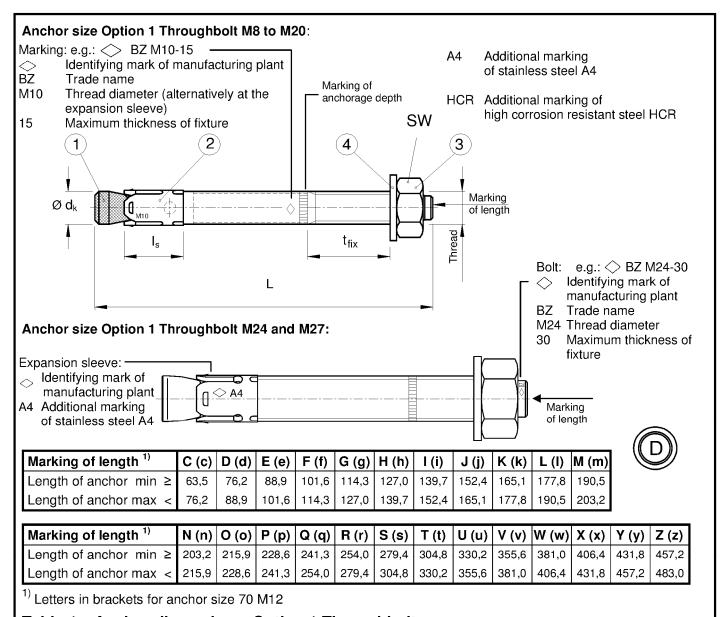


Table 1: Anchor dimensions, Option 1 Throughbolt

		Anchor size			M8	M10	70 M12	M16	M20	M24	125 M24	M27
	1	Conical bolt	-	Thread	M8	M10	M12	M16	M20	M24	M24	M27
Ш			$\emptyset d_k$	=	7,9	9,8	12,0	15,7	19,7	24	24	28
			t _{fix} max	≤	3000	3000	3000	3000	3000	3000	3000	3000
		Steel, zinc pla	ted	L max	3065	3080	3095	3120	3137	3161	-	3178
		Stainless ste A4, HCR	el	L max	3065	3080	3095	3120	3137	3153	3178	-
	2	Expansion sleeve	Is	II	14,5	18,5	22	24,3	28	32	32	36
	3	Hexagon nut		SW	13	17	19	24	30	36	36	41
	4	Washer						see	Table 2			

Anchor dimensions, Option 1 Throughbolt

Annex 3

Dimensions in mm

English translation prepared by DIBt



Table 2: Materials, Option 1 Throughbolt

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	Threaded bolt, steel property class 8.8, EN ISO 898-1	Stainless steel 1.4401, 1.4404, 1.4571 or 1.4578,	High corrosion resistant steel 1.4529 or 1.4565,
	Conical boil	coated (M8 to M20)	Threaded cone, steel, property class 8, EN ISO 898-2	EN 10088 Cone plastic coated	EN 10088 Cone plastic coated
2	Expansion sleeve	Steel acc. to EN 100 1.4301 or 1.4401 for Steel EN 10139 for	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	e. 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

JCP Option 1 Throughbolt and Option 1 Throughbolt ITS

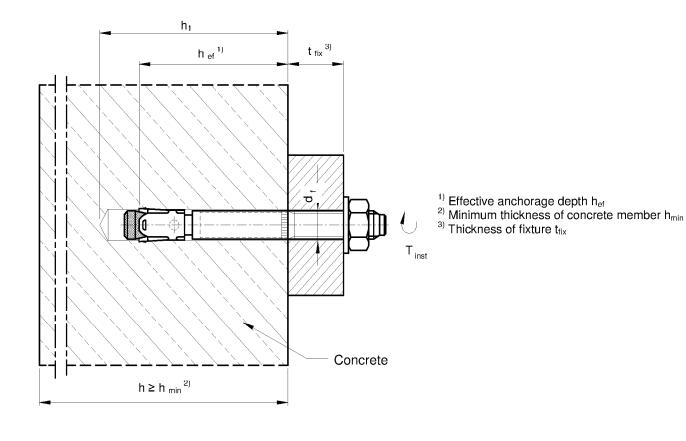
Materials, Option 1 Throughbolt

Annex 4



Table 3: Installation parameters, Option 1 Throughbolt

Anchor siz	e			М8	M10	70 M12	M16	M20	M24	125 M24	M27
Nominal dri	ll hole diameter	d_0	[mm]	8	10	12	16	20	24	24	28
Cutting diar	neter 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	$h_1 \ge$	[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
anchorage depth	Stainless steel A4, HCR	h _{ef}	[mm]	46	60	70	85	100	100	125	-
Installation	Steel, zinc plated	T _{inst}	[Nm]	20	25	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	clearance hole	$d_{f} \! \leq \!$	[mm]	9	12	14	18	22	26	26	30

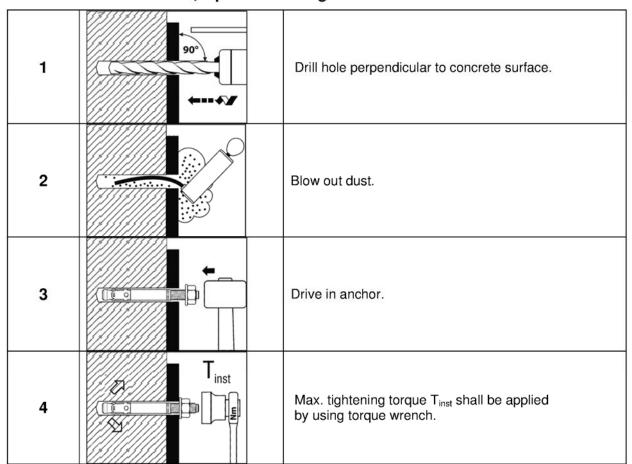


Installation parameters, Option 1 Throughbolt

Annex 5



Installation instructions, Option 1 Throughbolt



JCP Option 1 Throughbolt and Option 1 Throughbolt ITS

Installation instructions, Option 1 Throughbolt

Annex 6

Electronic copy of the ETA by DIBt: ETA-13/0364



Table 4: Standard thickness of concrete member and respective minimum spacing and edge distance, Option 1 Throughbolt

Anchor size			М8	M10	70 M12	M16	M20	M24	125 M24	M27
Steel zinc plated										
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 ≥	[mm]	70	70	100	100	150	180	-	300
Minimum edge distance	C _{min}	[mm]	40	45	60	60	95	100	-	180
	for s ≥	[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, Option 1 Throughbolt

Anchor size			M8	M10	70 M12	M16	M20	M24	125 M24	M27
Steel zinc plated and Stainles	s steel A	4, HCR	1							
Minimum thickness of member	h_{min}	[mm]	80	100	120	140	-	-	-	-
Cracked concrete										
Minimum spacing	Smin	[mm]	40	45	60	70	-	-	-	-
	for c ≥	[mm]	70	90	100	160	-	-	-	-
Minimum edge distance	C _{min}	[mm]	40	50	60	80	-	-	-	ı
	for s ≥	[mm]	80	115	140	180	-	-	-	ì
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	-	-	-	-

Intermediate values by linear interpolation.

