La qualité pour l'artisan

Déclaration de performance

conformément à l'annexe II du règlement (UE) no 305/2011

CE

292 Alfa Mortier d'injection pour béton et maçonnerie

N° DoP : 2920280K-0001

Code d'identification / Type de produit	**292 0280KFR**
Numéro de type, de lot ou de série ou tout autre identificateur permettant le repérage du produit de construction	–
Utilisation prévue du produit de construction	**Cheville composite pour ancrage dans le béton non fissuré, voir annexe B**
Nom et adresse de contact du fabricant	**Alfa GmbH** Ferdinand-Porsche-Str. 10 73479 Ellwangen / Allemagne Tél.: +33 (0)9 86 87 86 05 alfa-direct.fr
Nom et adresse de contact du représentant légal mandaté pour ces missions	**Non pertinent**
Système de notation et de verification de la constance des performances du produit de construction	**Système 1**
Pour les déclarations de performance concernant un produit de construction couvert par une norme harmonisée	**NB 1343 – MPA, Darmstadt**
Dans le cas d'une déclaration de performance concernant un produit de construction pour lequel une évaluation technique européenne a été délivrée	**EAD 330499-01-0601** **ETA-16/0898, 25.04.2020** **TZÚS, Prag**

Alfa GmbH
Ferdinand-Porsche-Str. 10
73479 Ellwangen / Allemagne

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La qualité pour l'artisan

Déclaration de performance

conformément à l'annexe II du règlement (UE) no 305/2011

Caractéristiques principales	Performances/ Point de consigne
Résistance mécanique et stabilité (BWR 1)	
Résistances caractéristiques sous sollicitation en traction (actions statiques et quasi-statiques)	Annexes C1, C2, C4
Résistances caractéristiques sous sollicitation transversale (actions statiques et quasi-statiques)	Annexes C1, C3, C5
Déplacements sous sollicitation	Annexes C6
Durabilité	Annexes B1
Hygiène, santé et environnement (BWR 3)	
Teneur, émission et/ou libération de substances dangereuses	Performance non évaluée

Les performances du produit correspondent aux performances déclarées. Le fabricant est seul responsable de l'établissement de cette déclaration de conformité.

Signé pour le fabricant et au nom du fabricant par

Arne Kochler, directeur général
Ellwangen, 11.08.2026

Alfa GmbH
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73479 Ellwangen/Allemagne

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292 Alfa Mortier d'injection pour béton et maçonnerie
État: 08-2026

Deutsches Institut für Bautechnik

Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

Member of EOTA

www.eota.eu

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

European Technical Assessment ETA-18/1113 of 22 February 2019

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	292 Alfa Injection mortar for masonry
Product family to which the construction product belongs	Metal Injection anchors for use in masonry
Manufacturer	Alfa GmbH Ferdinand-Porsche-Straße 10 73479 Ellwangen DEUTSCHLAND
Manufacturing plant	Werk 1,D und Werk 2, D
This European Technical Assessment contains	61 pages including 3 annexes which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	EAD 330076-00-0604

The European Technical Assessment is issued by the Technical Assessment Body in its official language. Translations of this European Technical Assessment in other languages shall fully correspond to the original issued document and shall be identified as such.

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Specific Part

1 Technical description of the product

The 292 Alfa Injection mortar for masonry is a bonded anchor (injection type) consisting of a mortar cartridge with injection mortar 292 Alfa, a perforated sleeve and an anchor rod with hexagon nut and washer. The steel elements are made of zinc coated steel or stainless steel.

The anchor rod is placed into a drilled hole filled with injection mortar and is anchored via the bond between steel element, injection mortar and masonry and mechanical interlock.

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 values for resistance	See Annexes C 1 to C 45
Displacements	See Annex C 5 to C 45

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1

3.3 Hygiene, health and the environment (BWR 3)

Essential characteristic	Performance
Content, emission and/or release of dangerous substances	No performance assessed

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

In accordance with the European Assessment Document EAD 330076-00-0604 the applicable European legal act is: [97/177/EC].

The system to be applied is: 1

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

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

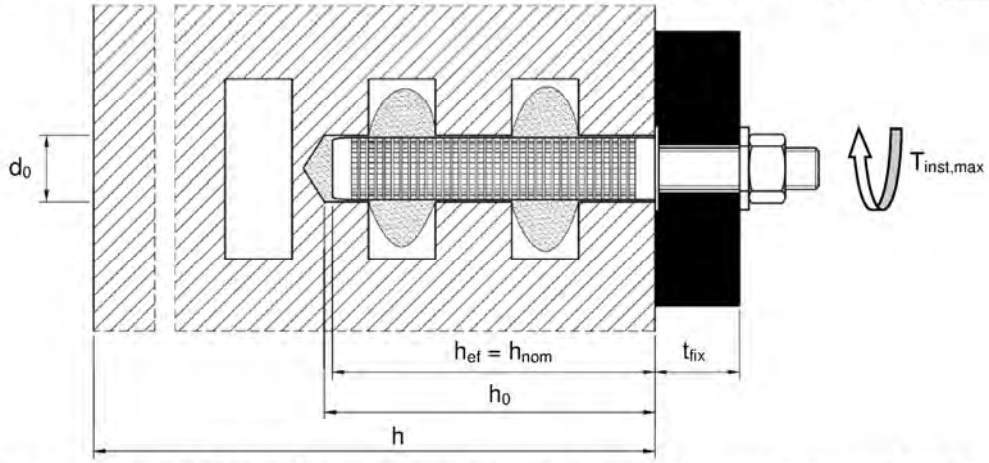
Issued in Berlin on 22 February 2019 by Deutsches Institut für Bautechnik

BD Dipl.-Ing. Andreas Kummerow
Head of Department

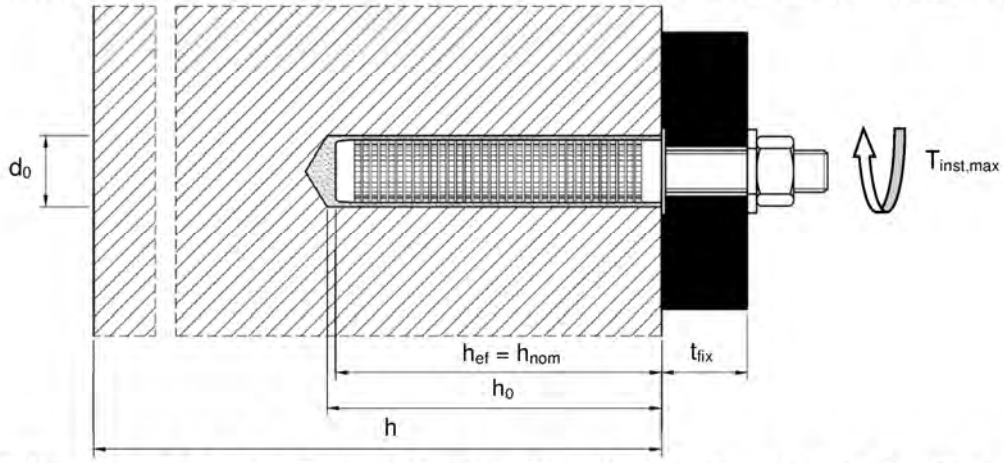
beglaubigt:
Baderschneider

Deutsches Institut für Bautechnik DIBt

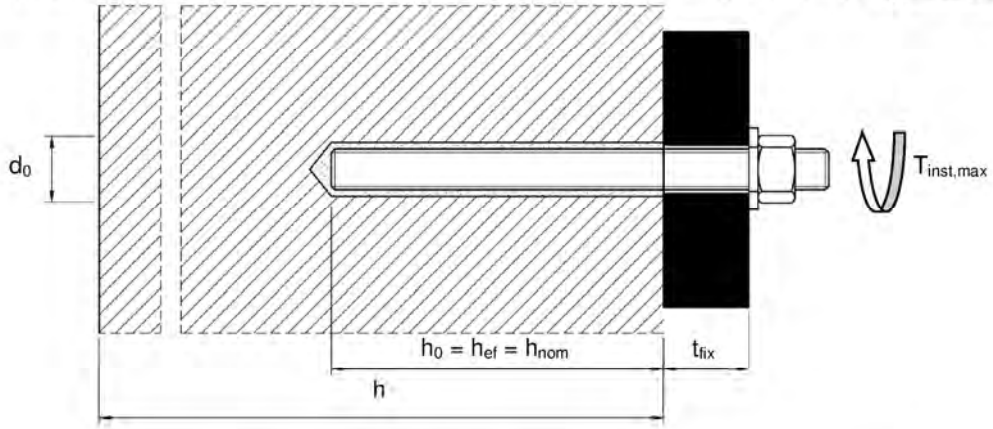
Installation in hollow brick: Threaded rod (optional with internal thread) with perforated sleeve



Installation in solid brick: Threaded rod (optional with internal thread) with perforated sleeve



Installation in solid brick: Threaded rod (optional with internal thread) without perforated sleeve



h_{ef}	= effective anchorage depth	t_{fix}	= thickness of fixture
h_{nom}	= nominal embedment depth	$T_{inst,max}$	= max. installation torque
h_0	= bore hole depth	h	= thickness of member
d_0	= bore hole diameter		

292 Alfa Injection mortar for masonry

Product description
Installed condition

Annex A1

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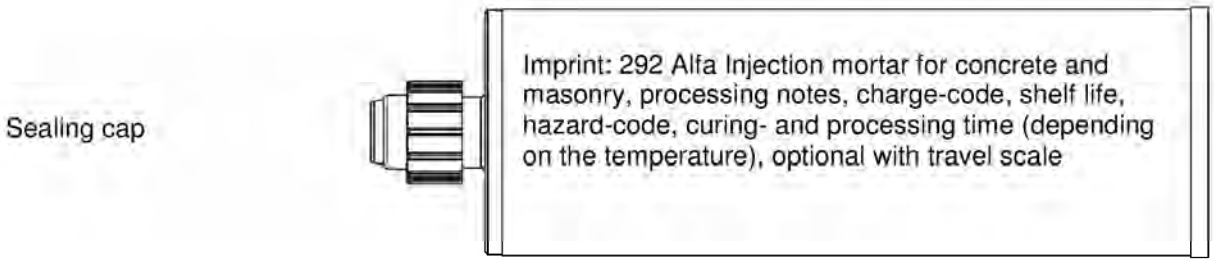
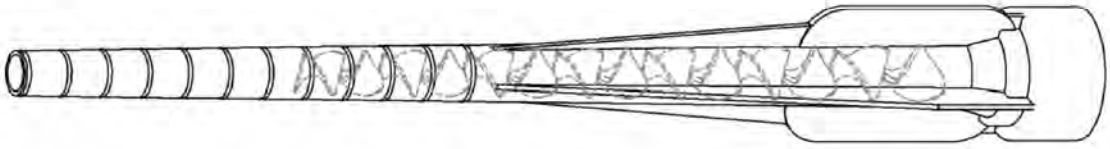
Cartridge 292 Alfa Injection mortar

280 ml cartridge (Type: coaxial)



Static Mixer



292 Alfa Injection mortar for masonry	Annex A2
Product description Injection System	

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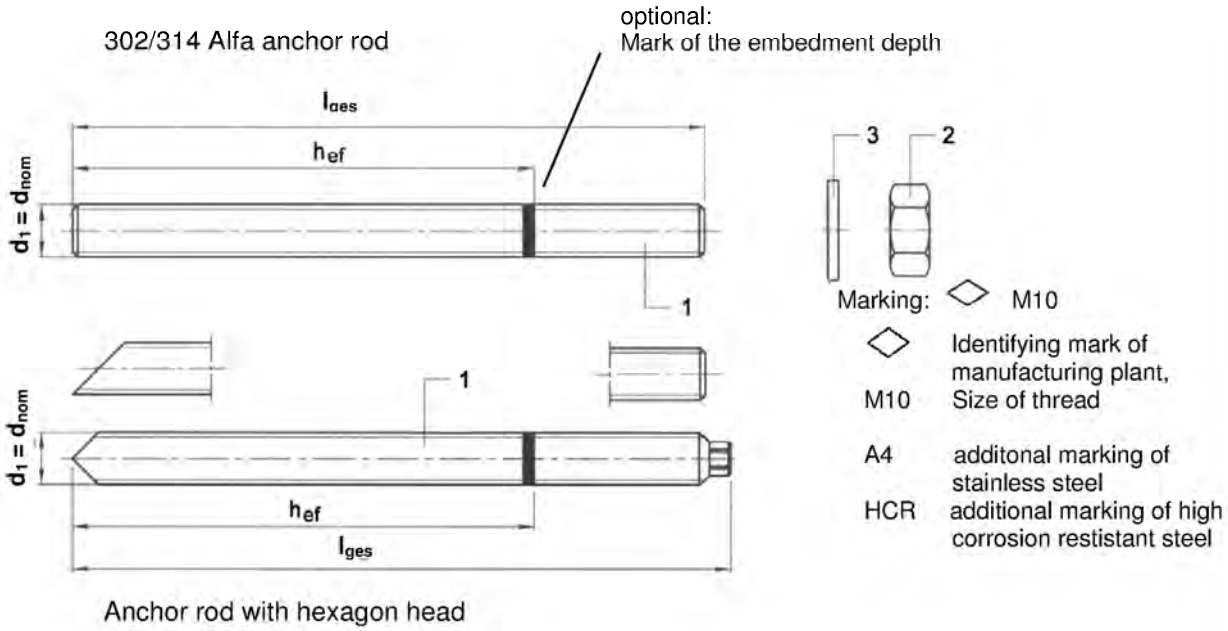
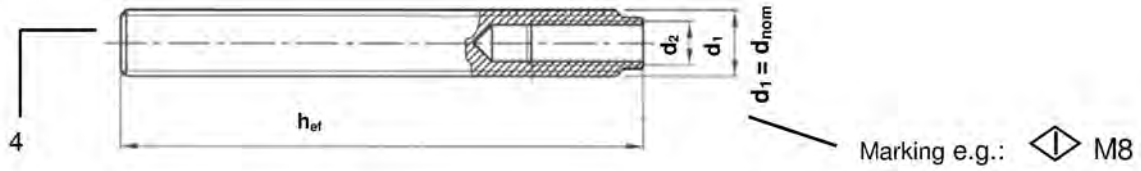
302/314 Alfa anchor rods or anchor rods with hexagon head M8, M10, M12, M16



Commercial standard threaded rod with:

- Materials, dimensions and mechanical properties see Table A1 and Table A2
- Inspection certificate 3.1 acc. to EN 10204:2004
- Marking of embedment depth

Threaded rod with internal thread IG M6, IG M8 and IG M10



◇	Identifying mark of manufacturing plant
I	Identifying of internal thread
M8	Size of internal thread
A4	additional marking for stainless steel
HCR	additional marking for high corrosion resistant steel HCR

