

Approval body for construction products
and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and
Laender Governments



European Technical Assessment

ETA-21/0371
of 29 November 2023

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the
European Technical Assessment:

Deutsches Institut für Bautechnik

Trade name of the construction product

HALFEN Anchor bolt HAB H

Product family
to which the construction product belongs

Cast-in anchor bolts

Manufacturer

Leviat GmbH
Liebigstraße 14
40764 Langenfeld
DEUTSCHLAND

Manufacturing plant

This European Technical Assessment
contains

14 pages including 3 annexes which form an integral part
of this assessment

This European Technical Assessment is
issued in accordance with Regulation (EU)
No 305/2011, on the basis of

330924-01-0601, Edition: 07/2022

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Specific Part

1 Technical description of the product

The HALFEN anchor bolt HAB H consists of ribbed reinforcing steel of the diameters 16, 20, 25, 32, and 40 mm, two hexagon nuts and two washers. One of the ends of the bolt is provided with an anchor head and the other end with a thread of the sizes M16, M20, M24, M30, and M39.

The anchor bolt is imbedded in concrete up to the threaded length.

The product description is given in Annex A.

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

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

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

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

3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic resistance under static and quasi-static tension load	See Annex B2 and C1
Characteristic resistance under static and quasi-static shear load	See Annex C2
Combined tension and shear under static and quasi-static load	See Annex C2
Displacement under static and quasi-static tension or shear load	See Annex C3

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire	No performance assessed

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

In accordance with EAD No. 330924-01-0601, the applicable European legal act is: [96/582/EC].

The system to be applied is: 1

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD

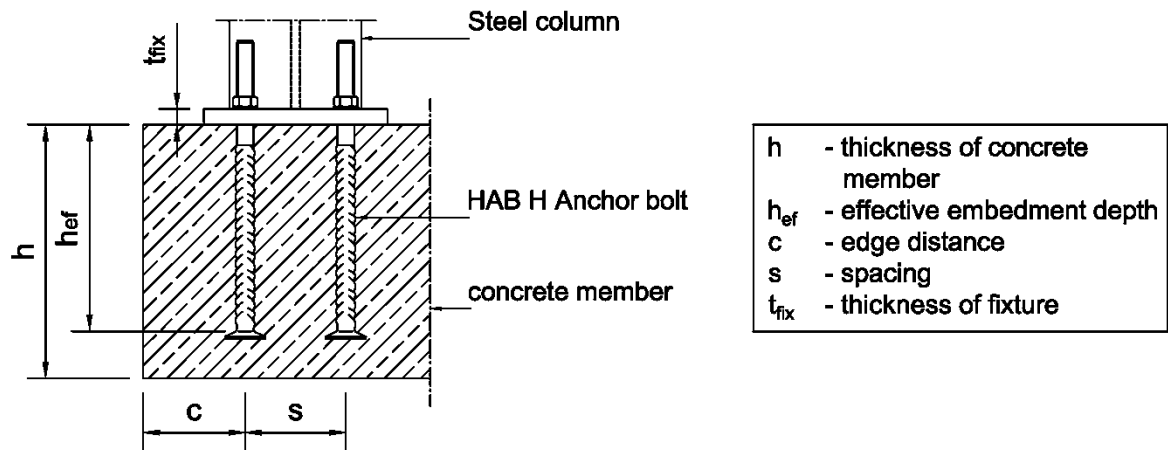
Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with Deutsches Institut für Bautechnik.