JCP Option 1 Throughbolt and Option 1 Throughbolt ITS

Minimum thickness of member, Minimum spacing and edge distance, Option 1 Throughbolt

Annex 7



Table 6: Characteristic values for tension loads, ETAG 001, Annex C, Option 1
Throughbolt, steel zinc plated

Anchor size			M8	M10	70 M12	M16	M20	M24	M27
Steel failure				•			1		•
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 o	f concrete n	nembei	r (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	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	$\mathbf{c}_{cr,sp}$	[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	h _{ef}		2,2 h _{ef}	1,5 h _{ef}	2,5 h _{ef}
Splitting for minimum thickness of	f concrete r	nembe	r						
Minimum thickness of concrete	h _{min} ≥	[mm]	80	100	120	140	-	-	-
Characteristic resistance in concrete C20/25	$N^0_{\text{Rk,sp}}$	[kN]	12 ¹⁾	16 ¹⁾	25 ¹⁾	35 ¹⁾	-	i	-
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	115	125
Spacing	S _{cr,N}	[mm]				3 h _{ef}			
Edge distance	C _{cr,N}	[mm]				1,5 h _{ef}			
Partial safety factor γ _M	p= γ _{Msp} =γ _{Mc}	[-]				1,5			

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

Pullout is not decisive

JCP Option 1 Throughbolt and Option 1 Throughbolt ITS

Characteristic values for tension loads, ETAG 001, Annex C, Option 1 Throughbolt, steel zinc plated

Annex 8

The values $s_{cr,sp}$ and $c_{cr,sp}$ may be linearly interpolated for the member thickness $h_{min} < h < h_{std}$ (Case 2) $(\psi_{h,sp} = 1,0)$.



Table 7: Characteristic values for tension loads, ETAG 001, Annex C, Option 1
Throughbolt, stainless steel A4, HCR

Anchor size			М8	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 Case	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	$N^0_{Rk,sp}$	[kN]	91)	12 ¹⁾	201)	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 o	f concrete r	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	h _{ef}		-	-	-
Respective edge distance	C _{cr,sp} ²⁾	[mm]		2,5	h _{ef}		-	-	-
Increasing factors	C30/37	[-]				1,22			
for $N_{Bk,p}$ and $N_{Bk,sp}^0$ 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			

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 (ψ_{ucr,N} = 1,0).

3) Pullout is not decisive

JCP Option 1 Throughbolt and Option 1 Throughbolt ITS

Characteristic values for tension loads, ETAG 001, Annex C, Option 1 Throughbolt, stainless steel A4, HCR

Annex 9

The values $s_{cr,sp}$ and $c_{cr,sp}$ may be linearly interpolated for the member thickness $h_{min} < h < h_{std}$ (Case 2) $(\psi_{h,sp} = 1,0)$.





Table 8:	Displacements under tension loads, Option 1 Throughbolt

Anchor size			М8	M10	70 M12	M16	M20	M24	125 M24	M27
Steel zinc plated										
Tension load in cracked concrete	N	[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
	$\delta_{N\infty}$	[mm]	1,4	1,2	1,4	1,3	1,0	1,2	-	1,4
Tension load in non-cracked concrete	N	[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
	$\delta_{N\infty}$	[mm]	0,	8	1,4		0,8		-	1,4
Stainless steel A4, HCI	R									
Tension load in cracked concrete	N	[kN]	2,4	4,3	7,6	11,9	17,1	17,0	19,0	ı
Displacement	δ_{N0}	[mm]	0,7	1,8	0,4	0,7	0,9	0,5	0,5	-
	$\delta_{N\infty}$	[mm]	1,2	1,4	1,4	1,4	1,0	1,6	1,8	1
Tension load in non-cracked concrete	N	[kN]	5,8	7,6	11,9	16,7	23,8	24,1	33,5	ı
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	-

Displacements under tension loads, Option 1 Throughbolt

Annex 10



Table 9: Characteristic values for shear loads, ETAG 001, Annex C, Option 1
Throughbolt

Anchor size			М8	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	γ̃Ms	[-]		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	γMs	[-]		1	,25		1,4	1,	25	-
Steel failure with lever arm, Steel	zinc pla	ted								
Characteristic bending resistance	$M^0_{Rk,s}$	[Nm]	23	47	82	209	363	898	-	1331,5
Partial safety factor	γMs	[-]		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	γ̃Ms	[-]		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	I _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, Option 1 Throughbolt

Anchor size			M8	M10	70 M12	M16	M20	M24	125 M24	M27
Steel zinc plated										
Shear load in cracked and non-cracked concrete	٧	[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
	$\delta_{\text{V}\infty}$	[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	٧	[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	=
	$\delta_{\text{V}_{\infty}}$	[mm]	4,8	6,6	7,8	9,8	4,3	4,	2	ı

Characteristic values for shear loads, ETAG 001, Annex C, Displacements under shear loads, Option 1 Throughbolt

Annex 11

English translation prepared by DIBt



Fine resistance Fine resis		cracked and non-	and	non-c	rack)]) •	te CZ	cracked concrete C20/25 to C 50/60, ETAG001, Annex C, Option 1	to C	5U/DC	, _	AGO	, - -	√nne	ز ×	C D E	on 1			
Fire resistance R Steel failure Characteristic No. 14 1.1 0.8 0.7 22 1.8 1.4 1.2 3.2 6.0 90 120 30 60 90 120 30 90 120 90 90 120 90 90 120 90 90 120 90 90 120 90 90 120 90 90 120 90 90 120 90 90 120 90 90 120 90 90 120 90 90 120 90 90 120 90 90 120 90 90 120 90 90 120 90 90 90 120 90 90 90 120 90 90 90 120 90 90 90 120 90 90 90 120 90 90 90 120 90 90 90 90 120 90 90 90 90 90 90 90 90 90 90 90 90 90		<u> </u>		18		M10	\vdash	70 M1	[2		M16			M20		M24/1	25 M2	24 A4		M27	
Steel failure Characteristic Ne _{NeAn} vz. 1,4 1,1 0.8 0,7 2,2 1,8 1,4 1,2 3,2 2,8 2,4 4,0 9,4 82 69 63 13,6 11,8 10,0 9,1 776 15,3 13,0 resistance NVI AGA 3,8 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 49,2 35,9 29 7,4 7 7 7 7 7 7 8 7 8 7 8 7 7 8				06	30	06		09							120						
Characteristic N _{NA,Mari} Varies (N _{NA,Mari} Varies) (N _{NA,Mari} V																					
resistance [kN] A47 3.8 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 35.9 23.6 17.4	I		4,	0,8 0,	2,2	4,1		2,8							6,3	13,6 1-	1,8 10,	9,1	17,6 15	5,3 13	1,0
Pullout failure Characteristic v.z. resistance in Na _{bab} Machine v.z. resistance cone failure resistance cone failur			3,8	2,0	6,9	3,5		8,6	4,2	21,51	6,0 10,4	7,8	33,5 25	,0 16,4		48,2 35	5,9 23,	6 17,4	1	,	<u> </u>
Characteristic resistance in Net call V.Z. 1.3 1.0 2.3 1.8 4.0 3.2 6.3 5.0 9.0 7.2 9.0 / 12.6 ll 1/0, 1 1.3 1.2 1.3 1.0 2.3 1.8 4.0 3.2 6.3 5.0 9.0 7.2 9.0 7.2 9.0 7.2 1.2 <		۵																			
Concrete cone failure Characteristic resistance in concrete on order or sistance in concrete in concrete states and the concrete states are sized of strane or under fire exposure from one side 2.6 2.1 4.0 7.4 5.9 12.0 9.6 18.0 14.4 14.4 31.5 20.4 31.5				₩			80,	4,0	3,2		e, 9	5,0	တ်	0_	7,2	9,0,6	1,0 12,6 ¹⁾	8,8 7,2 / 10,1		5,6	-
Characteristic resistance in concrete resistance in concrete resistance in concrete resistance in concrete (RM] A4 / A4		e failure																			
Scr.N.fi tance Ccr.N.fi spacing and ance under from one spacing and ance under suce under suce from n one side		vz. N ⁰ _{Rk,c,fi} —— [KN] A4 / HCR		ΩÎ.			0,1	7,4	5,9	-	2,0	9,6	18	0;	14,4	2,4	5,5 31,5 ¹⁾	20,4 14,4 / 25,2	က်	5,1	N
e distance $c_{\alpha,N,fi}$ num spacing and e distance under sure from one num spacing and e distance under exposure from e than one side	Spacing	S _{cr,N,fi}									4 ×	h _{ef}									
rum spacing and sure from one distance under sure from one distance under susposure from stance under stan one side	Edge distance	Ccr,N,fi									N ×	hef									
	Minimum spacedge distance fire exposure from side	ing and under one								Acc	ording t	o Ann									
	Minimum spaci edge distance fire exposure fr more than one	ing and under om side						တ်	min acco	ording	to Ann	ex 7; (VI S	00 mn	_						