292 Alfa Injection mortar for masonry	**Annex A3**
Product description Threaded rods	

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Table A1: Materials

Part	Designation	Material
Steel, zinc plated ≥ 5 µm acc. to EN ISO 4042:1999 or Steel, hot-dip galvanized ≥ 40 µm acc. to EN ISO 1461:2009 and EN ISO 10684:2004+AC:2009		
1	Anchor rod	Steel, EN 10087:1998 or EN 10263:2001 Property class 4.6, 4.8, 5.6, 5.8, and 8.8 acc. EN 1993-1-8:2005+AC:2009
2	Hexagon nut	Steel acc. EN 10087:1998 or EN 10263:2001 Property class 4 (for class 4.6, 4.8 rod) Property class 5 (for class 5.6, 5.8 rod) Property class 8 (for class 8.8 rod) acc. to EN ISO 898-2:2012
3	Washer, EN ISO 887:2006, EN ISO 7089:2000, EN ISO 7093:2000, or EN ISO 7094:2000	Steel, zinc plated or hot-dip galvanized
4	Threaded rod with internal thread	Steel, zinc plated Property class 5.6, 5.8 and 8.8 acc. to. EN ISO 898-1:2013
Stainless steel		
1	Anchor rod	Material 1.4401 / 1.4404 / 1.4571 / 1.4362, EN 10088-1:2014, Property class 70, EN ISO 3506-1:2009 Property class 80, EN ISO 3506-1:2009
2	Hexagon nut	Material 1.4401 / 1.4404 / 1.4571 / 1.4362, EN 10088-1:2014, Property class 70 (for class 70 rod), EN ISO 3506-2:2009 Property class 80 (for class 80 rod), EN ISO 3506-2:2009
3	Washer, EN ISO 887:2006, EN ISO 7089:2000, EN ISO 7093:2000, or EN ISO 7094:2000	Material 1.4401 / 1.4404 / 1.4571 / 1.4362 acc. to EN 10088-1:2014
4	Threaded rod with internal thread	Material 1.4401 / 1.4404 / 1.4571 / 1.4362 EN 10088-1:2014, Property class 70 acc. to EN ISO 3506-1:2009
High corrosion resistant steel (HCR)		
1	Anchor rod	Material 1.4529 / 1.4565, EN 10088-1:2014, Property class 70, acc. to EN ISO 3506-1:2009 Property class 80, acc. to EN ISO 3506-1:2009
2	Hexagon nut	Material 1.4529 / 1.4565, EN 10088-1:2014, Property class 70 (for class 70 rod) Property class 80 (for class 80 rod) acc. to EN ISO 3506-2:2009
3	Washer, EN ISO 887:2006, EN ISO 7089:2000, EN ISO 7093:2000, or EN ISO 7094:2000	Material 1.4529 / 1.4565 acc. to EN 10088-1:2014
4	Threaded rod with internal thread	Material 1.4529 / 1.4565 EN 10088-1:2014, Property class 70 acc. to. EN ISO 3506-1:2009
Perforated sleeve		Material: Polypropylene

292 Alfa Injection mortar for masonry

Product description
Materials

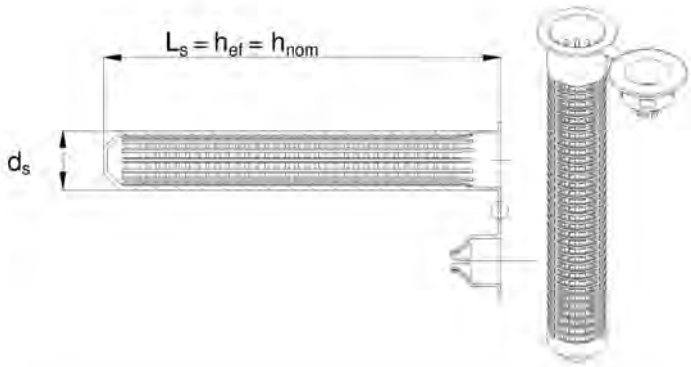
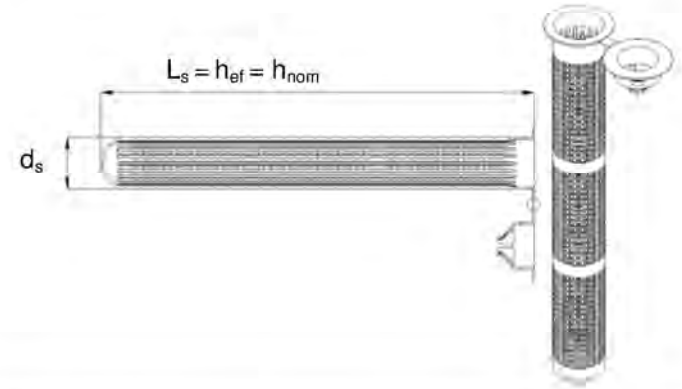
Annex A4

Deutsches Institut für Bautechnik DIBt

Table A2: Sizes of threaded rods

Type	Size	Diameter		Min. screw-in depth	Thread length (Internal thread)	Total length
		$d_1 = d_{nom}$	d_2	$L_{IG,min}$	L_{IG}	l_{ges}
		[mm]	[mm]	[mm]	[mm]	[mm]
Threaded rods						
302/314 Alfa anchor rod and **anchor rod with hexagon head**	M8	8	-	-	-	$h_{ef} + t_{fix} + 9,5$
	M10	10	-	-	-	$h_{ef} + t_{fix} + 11,5$
	M12	12	-	-	-	$h_{ef} + t_{fix} + 17,5$
	M16	16	-	-	-	$h_{ef} + t_{fix} + 20,0$
Threaded rods with internal thread and metric external thread						
IG	M6	10	6	8	20	with sleeve: h_{ef} - 5 mm without sleeve: h_{ef}
	M8	12	8	8	20	
	M10	16	10	10	25	

Table A3: Sizes of sleeves

Type	Size	$d_s = d_{nom}$	$L_s = h_{ef} = h_{nom}$
		[mm]	[mm]
	**349 Alfa sleeves 12x80**	12	80
	349 Alfa sleeves 16x85	16	85
	349 Alfa sleeves 20x85	20	
	**349 Alfa sleeves 16x130**	16	130
	349 Alfa sleeves 20x130	20	
	349 Alfa sleeves 20x200	20	200

292 Alfa Injection mortar for masonry

Product description

Sizes of threaded rods and sleeves

Annex A5

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Specifications of intended use

Anchorages subject to:
- Static and quasi-static loads

Base material:
- Autoclaved Aerated Concrete (use category d) according to Annex B2
- Solid brick masonry (use category b), according to Annex B2.
- Hollow brick masonry (use category c), according to Annex B2 and B3.
- Mortar strength class of the masonry M 2,5 at minimum according to EN 998-2:2010.
- For other bricks in solid masonry and in hollow or perforated masonry, the characteristic resistance of the anchor may be determined by job site tests according TR 053 (Recommendations for job site tests of metal injection anchors for use in masonry) under consideration of the β factor according to Annex C1, Table C1

Note: The characteristic resistance for solid bricks and autoclaved aerated concrete are also valid for larger brick sizes and larger compressive strength of the masonry unit.

Temperature range:
- T_a: - 40°C to +40°C (max. short term temperature +40°C and max. long term temperature +24°C)
- T_b: - 40°C to +80°C (max. short term temperature +80°C and max. long term temperature +50°C)
- T_c: - 40°C to +120°C (max. short term temperature +120°C and max. long term temperature +72°C)

Use conditions (Environmental conditions):
- Dry and wet structure (regarding injection mortar).
- Structures subject to dry internal conditions (zinc coated steel, stainless steel or high corrosion resistant steel).
- Structures subject to external atmospheric exposure (including industrial and marine environment) and to permanently damp internal condition, if no particular aggressive conditions exist (stainless steel or high corrosion resistant steel).
- Structures subject to external atmospheric exposure and to permanently damp internal condition, if other particular aggressive conditions exist (high corrosion resistant steel).

Note: 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).

Use categories in respect of installation and use:
- Category d/d: Installation and use in dry masonry
- Category w/d: Installation in wet masonry and use in dry masonry
- Category w/w: Installation and use in dry or wet masonry

Design:
- Verifiable calculation notes and drawings are prepared taking account the relevant masonry in the region of the anchorage, the loads to be transmitted and their transmission to the supports of the structure. The position of the anchor is indicated on the design drawings.
- The anchorages are designed in accordance with Technical Report TR 054, Design Method A under the responsibility of an engineer experienced in anchorages and masonry work.

Characteristic values	$N_{Rk,s}$ $V_{Rk,s}$	$N_{Rk,p} = N_{Rk,b}$ $V_{Rk,b}$ and $V_{Rk,c}$	$N_{Rk,pb}$ $V_{Rk,pb}$
Determination acc. to	Annex C2	Annex C4 to C45	TR 054

- For application <u>with</u> sleeve with drill bit size ≤ 15mm installed in joints not filled with mortar:
  $N_{Rk,p,j} = 0{,}18 * N_{Rk,p}$ and $N_{Rk,b,j} = 0{,}18 * N_{Rk,b}$ ($N_{Rk,p} = N_{Rk,b}$ see Annex C4 to C45)
  $V_{Rk,c,j} = 0{,}15 * V_{Rk,c}$ and $V_{Rk,b,j} = 0{,}15 * V_{Rk,b}$ ($V_{Rk,b}$ and $V_{Rk,c}$ see Annex C4 to C45)
- Application <u>without</u> sleeve installed in joints not filled with mortar is not allowed.

Installation:
- Dry or wet structures
- Drill method acc. to Annex C4 to C45.
- Anchor Installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.
- When using anchor rods with internal thread (IG) fastening screws or threaded rods (incl. nut and washer) must comply with the appropriate material and property class of the Internal threaded rod.

292 Alfa Injection mortar for masonry

Intended Use
Specifications

Annex B1

Deutsches Institut für Bautechnik DIBt

Table B1: Overview brick types and properties with corresponding fastening elements (Anchor and 349 Alfa Sleeve)

Brick-No.	Brick type	Picture	Brick size length width height [mm]	Compressive strength [N/mm²]	Bulk density [kg/dm³]	349 Alfa Sleeve - Anchor type	Annex
Autoclaved aerated concrete units according EN 771-4							
1	Autoclaved aerated concrete AAC6		499 240 249	6	0,6	M8/M10/M12/M16 IG-M6/IG-M8/IG-M10	C4 – C5
Calcium silicate masonry units according EN 771-2							
2	Calcium silicate solid brick KS-NF		240 115 71	10 20 27	2,0	M8/M10/M12/M16/IG-M6/IG-M8/IG-M10 349 12x80 – M8 349 16x85 – M8/M10/IG-M6 349 16x130 – M8/M10/IG-M6 349 20x85 – M12/M16/IG-M8/IG-M10 349 20x130 – M12/M16/IG-M8/IG-M10 349 20x200 – M12/M16/IG-M8/IG-M10	C6 – C8
3	Calcium silicate hollow brick KSL-3DF		240 175 113	8 12 14	1,4	349 12x80 – M8 349 16x85 – M8/M10/IG-M6 349 16x130 – M8/M10/IG-M6 349 20x85 – M12/M16/IG-M8/IG-M10 349 20x130 – M12/M16/IG-M8/IG-M10 349 20x200 – M12/M16/IG-M8/IG-M10	C9 – C11
4	Calcium silicate hollow brick KSL-12DF		498 175 238	10 12 16	1,4	349 12x80 – M8 349 16x85 – M8/M10/IG-M6 349 16x130 – M8/M10/IG-M6 349 20x85 – M12/M16/IG-M8/IG-M10 349 20x130 – M12/M16/IG-M8/IG-M10	C12 – C14
Clay masonry units according EN 771-1							
5	Clay solid brick Mz – DF		240 115 55	10 20 28	1,6	M8/M10/M12/M16/IG-M6/IG-M8/IG-M10 349 12x80 – M8 349 16x85 – M8/M10/IG-M6 349 16x130 – M8/M10/IG-M6 349 20x85 – M12/M16/IG-M8/IG-M10 349 20x130 – M12/M16/IG-M8/IG-M10 349 20x200 – M12/M16/IG-M8/IG-M10	C15 - C17
6	Clay hollow brick HLz-16DF		497 240 238	6 8 12 14	0,8	349 12x80 – M8 349 16x85 – M8/M10/IG-M6 349 16x130 – M8/M10/IG-M6 349 20x85 – M12/M16/IG-M8/IG-M10 349 20x130 – M12/M16/IG-M8/IG-M10 349 20x200 – M12/M16/IG-M8/IG-M10	C18 - C20
7	Clay hollow brick Porotherm Homebric		500 200 299	4 6 10	0,7	349 12x80 – M8 349 16x85 – M8/M10/IG-M6 349 16x130 – M8/M10/IG-M6 349 20x85 – M12/M16/IG-M8/IG-M10 349 20x130 – M12/M16/IG-M8/IG-M10	C21 – C23

292 Alfa Injection mortar for masonry

Intended use
Brick types and properties with corresponding fastening elements

Annex B2

Deutsches Institut für Bautechnik DIBt

Table B1: Overview brick types and properties with corresponding fastening elements (Anchor and 349 Alfa Sleeve) – continue

Brick-No.	Brick type	Picture	Brick size length width height [mm]	Compressive strength [N/mm²]	Bulk density [kg/dm³]	349 Alfa Sleeve - Anchor type	Annex
Clay masonry units according EN 771-1							
8	Clay hollow brick BGV Thermo		500 200 314	4 6 10	0,6	349 12x80 – M8 349 16x85 – M8/M10/IG-M6 349 16x130 – M8/M10/IG-M6 349 20x85 – M12/M16/IG-M8/IG-M10 349 20x130 – M12/M16/IG-M8/IG-M10	C24 - C26
9	Clay hollow brick Calibric R+		500 200 314	6 9 12	0,6	349 12x80 – M8 349 16x85 – M8/M10/IG-M6 349 16x130 – M8/M10/IG-M6 349 20x85 – M12/M16/IG-M8/IG-M10 349 20x130 – M12/M16/IG-M8/IG-M10	C27 - C29
10	Clay hollow brick Urbanbric		560 200 274	6 9 12	0,7	349 12x80 – M8 349 16x85 – M8/M10/IG-M6 349 16x130 – M8/M10/IG-M6 349 20x85 – M12/M16/IG-M8/IG-M10 349 20x130 – M12/M16/IG-M8/IG-M10	C30 - C32
11	Clay hollow brick Brique creuse C40		500 200 200	4 8 12	0,7	349 12x80 – M8 349 16x85 – M8/M10/IG-M6 349 16x130 – M8/M10/IG-M6 349 20x85 – M12/M16/IG-M8/IG-M10 349 20x130 – M12/M16/IG-M8/IG-M10	C33 - C35
12	Clay hollow brick Blocchi Leggeri		250 120 250	4 6 8 12	0,6	349 12x80 – M8 349 16x85 – M8/M10/IG-M6 349 16x130 – M8/M10/IG-M6 349 20x85 – M12/M16/IG-M8/IG-M10 349 20x130 – M12/M16/IG-M8/IG-M10 349 20x200 – M12/M16/IG-M8/IG-M10	C36 - C38
13	Clay hollow brick Doppio Uni		250 120 120	10 16 20 28	0,9	349 12x80 – M8 349 16x85 – M8/M10/IG-M6 349 16x130 – M8/M10/IG-M6 349 20x85 – M12/M16/IG-M8/IG-M10 349 20x130 – M12/M16/IG-M8/IG-M10 349 20x200 – M12/M16/IG-M8/IG-M10	C39 - C41
Lightweight concrete according EN 771-3							
14	Hollow lightweight concrete Bloc creux B40		494 200 190	4	0,8	349 12x80 – M8 349 16x85 – M8/M10/IG-M6 349 16x130 – M8/M10/IG-M6 349 20x85 – M12/M16/IG-M8/IG-M10 349 20x130 – M12/M16/IG-M8/IG-M10	C42 - C43
15	Solid lightweight concrete		300 123 248	2	0,6	M8/M10/M12/M16/IG-M6/IG-M8/IG-M10 349 12x80 – M8 349 16x85 – M8/M10/IG-M6 349 16x130 – M8/M10/IG-M6 349 20x85 – M12/M16/IG-M8/IG-M10 349 20x130 – M12/M16/IG-M8/IG-M10 349 20x200 – M12/M16/IG-M8/IG-M10	C44 - C45

292 Alfa Injection mortar for masonry

Intended use
Brick types and properties with corresponding fastening elements

Annex B3

Deutsches Institut für Bautechnik DIBt

Installation: Steel brush

Table B2: Installation parameters in autoclaved aerated concrete AAC and solid masonry (without sleeve)

Anchor type and size			**302/314 Alfa anchor rod M8 and anchor rod with hexagon head M8**	**302/314 Alfa anchor rod M10 and anchor rod with hexagon head M10**	**IG M6**	**302/314 Alfa anchor rod M12 and anchor rod with hexagon head M12**	**IG M8**	**302/314 Alfa anchor rod M16 and anchor rod with hexagon head M16**	**IG M10**
Nominal drill hole diameter	d_0	[mm]	10	12		14		18	
Drill hole depth	h_0	[mm]	80	90		100		100	
Effective anchorage depth	h_{ef}	[mm]	80	90		100		100	
Minimum wall thickness	h_{min}	[mm]	h_{ef} + 30						
Diameter of clearance hole in the fixture	$d_f \leq$	[mm]	9	12	7	14	9	18	12
Diameter of steel brush	d_b	[mm]	12	14		16		20	
Min. diameter of steel brush	$d_{b,min}$	[mm]	10,5	12,5		14,5		18,5	
Max. installation torque moment	$T_{inst,max}$	[Nm]	2 (14 for Mz DF)						

Table B3: Installation parameters in solid and hollow masonry (with sleeve)

Anchor size			**M8**	**M8 / M10 / IG-M6**		**M12 / M16 IG-M8 IG-M10**		
349 Alfa Sleeve			**12x80**	**16x85**	**16x130**	**20x85**	**20x130**	**20x200**
Nominal drill hole diameter	d_0	[mm]	12	16		20		
Drill hole depth	h_0	[mm]	85	90	135	90	135	205
Effective anchorage depth	h_{ef}	[mm]	80	85	130	85	130	200
Minimum wall thickness	h_{min}	[mm]	115	115	175	115	175	240
Diameter of clearance hole in the fixture	$d_f \leq$	[mm]	9	7 (IG-M6) 9 (M8) 12 (M10)		9 (IG-M8) 12 (IG-M10) 14 (M12) 18 (M16)		
Diameter of steel brush	d_b	[mm]	14	18		22		
Min. diameter of steel brush	$d_{b,min}$	[mm]	12,5	16,5		20,5		
Max. installation torque moment	$T_{inst,max}$	[Nm]	2					

292 Alfa Injection mortar for masonry

Intended use
Cleaning brush and installation parameters

Annex B4

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Table B4: Maximum working time and minimum curing time
292 Alfa Injectionmortar

Temperature in the base material	Temperature of cartridge	Working time	Minimum curing time in dry base material [1)]
0 °C to + 4 °C	+ 5°C to + 40°C	45 min	7 h
+ 5 °C to + 9 °C		25 min	2 h
+ 10 °C to + 19 °C		15 min	80 min
+ 20 °C to + 29 °C		6 min	45 min
+ 30°C to + 34 °C		4 min	25 min
+ 35°C to + 39 °C		2 min	20 min
+ 40 °C		1,5 min	15 min

1) In wet base material the curing time **must** be doubled.