Issued in Berlin on 29 November 2023 by Deutsches Institut für Bautechnik

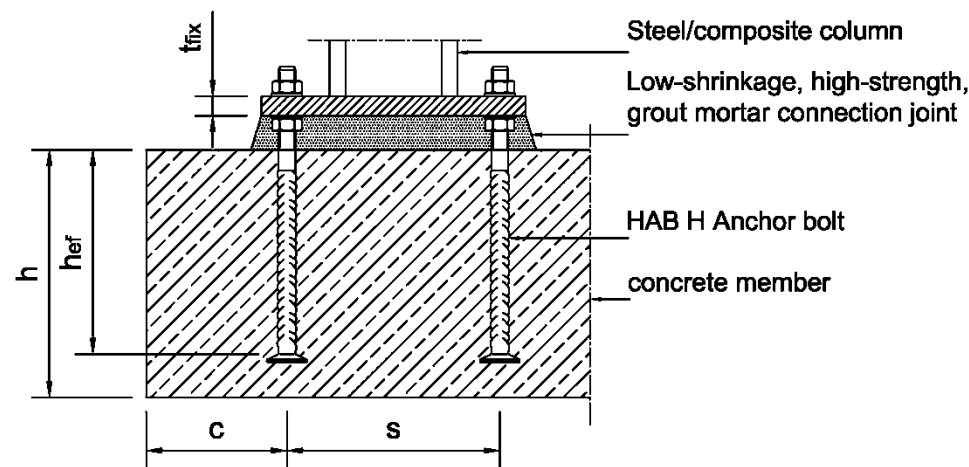
Dipl.-Ing. Beatrix Wittstock
Head of Section

beglaubigt:
Müller

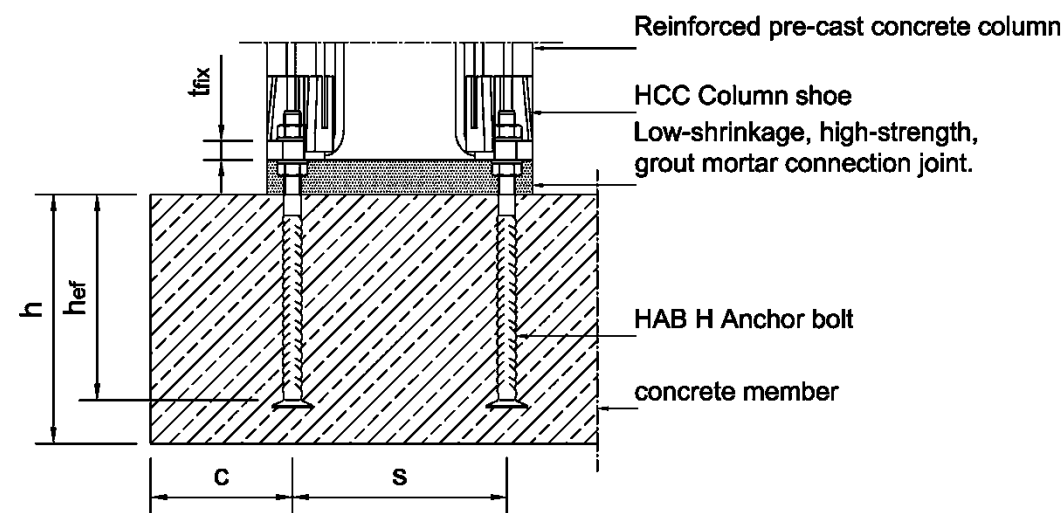
Steel column, without grout (Case a): General application



Steel-Concrete composite column with grout connection (Case b): Steel-Steel-Contact