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JCP Op																												
विष्ट L tion 1 Th	Table 12:	Characteristic shear resistance under fire exposure in cracked and non-cracked concrete C20/25 to C50 Throughbolt	ked hb	isti I an olt	c sh id n	on-	r reg cra	r resistance under -cracked concrete	ance d co	un (der ete	fire C2(fire exposure C20/25 to C50/60, ETAG001, Annex C, Option 1	30SI 10	ure C50	/60,	ET	AG(101,	An	nex	ပ်	Opti	uo	_			
	Anchor size				M8			M10		~	70 M12	2		Σ	M16			M20	_	╚	124 /	125 R	M24 / 125 M24 A4	\4		M27		
-	Fire resistance duration	R [min]	.,	30 60		90 120	30	06 09	90 120	30 6)6 09	90 120	02 0	09	06	120	30	09	90 13	120 3	30	09	90 13	120 3	30 66)6 09	90 13	120
	Steel failure without lever arm	ithout leve	rarı	٤																								
	Characteristic	VZ. Vrk.s.fi		1,6 1,	,5 1,2	1,0	2,6 2.	2,6 2,5 2,1	2,0	3,8 3	3,6 3,	3,5 3,4	1 7,0	6,8	6,5	6,4	11,0	11,0 1	11,0 10,0 10,0		16,0 1	15,0 1	15,0 14,0		20,6 19	19,8 19	19,0 18	18,6
	resistance	[kN] - - - - - - - - - - - - - - - - - - -	A4/ HCR 3	3,8 2,9	9 2,0	1,6	6,9 5,2	2 3,5	2,7	11,5 8	8,6 5,	5,6 4,2		21,5 16,0 10,5	10,5	7,8	33,5	25,0 1	25,0 16,4 12,1		48,2 3	35,9 2	23,6 17	17,4				
	Steel failure with lever	ith lever arm	Ę																									
	Characteristic	M ⁰ Rk.s.fi		1,7 1,6	6 1,2	1,1	3,3 3,	3,3 3,2 2,7	2,5	5,9 5	5,6 5,	5,4 5,3		15,0 14,0 14,0 13,0	14,0		29,0 ;	28,0 5	29,0 28,0 27,0 26,0		50,0 4	48,0 4	7,0 46	6,0 7	47,0 46,0 75,0 72,0 69,0 68,0	69 0"	39 0.6	8,0
	resistance	[Nm] A4 HC	A4/ HCR 3	3,8 2,9	9 2,1	1,6	9,0,6	9,0 6,8 4,5	3,4	17,9 13,3	3,3 8,	8,8 6,5	5 45,5	33,9	22,2 16,4		88,8	66,1 4	43,4 3,	32,1 15	3,5 1.	153,5 114,3 75,1	5,1 55	55,5	'	'		1
_	concrete pryout failure: In Equation (5.6) of ETAG 001, Annex C, 5.2.3.3	ut failure: of ETAG 001	1, Anı	nex C	3, 5.2.		ન ક	the k-factor 2,0 and the relevant values of $N^{0}_{Rk,c,fi}$ of Table 11 have to be considered.	,0 and	the re	əlevar	nt valu	jo sər	N Rk.o.	f of Ti	able 1	1 hav	e to b	e con	sidere	ģ							
Con	Concrete edge failure:	failure:																										
The	The initial value V_{Rkcfl}^0 of the characteristic resistance in concrete C20/25 to C50/60 under fire exposure may be determined by:	r ⁰ Rk,c,fi of the c	chara	acteris	stic re.	sistar	nce in	concr	ete C2	:0/25 1	to C5(n 09/0	ınder f	lire ex	posur	e ma)	be d	eterm	ined k	. y .								
with	$V_{RR,c,f}=0.25 \times V_{RR,c}$ (R30, R60, R90) $V_{RR,c,f}=0.20 \times V_{RR}$ with $V_{RR,c}$ initial value of the characteristic resistance in cracked concrete C20/25 under normal temperature.	alue of the ch	harac	۷ عوا	rk,c,fi	= 0,2. .istan(5 x V	$V_{RR,c,f} = 0.25 \times V_{RR,C}$ (R30, R60, R90) stic resistance in cracked concrete C2:	30, R(d conc	30, RS rete (30) 320/2:	5 und	ر" er nori	V° _{Rk,c,ff} = 0,20 x V° _{Rk,c} (R120) ormal temperature.	0,20 . mper	× V° RK ature.	e (R1)	50)										
In ab	In absence of other national regulations the partial factor for resistance under fire exposure $\gamma_{M,il}=1,0$ recommended.	er national re	egula	tions	the p	artial	factor	for re	sistan	Se un	der fir	e exp	osure	γ _{M,fi} =	1,0 re	comn	Jende	يَقِ										1

Characteristic shear resistance

under fire exposure, ETAG 001, Annex C, Option 1 Throughbolt

Annex 13



Table 13: Characteristic values for tension loads, CEN/TS 1992-4, Option 1 Throughbolt, steel zinc plated

Anchor size			М8	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	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 co	ncrete n	nembei	r (The high	ner resista	nce of Cas	e 1 and C	ase 2 may	be applied	d.)
Standard thickness of concrete		[mm]	100	120	140	170	200	230	250
Case 1				T				ı	
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	h _{ef}		2,2 h _{ef}	1,5 h _{ef}	2,5 h _{ef}
Splitting for minimum thickness of co	oncrete r	nembe	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 ⁰ _{Rk,sp}	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 $\gamma_{Mp} = \gamma$	м _{sp} =γмс	[-]				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 ($\psi_{ucr,N} = 1,0$).

Characteristic values for tension loads, CEN/TS 1992-4, Option 1 Throughbolt, steel zinc plated

Annex 14

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). Pullout is not decisive



Table 14: Characteristic values for tension loads, CEN/TS 1992-4, Option 1 Throughbolt, stainless steel A4, HCR

Anchor size			М8	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 o	oncrete m	nember	(The high	ner resista	nce 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	$N^0_{Rk,sp}$	[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	$N^0_{Rk,sp}$	[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			1						
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}			
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, $N^0_{Rk,c}$ in equation (12) has to be replaced by $N^0_{Rk,sp}$ with consideration of the member thickness ($\psi_{uor,N} = 1,0$).

Pullout is not decisive

JCP Option 1 Throughbolt and Option 1 Throughbolt ITS

Characteristic values for tension loads, CEN/TS 1992-4, Option 1 Throughbolt, stainless steel A4, HCR

Annex 15

The values $s_{cr,sp}$ and $c_{cr,sp}$ may be linearly interpolated for the member thickness $h_{min} < h < h_{std}$ (Case 2) $(\psi_{h,sp} = 1,0)$.