292 Alfa Injection mortar for masonry

Intended Use
Working and curing time

Annex B5

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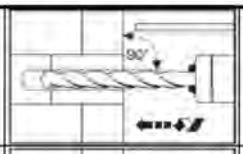
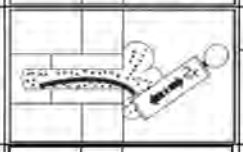
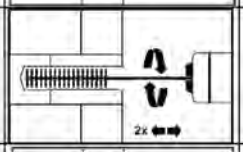
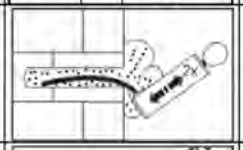
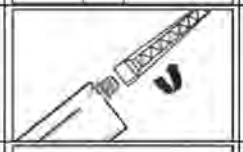
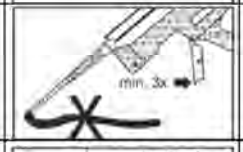
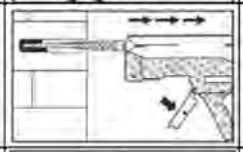
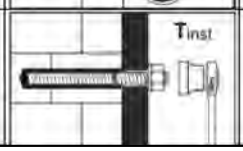
Installation Instruction - Solid masonry without sleeve

1.		Drill hole perpendicular to the surface of base material with drill method according to Annex C4-C45, with nominal drill hole diameter and bore hole depth according to the size and embedment depth required by the selected anchor. In case of aborted drill hole the hole shall be filled with mortar.
2a.		**Drill hole must be cleaned prior to installation of the anchor.** Blow out from the bottom of the bore hole two times.
2b.		Attach the appropriate sized brush (acc.to Annex B4) to a drilling machine or a battery screwdriver, brush the hole clean two times.
2c.		Finally blow out the hole again two times.
3.		Remove the cap and attach the supplied static-mixing nozzle to the cartridge and load the cartridge into the correct dispensing tool. In case of a foil tube cartridge, cut off the clip before use. For every working interruption longer than the recommended working time (Table B4) as well as for new cartridges, a new static-mixer shall be used.
4.		The position of the embedment depth shall be marked on the threaded rod. The anchor rod shall be free of dirt, grease, oil or other foreign material.
5.		Initial adhesive is not suitable for fixing the anchor. Prior to dispensing into the anchor hole, squeeze out separately a minimum of three full strokes, for foil tube cartridges six full strokes and discard non-uniformly mixed adhesive components until the mortar shows a consistent grey color.
6.		Starting from the bottom or back of the cleaned anchor hole, fill up the hole to min two-thirds with adhesive. Slowly withdraw the static mixing nozzle will avoid creating air pockets. Observe the working times given in Table B4.
7.		Push the threaded rod into the anchor hole while turning slightly to ensure positive distribution of the adhesive until the embedment depth is reached. Be sure that the annular gap is fully filled with mortar. If no excess mortar is visible at the top of the hole, the application has to be renewed.
8.		Allow the adhesive to cure to the specified curing time given in Table B4. Do not move or load the anchor until it is fully cured. After curing time remove access mortar.
9.		After full curing, the fixture can be installed with up to the max. installation torque acc. to Table B2 or B3 with calibrated torque wrench.

292 Alfa Injection mortar for masonry

Intended Use
Installation instructions (Solid masonry **without** **sleeve)**

Annex B6

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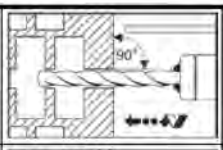
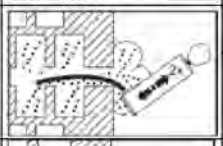
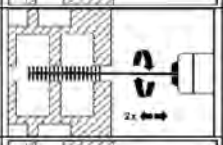
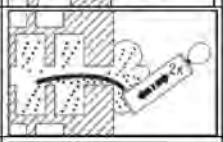
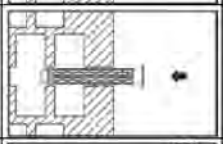
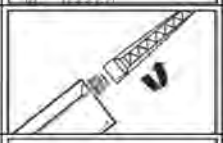
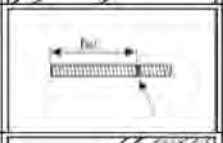
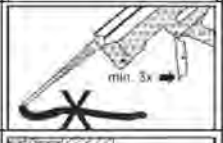
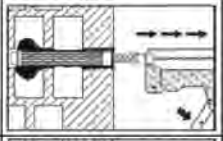
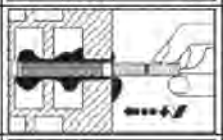
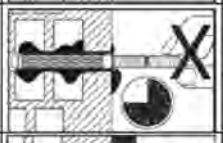
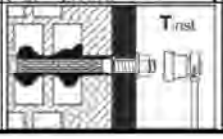
Installation Instructions - Solid or hollow masonry - with sleeve

1.		Drill hole perpendicular to the surface of base material with drill method according to Annex C4-C45, with nominal drill hole diameter and bore hole depth according to the size and embedment depth required by the selected anchor. In case of aborted drill hole the drill hole shall be filled with mortar.
2a.		**Drill hole must be cleaned prior to installation of the anchor.** Blow out from the bottom of the bore hole two times.
2b.		Attach the appropriate sized brush (acc.to Annex B4) to a drilling machine or a battery screwdriver, brush the hole clean two times.
2c.		Finally blow out the hole again two times.
3.		Insert the perforated sleeve flush with the surface of the masonry or plaster. Only use sleeves that have the right length. Never cut the sleeve.
4.		Remove the cap and attach the supplied static-mixing nozzle to the cartridge and load the cartridge into the correct dispensing tool. In case of a foil tube cartridge, cut off the clip before use. For every working interruption longer than the recommended working time (Table B4) as well as for new cartridges, a new static-mixer shall be used.
5.		The position of the embedment depth shall be marked on the threaded rod. The anchor rod shall be free of dirt, grease, oil or other foreign material.
6.		Initial adhesive is not suitable for fixing the anchor. Prior to dispensing into the anchor hole, squeeze out separately a minimum of three full strokes, for foil tube cartridges six full strokes and discard non-uniformly mixed adhesive components until the mortar shows a consistent grey colour.
7.		Starting from the bottom or back fill the sleeve with adhesive. For embedment depth equal to or larger than 130 mm an extension nozzle shall be used. For quantity of mortar attend cartridges label installation instructions. Observe the working times given in Table B4.
8.		Push the threaded rod into the anchor hole while turning slightly to ensure positive distribution of the adhesive until the embedment depth is reached.
9.		Allow the adhesive to cure to the specified curing time given in Table B4. Do not move or load the anchor until it is fully cured. After curing time remove access mortar.
10.		After full curing, the fixture can be installed with up to the max. installation torque acc. to Table B2 and B3 with calibrated torque wrench.

292 Alfa Injection mortar for masonry

Intended Use

Installation Instruction (Solid or hollow masonry - **with** sleeve)

Annex B7

Deutsches Institut für Bautechnik DIBt

Table C1: β - factor for job-site testing under tension loading

Brick-No. and abbreviation	Installation & Use category	β-Factor					
		T_a: 40°C / 24°C		T_b: 80°C / 50°C		T_c: 120°C / 72°C	
		d/d	w/d w/w	d/d	w/d w/w	d/d	w/d w/w
1 AAC6	All sizes	0,95	0,86	0,81	0,73	0,81	0,73
2 KS-NF	$d_0 \leq 14$ mm	0,93	0,80	0,87	0,74	0,65	0,56
	$d_0 \geq 16$ mm	0,93	0,93	0,87	0,87	0,65	0,65
3 KSL-3DF	$d_0 \leq 12$ mm	0,93	0,80	0,87	0,74	0,65	0,56
	$d_0 \geq 16$ mm	0,93	0,93	0,87	0,87	0,65	0,65
4 KSL-12DF	$d_0 \leq 12$ mm	0,93	0,80	0,87	0,74	0,65	0,56
	$d_0 \geq 16$ mm	0,93	0,93	0,87	0,87	0,65	0,65
5 MZ-DF	all sizes	0,86	0,86	0,86	0,86	0,73	0,73
6 Hlz-16DF							
7 Porotherm Homebric							
8 BGV-Thermo							
9 Calibric R+							
10 Urbanbric							
11 Brique creuse C40							
12 Blocchi Leggeri							
13 Doppio Uni							
14 Bloc creux B40	$d_0 \leq 12$ mm	0,93	0,80	0,87	0,74	0,65	0,56
	$d_0 \geq 16$ mm	0,93	0,93	0,87	0,87	0,65	0,65
15 Solid lightweight concrete	$d_0 \leq 12$ mm	0,93	0,80	0,87	0,74	0,65	0,56
	$d_0 \geq 16$ mm	0,93	0,93	0,87	0,87	0,65	0,65

292 Alfa Injection mortar for masonry

Performances
β - factors for job site testing under tension load

Annex C1

Deutsches Institut für Bautechnik DIBt

Table C2: Characteristic steel resistance under tension and shear load

Anchor type			**Internally threaded anchor rod IG**			**302/314 Alfa anchor rod** and **anchor rod with hexagon head**			
Anchor size			**M6**	**M8**	**M10**	**M8**	**M10**	**M12**	**M16**
Characteristic tension resistance									
Steel, property class 4.6	$N_{Rk,s}$	[kN]	-	-	-	15	23	34	63
	γ_{Ms}	[-]		-			2,0		
Steel, property class 4.8	$N_{Rk,s}$	[kN]	-	-	-	15	23	34	63
	γ_{Ms}	[-]		-			1,5		
Steel, property class 5.6	$N_{Rk,s}$	[kN]	10	18	29	18	29	42	79
	γ_{Ms}	[-]		2,0			2,0		
Steel, property class 5.8	$N_{Rk,s}$	[kN]	10	17	29	18	29	42	79
	γ_{Ms}	[-]		1,5			1,5		
Steel, property class 8.8	$N_{Rk,s}$	[kN]	16	27	46	29	46	67	126
	γ_{Ms}	[-]		1,5			1,5		
Stainless steel A4 / HCR, property class 70	$N_{Rk,s}$	[kN]	14	26	41	26	41	59	110
	γ_{Ms}	[-]		1,87			1,87		
Stainless steel A4 / HCR, property class 80	$N_{Rk,s}$	[kN]	16	29	46	29	46	67	126
	γ_{Ms}	[-]		1,6			1,6		
Characteristic shear resistance									
Steel, property class 4.6	$V_{Rk,s}$	[kN]	-	-	-	7	12	17	31
	γ_{Ms}	[-]		-			1,67		
Steel, property class 4.8	$V_{Rk,s}$	[kN]	-	-	-	7	12	17	31
	γ_{Ms}	[-]		-			1,25		
Steel, property class 5.6	$V_{Rk,s}$	[kN]	5	9	15	9	15	21	39
	γ_{Ms}	[-]		1,67			1,67		
Steel, property class 5.8	$V_{Rk,s}$	[kN]	5	9	15	9	15	21	39
	γ_{Ms}	[-]		1,25			1,25		
Steel, property class 8.8	$V_{Rk,s}$	[kN]	8	14	23	15	23	34	63
	γ_{Ms}	[-]		1,25			1,25		
Stainless steel A4 / HCR, property class 70	$V_{Rk,s}$	[kN]	7	13	20	13	20	30	55
	γ_{Ms}	[-]		1,56			1,56		
Stainless steel A4 / HCR, property class 80	$V_{Rk,s}$	[kN]	8	15	23	15	23	34	63
	γ_{Ms}	[-]		1,33			1,33		
Characteristic bending moment									
Steel, property class 4.6	$M_{Rk,s}$	[Nm]	-	-	-	15	30	52	133
	γ_{Ms}	[-]		-			1,67		
Steel, property class 4.8	$M_{Rk,s}$	[Nm]	-	-	-	15	30	52	133
	γ_{Ms}	[-]		-			1,25		
Steel, property class 5.6	$M_{Rk,s}$	[Nm]	8	19	37	19	37	66	167
	γ_{Ms}	[-]		1,67			1,67		
Steel, property class 5.8	$M_{Rk,s}$	[Nm]	8	19	37	19	37	66	167
	γ_{Ms}	[-]		1,25			1,25		
Steel, property class 8.8	$M_{Rk,s}$	[Nm]	12	30	60	30	60	105	266
	γ_{Ms}	[-]		1,25			1,25		
Stainless steel A4 / HCR, property class 70	$M_{Rk,s}$	[Nm]	11	26	52	26	52	92	233
	γ_{Ms}	[-]		1,56			1,56		
Stainless steel A4 / HCR, property class 80	$M_{Rk,s}$	[Nm]	12	30	60	30	60	105	266
	γ_{Ms}	[-]		1,33			1,33		

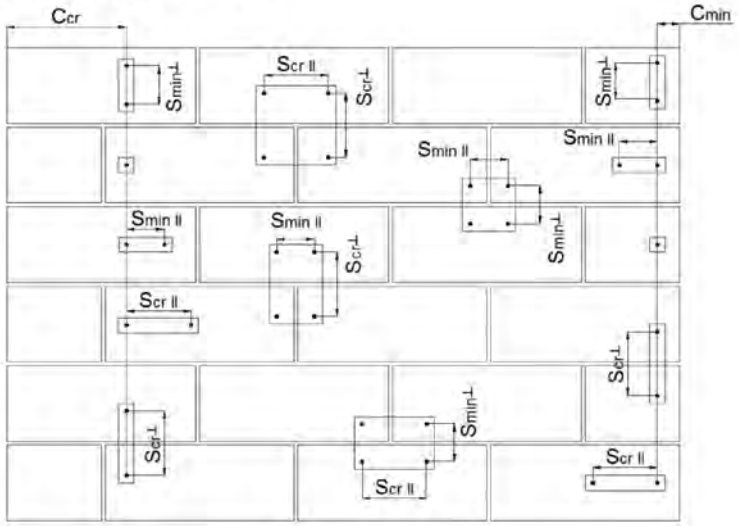
292 Alfa Injection mortar for masonry

Performances
Characteristic steel resistance under tension and shear load

Annex C2

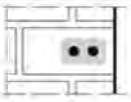
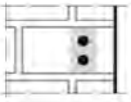
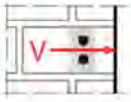
Deutsches Institut für Bautechnik DIBt

