Deutsches Institut für Bautechnik

Anstalt des öffentlichen Rechts

Kolonnenstr. 30 L
10829 Berlin
Germany

Tel.: +49(0)30 787 30 0
Fax: +49(0)30 787 30 320
E-mail: dibt@dibt.de
Internet: www.dibt.de

Authorised and notified according to Article 10 of the Council Directive of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products (89/106/EEC)

DIBt

Mitglied der EOTA
Member of EOTA

European Technical Approval ETA-09/0159

English translation prepared by DIBt - Original version in German language

Handelsbezeichnung *Trade name*	BTI Hochleistungsanker BHA *BTI heavy duty anchor BHA*
Zulassungsinhaber *Holder of approval*	BTI Befestigungstechnik GmbH Salzstraße 51 74653 Ingelfingen DEUTSCHLAND
Zulassungsgegenstand und Verwendungszweck *Generic type and use of construction product*	Kraftkontrolliert spreizender Metalldübel aus galvanisch verzinktem Stahl in den Größen 10, 12, 15, 18, 24, 28 und 32 zur Verankerung im Beton *Torque-controlled expansion anchor made of galvanised steel of sizes 10, 12, 15, 18, 24, 28 and 32 for use in concrete*
Geltungsdauer: vom *Validity: from*	26 July 2010
bis *to*	31 January 2012
Herstellwerk *Manufacturing plant*	BTI Herstellwerk 1

Diese Zulassung umfasst *This Approval contains*	15 Seiten einschließlich 8 Anhänge *15 pages including 8 annexes*
Diese Zulassung ersetzt *This Approval replaces*	ETA-09/0159 mit Geltungsdauer vom 12.05.2009 bis 31.01.2012 *ETA-09/0159 with validity from 12.05.2009 to 31.01.2012*

I LEGAL BASES AND GENERAL CONDITIONS

1 This European technical approval is issued by Deutsches Institut für Bautechnik in accordance with:

- Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products[1], modified by Council Directive 93/68/EEC[2] and Regulation (EC) N° 1882/2003 of the European Parliament and of the Council[3];
- Gesetz über das In-Verkehr-Bringen von und den freien Warenverkehr mit Bauprodukten zur Umsetzung der Richtlinie 89/106/EWG des Rates vom 21. Dezember 1988 zur Angleichung der Rechts- und Verwaltungsvorschriften der Mitgliedstaaten über Bauprodukte und anderer Rechtsakte der Europäischen Gemeinschaften (Bauproduktengesetz - BauPG) vom 28. April 1998[4], as amended by law of 31 October 2006[5];
- Common Procedural Rules for Requesting, Preparing and the Granting of European technical approvals set out in the Annex to Commission Decision 94/23/EC[6];
- 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
2 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
4 *Bundesgesetzblatt Teil I 1998*, p. 812
5 *Bundesgesetzblatt Teil I 2006*, p.2407, 2416
6 Official Journal of the European Communities L 17, 20 January 1994, p. 34

II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

1 Definition of the product and intended use

1.1 Definition of the construction product

The BTI heavy duty anchor BHA of sizes 10, 12, 15, 18, 24, 28 and 32 is an anchor made of galvanised steel which is placed into a drilled hole and anchored by torque-controlled expansion.

An illustration of the product and intended use is given in Annex 1.

1.2 Intended use

The anchor is intended to be used for anchorages for which requirements for mechanical resistance and stability and safety in use in the sense of the Essential Requirements 1 and 4 of Council Directive 89/106 EEC shall be fulfilled and failure of anchorages made with these products would cause risk to human life and/or lead to considerable economic consequences.

The anchor 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 minimum and C50/60 at most according to EN 206: 2000-12.

The anchor may be anchored in cracked and non-cracked concrete.

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

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 Annexes 2 and 3. The characteristic material values, dimensions and tolerances of the anchor not given in Annexes 2 and 3 shall correspond to the respective values laid down in the technical documentation[7] 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 Annexes 4 and 5.

The characteristic values for the design of anchorages regarding resistance to fire are given in Annexes 6 and 7. They are valid for use in a system that is required to provide a specific fire resistance class.