Table 15:	Displacements under tension loads, Option 1 Throughbolt

Anchor size			M8	M10	70 M12	M16	M20	M24	125 M24	M27
Steel zinc plated										
Tension load in cracked concrete	N	[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
	$\delta_{N\infty}$	[mm]	1,4	1,2	1,4	1,3	1,0	1,2	-	1,4
Tension load in non-cracked concrete	N	[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
	$\delta_{N\infty}$	[mm]	0,	,8	1,4		0,8		-	1,4
Stainless steel A4, HCR										
Tension load in cracked concrete	N	[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	-
	$\delta_{N\infty}$	[mm]	1,2	1,4	1,4	1,4	1,0	1,6	1,8	-
Tension load in non-cracked concrete	N	[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	-

Displacements under tension loads, Option 1 Throughbolt

Annex 16

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Anchor size				М8	M10	70 M12	M16	M20	M24	125 M24	M27
Steel failure witho	out lever arm, Ste	el zinc	plated		ı	'					
Characteristic resis	tance	$V_{Rk,s}$	[kN]	15	22	30	60	69	114	-	169,4
Factor of ductility		k ₂	[-]			1,	0			-	1,0
Partial safety factor		γMs	[-]		1	,25		1,33	1,25	-	1,25
Steel failure witho	ut lever arm, Sta	ainless	steel A4	, HCR							
Characteristic resis	tance	$V_{Rk,s}$	[kN]	13	20	30	55	86	123	,6	-
Factor of ductility		k ₂	[-]				1,0				-
Partial safety factor	•	γMs	[-]		1	,25		1,4	1,	,25	-
Steel failure with I	ever arm, Steel	zinc pla	ted								
Characteristic bend	ling resistance	M ⁰ _{Rk,s}	[Nm]	23	47	82	209	363	898	-	1331,5
Partial safety factor	•	γMs	[-]		1	,25		1,33	1,25	-	1,25
Steel failure with I	ever arm, Stainl	ess stee	A4, H	CR							
Characteristic bend	ling resistance	M ⁰ _{Rk,s}	[Nm]	26	52	92	233	454	785	,4	-
Partial safety factor		γMs	[-]		1	,25		1,4	1,	,25	-
Concrete pryout fa	ailure										
Factor in equation (CEN/TS 1992-4-4,		k ₃	[-]				2,	,0			
Partial safety factor	-	γмср	[-]				1,	,5			
Concrete edge fai	lure										
Effective length of	Steel zinc plated	I _f	[mm]	46	60	70	85	100	115	-	125
anchor in shear loading	Stainless steel A4, HCR	l _f	[mm]	46	60	70	85	100	100	125	-
Outside diameter o	f anchor	d_{nom}	[mm]	8	10	12	16	20	2	4	27
Partial safety factor		γмс	[-]				1,	,5			

Table 17: Displacements under shear loads, Option 1 Throughbolt

Anchor size			М8	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
	$\delta_{\text{V}\infty}$	[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_{V0}	[mm]	3,2	4,4	5,2	6,5	2,9	2,	8	-
	$\delta_{\text{V}\infty}$	[mm]	4,8	6,6	7,8	9,8	4,3	4,	2	-

Characteristic values for shear loads, CEN/TS 1992-4,

Displacements under shear loads, Option 1 Throughbolt

Annex 17



Per R Per P Per	ptio	Anchor size		Ш	M8		\dashv	Σ	M10		7	70 M12			Σ	M16			M20	ا	뤼	124/1	M24/125 M24 A4	24 A	4	2	M27	
Steel failure Characteristic Nise, and Adv. 1, 10, 8, 07, 22 1, 18, 14, 12, 32, 28, 24, 27, 15, 8, 6, 56, 42, 27, 15, 8, 6, 6, 52, 44, 40, 94, 82, 83, 82, 91, 18, 118, 100, 91, 14, 40, 40, 44, 40,	n 1 Tl	stance	n]	30					06	120						06	120	30								09	06	120
Characteristic Na _{Na,ball} Vz. 1, 4 1, 1 0, 8 0, 7 2, 2 1, 8 1, 4 1, 2 3, 2 2, 8 2, 4 2, 2 1, 5 16, 10, 5 7, 8 33, 525, 0 16, 4 1, 2 1, 10, 10, 10, 10, 10, 10, 10, 10, 10,	hro	Steel failure																										
Pullout failure	ughl				<u>-</u>		2	2	-								4,0	4,6				3,6	1,8			5 15,3	13,0	11,8
Pullout failure Characteristic Nisquest 1.3 1.0 2.3 1.8 4.0 3.2 6.3 5.0 9.0 7.2 9.0 / 12.6 9.0 14.4 14.1 18.1 1	bolt :			က်	2,9							9,6 5,6			16,0	10,5	2,8	33,5	25,0	16,4 1.	2,1 4.	8,2 35	5,9 23	3,6 17	4	,	,	'
Characteristic resistance in Newpil and resistance under fire exposure from one side with the safety of the exposure from more exposure from	and	Pullout failure								1]				1							
Concrete Cone failure	Ор																					-	0,	ω,	ω.			
Concrete cone failure vz.	tion 1	resistance in N _{Rk} concrete C20/25 [kN to C50/60	ij,o		د ,	τ-	oʻ	2,3		, 8,	4	oʻ	3,2		6,3		5,0		0,6		7,2	/ 0'6	12,61		loi E	12,6		10,1
Characteristic value resistance in N° characteristic concrete C20/25 [kN] A4 / HCR Spacing ScanAii Spacing ScanAii Spacing ScanAii Spacing and edge distance under from one side when one side than the side than th	Thro	Concrete cone fail	ure]		┨┈╽	┨┈		1	1				1] [1	1 }			$\ \cdot\ $	4			4
Parial safety With the specific concrete Note of the state Section Note of the state Section Section Note of the state Section	ougł	O	vZ.																			22	5,5	20	4			
Spacing s _{cr.N,fi} Edge distance c _{cr.N,fi} Minimum spacing and edge distance under fire exposure from one side Minimum spacing and edge distance under fire exposure from more than one side	nbolt IT	resistance in N ^r F concrete C20/25 [kN to C50/60	í,c,fi	ı	2,6	N	<u>-</u>	5,0		4,0	7	4,	5,9		12,0		9,6		18,0	-		18,1 /	31,5		4 N	31,5		25,2
e distance C _{Cr,N,fi} imum spacing and e distance under osure from one side imum spacing and e distance under exposure from more n one side	S		#'7													4 × h	et											4
e distance under osure from one side imum spacing and e distance under exposure from more n one side			ij ' Ź					l								2 x h	eŧ											
ore		Minimum spacing an edge distance under fire exposure from one s	nd ide											Acc	cordii	ng to	Ann	2 xe										
! M/ _/		Minimum spacing an edge distance under fire exposure from m than one side	nd									S _{mi}	aco	ordin	g to ,	Anne	× 7; (VI NI	300	E E								
		Partial safety Yw,fi factor														1,0												

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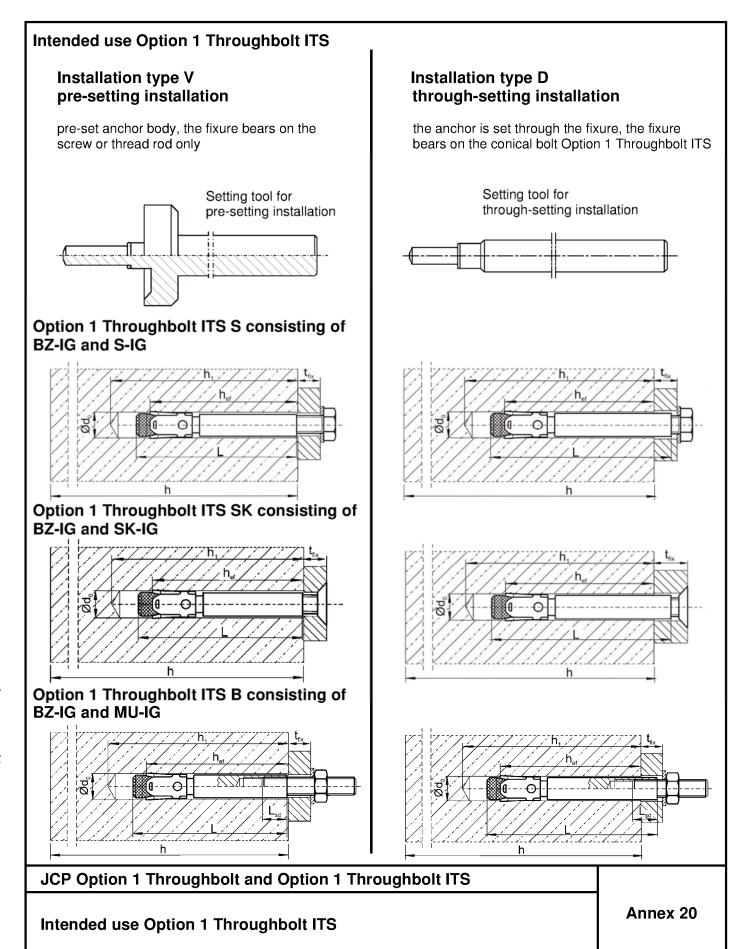
Table 19:	Characteristic shear resistance under fire exposure
	in cracked and non-cracked concrete C20/25 to C50/60. CEN/TS 1992-4. Option 1 Thro