Spacing and edge distance



c_{cr} = Characteristic edge distance
c_{min} = Minimum edge distance
s_{cr} = Characteristic spacing
s_{min} = Minimum spacing

$s_{cr,II}$; ($s_{min,II}$) = Characteristic (minimum) spacing for anchors placed parallel to bed joint
$s_{cr,\perp}$; ($s_{min,\perp}$) = Characteristic (minimum) spacing for anchors placed perpendicular to bed joint

Load direction / Anchor position	Tension load	Shear load parallel to free edge	Shear load perpendicular to free edge
Anchors places parallel to bed joint $s_{cr,II}$; ($s_{min,II}$)			
Anchors places perpendicular to bed joint $s_{cr,\perp}$; ($s_{min,\perp}$)			

$\alpha_{g,N,II}$ = Group factor in case of tension load for anchors placed parallel to the bed joint
$\alpha_{g,V,II}$ = Group factor in case of shear load for anchors placed parallel to the bed joint
$\alpha_{g,N,\perp}$ = Group factor in case of tension load for anchors placed perpendicular to the bed joint
$\alpha_{g,V,\perp}$ = Group factor in case of shear load for anchors placed perpendicular to the bed joint

Group of **2** anchors: $N^g_{Rk} = \alpha_{g,N} * N_{RK}$ and $V^g_{Rk} = \alpha_{g,V} * V_{Rk}$

Group of **4** anchors: $N^g_{Rk} = \alpha_{g,N,II} * \alpha_{g,N,\perp} * N_{RK}$ and $V^g_{Rk} = \alpha_{g,V,II} * \alpha_{g,V,\perp} * V_{Rk}$

(N_{Rk}: $N_{Rk,b}$ or $N_{Rk,b,j}$ for c_{cr})
(V_{Rk}: $V_{Rk,c}$; $V_{Rk,c,j}$; $V_{Rk,b}$ or $V_{Rk,b,j}$ for c_{cr})
(with the relevant α_g)

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Performances
Edge distance and Spacing

Annex C3

Deutsches Institut für Bautechnik DIBt

Brick type: Autoclaved Aerated Concrete – AAC6

Table C3: Description of the brick

Brick type		Autoclaved Aerated Concrete AAC6
Bulk density	ρ [kg/dm^3]	0,6
Compressive strength	$f_b \geq$ [N/mm^2]	6
Code		EN 771-4
Producer (country code)		e.g. Porit (DE)
Brick dimensions	[mm]	499 x 240 x 249
Drilling method		Rotary

Table C4: Spacing and edge distance

Anchor size			All sizes
Edge distance	c_{cr}	[mm]	$1{,}5*h_{ef}$
Minimum edge distance	$c_{min,N}$	[mm]	75
	$c_{min,V,II}$ ($c_{min,v,\perp}$)[1)]	[mm]	75 ($1{,}5*h_{ef}$)
Spacing	s_{cr}	[mm]	$3*h_{ef}$
Minimum spacing	s_{min}	[mm]	100

[1)] $c_{min,V,II}$ for shear loading parallel to the free edge; $c_{min,v,\perp}$ for shear loading perpendicular free edge

Table C5: Group factor for anchor group in case of tension loading

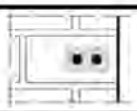
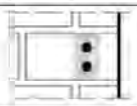
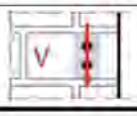
Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		125 (120 for M8)	100	$\alpha_{g,N,II}$	[-]	1,8
		1,5*hef	3*hef			2,0
⊥: anchors placed perpendicular to horizontal joint		75	100	$\alpha_{g,N,\perp}$		1,4
		1,5*hef	3*hef			2,0

Table C6: Group factor for anchor group in case of shear loading parallel to free edge

Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		75	100	$\alpha_{g,V,II}$	[-]	1,2
		1,5*hef	3*hef			2,0
⊥: anchors placed perpendicular to horizontal joint		1,5*hef	3*hef	$\alpha_{g,V,\perp}$		2,0

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Performances - Autoclaved Aerated Concrete - AAC6
Description of the brick, Spacing and edge distance, Group factors

Annex C4

Deutsches Institut für Bautechnik DIBt

Brick type: Autoclaved Aerated Concrete – AAC6

Table C7: Group factor for anchor group in case of shear loading perpendicular to free edge

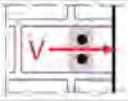
Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		1,5*hef	3,0*hef	$\alpha_{g,V,II}$	[-]	2,0
⊥: anchors placed perpendicular to horizontal joint		1,5*hef	3,0*hef	$\alpha_{g,V,\perp}$		2,0

Table C8: Characteristic values of resistance under tension and shear loads

Anchor size	Effective anchorage depth	Characteristic resistance						
		Use category						
		d/d			w/w w/d			d/d w/d w/w
		40°C/24°C	80°C/50°C	120°C/72°C	40°C/24°C	80°C/50°C	120°C/72°C	All temperature ranges
	h_{ef}	$N_{Rk,b} = N_{Rk,p}$ [1]			$N_{Rk,b} = N_{Rk,p}$ [1]			$V_{Rk,b}$ [2)3)]
	[mm]	[kN]						
Compressive strength $f_b \geq 6$ N/mm²								
M8	80	2,5 (2,0)	2,5 (1,5)	2,0 (1,2)	2,5 (1,5)	2,0 (1,5)	1,5 (1,2)	6,0
M10/IG-M6	90	4,0 (2,5)	3,0 (2,0)	2,5 (1,5)	3,5 (2,5)	3,0 (2,0)	2,5 (1,5)	10,0
M12/IG-M8	100	5,0 (3,5)	4,0 (3,0)	3,0 (2,5)	4,5 (3,0)	3,5 (2,5)	3,0 (2,5)	10,0
M16/IG-M10	100	6,5 (4,5)	5,5 (3,5)	4,0 (3,0)	5,5 (4,0)	5,0 (3,5)	4,0 (3,0)	10,0

1) Values are valid for c_{cr}, values in brackets are valid for single anchors with c_{min}
2) For calculation of $V_{Rk,c}$ see Technical Report TR 054;
3) The values are valid for steel 5.6 or higher. For steel 4.6 and 4.8 multiply $V_{Rk,b}$ by 0,8

Table C9: Displacements

Anchor size	h_{ef}	N	δ_N / N	δ_{N0}	$\delta_{N\infty}$	V	δ_{V0}	$\delta_{V\infty}$
	[mm]	[kN]	[mm/kN]	[mm]	[mm]	[kN]	[mm]	[mm]
M8	80	0,9	0,18	0,16	0,32	1,3	0,8	1,20
M10/IG-M6	90	1,4		0,26	0,51	1,8	1,2	1,80
M12/IG-M8	100	1,8	0,08	0,14	0,29	2,1	1,4	2,10
M16/IG-M10	100	2,3		0,19	0,37	2,3	1,5	2,25

292 Alfa Injection mortar for masonry

Performances - Autoclaved Aerated Concrete – AAC6
Group factor, Characteristic values of resistance, Displacements

Annex C5

Deutsches Institut für Bautechnik DIBt

Brick type: Calcium silicate solid brick KS-NF

Table C10: Description of the brick

Brick type		Calcium silicate solid brick KS-NF
Bulk density	ρ [kg/dm³]	2,0
Compressive strength	$f_b \geq$ [N/mm²]	10, 20 or 27
Code		EN 771-2
Producer (country code)		e.g. Wemding (DE)
Brick dimensions	[mm]	240 x 115 x 71
Drilling method		Hammer

Table C11: Spacing and edge distance

Anchor size			All sizes
Edge distance	c_{cr}	[mm]	$1,5*h_{ef}$
Minimum edge distance	c_{min}	[mm]	60
Spacing	s_{cr}	[mm]	$3*h_{ef}$
Minimum spacing	s_{min}	[mm]	120

Table C12: Group factor for anchor group in case of tension loading

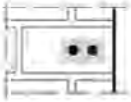
Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		60	120	$\alpha_{g,N,II}$	[-]	1,0
		140	120			1,5
		1,5*hef	$3*h_{ef}$			2,0
⊥: anchors placed perpendicular to horizontal joint		60	120	$\alpha_{g,N,\perp}$		0,5
		1,5*hef	120			1,0
		1,5*hef	$3*h_{ef}$			2,0

Table C13: Group factor for anchor group in case of shear loading parallel to free edge

Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		60	120	$\alpha_{g,V,II}$	[-]	1,0
		115	120			1,7
		1,5*hef	$3*h_{ef}$			2,0
⊥: anchors placed perpendicular to horizontal joint		60	120	$\alpha_{g,V,\perp}$		1,0
		1,5*hef	120			1,0
		1,5*hef	$3*h_{ef}$			2,0

Table C14: Group factor for anchor group in case of shear loading perpendicular to free edge

Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		60	120	$\alpha_{g,V,II}$	[-]	1,0
		1,5*hef	$3*h_{ef}$			2,0
⊥: anchors placed perpendicular to horizontal joint		60	120	$\alpha_{g,V,\perp}$		1,0
		1,5*hef	$3*h_{ef}$			2,0

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Performances - Calcium solid brick KS-NF
Description, Spacing and edge distance, Group factor

Annex C6

Deutsches Institut für Bautechnik DIBt

Brick type: Calcium silicate solid brick KS-NF

Table C15: Characteristic values of resistance under tension and shear loads

Anchor size	349 Alfa Sleeve	Effective anchorage depth	Characteristic resistance						
			Use category						
			d/d			w/d w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	40°C/24°C	80°C/50°C	120°C/72°C	All temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ [1]			$N_{Rk,b} = N_{Rk,p}$ [1]			$V_{Rk,b}$ [2)3)]
		[mm]	[kN]						
Compressive strength $f_b \geq 10$ N/mm²									
M8	-	80	4,5 (2,0)	4,5 (2,0)	3,0 (1,5)	3,5 (1,5)	3,5 (1,5)	2,5 (1,2)	2,5 (1,5)
M10 / IG-M6	-	90							3,0 (2,0)
M12 / IG-M8	-	100							2,5 (1,5)
M16 / IG-M10	-	100	3,5 (1,5)	3,5 (1,5)	2,5 (1,2)	3,0 (1,5)	3,5 (1,5)	2,0 (0,9)	2,5 (1,5)
M8	12x80	80	3,5 (1,5)	3,5 (1,5)	2,5 (1,2)	3,5 (1,5)	3,0 (1,5)	2,5 (1,2)	2,5 (1,5)
M8 / M10/ IG-M6	16x85	85	3,5 (1,5)	3,0 (1,5)	2,0 (0,9)	3,5 (1,5)	3,0 (1,5)	2,5 (1,2)	2,5 (1,5)
	16x130	130	3,5 (1,5)	3,0 (1,5)	2,0 (0,9)	3,5 (1,5)	3,0 (1,5)	2,5 (1,2)	2,5 (1,5)
M12 / M16 / IG-M8 / IG-M10	20x85	85	3,0 (1,5)	2,5 (1,2)	2,0 (0,9)	3,0 (1,5)	2,5 (1,2)	2,0 (0,9)	2,5 (1,5)
	20x130	130							
	20x200	200							
Compressive strength $f_b \geq 20$ N/mm²									
M8	-	80	6,0 (3,0)	5,5 (2,5)	4,0 (2,0)	5,0 (2,5)	5,0 (2,5)	3,5 (1,5)	4,0 (2,5)
M10 / IG-M6	-	90							4,5 (2,5)
M12/ IG-M8	-	100							4,0 (2,5)
M16/ IG-M10	-	100	5,0 (2,5)	5,0 (2,5)	3,5 (1,5)	5,0 (2,5)	5,0 (2,5)	3,5 (1,5)	4,0 (2,5)
M8	12x80	80	5,5 (2,5)	5,0 (2,5)	3,5 (1,5)	4,5 (2,0)	4,5 (2,0)	3,0 (1,5)	4,0 (2,5)
M8 / M10/ IG-M6	16x85	85	5,0 (2,5)	4,5 (2,0)	3,5 (1,5)	5,0 (2,5)	4,5 (2,0)	3,5 (1,5)	4,0 (2,5)
	16x130	130	5,0 (2,5)	4,5 (2,0)	3,5 (1,5)	5,0 (2,5)	4,5 (2,0)	3,5 (1,5)	4,0 (2,5)
M12 / M16 / IG-M8 / IG-M10	20x85	85	4,0 (2,0)	4,0 (2,0)	3,0 (1,5)	4,0 (2,0)	4,0 (2,0)	3,0 (1,5)	4,0 (2,5)
	20x130	130							
	20x200	200							

1) Values are valid for c_{cr}, values in brackets are valid for single anchors with c_{min}
2) For c_{cr} calculation of $V_{Rk,c}$ see Technical Report TR 054; values in brackets $V_{Rk,c} = V_{Rk,b}$ for single anchors with c_{min}
3) The values are valid for steel 5.6 or higher. For steel 4.6 and 4.8 multiply $V_{Rk,b}$ by 0,8.

292 Alfa Injection mortar for masonry

Performances - Calcium solid brick KS-NF
Characteristic values of resistance

Annex C7

Deutsches Institut für Bautechnik DIBt

Brick type: Calcium silicate solid brick KS-NF

Table C16: Characteristic values of resistance under tension and shear loads (continue)

Anchor size	349 Alfa Sleeve	Effective anchorage depth	Characteristic resistance						
			Use category						
			d/d			w/d w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	40°C/24°C	80°C/50°C	120°C/72°C	All temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ [1]			$N_{Rk,b} = N_{Rk,p}$ [1]			$V_{Rk,b}$ [2)3)]
		[mm]	[kN]						
Compressive strength $f_b \geq 27$ N/mm²									
M8	-	80	7,0 (3,5)	6,5 (3,0)	5,0 (2,5)	6,0 (3,0)	5,5 (2,5)	4,0 (2,0)	4,5 (2,5)
M10 / IG-M6	-	90							5,5 (3,0)
M12 / IG-M8	-	100							4,5 (2,5)
M16 / IG-M10	-	100	6,0 (3,0)	5,5 (2,5)	4,5 (2,0)	6,0 (3,0)	5,5 (2,5)	4,0 (2,0)	4,5 (2,5)
M8	12x80	80	6,5 (3,0)	6,0 (3,0)	4,5 (2,0)	5,5 (2,5)	5,0 (2,5)	3,5 (1,5)	4,5 (2,5)
M8 / M10/ IG-M6	16x85	85	5,5 (2,5)	5,0 (2,5)	4,0 (2,0)	5,5 (2,5)	5,0 (2,5)	4,0 (2,0)	4,5 (2,5)
	16x130	130	5,5 (2,5)	5,0 (2,5)	4,0 (2,0)	5,5 (2,5)	5,0 (2,5)	4,0 (2,0)	4,5 (2,5)
M12 / M16 / IG-M8 / IG-M10	20x85	85	5,0 (2,5)	4,5 (2,0)	3,5 (1,5)	5,0 (2,5)	4,5 (2,0)	3,5 (1,5)	4,5 (2,5)
	20x130	130							
	20x200	200							

1) Values are valid for c_{cr}, values in brackets are valid for single anchors with c_{min}
2) For c_{cr} calculation of $V_{Rk,c}$ see Technical Report TR 054; values in brackets $V_{Rk,c} = V_{Rk,b}$ for single anchors with c_{min}
3) The values are valid for steel 5.6 or higher. For steel 4.6 and 4.8 multiply $V_{Rk,b}$ by 0,8