Reinforced precast concrete column (Case b): Steel-Steel-Contact



HALFEN Anchor bolt HAB H

Product description
Installed conditions

Annex A1

Anchor bolt with thread

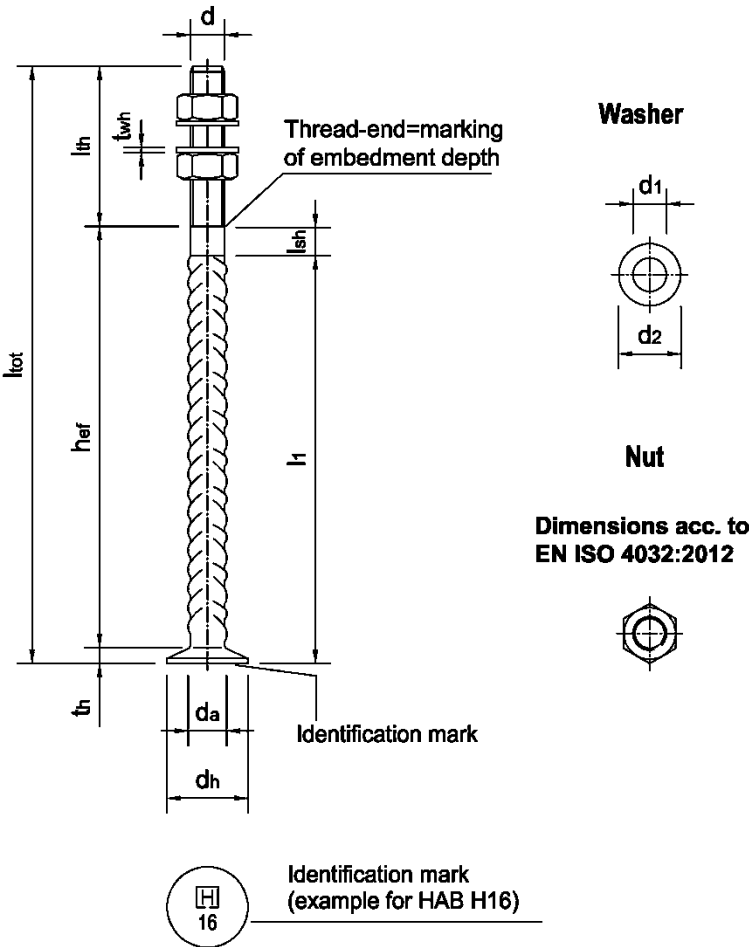


Table A1: dimension of components

HAB H	Anchor bolt [mm]									Washer [mm]			Nut
	d	d _a	d _n ≥	h _{ef}	t _h	l _{th}	l ₁ ≥	l ₁ ≤	l _{tot}	d ₁	d ₂	t _{wh}	
16	16	16	38	165	10	105	140	175	280	18	38	5	M16
20	20	20	46	223	12	115	210	235	350	22	46	6	M20
24	24	25	55	287	13	130	260	300	430	25	55	6	M24
30	30	32	70	335	15	150	310	350	500	31	65	8	M30
39	39	40	90	517	18	165	490	535	700	41	90	10	M39

HALFEN Anchor bolt HAB H

Product description
Components and dimensions

Annex A2

Table A3: Material

	1	2
Anchor bolts	Ø16 – Ø40 B500 according to EN 1992-1-1:2004 + A1:2014, Annex C	Ø16 – Ø40 B500 according to EN 1992-1-1:2004 + A1:2014, Annex C Hot dip galvanized according to EN ISO 1461:2009 or EN ISO 10684:2004 + AC:2009
Washers	S355J0 according to EN 10025-2:2019, S355MC according to EN 10149-2:2013, S355J2 according to EN 10025-2:2019, S355J2C according to EN 10025-2:2019	S355J0 according to EN 10025-2:2019, S355MC according to EN 10149-2:2013, S355J2 according to EN 10025-2:2019, S355J2C Hot dip galvanized according to EN ISO 1461:2009 or EN ISO 10684:2004 + AC:2009
6KT - Nuts	Hexagonal nuts according to EN ISO 4032:2012 Strength class 8 according to EN ISO 898-2:2022	Hexagonal nuts according to EN ISO 4032:2012 Strength class 8 according to EN ISO 898-2:2022 Hot dip galvanized according to EN ISO 1461:2009 or EN ISO 10684:2004 + AC:2009

HALFEN Anchor bolt HAB H

Product description
Components and material

Annex A3

Specifications of intended use

Anchor bolt subject to

- Static or quasi- static tension, shear or a combination of tension and shear

Base material

- Reinforced normal weight concrete according to EN 206-1:2000
- Strength class C20/25 to C90/105 according to EN 206-1:2000
- Cracked or uncracked concrete

Conditions of use (Environmental conditions)

- Anchor bars made of steel or ribbed reinforcing steel, washer and hexagonal nut are made of steel: Anchor bolts for use in structures subject to dry internal conditions.
- Anchor bars made of steel or ribbed reinforcing steel, washer and hexagonal nut are made of steel with concrete cover according to EN 1992-1-1:2004 + AC:2010 + A1:2014: Anchor bolts for use in structures subject to appropriate exposition relating to the concrete cover.
- Anchor bars made of steel or ribbed reinforcing steel, washer and hexagonal nut are made of steel hot dip galvanized according to EN ISO 1461 or EN ISO 10684 with at least 50 µm thickness: Anchor bolts for use in structures subject to internal conditions with usual humidity (exceptional permanently damp conditions and applications under water).