_						ľ				ŀ			ſ	l			ŀ				İ				ſ
	Anchor size	M8			M10		7	70 M12	7		Σ	M16			M20	o.		M24 /	M24 / 125 M24 A4	M24	A 4		M27	_	
ghbo	Fire resistance R duration [min]	06 09 08	120	30	06 09	120	30 (6 09	90 120	0 30	09	06	120	30	09	06	120	30	09	06	120	30	09	06	120
	Steel failure without lever arm	r arm																							
<u> </u>	Characteristic V _{Rk.s.fi}	1,6 1,5 1,2	1,0	2,6 2	2,6 2,5 2,1	2,0	3,8	3,6	3,5 3,4	1 7,0	6,8	6,5	6,4		11,0	11,0 11,0 10,0 10,0		16,0	15,0	15,0 14,0		- 50,6	19,8	19,0	18,6
	resistance [kN] A4/ HCR	3,8 2,9 2,0	1,6	6'9	5,2 3,5	2,7	11,5 8	8,6 5,	5,6 4,2	2 21,5	21,5 16,0 10,5	10,5	7,8	33,5	25,0 16,4	16,4	12,1	48,2	35,9	23,6	17,4				1
	Steel failure with lever arm	щ																							
	Characteristic M ⁰ Rks.fi	1,7 1,6 1,2	1,1	3,3	3,3 3,2 2,7 2,5		5,9 5	5,6 5,	5,4 5,3	3 15,C	5,3 15,0 14,0 14,0 13,0 29,0 28,0 27,0 26,0	14,0	13,0	29,0	28,0	27,0	26,0 {	20,0	50,0 48,0 47,0 46,0 75,0 72,0 69,0 68,0	47,0	16,0	75,0 7	72,0 6	9 0'69	98,0
	resistance [Nm] A4/	3,8 2,9 2,1	1,6	9 0,6	9,0 6,8 4,5	3,4	17,9	3, 3, 8,	8,8 6,5	6,5 45,5	33,9	33,9 22,2 16,4 88,8	16,4	88,8	66,1	43,4	32,1	53,5	66,1 43,4 32,1 153,5 114,3 75,1 55,5	75,1	55,5	1	1	1	-
	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 ^{BK, D, II} of Table 18 have to be considered.	CEN/TS 19	92-4-1	, Ann	a,a xe	.3.3.2	the k	-facto	r is si	imilar	to the	k ₃ -fac	otor fc	ır norı	mal te	mper	ature	and th	ie rele	vant v	alues	of N	Rk,c,fi O	f Tab	e
	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: $V^{0}_{Rkc,fl} = 0.25 \times V^{0}_{Rkc} (R30, R60, R90) \qquad V^{0}_{Rkc,fl} = 0.20 \times V^{0}_{Rkc} (R120)$	characteristic V ^o re	istic resistance in concrete C20/25 to $V_{\rm PR,c,fl} = 0.25 \times V^{\rm 0}_{\rm PR,c}$ (R30, R60, R90)	tance ,25 x [']	in con	crete R30,	C20/2 R60, I	5 to C 390))20/60) unde	er fire exposure may be dete $V^0_{Rk_c,fl} = 0,20 \times V^0_{Rk_c} (R120)$	expos = 0,2	ure n 0 x V'	lay be	dete (3120)	rmine	d by:								
	with $V^{0}_{ m RK,c}$ initial value of the characteristic resistance in cracked concrete C20/25 under normal temperature.	naracteristic	resista	ance ii	n cracł	sed cc	ncret	e C20	/25 ur	nder n	ormal	temp	eratu	Θį											
	Partial safety Ym.fi factor [-]												1,0												

JCP Option 1 Th

Characteristic shear resistance under fire exposure, CEN/TS 1992-4, Option 1 Throughbolt Annex 19







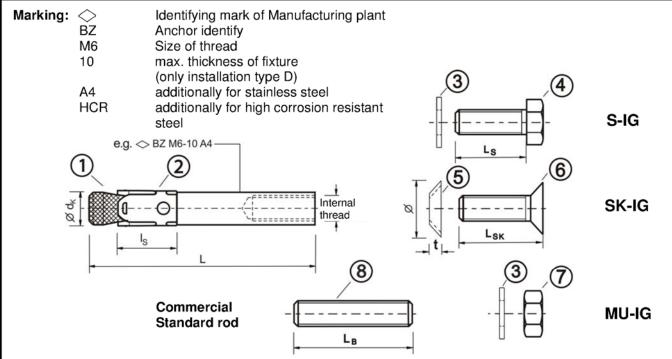


Table 20: Anchor dimensions, Option 1 Throughbolt ITS

No.	Anchor size		М6	M8	M10	M12
1	Conical bolt with Internal thread	\emptyset d _k	7,9	9,8	11,8	15,7
l l	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	Is	14,5	18,5	22,0	24,3
3	Washer			see ta	ıble 21	
4	Hexagon head screw	width accross flats	10	13	17	19
4	Installation type V	L _S	t_{fix} + (13 to 21)	t _{fix} + (17 to 23)	t _{fix} + (21 to 25)	t _{fix} + (24 to 29)
	Installation type D	L _S	14 to 20	18 to 22	20 to 22	25 to 28
5		Ø countersink	17,3	21,5	25,9	30,9
,	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
	Installation type V	L _{sk}	t _{fix} + (11 to 19)	t _{fix} + (15 to 21)	t_{fix} + (19 to 23)	t _{fix} + (21 to 27)
	Installation type D	L _{sk}	16 to 20	20 to 25	25	30
7	Hexagon nut wid	dth accross flats	10	13	17	19
8	Commercial ty	pe V L _B ≥	t _{fix} + 21	t _{fix} + 28	t _{fix} + 34	t _{fix} + 41
0	Standard rod ¹⁾ ty	pe D L _B ≥	21	28	34	41

1) acc. to specifications (Table 21)

Dimensions in mm

JCP Option 1 Throughbolt and Option 1 Throughbolt ITS

Anchor dimensions, Option 1 Throughbolt ITS

Annex 21

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Table 21: Materials, Option 1 Throughbolt ITS

No.	Part	Steel, zinc plated ≥ 5 µm acc. to EN ISO 4042	Stainless steel A4	High corrosion resistant steel HCR
1	Conical bolt Option 1 Throughbolt ITS 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 Option 1 Throughbolt ITS	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

JCP Option 1 Throughbolt and Option 1 Throughbolt ITS	
Materials, Option 1 Throughbolt ITS	Annex 22



Table 22: Installation parameters, Option 1 Throughbolt ITS

Anchor size				М6	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		h₁ ≥	[mm]	60	75	90	105
Screwing depth of thread rod		$L_{sd}^{(2)} \ge$	[mm]	9	12	15	18
In the Heating in a constant		S	[Nm]	10	30	30	55
Installation moment, zinc plated steel	T_{inst}	SK	[Nm]	10	25	40	50
zinc piated steel		В	[Nm]	8	25	30	45
Installation moment,		S	[Nm]	15	40	50	100
stainless steel A4 and high	T_{inst}	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	$d_{f} \leq$	[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	$d_f \leq$	[mm]	9	12	14	18
		S	[mm]	5	7	8	9
Minimum thickness of fixture 1)	$t_{fix} \geq$	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.