Table C17: Displacements

Anchor size	349 Alfa Sleeve	h_{ef}	N	δ_N / N	δ_{N0}	$\delta_{N\infty}$	V	δ_{V0}	$\delta_{V\infty}$
		[mm]	[kN]	[mm/kN]	[mm]	[mm]	[kN]	[mm]	[mm]
M8	-	80	2,0	0,15	0,30	0,60	1,7	0,90	1,35
M10 / IG-M6	-	90					2,0	1,10	1,65
M12 / IG-M8	-	100					1,7	0,90	1,35
M16 / IG-M10	-	100	1,7		0,26	0,51			
M8	12x80	80							
M8 / M10/ IG-M6	16x85	85	1,4		0,21	0,43			
	16x130	130							
M12 / M16 IG-M8 / IG-M10	20x85	85	1,3		0,19	0,39			
	20x130	130							
	20x200	200							

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Performances - Calcium solid brick KS-NF
Characteristic values of resistance (continue), Displacements

Annex C8

Deutsches Institut für Bautechnik DIBt

Brick type: Calcium silicate hollow brick KSL-3DF

Table C18: Description of the brick

Brick type		Calcium silicate hollow brick KSL-3DF
Bulk density	ρ [kg/dm^3]	1,4
Compressive strength	$f_b \geq$ [N/mm^2]	8, 12 or 14
Code		EN 771-2
Producer (country code)		e.g. Wemding (DE)
Brick dimensions	[mm]	240 x 175 x 113
Drilling method		Rotary

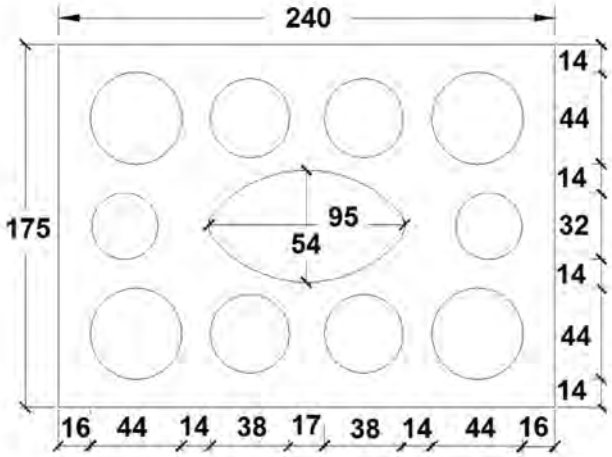
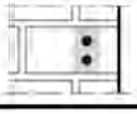


Table C19: Spacing and edge distance

Anchor size			All sizes
Edge distance	c_{cr}	[mm]	100 (120)[1)]
Minimum edge distance	c_{min}	[mm]	60
Spacing	$s_{cr,II}$	[mm]	240
	$s_{cr,\perp}$	[mm]	120
Minimum spacing	s_{min}	[mm]	120

1) Value in brackets for 349 Alfa Siebhülse 20x85; 349 Alfa Siebhülse 20x130 and 349 Alfa Siebhülse 20x200

Table C20: Group factor for anchor group in case of tension loading

Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		60	120	$\alpha_{g,N,II}$	[-]	1,5
		c_{cr}	240			2,0
		160	120			2,0
⊥: anchors placed perpendicular to horizontal joint		60	120	$\alpha_{g,N,\perp}$		1,0
		c_{cr}	120			2,0

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Performances - Calcium silicate hollow brick KSL-3DF
Description of the brick, Spacing and edge distance, Group factor

Annex C9

Deutsches Institut für Bautechnik DIBt

Brick type: Calcium silicate hollow brick KSL-3DF

Table C21: Group factor for anchor group in case of shear loading parallel to free edge

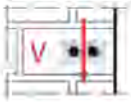
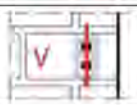
Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		60	120	$\alpha_{g,V,II}$	[-]	1,0
		160	120			1,6
		c_{cr}	240			2,0
⊥: anchors placed perpendicular to horizontal joint		60	120	$\alpha_{g,V,\perp}$		1,0
		c_{cr}	120			2,0

Table C22: Group factor for anchor group in case of shear loading perpendicular to free edge

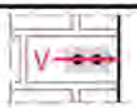
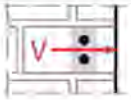
Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		60	120	$\alpha_{g,V,II}$	[-]	1,0
		c_{cr}	240			2,0
⊥: anchors placed perpendicular to horizontal joint		60	120	$\alpha_{g,V,\perp}$		1,0
		c_{cr}	120			2,0

Table C23: Characteristic values of resistance under tension and shear loads

Anchor size	349 Alfa Sleeve	Effective anchorage depth	Characteristic resistance						
			Use category						
			d/d			w/d; w/w			d/d; w/d; w/w
			40°C/24°C	80°C/50°C	120°C/72°C	40°C/24°C	80°C/50°C	120°C/72°C	All temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ [1]			$N_{Rk,b} = N_{Rk,p}$ [1]			$V_{Rk,b}$ [4]
		[mm]	[kN]						
			Compressive strength $f_b \geq 8$ N/mm²						
M8	12x80	80	1,5	1,5	1,2	1,5	1,2	0,9	2,5 [2] (0,9) [3]
M8 / M10 / IG-M6	16x85	85					1,5	1,2	4,0 [2] (1,5) [3]
	16x130	130					1,5	1,2	4,0 [2] (1,5) [3]
M12 / M16 / IG-M8 / IG-M10	20x85	85	4,5	4,0	3,0	4,5	4,0	3,0	4,0 [2] (1,5) [3]
	20x130	130							
	20x200	200							
			Compressive strength $f_b \geq 12$ N/mm²						
M8	12x80	80	2,0	2,0	1,5	2,0	1,5	1,2	3,0 [2] (1,2) [3]
M8 / M10 / IG-M6	16x85	85	2,0	2,0	1,5	2,0	2,0	1,5	4,5 [2] (1,5) [3]
	16x130	130	2,5	2,5	1,5	2,5	2,5	1,5	4,5 [2] (1,5) [3]
M12 / M16 / IG-M8 / IG-M10	20x85	85	6,0	5,5	4,0	6,0	5,5	4,0	4,5 [2] (1,5) [3]
	20x130	130							
	20x200	200							

1) Values are valid for c_{cr} and c_{min}
2) $V_{Rk,c,II} = V_{Rk,b}$ valid for shear load parallel to free edge
3) $V_{Rk,c,\perp} = V_{Rk,b}$ (values in brackets) valid for shear load in direction to free edge
4) The values are valid for steel 5.6 or higher. For steel 4.6 and 4.8 multiply $V_{Rk,b}$ by 0,8

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Performances - Calcium silicate hollow brick KSL-3DF
Group factor, Characteristic values of resistance

Annex C10

Brick type: Calcium silicate hollow brick KSL-3DF

Table C24: Characteristic values of resistance under tension and shear loads (continue)

Anchor size	349 Alfa Sleeve	Effective anchorage depth	Characteristic resistance						
			Use category						
			d/d			w/d; w/w			d/d; w/d; w/w
			40°C/24°C	80°C/50°C	120°C/72°C	40°C/24°C	80°C/50°C	120°C/72°C	All temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ [1]			$N_{Rk,b} = N_{Rk,p}$ [1]			$V_{Rk,b}$ [4]
		[mm]	[kN]						
			Compressive strength $f_b \geq 14$ N/mm²						
M8	12x80	80	2,5	2,5	1,5	2,0	2,0	1,5	3,5 [2] (1,5) [3]
M8 / M10 / IG-M6	16x85	85	2,5	2,5	1,5	2,5	2,5	1,5	6,0 [2] (2,0) [3]
	16x130	130	2,5	2,5	2,0	2,5	2,5	2,0	6,0 [2] (2,0) [3]
M12 / M16 / IG-M8 / IG-M10	20x85	85	6,5	6,0	4,5	6,5	6,0	4,5	6,0 [2] (2,0) [3]
	20x130	130							
	20x200	200							

1) Values are valid for c_{cr} and c_{min}
2) $V_{Rk,c,II} = V_{Rk,b}$ valid for shear load parallel to free edge
3) $V_{Rk,c,\perp} = V_{Rk,b}$ (values in brackets) valid for shear load in direction to free edge
4) The values are valid for steel 5.6 or higher. For steel 4.6 and 4.8 multiply $V_{Rk,b}$ by 0,8

Table C25: Displacements

Anchor size	349 Alfa Sleeve	h_{ef}	N	δ_N / N	δ_{N0}	$\delta_{N\infty}$	V	δ_{V0}	$\delta_{V\infty}$
		[mm]	[kN]	[mm/kN]	[mm]	[mm]	[kN]	[mm]	[mm]
M8	12x80	80	0,71	0,90	0,64	1,29	1,0	1,0	1,50
M8 / M10 / IG-M6	16x85	85					1,7	1,9	2,85
	16x130	130							
M12 / M16 / IG-M8 / IG-M10	20x85	85	1,86		1,67	3,34			
	20x130	130							
	20x200	200							

292 Alfa Injection mortar for masonry

Performance - Calcium silicate hollow brick KSL-3DF
Characteristic values of resistance, Displacements

Annex C11

Deutsches Institut für Bautechnik DIBt

Brick type: Calcium silicate hollow brick KSL-12DF

Table C26: Description of the brick

Brick type		Calcium silicate hollow brick KSL-12DF
Bulk density	ρ [kg/dm^3]	1,4
Compressive strength	$f_b \geq$ [N/mm^2]	10, 12 or 16
Code		EN 771-2
Producer (country code)		e.g. Wemding (DE)
Brick dimensions	[mm]	498 x 175 x 238
Drilling method		Rotary

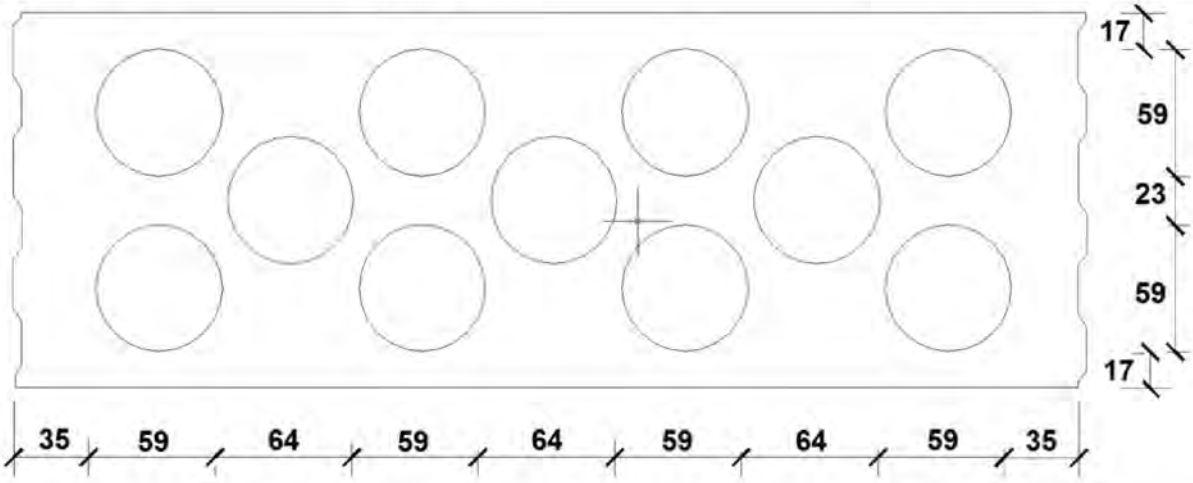


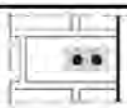
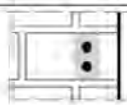
Table C27: Spacing and edge distances

Anchor size			**All sizes**
Edge distance	c_{cr}	[mm]	100 (120)[1]
Minimum edge distance	c_{min}[2]	[mm]	100 (120)[1]
Spacing	$s_{cr,II}$	[mm]	498
	$s_{cr,\perp}$	[mm]	238
Minimum spacing	s_{min}	[mm]	120

[1] Value in brackets for 349 Alfa Siebhülse 20x85 and 349 Alfa Siebhülse 20x130

[2] For $V_{Rk,c}$: c_{min} according to Technical Report TR 054

Table C28: Group factor for anchor group in case of tension loading

Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		100	120	$\alpha_{g,N,II}$	[-]	1,0
		c_{cr}	498			2,0
⊥: anchors placed perpendicular to horizontal joint		100	120	$\alpha_{g,N,\perp}$		1,0
		c_{cr}	238			2,0

292 Alfa Injection mortar for masonry

Performance - Calcium silicate hollow brick KSL-12DF
Description of the brick, Spacing and edge distances, Group factor

Annex C12

Deutsches Institut für Bautechnik DIBt

Brick type: Calcium silicate hollow brick KSL-12DF

Table C29: Group factor for anchor group in case of shear loading parallel to free edge

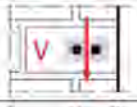
Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		c_{cr}	498	$\alpha_{g,V,II}$	[-]	2,0
⊥: anchors placed perpendicular to horizontal joint		c_{cr}	238	$\alpha_{g,V,\perp}$		2,0

Table C30: Group factor for anchor group in case of shear load perpendicular to free edge

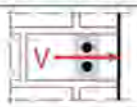
Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		c_{cr}	498	$\alpha_{g,V,II}$	[-]	2,0
⊥: anchors placed perpendicular to horizontal joint		c_{cr}	238	$\alpha_{g,V,\perp}$		2,0

Table C31: Characteristic values of resistance under tension and shear loads

Anchor size	349 Alfa Sleeve	Effective anchorage depth	Characteristic resistance						
			Use category						
			d/d			w/d; w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	40°C/24°C	80°C/50°C	120°C/72°C	All temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ [1]			$N_{Rk,b} = N_{Rk,p}$ [1]			$V_{Rk,b}$ [2)3)]
		[mm]	[kN]						
			Compressive strength $f_b \geq 10$ N/mm²						
M8	12x80	80	0,6	0,6	0,4	0,5	0,5	0,4	2,5
M8 / M10 / IG-M6	16x85	85	0,6	0,6	0,4	0,6	0,6	0,4	5,5
	16x130	130	2,5	2,5	2,0	2,5	2,5	2,0	5,5
M12 / M16 / IG-M8 / IG-M10	20x85	85	1,5	1,5	0,9	1,5	1,5	0,9	5,5
	20x130	130	2,5	2,5	2,0	2,5	2,5	2,0	5,5
			Compressive strength $f_b \geq 12$ N/mm²						
M8	12x80	80	0,75	0,6	0,5	0,6	0,6	0,4	3,0
M8 / M10 / IG-M6	16x85	85	0,75	0,6	0,5	0,75	0,6	0,5	6,5
	16x130	130	3,0	3,0	2,0	3,0	3,0	2,0	6,5
M12 / M16 / IG-M8 / IG-M10	20x85	85	1,5	1,5	1,2	1,5	1,5	1,2	6,5
	20x130	130	3,0	3,0	2,0	3,0	3,0	2,0	6,5

1) Values are valid for c_{cr} and c_{min}
2) Calculation of $V_{Rk,c}$ see Technical Report TR 054, except for shear load parallel to free edge with c ≥ 120 mm: $V_{Rk,c,II} = V_{Rk,b}$
3) The values are valid for steel 5.6 or higher. For steel 4.6 and 4.8 multiply $V_{Rk,b}$ by 0,8

292 Alfa Injection mortar for masonry

Performance - Calcium silicate hollow brick KSL-12DF
Group factor, Characteristic values of resistance

Annex C13

Brick type: Calcium silicate hollow brick KSL-12DF

Table C32: Characteristic values of resistance under tension and shear loads (continue)

Anchor size	349 Alfa Sleeve	Effective anchorage depth	Characteristic resistance						
			Use category						
			d/d			w/d; w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	40°C/24°C	80°C/50°C	120°C/72°C	All temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ [1]			$N_{Rk,b} = N_{Rk,p}$ [1]			$V_{Rk,b}$ [2)3)]
		[mm]	[kN]						
			Compressive strength $f_b \geq 16$ N/mm²						
M8	12x80	80	0,9	0,9	0,6	0,75	0,75	0,5	3,5
M8 / M10 / IG-M6	16x85	85	0,9	0,9	0,6	0,9	0,9	0,6	8,0
	16x130	130	4,0	3,5	2,5	4,0	3,5	2,5	8,0
M12 / M16 / IG-M8 / IG-M10	20x85	85	2,0	2,0	1,5	2,0	2,0	1,5	8,0
	20x130	130	4,0	3,5	2,5	4,0	3,5	2,5	8,0