Design

- Anchor bolts are designed under the responsibility of an engineer experienced in anchorages and concrete work.
- Verifiable calculation notes and drawings are prepared taking into account the loads to be anchored. The position of the anchor bolts are indicated on the design drawings (e.g. position of the anchor bolts relative to reinforcement or to the support).
- For static and quasi-static loading the anchor bolts are designed in accordance with EN 1992-4: 2018
- The occurring splitting forces are resisted by the reinforcement. The required cross section of the minimum reinforcement is determined according to EN 1992-4:2018, Section 7.2.1.7.

HALFEN Anchor bolt HAB H

Intended use
Specifications

Annex B1

Installation

- The installation of the anchor bolts is carried out by appropriately qualified personnel under supervision of the person responsible for technical matters on site.
- Use of the product only as supplied by the manufacturer, without any manipulation or exchanging of components.
- Installation in accordance with manufacturer's product installation instructions given in Annex B3 and Annex B4.
- The anchor bolts are fixed to the formwork, reinforcement or auxiliary construction such that no movement of the product will occur during the time of laying the reinforcement and of placing and compacting the concrete.
- The anchor bolts are embedded in concrete up to the marking of embedment depth.
- The Concrete under the anchor bar head is properly compacted.
- The thread is protected against contamination.
- Maximum installation torque according to Table B2 must not be exceeded.

Table B2: Installation Parameter

Anchor bolt			HAB H16	HAB H20	HAB H24	HAB H30	HAB H39
Effective embedment depth	h_{ef}	[mm]	165	223	287	335	517
Minimum spacing	s_{min}	[mm]	80	100	100	130	150
Minimum edge distance	c_{min}	[mm]	50	70	70	100	130
Thread length	l_{th}	[mm]	105	115	130	150	165
Minimum thickness of concrete member	h_{min}	[mm]	$h_{ef} + l_{th} + c_{nom}^{1)}$				
max. Installation torque general application (Case a) ³⁾	$T_{inst,g} \leq$	[Nm]	15	35	40	80	150
max. Installation torque Steel-Steel-contact (Case b) ²⁾	$T_{inst,s} \leq$	[Nm]	95	185	325	645	1460

¹⁾ Concrete cover according to EN 1992-1-1: 2004 + AC2010 + A1:2014

²⁾ Connected component is clamped between the two nuts (See Annex A1)

³⁾ Connected component has contact with concrete surface (see Annex A1)

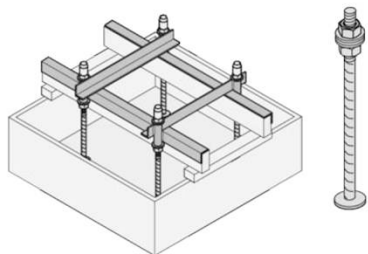
HALFEN Anchor bolt HAB H

Intended use
Installation

Annex B2

Installation instruction: reinforced Precast concrete column

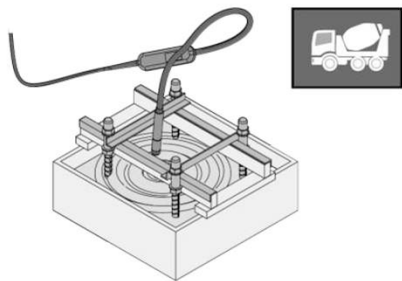
1. Anchor positioning



Scope of delivery: Anchor bolts each with two hexagon nuts and custom washers (reusable)

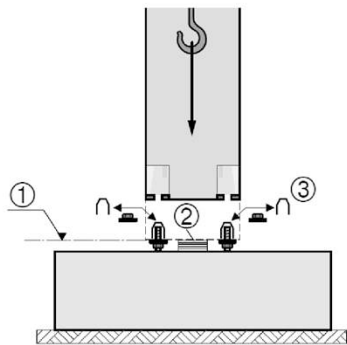
- Position the installation frame (reusable).
- Fit bolts to installation frame.
- Position the anchor bolts and any necessary, additional reinforcement according to the structural engineer's specifications and reinforcement plans.
- The anchor bolts must be correctly positioned and fixed in the specified axes and planes.