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.

Table 23: Minimum thickness of concrete member, minimum spacing and minimum edge distance, Option 1 Throuhbolt ITS

Anchor size			M6	М8	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

JCP Option 1 Throughbolt and Option 1 Throughbolt ITS

Installation parameters,
Minimum member thickness,
Minimum spacing and edge distance, Option 1 Throughbolt ITS

Annex 23



Installation instructions pre-setting installation, Option 1 Thoughbolt ITS Drill hole perpendicular to concrete surface. 2 Blow out dust. 3 Setting tool insert in anchor. Drive in anchor with setting tool. Check screwing depth by the excess length (K) of the 5 screw. Max. tightening torque T_{inst} may be applied by using torque wrench.

JCP Option 1	Throughbolt and	Option 1	Throughbolt ITS
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Installation instructions, Option 1 Throughbolt ITS

Annex 24



Installation instructions through-setting installation, Option 1 Throughbolt ITS Drill hole perpendicular to concrete surface. 2 Blow out dust. 3 **BZ-IGS** Setting tool insert in anchor. **BZ-IGS** Drive in anchor with setting tool. 5 Drive in screw. T_{INST} Max. tightening torque T_{inst} may be applied 6 by using torque wrench.

JCP Option 1 Throughbolt and Option 1 Throughbolt ITS	
Installation instructions through-setting installation, Option 1 Throughbolt ITS	Annex 25



Table 24: Characteristic values for tension loads, ETAG 001, Annex C, Option 1
Throughbolt ITS

Anchor size			М6	M8	M10	M12
Steel failure				1	•	•
Characteristic resistance, steel zinc plated	$N_{Rk,s}$	[kN]	16,1	22,6	26,0	56,6
Partial safety factor	$\gamma_{\sf Ms}$	[-]		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 n	ninimum spa	cing and	d 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 n	naximum 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	h _{ef}	
Increasing factors for N _{Rk,p} for	C30/37	[-]		1,	22	
	_{/C} C40/50	[-]		1,	41	
concrete	C50/60	[-]		1,	55	
Concrete cone failure						
Effective anchoring depth	h _{ef}	[mm]	45	58	65	80
Spacing	S _{cr,N}	[mm]			h _{ef}	
Edge distance	$C_{cr,N}$	[mm]		1,5	h _{ef}	
Partial safety factor γ_{Mp}	$=\gamma_{Msp}=\gamma_{Mc}$	[-]		1	,8	

Table 25: Displacements under tension loads

Anchor size			М6	М8	M10	M12
Tension load in cracked concrete	N	[kN]	2,0	3,6	4,8	8,0
Displacement -	δ_{N0}	[mm]	0,6	0,6	0,8	1,0
Displacement	$\delta_{N\infty}$	[mm]	0,8	0,8	1,2	1,4
Tension load in non-cracked concrete	N	[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

JCP Option 1 Throughbolt and Option 1 Throughbolt ITS

Characteristic values for tension loads, ETAG 001, Annex C

Displacements under tension loads, Option 1 Throughbolt ITS

Annex 26



Table 26: Characteristic values for shear loads, ETAG 001, Annex C, Option 1 **Throughbolt ITS**

Anchor size			М6	M8	M10	M12
Option 1 Throughbolt ITS 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,	25	
Option 1 Throughbolt ITS stainless st	eel A4 ar	nd high	corrosion re	esistant ste	el HCR	
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	γMs	[-]		1,	25	
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	γ _{Ms}	[-]		1,	56	
Steel failure with lever arm, Installation						
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	•					
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	L
Concrete edge failure						
Effective length of anchor in shear loading	l _f	[mm]	45	58	65	80
Effective diameter of anchor	d_{nom}	[mm]	8	10	12	16
Partial safety factor	γмс	[-]		1	,5	

Displacements under shear loads, Option 1 Throughbolt ITS Table 27:

Anchor size			М6	М8	M10	M12
Shear load in cracked and non-cracked concrete	V	[kN]	4,2	5,3	6,2	16,9
Displacements	δ_{V0}	[mm]	2,8	2,9	2,5	3,6
	$\delta_{V^{\infty}}$	[mm]	4,2	4,4	3,8	5,3

JCP Option 1 Throughbolt and Option 1 Throughbolt ITS

Characteristic values for shear loads, ETAG 001, Annex C,

Displacements under shear loads, Option 1 Throughbolt ITS

Annex 27

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English translation prepared by DIBt