7 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.

Each expansion sleeve is marked with the identifying mark of the producer, the trade name and the size and the maximum thickness of fixture according to Annex 1.

The anchor shall only be 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.

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 Commission[8] the system 2(i) (referred to as system 1) of attestation of conformity applies.

This system of attestation of conformity is defined as follows:

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.

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

The manufacturer may only use initial/ raw/ constituent materials stated in the technical documentation of this European technical approval.

The factory production control shall be in accordance with the control plan which is part of the technical documentation of this European technical approval. The control plan is laid down in the context of the factory production control system operated by the manufacturer and deposited at Deutsches Institut für Bautechnik[9].

The results of factory production control shall be recorded and evaluated in accordance with the provisions of the control plan.

3.2.1.2 Other tasks of manufacturer

The manufacturer shall, on the basis of a contract, involve a body which is approved for the tasks referred to in section 3.1 in the field of anchors in order to undertake the actions laid down in section 3.2.2. For this purpose, the control plan referred to in sections 3.2.1.1 and 3.2.2 shall be handed over by the manufacturer to the approved body involved.

The manufacturer shall make a declaration of conformity, stating that the construction product is in conformity with the provisions of this European technical approval.

3.2.2 Tasks of approved bodies

The approved body shall perform the

- initial type-testing of the product ,
- initial inspection of factory and of factory production control,
- continuous surveillance, assessment and approval of factory production control,

in accordance with the provisions laid down in the control plan.

The approved body shall retain the essential points of its actions referred to above and state the results obtained and conclusions drawn in a written report.

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.

9 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.

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 approval and consequently the validity of the CE marking on the basis of the approval and if so whether further assessment or alterations to the approval shall be necessary.

4.2 Design of anchorages

The fitness of the anchor for the intended use is given under the following conditions:

The anchorages are designed in accordance with the "Guideline for European technical approval of Metal Anchors for Use in Concrete", Annex C, 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 6 and 7. 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 $c \geq 300$ 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,
- 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 spacings 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,

- 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 Annex 3 using a calibrated torque wrench.

5 Responsibility of 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).

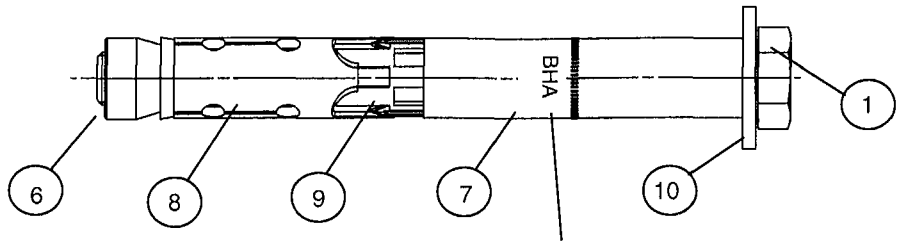
The minimum data required are:

- Diameter of drill bit,
- Thread diameter,
- Maximum 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.

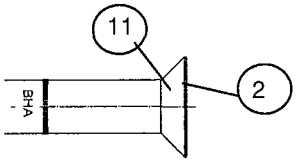
Dipl.-Ing. Georg Feistel
Head of Division construction Engineering
of Deutsches Institut für Bautechnik
Berlin, 26 July 2010

beglaubigt
Tempel

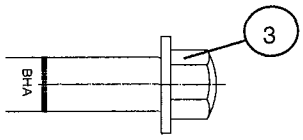


Screw type S
BHA 10 - 32

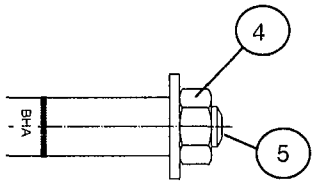
Marking: Identifying mark of the producer, anchor identity
nominal drill hole diameter / max. thickness of fixture
e.g. BHA 15/25