1) Values are valid for c_{cr} and c_{min}
2) Calculation of $V_{Rk,c}$ see Technical Report TR 054, except for shear load parallel to free edge with $c \geq 120$ mm: $V_{Rk,c,II} = V_{Rk,b}$
3) The values are valid for steel 5.6 or higher. For steel 4.6 and 4.8 multiply $V_{Rk,b}$ by 0,8

Table C33: Displacements

Anchor size	349 Alfa Sleeve	h_{ef}	N	δ_N / N	δ_{N0}	$\delta_{N\infty}$	V	δ_{V0}	$\delta_{V\infty}$
		[mm]	[kN]	[mm/kN]	[mm]	[mm]	[kN]	[mm]	[mm]
M8	12x80	80	0,26	0,90	0,23	0,46	1,0	1,3	1,95
M8 / M10 / IG-M6	16x85	85					2,3	2,5	3,75
	16x130	130	1,14		1,03	2,06			
M12 / M16 / IG-M8 / IG-M10	20x85	85	0,57		0,51	1,03			
	20x130	130	1,14		1,03	2,06			

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Performance - Calcium silicate hollow brick KSL-12DF
Characteristic values of resistance (continue), Displacements

Annex C14

Deutsches Institut für Bautechnik DIBt

Brick type: Clay solid brick Mz-DF

Table C34: Description of the brick

Brick type		Clay solid brick Mz-DF
Bulk density	ρ [kg/dm^3]	1,6
Compressive strength	$f_b \geq$ [N/mm^2]	10, 20 or 28
Code		EN 771-1
Producer (country code)		e.g. Unipor (DE)
Brick dimensions	[mm]	240 x 115 x 55
Drilling method		Hammer

Table C35: Spacing and edge distances

Anchor size			Alle Größen
Edge distance	c_{cr}	[mm]	$1,5*h_{ef}$
Minimum edge distance	c_{min}	[mm]	60
Spacing	s_{cr}	[mm]	$3*h_{ef}$
Minimum spacing	s_{min}	[mm]	120

Table C36: Group factor for anchor group in case of tension loading

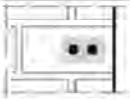
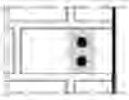
Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		60	120	$\alpha_{g,N,II}$	[-]	0,7
		1,5*hef	$3*h_{ef}$			2,0
⊥: anchors placed perpendicular to horizontal joint		60	120	$\alpha_{g,N,\perp}$		0,5
		1,5*hef	120			1,0
		1,5*hef	$3*h_{ef}$			2,0

Table C37: Group factor for anchor group in case of shear loading parallel to free edge

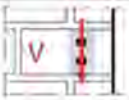
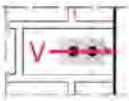
Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		60	120	$\alpha_{g,V,II}$	[-]	0,5
		90	120			1,1
		1,5*hef	$3*h_{ef}$			2,0
⊥: anchors placed perpendicular to horizontal joint		60	120	$\alpha_{g,V,\perp}$		0,5
		1,5*hef	120			1,0
		1,5*hef	$3*h_{ef}$			2,0

Table C38: Group factor for anchor group in case of shear load perpendicular to free edge

Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		60	120	$\alpha_{g,V,II}$	[-]	0,5
		1,5*hef	120			1,0
		1,5*hef	$3*h_{ef}$			2,0
⊥: anchors placed perpendicular to horizontal joint		60	120	$\alpha_{g,V,\perp}$		0,5
		1,5*hef	120			1,0
		1,5*hef	$3*h_{ef}$			2,0

292 Alfa Injection mortar for masonry

Performance - Clay solid brick Mz-DF
Description of the brick , Spacing and edge distances, Group factor

Annex C15

Brick type: Clay solid brick Mz-DF

Table C39: Characteristic values of resistance under tension and shear loads

Anchor size	349 Alfa Sleeve	Effective Anchorage depth	Characteristic resistance			
			Use category			
			d/d w/d w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	All temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ [1]			$V_{Rk,b}$ [2)3)]
		[mm]	[kN]			
Compressive strength $f_b \geq 10$ N/mm²						
M8	-	80	3,5 (1,5)	3,5 (1,5)	2,5 (1,2)	3,5 (1,2)
M10 / IG-M6	-	90	3,5 (1,5)	3,5 (1,5)	3,0 (1,5)	3,5 (1,2)
M12 / IG-M8	-	100	4,0 (2,0)	4,0 (2,0)	3,5 (1,5)	3,5 (1,2)
M16 / IG-M10	-	100	4,0 (2,0)	4,0 (2,0)	3,5 (1,5)	5,5 (1,5)
M8	12x80	80	3,5 (1,5)	3,5 (1,5)	3,0 (1,2)	3,5 (1,2)
M8 / M10 / IG-M6	16x85	85	3,5 (1,5)	3,5 (1,5)	3,0 (1,5)	3,5 (1,2)
	16x130	130				
M12 / M16 / IG-M8 / IG-M10	20x85	85				
	20x130	130				
	20x200	200				
Compressive strength $f_b \geq 20$ N/mm²						
M8	-	80	4,5 (2,5)	4,5 (2,5)	4,0 (2,0)	5,0 (1,5)
M10 / IG-M6	-	90	5,5 (2,5)	5,5 (2,5)	4,5 (2,0)	5,0 (1,5)
M12 / IG-M8	-	100	6,0 (3,0)	6,0 (3,0)	5,0 (2,5)	5,0 (1,5)
M16 / IG-M10	-	100	6,0 (3,0)	6,0 (3,0)	5,0 (2,5)	8,0 (2,5)
M8	12x80	80	4,5 (2,5)	4,5 (2,5)	4,0 (2,0)	5,0 (1,5)
M8 / M10 / IG-M6	16x85	85	5,0 (2,5)	5,0 (2,5)	4,0 (2,0)	5,0 (1,5)
	16x130	130				
M12 / M16 / IG-M8 / IG-M10	20x85	85				
	20x130	130				
	20x200	200				
Compressive strength $f_b \geq 28$ N/mm²						
M8	-	80	5,5 (2,5)	5,5 (2,5)	4,5 (2,5)	5,5 (2,0)
M10 / IG-M6	-	90	6,0 (3,0)	6,0 (3,0)	5,0 (2,5)	5,5 (2,0)
M12 / IG-M8	-	100	7,0 (3,5)	7,0 (3,5)	6,0 (3,0)	5,5 (2,0)
M16 / IG-M10	-	100	7,0 (3,5)	7,0 (3,5)	6,0 (3,0)	9,0 (3,0)
M8	12x80	80	5,5 (2,5)	5,5 (2,5)	4,5 (2,5)	5,5 (2,0)
M8 / M10 / IG-M6	16x85	85	6,0 (3,0)	6,0 (3,0)	5,0 (2,5)	5,5 (2,0)
	16x130	130				
M12 / M16 / IG-M8 / IG-M10	20x85	85				
	20x130	130				
	20x200	200				

1) Values are valid for c_{cr}, values in brackets are valid for single anchors with c_{min}

2) For c_{cr} calculation of $V_{Rk,c}$ see Technical Report TR 054; for c_{min} values in brackets $V_{Rk,c} = V_{Rk,b}$

3) The values are valid for steel 5.6 or higher. For steel 4.6 and 4.8 multiply $V_{Rk,b}$ by 0,8.

292 Alfa Injection mortar for masonry

Performance - Clay solid brick Mz-DF
Characteristic values of resistance

Annex C16

Deutsches Institut für Bautechnik DIBt

Brick type: Clay solid brick Mz-DF

Table C40: Displacements

Anchor size	349 Alfa Sleeve	h_{ef}	N	δ_N / N	δ_{N0}	$\delta_{N\infty}$	V	δ_{V0}	$\delta_{V\infty}$
		[mm]	[kN]	[mm/kN]	[mm]	[mm]	[kN]	[mm]	[mm]
M8	-	80	1,3	0,15	0,19	0,39	1,9	1,00	1,50
M10 / IG-M6	-	90	1,6		0,24	0,47			
M12 / IG-M8	-	100	1,7		0,26	0,51			
M16 / IG-M10	-	100					2,9		
M8	12x80	80	1,3		0,19	0,39	1,9		
M8 / M10 / IG-M6	16x85	85							
	16x130	130							
M12 / M16 / IG-M8 / IG-M10	20x85	85							
	20x130	130							
	20x200	200							

Deutsches Institut für Bautechnik DIBt

Brick type: Clay hollow brick HLz-16-DF

Table C41: Description of the brick

Brick type		Clay hollow brick HLz-16-DF
Bulk density	ρ [kg/dm^3]	0,8
Compressive strength	$f_b \geq$ [N/mm^2]	6, 8, 12 or 14
Code		EN 771-1
Producer (country code)		e.g. Unipor (DE)
Brick dimensions	[mm]	497 x 240 x 238
Drilling method		Rotary

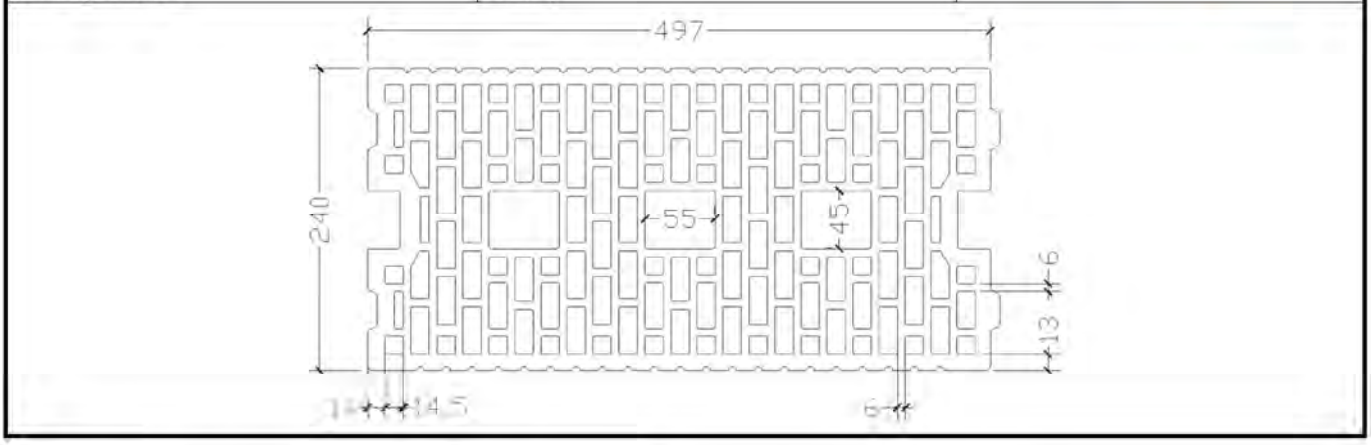
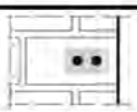
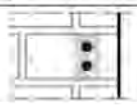


Table C42: Spacing and edge distances

Anchor size			**All sizes**
Edge distance	c_{cr}	[mm]	100 (120)[1]
Minimum edge distance	c_{min}[2]	[mm]	100 (120)[1]
Spacing	$s_{cr,II}$	[mm]	497
	$s_{cr,\perp}$	[mm]	238
Minimum spacing	s_{min}	[mm]	100

[1] Value in bracket for 349 Alfa Siebhülse 20x85; 349 Alfa Siebhülse 20x130 and 349 Alfa Siebhülse 20x200
[2] For $V_{Rk,c}$: c_{min} according to Technical Report TR 054

Table C43: Group factor for anchor group in case of tension loading

Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		c_{cr}	100	$\alpha_{g,N,II}$	[-]	1,3
		c_{cr}	497			2,0
⊥: anchors placed perpendicular to horizontal joint		c_{cr}	100	$\alpha_{g,N,\perp}$		1,1
		c_{cr}	238			2,0

292 Alfa Injection mortar for masonry

Performance - Clay hollow brick HLz-16DF
Description of the brick, Spacing and edge distances, Group factor

Annex C18

Deutsches Institut für Bautechnik DIBt

Brick type: Clay hollow brick HLz-16-DF

Table C44: Group factor for anchor group in case of shear loading parallel to free edge

Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		c_{cr}	497	$\alpha_{g,V,II}$	[-]	2,0
⊥: anchors placed perpendicular to horizontal joint		c_{cr}	238	$\alpha_{g,V,\perp}$		2,0

Table C45: Group factor for anchor group in case of shear load perpendicular to free edge

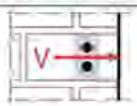
Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		c_{cr}	497	$\alpha_{g,V,II}$	[-]	2,0
⊥: anchors placed perpendicular to horizontal joint		c_{cr}	238	$\alpha_{g,V,\perp}$		2,0

Table C46: Characteristic values of resistance under tension and shear loads

Anchor size	349 Alfa Sleeve	Effective Anchorage depth	Characteristic resistance			
			Use category			
			d/d w/d w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	All temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ [1]			$V_{Rk,b}$ [2)3)]
		[mm]	[kN]			[kN]
Compressive strength $f_b \geq 6$ N/mm²						
M8	12x80	80	2,5	2,5	2,0	2,5
M8 / M10/ IG-M6	16x85	85	2,5	2,5	2,0	4,5
	16x130	130	3,5	3,5	3,0	4,5
M12 / M16 / IG-M8 / IG-M10	20x85	85	2,5	2,5	2,0	5,0
	20x130	130	3,5	3,5	3,0	6,0
	20x200	200	3,5	3,5	3,0	6,0
Compressive strength $f_b \geq 8$ N/mm²						
M8	12x80	80	3,0	3,0	2,5	3,0
M8 / M10/ IG-M6	16x85	85	3,0	3,0	2,5	5,5
	16x130	130	4,5	4,5	3,5	5,5
M12 / M16 / IG-M8 / IG-M10	20x85	85	3,0	3,0	2,5	6,0
	20x130	130	4,5	4,5	3,5	7,0
	20x200	200	4,5	4,5	3,5	7,0

1) Values are valid for c_{cr} and c_{min}

2) Calculation of $V_{Rk,c}$ see Technical Report TR 054, except for shear load parallel to free edge with c ≥ 125 mm: $V_{Rk,c,II} = V_{Rk,b}$

3) The values are valid for steel 5.6 or higher. For steel 4.6 and 4.8 multiply $V_{Rk,b}$ by 0,8

292 Alfa Injection mortar for masonry

Performance - Clay hollow brick HLz-16DF
Group factor, Characteristic values of resistance

Annex C19

Brick type: Clay hollow brick HLz-16DF

Table C47: Characteristic values of resistance under tension and shear loads (continue)

Anchor size	349 Alfa Sleeve	Effective Anchorage depth	Characteristic resistance			
			Use category			
			d/d w/d w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	All temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ [1]			$V_{Rk,b}$ [2)3)]
		[mm]	[kN]			[kN]
Compressive strength $f_b \geq 12$ N/mm²						
M8	12x80	80	3,5	3,5	3,0	4,0
M8 / M10/ IG-M6	16x85	85	3,5	3,5	3,0	6,5
	16x130	130	5,0	5,0	4,5	6,5
M12 / M16 / IG-M8 / IG-M10	20x85	85	3,5	3,5	3,0	7,0
	20x130	130	5,0	5,0	4,5	9,0
	20x200	200	5,0	5,0	4,5	9,0
Compressive strength $f_b \geq 14$N/mm²						
M8	12x80	80	4,0	4,0	3,0	4,0
M8 / M10/ IG-M6	16x85	85	4,0	4,0	3,0	6,5
	16x130	130	5,5	5,5	4,5	6,5
M12 / M16 / IG-M8 / IG-M10	20x85	85	4,0	4,0	3,0	7,0
	20x130	130	5,5	5,5	4,5	9,0
	20x200	200	5,5	5,5	4,5	9,0