No.	P Option	Table 28: Characteristic val in cracked and no Throughbolt ITS	Characteristic values to tension loads under fire exposure in cracked and non-cracked concrete C20/25 to C50/60, ETAG 001, Annex C, Option 1 Throughbolt ITS	ensic ted c	on log	ads u ete C	ınder 20/2₹	fire to (expc 350/6	sure 0, E	LAG.	001,	Ann	Š	o,	tion	-	
Fire resistance duration Fire resistance or other mational regulations the partial safety factor for resistance or other mational regulations the partial safety factor for resistance or other mational regulations the partial safety factor for resistance under fire Fire resistance duration Fire resistance duration Fire resistance or other mational regulations the partial safety factor for resistance under fire Fire resistance or other mational regulations the partial safety factor for resistance under fire Fire responsing to Annex 23; cmin = 2,0 12,0	1 TI	size			Σ	9				_ س			Σ				M 12	
Steel failure: Characteristic resistance RMJ Stanless steel 0.7 0.6 0.5 0.4 1.4 1.2 0.9 0.8 2.5 2.0 1.5 1.3 3.7 1.2 1.3 3.7 1.2 1.3 3.7 1.2 1.3 3.7 1.2 1.3 3.7 1.2 1.3 3.7 1.2 1.3 3.7 1.2 1.3 3.7 1.2 1.3 3.7 1.2 1.3 3.7 1.2 1.3 3.7 1.2 1.3 3.7 1.2 1.3 3.7 1.2 1.2 1.3 3.7 1.2 1.2 1.3 3.7 1.2 1.2 1.2 1.3 3.7 1.2 1.3 3.7 1.2 1.3 3.7 1.2 1.3 3.7 1.2 1.2 1.3 3.7 1.2 1.3 3.7 1.2 1.3 3.7 1.2 1.3 3.7 1.2 3.7 1.2 1.3 3.7	hrough	Fire resistance duration	R [min]	30	09	06	120	30	09		120	30	09		120	30		90 120
Characteristic N _{Riv.g.11} Stainless steel 2.9 1.9 1.0 0.5 5.4 3.8 2.1 1.3 8.7 6.3 3.9 2.7 12.6 Pullout failure: Characteristic resistance in N _{Riv.g.11} 1.3 1.0 0.5 5.4 3.8 2.1 1.3 8.7 6.3 3.9 2.7 12.6 Characteristic resistance in N _{Riv.g.11} 1.3 1.0 2.3 1.8 3.7 3.0 2.4 3.8 2.1 1.5 Characteristic resistance in N _{Riv.g.11} 2.4 2.0 4.6 3.7 4.5 4.9 1.0 Characteristic resistance in N _{Riv.g.11} 2.4 2.0 4.6 3.7 4.5 4.9 1.0 Spacing S _{GZIV.M.11} 2.4 2.0 4.6 3.7 4.5 4.9 1.0 Spacing and edge distance under fire exposure from more than one size S _{GZIV.M.11} 3.0 3.0 3.7 4.5 3.0 3.0 3.0 Minimum spacing and edge distance under fire exposure from more than one size S _{GZIV.M.11} 3.0 3	nbol	Steel failure:																1
National Parameter Nationa	t and		Steel zinc plated	2,0	9,0	0,5	0,4	4.,1	2,	6,0	8,0	2,5	2,0	7,5	6,1	3,7		2,2
Pullout failure: Characteristic resistance in concrete C20/25 to C50/60 [kN] NRKp, fl 1,3 1,0 2,3 1,8 3,0 2,4 Concrete C20/25 to C50/60 [kN] Characteristic resistance in concrete C20/25 to C50/60 [kN] Sc, N, fl 4 x her 4 x her Spacing Sc, N, fl 2,4 2,0 4,6 3,7 6,1 4,9 Spacing source C20/25 to C50/60 gix and edge distance under fire exposure from one side Sc, N, fl 2 x her 2 x her Minimum spacing and edge distance under fire exposure from more than one size exposure from more than one size Smin according to Annex 23; Cmin ≥ 300 mm. In absence of other national regulations the partial safety factor for resistance under fire exposure $\gamma_{M,ii} = 1,0$ is recommended	Option		Stainless steel A4 / HCR	2,9	1,9	1,0	0,5	5,4		2,1	1,3	8,7	6,3	3,9		12,6		5,7 4,0
Concrete C20/25 to C50/60 [kN] Concrete Can failure: Characteristic resistance in Ne _{R,c,if} Concrete Can failure: Characteristic resistance in Ne _{R,c,if} Characteristic resistance in Ne _{R,c,if} Characteristic resistance in Ne _{R,c,if} Spacing Spacing Spacing Minimum spacing and edge distance under fire exposure from one side Minimum spacing and edge distance under fire exposure from more than one size Minimum spacing and edge distance under fire exposure from more than one size In absence of other national regulations the partial safety factor for resistance under fire exposure $t_{NM,ll} = 1,0$ is recommende	າ 1 ⁻	Pullout failure:								-			-	-				
Concrete cone failure: Characteristic resistance in concrete C20/25 to C50/60 [kN] N° R _{ic.o.fi} 2,4 2,0 4,6 3,7 6,1 4,9 Spacing S _{Gr.N,fi} 4 x h _{ef} 4 x h _{ef} Edge Distance C _{Gr.N,fi} 2 x h _{ef} Minimum spacing and edge distance under fire exposure from one side according to Annex 23 Minimum spacing and edge distance under fire exposure from more than one size exposure from more than one size s _{min} according to Annex 23; c _{min} ≥ 300 mm. In absence of other national regulations the partial safety factor for resistance under fire exposure $\gamma_{M,fi}$ = 1,0 is recommended	Throug	Characteristic resistance in concrete C20/25 to C50/60	N _{Rk,p,fi} [KN]		6,1		1,0		2,3		8,1		3,0		2,4		2,0	4,0
Characteristic resistance in concrete C20/25 to C50/60 [kN] N° Rk.c.fi 2,4 2,0 4,6 3,7 6,1 4,9 4,9 Spacing Scr.N.fi 4 x her 4 x her 4 x her 2 x her Edge Distance Ccr.N,fi 2 x her 2 x her 2 x her Minimum spacing and edge distance under fire exposure from one side Minimum spacing and edge distance under fire exposure from more than one size Smin according to Annex 23; Cmin ≥ 300 mm. In absence of other national regulations the partial safety factor for resistance under fire exposure $\gamma_{M,ti} = 1,0$ is recommended	jhbo	Concrete cone failure:								-								
Spacing S _{αr,N,fi} Edge Distance C _{αr,N,fi} Minimum spacing and edge distance Lexposure from one side Minimum spacing and edge distance Lexposure from more than one size In absence of other national regulation	olt ITS	Characteristic resistance in concrete C20/25 to C50/60	N ⁰ Rk,c,fi [KN]		2,4		2,0		4,6		3,7		6,1		6,4	_	6,0	8,2
Edge Distance $C_{cr,N,fl}$ Minimum spacing and edge distance under fire exposure from one side Minimum spacing and edge distance under fire exposure from more than one size exposure from more than one size In absence of other national regulations the partial safety factor for resistance under fire exposure $\gamma_{M,fl} = 1,0$ is recommended.		Spacing	Sor,N,fi								4 × h	<u></u>						
Minimum spacing and edge distance under fire exposure from one side Minimum spacing and edge distance under fire exposure from more than one size exposure from more than one size In absence of other national regulations the partial safety factor for resistance under fire exposure $\gamma_{M,fi} = 1,0$ is recommended.		Edge Distance	Ccr,N,fi								2 x h _e	,						
<u>_</u> _		Minimum spacing and edge ce exposure from one side	distance under fire						10	accord	ing to /	Annex	23					
		Minimum spacing and edge cexposure from more than one						S _{min} a	ccordi	ng to	Annex	23; c _r	νι Θ	00 mr	Ė			
		In absence of other national r		ial saf	ety fac	tor for	resist	ance	under	fire e.	nsodx	re γ _{M,f}	1,0	is rec	mmoc	endec		

under fire exposure, ETAG001, Annex C, Option 1 Throughbolt ITS

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in cracked and non-cracked concrete C20/25 to C50/60, ETAG 001, Annex C, Option 1 Characteristic values to tension loads under fire exposure Throughbolt ITS Table 29

0,5 1,0 1,0 9,0 2,9 0,7 Stainless steel Zinc plated A4 / HCR Steel failure without lever arm: V_{Rk.s.fi} resistance Characteristic

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7,5 4,0 A4 / HCR Steel Steel failure with lever arm: [Nm] Characteristic Resistance

Concrete pryout failure:

considered

In Equation (5.6) of ETAG 001, Annex C, 5.2.3.3 the k-factor of Table 26 and the relevant values of N BR, of of Table 28 have to be

Concrete edge failure:

The initial value V⁰nk,c,fi of the characteristic resistance in concrete C20/25 to C50/60 under fire exposure may be determined by: $V_{Rk,c,fi}^0 = 0,20 \times V_{Rk,c}^0$ (R120) $V_{Rk,c,fi}^0 = 0.25 \times V_{Rk,c}^0$ (R30, R60, R90)

with $V^0_{
m Rk,c}$ initial value if the characteristic resistance in cracked concrete C20/25 under normal temperature.

absence of other national regulations the partial safety factor for resistance under fire exposure $\gamma_{M,fi} = 1.0$ is recommended.

JCP Option 1 Throughbolt and Option 1 Throughbolt ITS

Characteristic values of shear resistance under fire exposure, ETAG 001, Annex C, Option 1 Throughbolt ITS

Annex 29



Table 30: Characteristic values for tension loads, CEN/TS 1992-4, Option 1 Throughbolt ITS

Anchor size			М6	М8	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}	[-]		1,8	87	
Pullout failure						
Characteristic resistance in cracked concrete C20/25	$N_{Rk,p}$	[kN]	5	9	12	20
Pullout and splitting (Choice of mir	nimum spa	cing and	d 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]			h _{ef}	
Respective edge distance	C _{cr,sp}	[mm]	1,5 h _{ef}			
Pullout and splitting (Choice of ma	ximum res	istance)				
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	h _{ef}	
Increasing factors for N _{Rk,p} for	C30/37	[-]		1,5	22	
cracked and non-cracked ψ_{C}	C40/50	[-]		1,4	41	
concrete	C50/60	[-]		1,	55	
Concrete cone failure						_
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	$\mathbf{C}_{cr,N}$	[mm]		1,5	h _{ef}	
Partial safety factor $\gamma_{Mp} =$	$\gamma_{Msp} = \gamma_{Mc}$	[-]		1,	,8	