Type with countersunk screw
head SK BHA 10 - 18

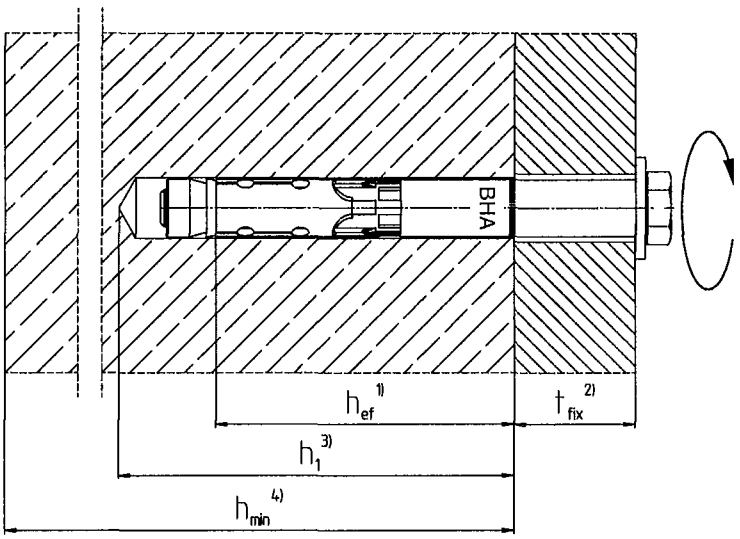


Type with cap nut H
BHA 10 - 24



Bolt type B
BHA 10 - 32

1. Hexagon screw
2. Countersunk screw
3. Cap nut
4. Hexagon nut
5. Threaded rod
6. Conical nut
7. Spacer sleeve
8. Expansion sleeve
9. Plastic sleeve
10. Washer
11. Conical washer



1) h_{ef}: effective anchorage depth
2) t_{fix}: thickness of fixture
3) h_1: drill hole depth
4) h_{min}: minimal member thickness
5) T_{inst}: installation torque

BTI heavy duty anchor BHA	**Annex 1** of European technical approval ETA – 09/0159
Product and intended use	