1) Values are valid for c_{cr} and c_{min}

2) Calculation of $V_{Rk,c}$ see Technical Report TR 054, except for shear load parallel to free edge with $c \geq 125$ mm: $V_{Rk,c,II} = V_{Rk,b}$

3) The values are valid for steel 5.6 or higher. For steel 4.6 and 4.8 multiply $V_{Rk,b}$ by 0,8

Table C48: Displacements

Anchor size	349 Alfa Sleeve	h_{ef}	N	δ_N / N	δ_{N0}	$\delta_{N\infty}$	V	δ_{V0}	$\delta_{V\infty}$
		[mm]	[kN]	[mm/kN]	[mm]	[mm]	[kN]	[mm]	[mm]
M8	12x80	80	1,14	0,10	0,11	0,23	1,10	1,20	1,80
M8 / M10/ IG-M6	16x85	85					1,86	1,50	2,25
	16x130	130	1,57		0,16	0,31			
M12 / M16 / IG-M8 / IG-M10	20x85	85	1,14		0,11	0,23	1,86	1,50	2,25
	20x130	130	1,57		0,16	0,31	2,57	2,10	3,15
	20x200	200							

Deutsches Institut für Bautechnik DIBt

Brick type: Clay hollow brick Porotherm Homebric

Table C49: Description of the brick

Brick type		Clay hollow brick Porotherm Homebric
Bulk density	ρ [kg/dm^3]	0,7
Compressive strength	$f_b \geq$ [N/mm^2]	4, 6 or 10
Code		EN 771-1
Producer (country code)		e.g. Wienerberger (FR)
Brick dimensions	[mm]	500 x 200 x 299
Drilling method		Rotary

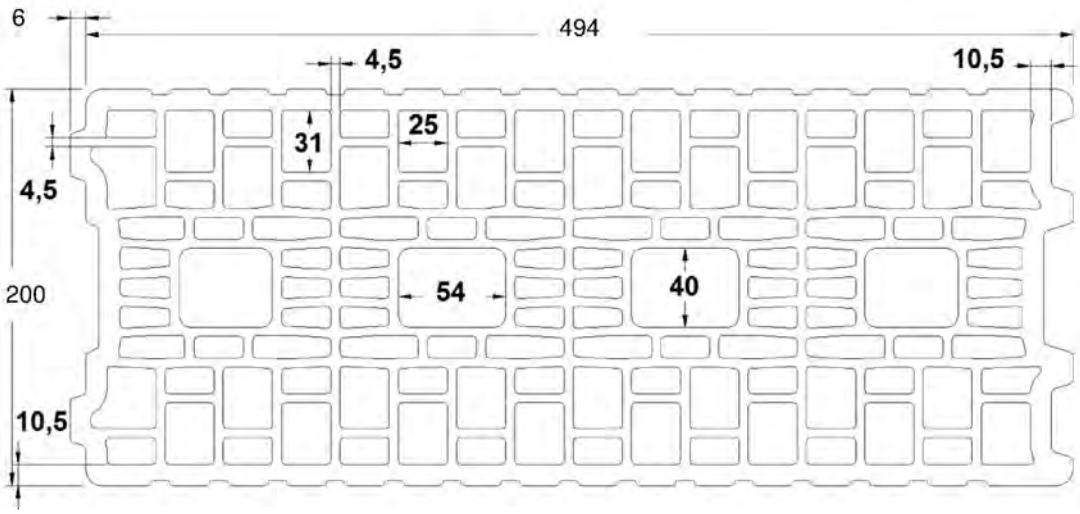
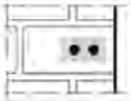


Table C50: Spacing and edge distances

Anchor size			All sizes
Edge distance	c_{cr}	[mm]	100 (120)[1]
Minimum edge distance	c_{min}[2]	[mm]	100 (120)[1]
Spacing	$s_{cr,II}$	[mm]	500
	$s_{cr,\perp}$	[mm]	299
Minimum spacing	s_{min}	[mm]	100

[1] Value in brackets for 349 Alfa Siebhülse 20x85 and 349 Alfa Siebhülse 20x130
[2] For $V_{Rk,c}$: c_{min} according to Technical Report TR 054

Table C51: Group factor for anchor group in case of tension loading

Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		200	100	$\alpha_{g,N,II}$	[-]	2,0
		c_{cr}	500			2,0
⊥: anchors placed perpendicular to horizontal joint		200	100	$\alpha_{g,N,\perp}$		1,2
		c_{cr}	299			2,0

292 Alfa Injection mortar for masonry

Performance - Clay hollow brick Porotherm Homebric
Description of the brick, Spacing and edge distances, Group factor

Annex C21

Deutsches Institut für Bautechnik DIBt

Brick type: Clay hollow brick Porotherm Homebric

Table C52: Group factor for anchor group in case of shear loading parallel to free edge

Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		c_{cr}	500	$\alpha_{g,V,II}$	[-]	2,0
⊥: anchors placed perpendicular to horizontal joint		c_{cr}	299	$\alpha_{g,V,\perp}$		2,0

Table C53: Group factor for anchor group in case of shear load perpendicular to free edge

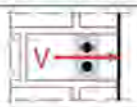
Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		c_{cr}	500	$\alpha_{g,V,II}$	[-]	2,0
⊥: anchors placed perpendicular to horizontal joint		c_{cr}	299	$\alpha_{g,V,\perp}$		2,0

Table C54: Characteristic values of resistance under tension and shear loads

Anchor size	349 Alfa Sleeve	Effective Anchorage depth	Characteristic resistance			
			Use category			
			d/d w/d w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	All temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ [1]			$V_{Rk,b}$ [2)3)]
		[mm]	[kN]			[kN]
Compressive strength $f_b \geq 4$ N/mm²						
M8	12x80	80	0,9	0,9	0,75	2,0
M8 / M10 / IG-M6	16x85	85	0,9	0,9	0,75	2,0
	16x130	130	1,2	1,2	0,9	2,0
M12 / M16 / IG-M8 / IG-M10	20x85	85	0,9	0,9	0,75	2,5
	20x130	130	1,2	1,2	0,9	2,5
Compressive strength $f_b \geq 6$ N/mm²						
M8	12x80	80	0,9	0,9	0,9	2,5
M8 / M10 / IG-M6	16x85	85	0,9	0,9	0,9	2,5
	16x130	130	1,2	1,2	1,2	2,5
M12 / M16 / IG-M8 / IG-M10	20x85	85	0,9	0,9	0,9	3,0
	20x130	130	1,2	1,2	1,2	3,0

1) Values are valid for c_{cr} and c_{min}
2) Calculation of $V_{Rk,c}$ see Technical Report TR 054, except for shear load parallel to free edge with c ≥ 200 mm: $V_{Rk,c,II} = V_{Rk,b}$
3) The values are valid for steel 5.6 or higher. For steel 4.6 and 4.8 multiply $V_{Rk,b}$ by 0,8

292 Alfa Injection mortar for masonry

Performance - Clay hollow brick Porotherm Homebric
Group factor, Characteristic values of resistance

Annex C22

Brick type: Clay hollow brick Porotherm Homebric

Table C55: Characteristic values of resistance under tension and shear loads (continue)

Anchor size	349 Alfa Sleeve	Effective Anchorage depth	Characteristic resistance			
			Use category			
			d/d w/d w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	All temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ [1]			$V_{Rk,b}$ [2)3)]
		[mm]	[kN]			[kN]
Compressive strength $f_b \geq 10$ N/mm²						
M8	12x80	80	1,2	1,2	1,2	3,0
M8 / M10/ IG-M6	16x85	85	1,2	1,2	1,2	3,0
	16x130	130	1,5	1,5	1,5	3,5
M12 / M16 / IG-M8 / IG-M10	20x85	85	1,2	1,2	1,2	4,0
	20x130	130	1,5	1,5	1,5	4,0

1) Values are valid for c_{cr} and c_{min}

2) Calculation of $V_{Rk,c}$ see Technical Report TR 054, except for shear load parallel to free edge with $c \geq 200$ mm: $V_{Rk,c,II} = V_{Rk,b}$

3) The values are valid for steel 5.6 or higher. For steel 4.6 and 4.8 multiply $V_{Rk,b}$ by 0,8

Table C56: Displacements

Anchor size	349 Alfa Sleeve	h_{ef}	N	δ_N / N	δ_{N0}	$\delta_{N\infty}$	V	δ_{V0}	$\delta_{V\infty}$
		[mm]	[kN]	[mm/kN]	[mm]	[mm]	[kN]	[mm]	[mm]
M8	12x80	80	0,34	0,80	0,27	0,55	0,9	1,20	1,80
M8 / M10/ IG-M6	16x85	85					0,9		
	16x130	130	0,43		0,34	0,69	1,0		
M12 / M16 / IG-M8 / IG-M10	20x85	85	0,34		0,27	0,55	1,14		
	20x130	130	0,43		0,34	0,69			

292 Alfa Injection mortar for masonry

Performance - Clay hollow brick Porotherm Homebric
Characteristic values of resistance (continue), Displacements

Annex C23

Deutsches Institut für Bautechnik DIBt

Brick type: Clay hollow brick BGV Thermo

Table C57: Description of the brick

Brick type		Clay hollow brick BGV Thermo
Bulk density	ρ [kg/dm^3]	0,6
Compressive strength	$f_b \geq$ [N/mm^2]	4, 6 or 10
Code		EN 771-1
Producer (country code)		e.g. Leroux (FR)
Brick dimensions	[mm]	500 x 200 x 314
Drilling method		Rotary

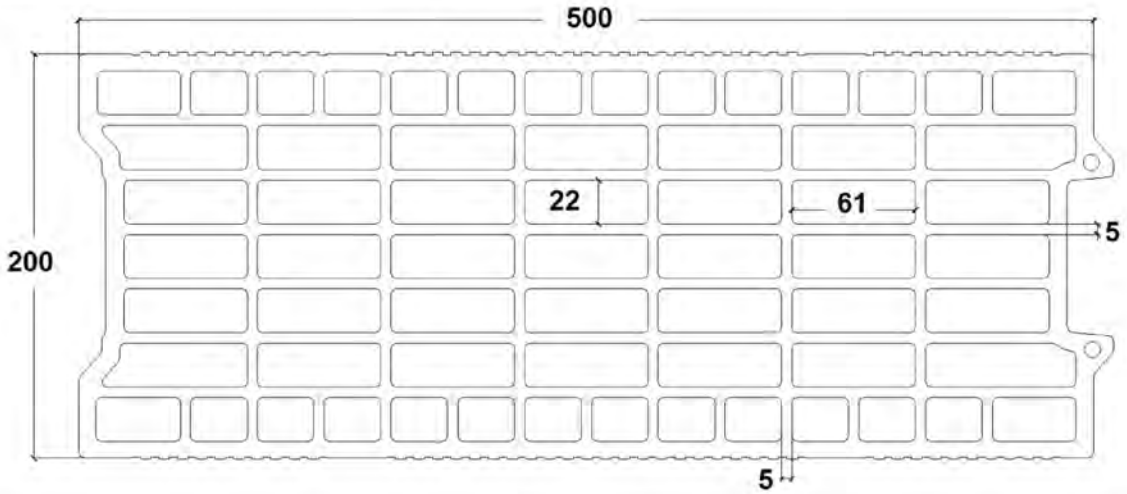
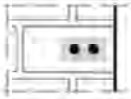
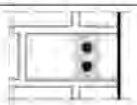


Table C58: Spacing and edge distances

Anchor size			**All sizes**
Edge distance	c_{cr}	[mm]	100 (120)[1]
Minimum edge distance	c_{min}[2]	[mm]	100 (120)[1]
Spacing	$s_{cr,II}$	[mm]	500
	$s_{cr,\perp}$	[mm]	314
Minimum spacing	s_{min}	[mm]	100

1) Values in brackets for 349 Alfa Siebhülse 20x85 and 349 Alfa Siebhülse 20x130
2) For $V_{Rk,c}$: c_{min} according to Technical Report TR 054

Table C59: Group factor for anchor group in case of tension loading

Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		200	100	$\alpha_{g,N,II}$	[-]	1,7
		c_{cr}	500			2,0
⊥: anchors placed perpendicular to horizontal joint		200	100	$\alpha_{g,N,\perp}$		1,1
		c_{cr}	314			2,0

292 Alfa Injection mortar for masonry

Performance - Clay hollow brick BGV Thermo
Description of the brick, Spacing and edge distances, Group factor

Annex C24

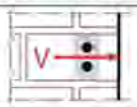
Deutsches Institut für Bautechnik DIBt

Brick type: Clay hollow brick BGV Thermo

Table C60: Group factor for anchor group in case of shear loading parallel to free edge

Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		c_{cr}	500	$\alpha_{g,V,II}$	[-]	2,0
⊥: anchors placed perpendicular to horizontal joint		c_{cr}	314	$\alpha_{g,V,\perp}$		2,0

Table C61: Group factor for anchor group in case of shear load perpendicular to free edge

Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		c_{cr}	500	$\alpha_{g,V,II}$	[-]	2,0
⊥: anchors placed perpendicular to horizontal joint		c_{cr}	314	$\alpha_{g,V,\perp}$		2,0

292 Alfa Injection mortar for masonry

Performance - Clay hollow brick BGV Thermo
Group factor

Annex C25

Brick type: Clay hollow brick BGV Thermo

Table C62: Characteristic values of resistance under tension and shear loads

Anchor size	349 Alfa Sleeve	Effective Anchorage depth	Characteristic resistance			
			Use category			
			d/d w/d w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	All temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ [1]			$V_{Rk,b}$ [2)3)]
		[mm]	[kN]			[kN]
Compressive strength $f_b \geq 4$ N/mm²						
M8	12x80	80	0,6	0,6	0,6	2,0
M8 / M10/ IG-M6	16x85	85	0,6	0,6	0,6	2,0
	16x130	130	1,2	1,2	0,9	2,5
M12 / M16 / IG-M8 / IG-M10	20x85	85	0,6	0,6	0,6	2,5
	20x130	130	1,2	1,2	0,9	2,5
Compressive strength $f_b \geq 6$ N/mm²						
M8	12x80	80	0,9	0,9	0,75	2,5
M8 / M10/ IG-M6	16x85	85	0,9	0,9	0,75	2,5
	16x130	130	1,5	1,5	1,2	3,0
M12 / M16 / IG-M8 / IG-M10	20x85	85	0,9	0,9	0,75	3,0
	20x130	130	1,5	1,5	1,2	3,0
Compressive strength $f_b \geq 10$ N/mm²						
M8	12x80	80	0,9	0,9	0,9	3,5
M8 / M10/ IG-M6	16x85	85	0,9	0,9	0,9	3,5
	16x130	130	2,0	2,0	1,5	4,0
M12 / M16 / IG-M8 / IG-M10	20x85	85	0,9	0,9	0,9	4,0
	20x130	130	2,0	2,0	1,5	4,0

1) Values are valid for c_{cr} and c_{min}

2) Calculation of $V_{Rk,c}$ see Technical Report TR 054, except for shear load parallel to free edge with $c \geq 250$ mm: $V_{Rk,c,II} = V_{Rk,b}$

3) The values are valid for steel 5.6 or higher. For steel 4.6 and 4.8 multiply $V_{Rk,b}$ by 0,8

Table C63: Displacements

Anchor size	349 Alfa Sleeve	h_{ef}	N	δ_N / N	δ_{N0}	$\delta_{N\infty}$	V	δ_{V0}	$\delta_{V\infty}$
		[mm]	[kN]	[mm/kN]	[mm]	[mm]	[kN]	[mm]	[mm]
M8	12x80	80	0,26	0,80	0,21	0,41	0,7	1,00	1,50
M8 / M10/ IG-M6	16x85	85							
	16x130	130	0,43		0,34	0,69	0,86		
M12 / M16 / IG-M8 / IG-M10	20x85	85	0,26		0,21	0,41			
	20x130	130	0,43		0,34	0,69			

292 Alfa Injection mortar for masonry

Performance - Clay hollow brick BGV Thermo
Characteristic values of resistance, Displacements