Table 31: Displacements under tension loads, Option 1 Throughbolt ITS

Anchor size			М6	М8	M10	M12
Tension load in cracked concrete	N	[kN]	2,0	3,6	4,8	8,0
Displacement	δ_{N0}	[mm]	0,6	0,6	0,8	1,0
Displacement -	$\delta_{N\infty}$	[mm]	0,8	0,8	1,2	1,4
Tension load in non-cracked concrete	N	[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

Characteristic values for tension loads, CEN/TS 1992-4,

Displacements under tension loads, Option 1 Throughbolt ITS

Annex 30



Table 32: Characteristic values for shear loads, CEN/TS 1992-4, Option 1 Throughbolt ITS

Anchor size			М6	М8	M10	M12		
Option 1 Throughbolt ITS zinc plated		•						
Steel failure without lever arm, Instal	lation typ	e V						
Characteristic resistance	$V_{Rk,s}$	[kN]	5,8	6,9	10,4	25,8		
Steel failure without lever arm, Instal	lation typ	e D						
Characteristic resistance	$V_{Rk,s}$	[kN]	5,1	7,6	10,8	24,3		
Steel failure with lever arm, Installation	on type V							
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}	[-]		1,2	25			
Factor of ductility	k ₂	[-]		1,	0			
Option 1 Throughbolt ITS stainless s	teel A4 ar	nd high c	orrosion r	esistant ste	el HCR			
Steel failure without lever arm, Instal								
Characteristic resistance	$V_{Rk,s}$	[kN]	5,7	9,2	10,6	23,6		
artial safety factor γ_{Ms} [-] 1,25								
Steel failure without lever arm, Instal				·				
Characteristic resistance	$V_{Rk,s}$	[kN]	7,3	7,6	9,7	29,6		
Partial safety factor	γMs	[-]	,	1,2	<u> </u>	,		
Steel failure with lever arm, Installation	•			<u> </u>				
Characteristic bending resistance	M ⁰ _{Rk.s}	[Nm]	10,7	26,2	52,3	91,6		
Partial safety factor	γMs	[-]	•	1,56				
Steel failure with lever arm, Installation	•			·				
Characteristic bending resistance	M ⁰ _{Rk,s}	[Nm]	28,2	44,3	69,9	191,2		
Partial safety factor	γMs	[-]	· · · · · · · · · · · · · · · · · · ·	1,2		,		
Factor of ductility	k ₂	[-]		1,				
Concrete pryout failure								
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	l _f	[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, Option 1 Throughbolt ITS

Anchor size			М6	М8	M10	M12
Shear load in cracked and non-cracked concrete	V	[kN]	4,2	5,3	6,2	16,9
Displacements	δ_{V0}	[mm]	2,8	2,9	2,5	3,6
	 δ _V ∞	[mm]	4,2	4,4	3,8	5,3

Characteristic values for shear loads, CEN/TS 1992-4,

Displacements under shear loads, Option 1 Throughbolt ITS

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Anchor size			ž	9			Σ	 @			M 10				M 12	~
Fire resistance duration	R [min]	30	09	06	120	30	09	06	120	30	09	06	120	30	09	06
Steel failure:						1	1	1	1	1		1	1			1
Characteristic Neces	Steel zinc plated	2,0	9,0	0,5	0,4	4.,1	1,2	6,0	8,0	2,5	2,0	1,5	6,1	3,7	2,9	2,2
resistance [kN]	Stainless steel A4 / HCR	2,9	1,9	1,0	0,5	5,4	8,6	2,1	1,3	8,7	6,3	3,9	2,7	12,6	9,2	5,7
Pullout failure:																•
Characteristic resistance in concrete C20/25 to C50/60	N _{Rsp.ff} [KN]		6,1		1,0		2,3		8,1		3,0		2,4		5,0	
Concrete cone failure:																
Characteristic resistance in concrete C20/25 to C50/60	N ⁰ _{Rk,c,fi} [KN]		2,4		2,0		4,6		3,7		6,1		6,4		10,3	
Spacing	S _{cr,N,fi}								4 x h _{ef}	Je.						
Edge Distance	Cor,N,fi								$2 \text{ x h}_{\text{ef}}$	əf						
Minimum spacing and edge distanc fire exposure from one side	distance under						"	according to Annex 23	ing to ,	Annex	23					
Minimum spacing and edge distance under fire exposure from more than one size	distance under n one size					S _{min} æ	ccord	s _{min} according to Annex 23; c _{min} ≥ 300 mm.	Annex	23; c	ا الا	00 mr	E.			
Partial safety factor	γм,fi [-]									1,0						

Characteristic values of tension resistance

under fire exposure, CEN/TS 1992-4, Option 1 Throughbolt ITS

Annex 32

ည္		120		1,8	4,0		2,8	6,2	and					
olt I	2	06		2,2	5,7		3,4	8,9	ature a	ed by:				
racked concrete C20/25 to C50/60, CEN/TS 1992-4, Option 1 Throughbolt ITS	M12	09		2,9	9,2		4,6	14,3	mpera	ermine				
		30		3,7	12,6		5,7	19,6	1992-4-1, Annex D,D.3.3.2 the k-factor is similar to the k_3 -factor for normal temperature and 4 have to be considered.	be det				
l		120		1,3	2,7		1,6	3,5	for no	may	(<u>1</u>	CE		
	0	06		1,5	3,9		2,0	5,1	actor	osure	2	lbera B		
l	M10	09		2,0	6,3		2,6	8,1	ne k ₃ -f	re exp	(0)	<u>a</u>		
		30		2,5	8,7		3,3	11,2	ar to th	nder fi	$V_{Rk,c,fi}^0 = 0.20 \times V_{Rk,c}^0$ (R120)			
		120		0,8	1,3		8,0	1,3	simila	/60 ur	V Bk,c		1,0	
	M8	06		6,0	2,1		6,0	2,2	ctor is	o C50	0,20 x	C7/07		
	2	09		1,2	3,8		1,2	3,9	e k-fa	0/25 t	lk,c,fi = () ale		
		30		1,4	5,4		4,1	5,5	3.2 th t.	te C2	V 50	<u></u>		
		120		0,4	0,5		0,3	0,4),D.3. dered	oncre	\(\frac{7}{2}\)	ZCK GC		
	M6	06 (3 0,5	9 1,0		4 0,4	5 0,7	ınex [consi	e ii	2.	5 =		
		09 (9,0 7	9 1,9		5 0,4	2 1,5	1, An to be	stanc		alice		
I		30		0,7	2,9		0,5	2,2	92-4- nave 1	c resi	, R90	lesisi Lesisi		
		R [min]	rarm:	Steel zinc plated	Stainless steel A4 / HCR	: E	Steel	A4 / HCR		Concrete edge failure: The initial value V ⁰ Rk _{off} of the characteristic resistance in concrete C20/25 to C50/60 under fire exposure may be determined by:	$V_{Rk,c,ff}^0 = 0.25 \times V_{Rk,c}^0$ (R30, R60, R90)	WITH VIRKE ITHINALVAIDE IL LIE CHAFACIETISTIC FESISIANCE IN CFACKED CONCLETE OZU/ZO UNDER NOTHALIEMPERALDES.		
		e duration	without leve	V		with lever ar	M ⁰ Rk.s.fi		/out failure: (D.6 snd D.7) alues of N ⁰ _{Rk}	ge failure: ue V ^o _{Rk,c,fi} of t	k,c,fi = 0,25 x \	iai value II lite	γм,fi [-]	
	Anchor size:	Fire resistance duration	Steel failure without lever arm:	Characteristic	resistance	Steel failure with lever arm:	Characteristic	Resistance	Concrete pryout failure: In Equations (D.6 snd D.7) of CEN/TS the relevant values of N ⁰ Rk,c,fi of Table 3	Concrete ed The initial val	V ⁰ _R	WILL V RK,c ITIIL	Partial safety factor	
ac	eterist	1 Throu	es of s	shear	resista	ance			olt ITS	TS		-	Ann	ex 33