Doc: ETA-FH II-E

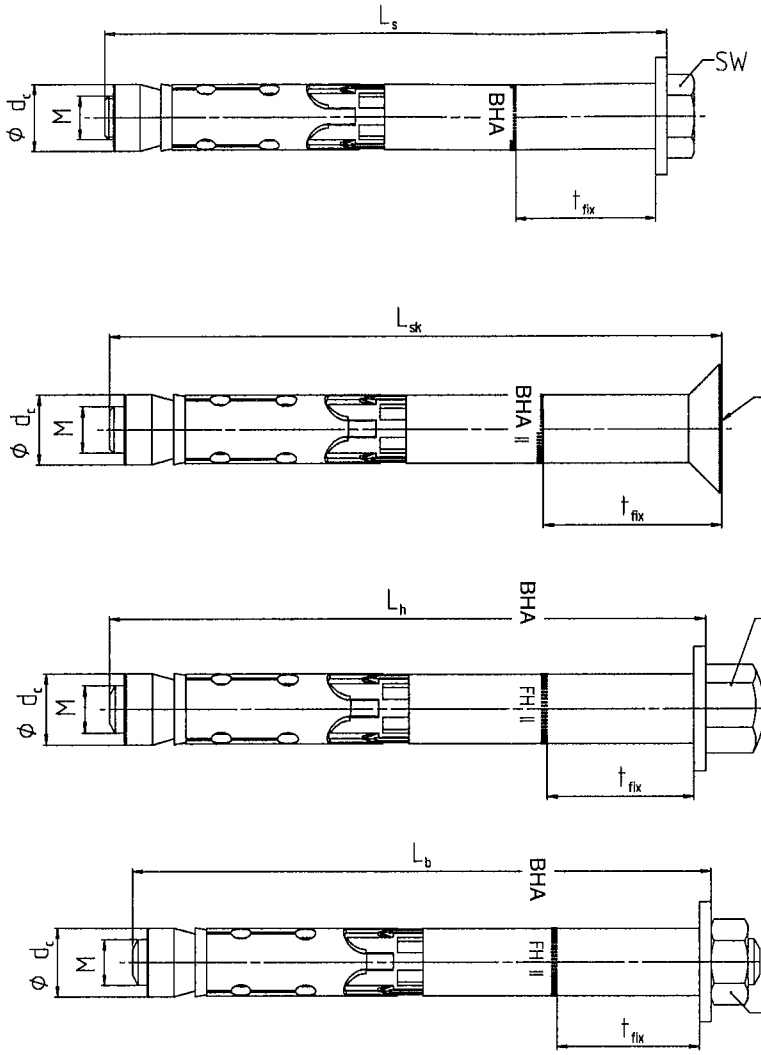


Table 1: Anchor Dimensions [mm]

Type of anchor / size			BHA 10	BHA 12	BHA 15	BHA 18	BHA 24	BHA 28	BHA 32
thread	M	=	6	8	10	12	16	20	24
ø d_c		=	10	12	14,8	17,8	23,7	27,5	31,5
SW	type H	=	13	17	17	19	24	-	-
	type SK 1)		4	5	6	8	-	-	-
	type S / B		10	13	17	19	24	30	36
t_{fix} type H / S / B	min	≥	0	0	0	0	0	0	0
t_{fix} type SK	min	≥	5	6	6	8	-	-	-
t_{fix} type H / S / B / SK	max	≤	250	250	300	350	400	500	500
anchor length screw/bolt	L_s, L_h, L_b (- t_{fix})	≥	50	74	89	99	124	149	169
anchor length countersunk	L_{sk} (- t_{fix})	≥	53	78	92	104	-	-	-

1) internal hexagon

Table 2: Materials

Part	Designation	Material
1	Hexagon screw	Steel class 8.8; DIN EN ISO 898-1 [1) 2)]
2	Countersunk screw head	Steel class 8.8; DIN EN ISO 898-1 [1)]
3	Cap nut	Steel class 8 [1)]
4	Hexagon nut	Steel class 8 [1)]
5	Thread rod	Steel $R_m \geq 800 N/mm^2$; $R_e \geq 640 N/mm^2$ [1)]
6	Conical nut	Steel EN 10277 [1) 3)]
7	Spacer sleeve	Steel EN 10305 [1)]
8	Expansion sleeve	Steel EN 10139 [1)]
9	Plastic sleeve	PE / POM / PC
10	Washer	Steel EN 10139 [1) 2)]
11	Conical washer	Steel EN 10277 [1) 2)]

1) galvanized according to EN ISO 4042, min 5µm
2) Functional coating BHA 10 – 24 (conical-) washer, BHA 28 – 32 hexagon screw
3) Functional coating BHA 10 – 32 conical nut

Table 3: Installation parameters

Type of anchor / size			BHA 10	BHA 12	BHA 15	BHA 18	BHA 24	BHA 28	BHA 32
Nominal drill hole diameter		d_0 = [mm]	10	12	15	18	24	28	32
Cutting diameter of drill bit		$d_{cut} \leq$ [mm]	10,45	12,50	15,50	18,50	24,55	28,55	32,70
Depth of drill hole		$h_1 \geq$ [mm]	55	80	90	105	125	155	180
Diameter of clearance hole in the fixture		$d_f \leq$ [mm]	12	14	17	20	26	31	35
Required installation torque	Type S	T_{inst} = [Nm]	10	22,5	40	80	160	180	200
	Type SK		10	22,5	40	80	-	-	-
	Type H		10	22,5	40	80	90	-	-
	Type B		10	17,5	38	80	120	180	200

Table 4: Minimum thickness of concrete member, minimum spacing and minimum edge distances of anchors

Anchor type/size		BHA 10	BHA 12	BHA 15	BHA 18	BHA 24	BHA 28	BHA 32
Minimum thickness of concrete member	h_{min} [mm]	80	120	140	160	200	250	300
Minimum spacing, cracked concrete	s_{min} [mm]	40	50	60	70	80	100	120
	for c ≥ [mm]	40	80	120	140	180	200	260
Minimum spacing, non-cracked concrete	s_{min} [mm]	40	60	70	80	100	120	160
	for c ≥ [mm]	70	100	100	160	200	220	360
Minimum edge distance, cracked concrete	c_{min} [mm]	40	50	60	70	80	100	120
	for s ≥ [mm]	40	80	120	160	200	220	280
Minimum edge distance, non-cracked concrete	c_{min} [mm]	40	60	70	80	100	120	180
	for s ≥ [mm]	70	100	140	200	220	240	380

Intermediate values by linear interpolation.