2. Concreting

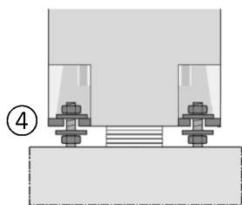


- Ensure the concrete is properly compacted around the anchor bolt heads.
- Ensure the anchor bolts do not move or are damaged.
- Protect the thread of the anchor bolts against contamination.
- The anchor bolts must only be subjected to load after minimum concrete strength has been reached.

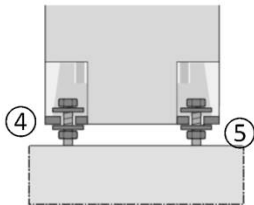
3. Place and adjust the column



Variant 3A



Variant 3B



- Adjust and set the bottom nuts and washers of the anchor bolts to the required height ①. Maneuver the precast column over the anchor bolts with a crane.
- Variant 3A: Positioning and subsequent adjustment of heavy columns is facilitated with steel shims ② which are placed dead center under the column; In this case fix the bottom nuts 5mm lower. Lower the column on to the steel shims and adjust using the top nuts ④.
- When moving columns by crane the anchor bolts threads must be protected using assembly caps ③.
- Variant 3B: Adjust and fix the bottom nuts and washers of the anchor bolts to the required height ④.
- Adjust the column using the bottom nuts ⑤.
- Tighten top nuts after column is orientated.
- The maximal installation torque $T_{inst,s}$ as specified in annex B2 must not be exceeded (see: Steel-Steel-Contact)

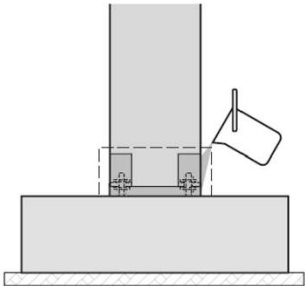
HALFEN Ankerbolzen HAB H

Intended use

Installation instruction for reinforced precast concrete column

Annex B3

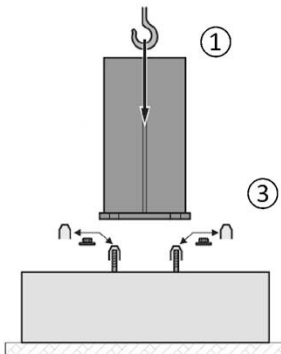
4. Seal the connection joint



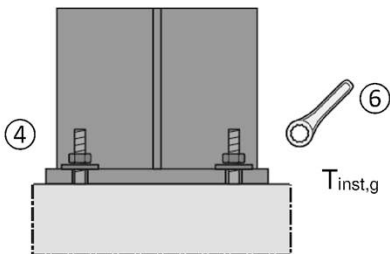
- The assembly joint and the recess must be filled with an appropriate high-strength low-shrink grouting mortar according to manufacturer's product installation instruction.
- The mortar strength must be at least the same strength as the concrete used for the column concrete.

Installation Instruction: Steel column

1. Position the anchors
Analogue to the manufacturer's product installation instruction for reinforced precast concrete column (Annex B3).
2. Pour the concrete
Analogue to the manufacturer's product installation instruction for reinforced precast concrete column (Annex B3).
3. Install the column



- Position the column, keeping it connected to the crane ①.
- Ensure the protection caps ③ are installed on the threads.
- Screw on the top nuts ④.
- The maximal installation torque $T_{inst,g}$ according to Annex B2 must not be exceeded ⑥.