Table 5: Design method A - characteristic values for tension loads, Type S, SK, H, B

Type of anchor S, SK, B, H / size			BHA 10	BHA 12	BHA 15	BHA 18	BHA 24	BHA 28	BHA 32
Steel failure									
Characteristic resistance	$N_{Rk,s}$	[kN]	16,1	29,3	46,4	67,4	125,3	195,8	282,0
Partial safety factor	γ_{Ms} [1]		1,5						
Pullout failure									
Characteristic resistance in cracked concrete	$N_{Rk,p}$ [kN]	C20/25	7,5	12	16	25	[2]	[2]	[2]
Characteristic resistance in non-cracked concrete	$N_{Rk,p}$ [kN]	C20/25	[2]	[2]	[2]	[2]	[2]	[2]	[2]
Increasing factors for $N_{Rk,p}$	ψ_c	C25/30	1,10						
		C30/37	1,22						
		C35/45	1,34						
		C40/50	1,41						
		C45/55	1,48						
		C50/60	1,55						
Partial safety factor	γ_{Mp} [1]		1,5 [3]						
Concrete cone failure and splitting failure									
Effective anchorage depth	h_{ef}	[mm]	40	60	70	80	100	125	150
Spacing	$s_{cr,N}$	[mm]	120	180	210	240	300	375	450
Edge distance	$c_{cr,N}$	[mm]	60	90	105	120	150	187,5	225
Spacing (splitting)	$s_{cr,sp}$	[mm]	190	300	320	340	380	480	570
Edge distance (splitting)	$c_{cr,sp}$	[mm]	95	150	160	170	190	240	285
Partial safety factor	γ_{Mc} [1]		1,5 [3]						

[1] In absence of other national regulations.
[2] Pullout failure not decisive.
[3] The partial safety factor γ_2 = 1,0 included.

Table 6: Displacements under tension loads, Type S, SK, H, B

Type of anchor S, SK, B, H / size			BHA 10	BHA 12	BHA 15	BHA 18	BHA 24	BHA 28	BHA 32
Tension load in cracked concrete	N	[kN]	3,6	5,7	7,6	11,9	17,1	24,0	31,5
Corresponding displacement	δ_{N0}	[mm]	0,8	0,2	0,3	0,4	0,6	0,7	0,7
	$\delta_{N\infty}$	[mm]	1,7	0,9	1,3	1,6	1,8	1,3	1,1
Tension load in non-cracked concrete	N	[kN]	6,0	11,2	14,1	17,2	24,0	33,6	44,2
Corresponding displacement	δ_{N0}	[mm]	0,6	0,1	0,2	0,3	0,2	0,3	0,3
	$\delta_{N\infty}$	[mm]	1,7	0,9	1,3	1,6	1,8	1,3	1,1

Table 7: Design method A, characteristic values for shear loads

Type of anchor S, SK, B, H /size		BHA 10	BHA 12	BHA 15	BHA 18	BHA 24	BHA 28	BHA 32
Steel failure without lever arm								
Characteristic resistance Type S / SK	$V_{Rk,s}$ [kN]	18	29	46	66	119	140	181
Characteristic resistance Type B / H	$V_{Rk,s}$ [kN]	15,5	24	39	57	105	121	149
Partial safety factor	γ_{Ms} [1)]	1,25						
Steel failure with lever arm								
Characteristic bending resistance	$M^0_{Rk,s}$ [Nm]	12	30	60	105	266	518	896
Partial safety factor	γ_{Ms} [1)]	1,25						
Concrete pryout failure								
Factor in equation (5.6) of ETAG 001 Annex C, 5.2.3.3	k	1,0	2,0					
Partial safety factor	γ_{Mcp} [1)]	1,5 [2)]						
Concrete edge failure								
Effective length of anchor under shear loading	l_f [mm]	40	60	70	80	100	125	150
Effective diameter of anchor	d_{nom} [mm]	10	12	15	18	24	28	32
Partial safety factor	γ_{Mc} [1)]	1,5 [2)]						

[1)] In absence of other national regulations.
[2)] The partial safety factor $\gamma_2 = 1,0$ is included.

Table 8: Displacements under shear loads

Type of anchor S, SK / size			BHA 10	BHA 12	BHA 15	BHA 18	BHA 24	BHA 28	BHA 32
Shear load in cracked and cracked concrete	V	[kN]	10,3	17,1	26,9	38,9	70,3	80,0	103,4
Corresponding displacement	δ_{V0}	[mm]	2,4	1,5	2,0	2,5	4,0	2,5	3,0
	$\delta_{V\infty}$	[mm]	3,6	2,3	3,0	3,8	6,0	3,8	4,5

Type of anchor H, B / size			BHA 10	BHA 12	BHA 15	BHA 18	BHA 24	BHA 28	BHA 32
Shear load in cracked and non-cracked concrete	V	[kN]	8,9	14,3	22,9	33,7	62,3	69,1	85,1
Corresponding displacement	δ_{V0}	[mm]	2,2	1,0	1,5	2,5	4,0	2,2	2,7
	$\delta_{V\infty}$	[mm]	3,3	1,5	2,3	3,8	6,0	3,3	4,1

Table 9: Characteristic values of resistance to tension loads under fire exposure

Fire resistance duration = 30 minutes			**BHA 10**	**BHA 12**	**BHA 15**	**BHA 18**	**BHA 24**	**BHA 28**	**BHA 32**
Steel failure									
Characteristic resistance	$N_{Rk,s,fi,30}$	(kN)	0,2	2,0	3,2	4,8	8,9	13,9	20,0
Pull-out failure									
Characteristic resistance in concrete C20/25 to C50/60	$N_{Rk,p,fi,30}$	(kN)	1,8	3,0	4,0	6,3	9,0	12,6	16,5
Concrete cone failure									
Characteristic resistance in concrete C20/25 to C50/60	$N_{Rk,c,fi,30}$	(kN)	1,8	5,0	7,4	10,3	18,0	31,4	49,6

Fire resistance duration = 60 minutes			**BHA 10**	**BHA 12**	**BHA 15**	**BHA 18**	**BHA 24**	**BHA 28**	**BHA 32**
Steel failure									
Characteristic resistance	$N_{Rk,s,fi,60}$	(kN)	0,2	1,3	2,3	3,9	7,3	11,3	16,3
Pull-out failure									
Characteristic resistance in concrete C20/25 to C50/60	$N_{Rk,p,fi,60}$	(kN)	1,8	3,0	4,0	6,3	9,0	12,6	16,5
Concrete cone failure									
Characteristic resistance in concrete C20/25 to C50/60	$N_{Rk,c,fi,60}$	(kN)	1,8	5,0	7,4	10,3	18,0	31,4	49,6

Fire resistance duration = 90 minutes			**BHA 10**	**BHA 12**	**BHA 15**	**BHA 18**	**BHA 24**	**BHA 28**	**BHA 32**
Steel failure									
Characteristic resistance	$N_{Rk,s,fi,90}$	(kN)	0,1	0,6	1,4	3,0	5,6	8,8	12,6
Pull-out failure									
Characteristic resistance in concrete C20/25 to C50/60	$N_{Rk,p,fi,90}$	(kN)	1,8	3,0	4,0	6,3	9,0	12,6	16,5
Concrete cone failure									
Characteristic resistance in concrete C20/25 to C50/60	$N_{Rk,c,fi,90}$	(kN)	1,8	5,0	7,4	10,3	18,0	31,4	49,6