HALFEN Anchor bolt HAB H

Intended use
Installation instructions for steel columns

Annex B4

Table C1: Characteristic resistances under tension load

Anchor bolt size	HAB H	16	20	24	30	39
Steel failure						
Characteristic resistance	$N_{Rk,s}$ [kN]	86	135	194	309	537
Partial factor	$\gamma_{Ms}^{1)}$ [-]	1,4				
Pull-out failure						
Characteristic resistance in uncracked concrete and concrete strength class C20/25	$N_{Rk,p}$ [kN]	196	283	396	639	1072
Characteristic resistance in cracked concrete and concrete strength class C20/25	$N_{Rk,p}$ [kN]	140	202	282	457	766
Increase factor for higher concrete grades for $N_{Rk,p}$: $N_{Rk,p} = N_{Rk,p(20/25)} \cdot \Psi_c$	Ψ_c C25/30	1,25				
	C30/37	1,50				
	C35/45	1,75				
	C40/50	2,00				
	C45/55	2,25				
	C50/60	2,50				
	C55/67	2,75				
	$\geq C60/75$	3,00				
Partial factor	$\gamma_{Mp}^{1)}$ [-]	1,5				
Concrete cone failure						
Effective embedment depth	h_{ef} [mm]	165	223	287	335	517
Characteristic axial spacing	$s_{cr,N} = s_{cr,sp}$ [mm]	495	669	861	1005	1551
Characteristic edge distance	$c_{cr,N} = c_{cr,sp}$ [mm]	248	335	431	503	776
Factor to take into account the influence of load transfer mechanism:						
- in cracked concrete	$k_{cr,N}$ [-]	8,9				
- in uncracked concrete	$k_{ucr,N}$ [-]	12,7				
Partial factor	$\gamma_{Mc}^{1)}$ [-]	1,5				
Splitting failure						
Reinforcement, which limits the crack width to $w_k \leq 0.3$ mm, must be installed to resist splitting forces (see EN 1992-4:2019, Section 7.2.1.7).						

¹⁾ in absence of other national regulations

HALFEN Anchor bolt HAB H

Performances

Characteristic resistances under tension load

Annex C1

Table C2.1: Characteristic resistances under shear load

Anchor bolt size	HAB-H	16	20	24	30	39
Steel failure without lever arm						
Characteristic resistance	$V_{Rk,s}^0$ [kN]	43	68	97	155	269
Factor according to EN 1992-4:2018, Section 7.2.2.3.1	k_7 [-]	1,0				
Partial factor	$\gamma_{Ms}^{1)}$ [-]	1,5				
Steel failure with lever arm						
Characteristic resistance	$M_{Rk,s}^0$ [Nm]	183	357	618	1237	2838
Partial factor	$\gamma_{Ms}^{1)}$ [-]	1,5				
Concrete pry-out failure						
Factor according to EN 1992-4:2018, Section 7.2.2.4, eq. (7.39a) and eq. (7.39b)	k_8 [-]	2,0				
Partial factor	$\gamma_{Mcp}^{1)}$ [-]	1,5				
Concrete edge failure						
Effective embedment depth	l_f [mm]	128	160	192	240	312
Effective outer diameter of the anchor bolt	$d_{nom} = d$ [mm]	16	20	24	30	39
Partial factor	$\gamma_{Mc}^{1)}$ [-]	1,5				

¹⁾ in absence of other national regulations.

Table C2.2: Combined tension and shear load

Factor according to EN 1992-4:2018, Section 7.2.3.2	k_{11} [-]	2/3
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HALFEN Anchor bolt HAB H

Performances

Characteristic resistance under shear load and combined tension and shear loads

Annex C2

Table C3.1: Displacement under tension load

Anchor bolt size		HAB-H	16	20	24	30	39
Tension load		N [kN]	67	96	135	218	365
Displacement	short-term	δ_{N0} [mm]	0,3	0,4	0,5	0,7	0,9
	long-term	$\delta_{N\infty}$ [mm]	0,6	0,8	1,0	1,4	1,8

Table C3.2: Displacement under shear load

Anchor bolt size		HAB-H	16	20	24	30	39
Shear load		V [kN]	9	15	16	28	44
Displacement	short-term	δ_{V0} [mm]	0,8	0,9	0,6	0,6	0,6
	long-term	$\delta_{V\infty}$ [mm]	1,2	1,4	0,9	0,9	0,9

HALFEN Anchor bolt HAB H

Performance
Displacement under tension and / or shear load

Anlage C3