Fire resistance duration = 120 minutes			**BHA 10**	**BHA 12**	**BHA 15**	**BHA 18**	**BHA 24**	**BHA 28**	**BHA 32**
Steel failure									
Characteristic resistance	$N_{Rk,s,fi,120}$	(kN)	0,1	0,2	1,0	2,6	4,8	7,5	10,8
Pull-out failure									
Characteristic resistance in concrete C20/25 to C50/60	$N_{Rk,p,fi,120}$	(kN)	1,5	2,4	3,2	5,0	7,2	10,1	13,2
Concrete cone failure									
Characteristic resistance in concrete C20/25 to C50/60	$N_{Rk,c,fi,120}$	(kN)	1,5	4,0	5,9	8,2	14,4	25,2	39,7

Spacing	$s_{cr,N}$	(mm)		**4 x h_{ef}**					
	s_{min}	(mm)	40	60	70	80	100	125	150
Edge distance	$c_{cr,N}$	(mm)		**2 x h_{ef}**					
	c_{min}	(mm)	c min = 2 x hef ; if fire attack is from more than one side, the edge distanceof the anchor has to be >= 300 mm and >= 2 x hef.						

In absence of other national regulations the partial safety factor for resistance under fire exposure $\gamma_{M,fi}$ = 1,0 is recommended

Table 10: Characteristic values of resistance to shear loads under fire exposure

Fire resistance duration = 30 minutes			**BHA 10**	**BHA 12**	**BHA 15**	**BHA 18**	**BHA 24**	**BHA 28**	**BHA 32**
Steel failure without lever arm									
Characteristic resistance	$V^0_{Rk,s,fi,30}$	(kN)	0,3	2,0	3,2	4,8	8,9	13,9	20,0
Steel failure with lever arm									
Characteristic bending resistance	$M^0_{Rk,s,fi,30}$	(Nm)	0	2	4	7	19	37	64

Fire resistance duration = 60 minutes			**BHA 10**	**BHA 12**	**BHA 15**	**BHA 18**	**BHA 24**	**BHA 28**	**BHA 32**
Steel failure without lever arm									
Characteristic resistance	$V^0_{Rk,s,fi,60}$	(kN)	0,3	1,3	2,3	3,9	7,3	11,3	16,3
Steel failure with lever arm									
Characteristic bending resistance	$M^0_{Rk,s,fi,60}$	(Nm)	0	1	3	6	15	30	52

Fire resistance duration = 90 minutes			**BHA 10**	**BHA 12**	**BHA 15**	**BHA 18**	**BHA 24**	**BHA 28**	**BHA 32**
Steel failure without lever arm									
Characteristic resistance	$V^0_{Rk,s,fi,90}$	(kN)	0,2	0,6	1,4	3,0	5,6	8,8	12,6
Steel failure with lever arm									
Characteristic bending resistance	$M^0_{Rk,s,fi,90}$	(Nm)	0	1	2	5	12	23	40

Fire resistance duration = 120 minutes			**BHA 10**	**BHA 12**	**BHA 15**	**BHA 18**	**BHA 24**	**BHA 28**	**BHA 32**
Steel failure without lever arm									
Characteristic resistance	$V^0_{Rk,s,fi,120}$	(kN)	0,1	0,2	1,0	2,6	4,8	7,5	10,8
Steel failure with lever arm									
Characteristic bending resistance	$M^0_{Rk,s,fi,120}$	(Nm)	0	0	1	4	10	20	34

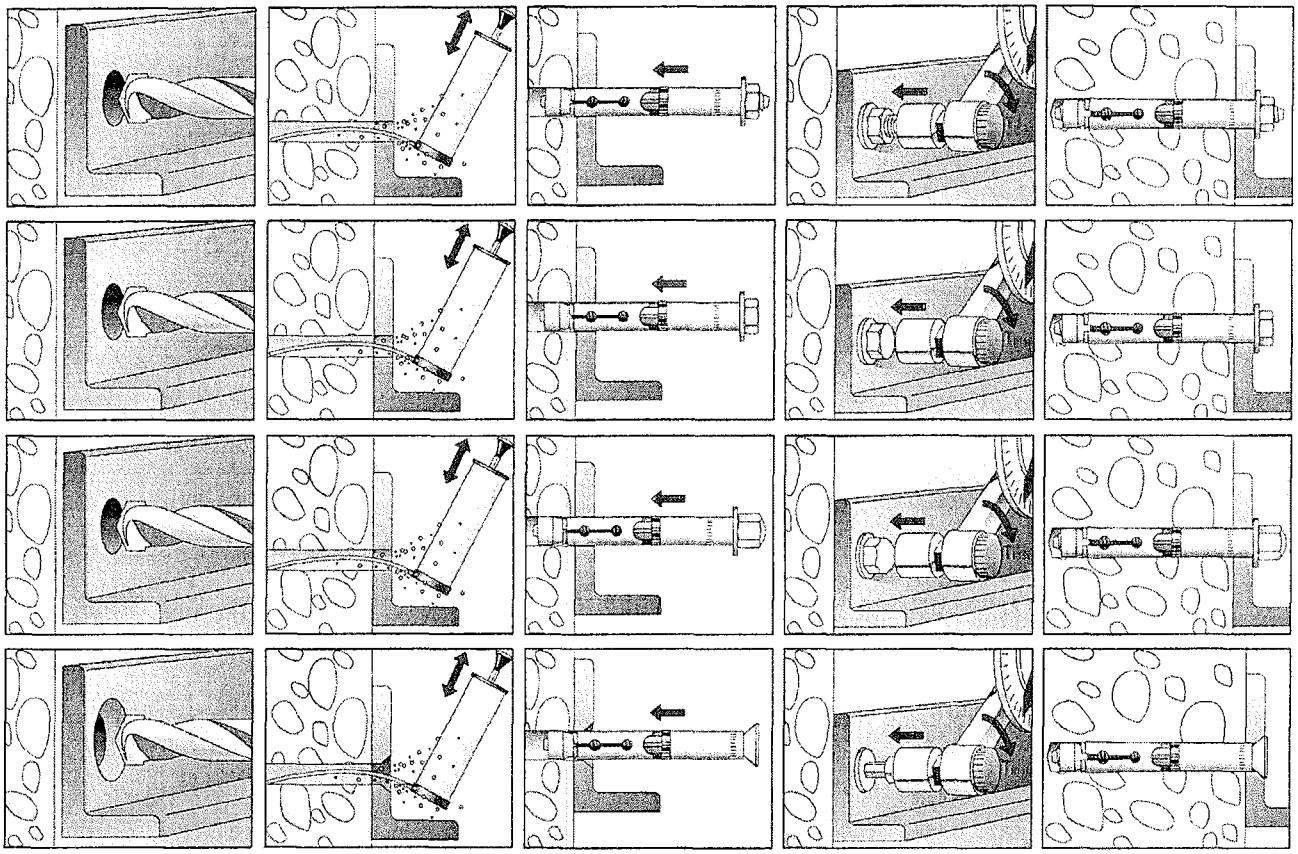
Concrete pry-out failure
In Equation (5.6) of ETAG 001, Annex C, 5.2.3.3, the k-factor = 2 and the relevant values of $N_{Rk,c,fi}$ above Annex 6 Table 9 have to be considered in the design.

Concrete edge failure
The characteristic resistence $V^0_{Rk,c,fi}$ in concrete C20/25 to C50/60 is determined by: $V^0_{Rk,c,fi} = 0,25 \times V^0_{Rk,c}$ (R30, R60, R90) $V^0_{Rk,c,fi} = 0,20 \times V^0_{Rk,c}$ (R120) with $V^0_{Rk,c}$ initial value of the characteristic resistance in cracked concrete C20/25 under normal temperature according to ETAG 001, Annex C, 5.2.3.4..

In absence of other national regulations the partial safety factor for resistance under fire exposure $\gamma_{M,fi} = 1,0$ is recommended

Installation instruction for the BTI heavy duty anchor BHA

BHA 10 M6 to BHA 32 M24 S, H, B, SK



BTI heavy duty anchor BHA	**Annex 8** of European technical approval ETA – 09/0159
Installation instruction	