Annex C26

Deutsches Institut für Bautechnik DIBt

Brick type: Clay hollow brick Calibric R+

Table C64: Description of the brick

Brick type		Clay hollow brick Calibric R+
Bulk density	ρ [kg/dm^3]	0,6
Compressive strength	$f_b \geq$ [N/mm^2]	6, 9 or 12
Code		EN 771-1
Producer (country code)		e.g. Terreal (FR)
Brick dimensions	[mm]	500 x 200 x 314
Drilling method		Rotary

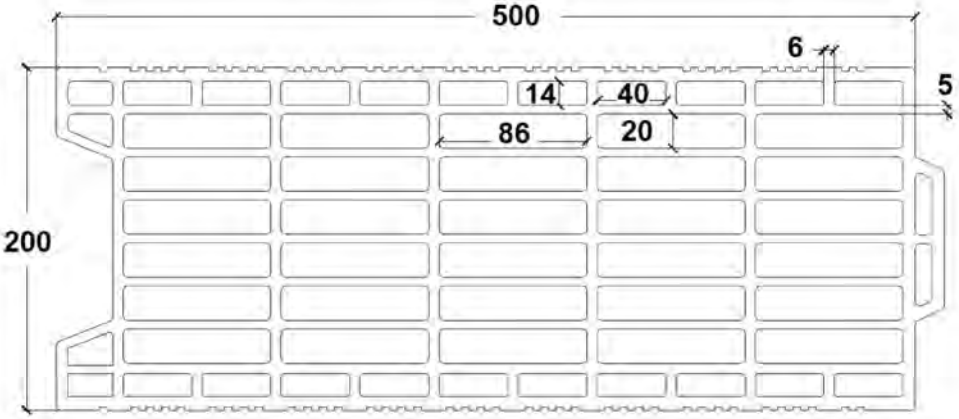


Table C65: Spacing and edge distances

Anchor size			**All sizes**
Edge distance	c_{cr}	[mm]	100 (120)[1]
Minimum edge distance	c_{min}[2]	[mm]	100 (120)[1]
Spacing	$s_{cr,II}$	[mm]	500
	$s_{cr,\perp}$	[mm]	314
Minimum spacing	s_{min}	[mm]	100

[1] Value in brackets for 349 Alfa Siebhülse 20x85 and 349 Alfa Siebhülse 20x130
[2] For $V_{Rk,c}$: c_{min} according to Technical Report TR 054

Table C66: Group factor for anchor group in case of tension loading

Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		175	100	$\alpha_{g,N,II}$	[-]	1,7
		c_{cr}	500			2,0
⊥: anchors placed perpendicular to horizontal joint		175	100	$\alpha_{g,N,\perp}$		1,0
		$c_{cr,\perp}$	314			2,0

292 Alfa Injection mortar for masonry

Performance - Clay hollow brick Calibric R+
Description of the brick, Spacing and edge distances, Group factor

Annex C27

Deutsches Institut für Bautechnik DIBt

Brick type: Clay hollow brick Calibric R+

Table C67: Group factor for anchor group in case of shear loading parallel to free edge

Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		c_{cr}	500	$\alpha_{g,V,II}$	[-]	2,0
⊥: anchors placed perpendicular to horizontal joint		c_{cr}	314	$\alpha_{g,V,\perp}$		2,0

Table C68: Group factor for anchor group in case of shear load perpendicular to free edge

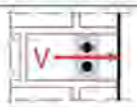
Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		c_{cr}	500	$\alpha_{g,V,II}$	[-]	2,0
⊥: anchors placed perpendicular to horizontal joint		c_{cr}	314	$\alpha_{g,V,\perp}$		2,0

Table C69: Characteristic values of resistance under tension and shear loads

Anchor size	349 Alfa Sleeve	Effective Anchorage depth	Characteristic resistance			
			Use category			
			d/d w/d w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	All temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ [1]			$V_{Rk,b}$ [2)3)]
		[mm]	[kN]			[kN]
Compressive strength $f_b \geq 6$ N/mm²						
M8	12x80	80	0,9	0,9	0,75	3,0
M8 / M10/ IG-M6	16x85	85	0,9	0,9	0,75	4,0
	16x130	130	1,2	1,2	0,9	4,0
M12 / M16 / IG-M8 / IG-M10	20x85	85	0,9	0,9	0,75	6,0
	20x130	130	1,2	1,2	0,9	6,0
Compressive strength $f_b \geq 9$ N/mm²						
M8	12x80	80	1,2	1,2	0,9	3,5
M8 / M10/ IG-M6	16x85	85	1,2	1,2	0,9	5,0
	16x130	130	1,5	1,5	1,2	5,0
M12 / M16 / IG-M8 / IG-M10	20x85	85	1,2	1,2	0,9	7,5
	20x130	130	1,5	1,5	1,2	7,5

1) Values are valid for c_{cr} and c_{min}

2) Calculation of $V_{Rk,c}$ see Technical Report TR 054, except for shear load parallel to free edge with c ≥ 250 mm: $V_{Rk,c,II} = V_{Rk,b}$

3) The values are valid for steel 5.6 or higher. For steel 4.6 and 4.8 multiply $V_{Rk,b}$ by 0,8

292 Alfa Injection mortar for masonry

Performance - Clay hollow brick Calibric R+
Group factor, Characteristic values of resistance

Annex C28

Brick type: Clay hollow brick Calibric R+

Table C70: Characteristic values of resistance under tension and shear load (continue)

Anchor size	349 Alfa Sleeve	Effective Anchorage depth	Characteristic resistance			
			Use category			
			d/d w/d w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	All temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ [1]			$V_{Rk,b}$ [2)3)]
		[mm]	[kN]			[kN]
Compressive strength $f_b \geq 12$ N/mm²						
M8	12x80	80	1,2	1,2	0,9	4,0
M8 / M10/ IG-M6	16x85	85	1,2	1,2	0,9	5,5
	16x130	130	1,5	1,5	1,2	5,5
M12 / M16 / IG-M8 / IG-M10	20x85	85	1,2	1,2	0,9	8,5
	20x130	130	1,5	1,5	1,2	8,5

1) Values are valid for c_{cr} and c_{min}

2) Calculation of $V_{Rk,c}$ see Technical Report TR 054, except for shear load parallel to free edge with $c \geq 250$ mm: $V_{Rk,c,II} = V_{Rk,b}$

3) The values are valid for steel 5.6 or higher. For steel 4.6 and 4.8 multiply $V_{Rk,b}$ by 0,8

Table C71: Displacements

Anchor size	349 Alfa Sleeve	h_{ef}	N	δ_N / N	δ_{N0}	$\delta_{N\infty}$	V	δ_{V0}	$\delta_{V\infty}$
		[mm]	[kN]	[mm/kN]	[mm]	[mm]	[kN]	[mm]	[mm]
M8	12x80	80	0,34	0,80	0,27	0,55	1,0	1,10	1,65
M8 / M10/ IG-M6	16x85	85					1,43	2,0	3,0
	16x130	130	0,43		0,34	0,69			
M12 / M16 / IG-M8 / IG-M10	20x85	85	0,34		0,27	0,55	2,14		
	20x130	130	0,43		0,34	0,69			

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Brick type: Clay hollow brick Urbanbric

Table C72: Description of the brick

Brick type		Clay hollow brick Urbanbric
Bulk density	ρ [kg/dm^3]	0,7
Compressive strength	$f_b \geq$ [N/mm^2]	6, 9 or 12
Code		EN 771-1
Producer (country code)		e.g. Imerys (FR)
Brick dimensions	[mm]	560 x 200 x 274
Drilling method		Rotary

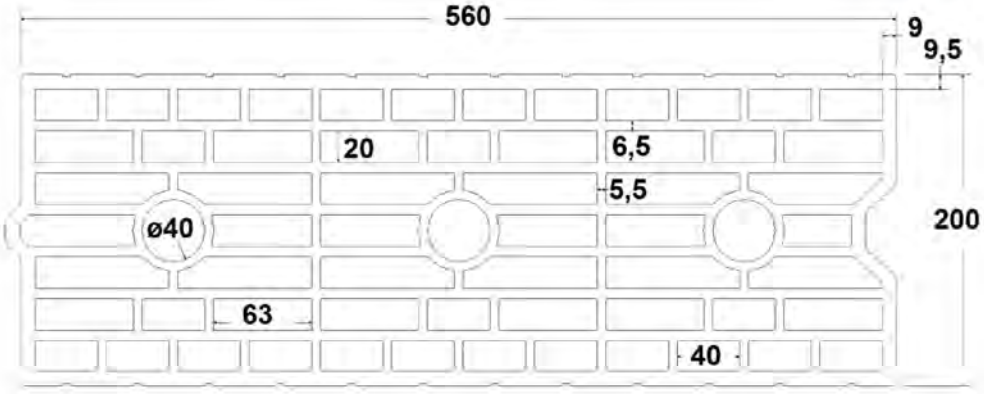
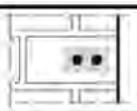
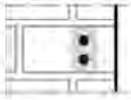


Table C73: Spacing and edge distances

Anchor size			**All sizes**
Edge distance	c_{cr}	[mm]	100 (120)[1]
Minimum edge distance	c_{min}[2]	[mm]	100 (120)[1]
Spacing	$s_{cr,II}$	[mm]	560
	$s_{cr,\perp}$	[mm]	274
Minimum spacing	s_{min}	[mm]	100

[1] Value in brackets for 349 Alfa Siebhülse 20x85 and 349 Alfa Siebhülse 20x130
[2] For $V_{Rk,c}$: c_{min} according to Technical Report TR 054

Table C74: Group factor for anchor group in case of tension loading

Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		185	100	$\alpha_{g,N,II}$	[-]	1,9
		c_{cr}	560			2,0
⊥: anchors placed perpendicular to horizontal joint		185	100	$\alpha_{g,N,\perp}$		1,1
		c_{cr}	274			2,0

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Performance - Clay hollow brick Urbanbric
Description of the brick, Spacing and edge distances, Group factor

Annex C30

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Brick type: Clay hollow brick Urbanbric

Table C75: Group factor for anchor group in case of shear loading parallel to free edge

Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		c_{cr}	560	$\alpha_{g,V,II}$	[-]	2,0
⊥: anchors placed perpendicular to horizontal joint		c_{cr}	274	$\alpha_{g,V,\perp}$		2,0

Table C76: Group factor for anchor groups in case of shear load perpendicular to free edge

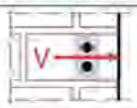
Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		c_{cr}	560	$\alpha_{g,V,II}$	[-]	2,0
⊥: anchors placed perpendicular to horizontal joint		c_{cr}	274	$\alpha_{g,V,\perp}$		2,0

Table C77: Characteristic values of resistance under tension and shear load

Anchor size	349 Alfa Sleeve	Effective Anchorage depth	Characteristic resistance			
			Use category			
			d/d w/d w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	All temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ [1]			$V_{Rk,b}$ [2)3)]
		[mm]	[kN]			[kN]
Compressive strength $f_b \geq 6$ N/mm²						
M8	12x80	80	0,9	0,9	0,75	3,0
M8 / M10/ IG-M6	16x85	85	0,9	0,9	0,75	3,0
	16x130	130	2,0	2,0	1,5	3,0
M12 / M16 / IG-M8 / IG-M10	20x85	85	0,9	0,9	0,75	3,5
	20x130	130	2,0	2,0	1,5	3,5
Compressive strength $f_b \geq 9$ N/mm²						
M8	12x80	80	0,9	0,9	0,9	4,0
M8 / M10/ IG-M6	16x85	85	0,9	0,9	0,9	4,0
	16x130	130	2,5	2,5	2,0	4,0
M12 / M16 / IG-M8 / IG-M10	20x85	85	0,9	0,9	0,9	4,5
	20x130	130	2,5	2,5	2,0	4,5

1) Values are valid for c_{cr} and c_{min}
2) Calculation of $V_{Rk,c}$ see Technical Report TR 054, except for shear load parallel to free edge with c ≥ 190 mm: $V_{Rk,c,II} = V_{Rk,b}$
3) The values are valid for steel 5.6 or higher. For steel 4.6 and 4.8 multiply $V_{Rk,b}$ by 0,8

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Performance - Clay hollow brick Urbanbric
Group factor, Characteristic values of resistance

Annex C31

Brick type: Clay hollow brick Urbanbric

Table C78: Characteristic values of resistance under tension and shear load (continue)

Anchor size	349 Alfa Sleeve	Effective Anchorage depth	Characteristic resistance			
			Use category			
			d/d w/d w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	All temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ [1]			$V_{Rk,b}$ [2)3)]
		[mm]	[kN]			[kN]
Compressive strength $f_b \geq 12$ N/mm²						
M8	12x80	80	1,2	1,2	0,9	4,5
M8 / M10/ IG-M6	16x85	85	1,2	1,2	0,9	4,5
	16x130	130	3,0	3,0	2,5	4,5
M12 / M16 / IG-M8 / IG-M10	20x85	85	1,2	1,2	0,9	5,0
	20x130	130	3,0	3,0	2,5	5,0

1) Values are valid for c_{cr} and c_{min}

2) Calculation of $V_{Rk,c}$ see Technical Report TR 054, except for shear load parallel to free edge with $c \geq 190$ mm: $V_{Rk,c,II} = V_{Rk,b}$

3) The values are valid for steel 5.6 or higher. For steel 4.6 and 4.8 multiply $V_{Rk,b}$ by 0,8

Table C79: Displacements

Anchor size	349 Alfa Sleeve	h_{ef}	N	δ_N / N	δ_{N0}	$\delta_{N\infty}$	V	δ_{V0}	$\delta_{V\infty}$
		[mm]	[kN]	[mm/kN]	[mm]	[mm]	[kN]	[mm]	[mm]
M8	12x80	80	0,34	0,80	0,27	0,55	1,30	1,00	1,50
M8 / M10/ IG-M6	16x85	85							
	16x130	130	0,86		0,69	1,37			
M12 / M16 / IG-M8 / IG-M10	20x85	85	0,34		0,27	0,55	1,43		
	20x130	130	0,86		0,69	1,37			

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Performance - Clay hollow brick Urbanbric
Characteristic values of resistance, Displacements

Annex C32

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Brick type: Clay hollow brick Brique creuse C40

Table C80: Description of the brick

Brick type		Clay hollow brick Brique creuse C40
Bulk density	ρ [kg/dm^3]	0,7
Compressive strength	$f_b \geq$ [N/mm^2]	4, 8 or 12
Code		EN 771-1
Producer (country code)		e.g. Terreal (FR)
Brick dimensions	[mm]	500 x 200 x 200
Drilling method		Rotary

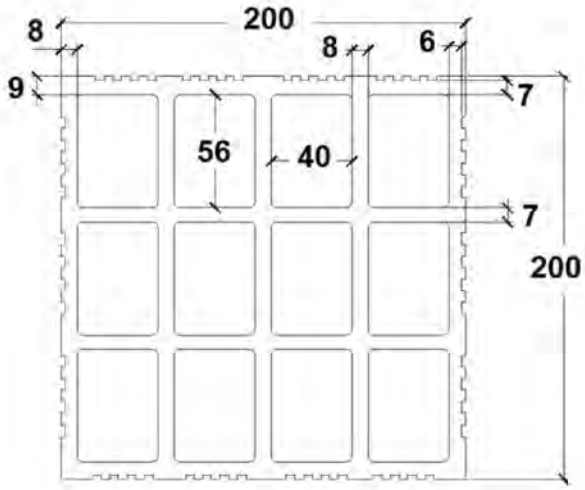
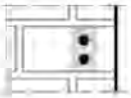


Table C81: Spacing and edge distances

Anchor size			**All sizes**
Edge distance	c_{cr}	[mm]	100 (120)[1]
Minimum edge distance	c_{min}[2]	[mm]	100 (120)[1]
Spacing	$s_{cr,II}$	[mm]	500
	$s_{cr,\perp}$	[mm]	200
Minimum spacing	s_{min}	[mm]	200

[1] Values in brackets for 349 Alfa Siebhülse 20x85 and 349 Alfa Siebhülse 20x130
[2] For $V_{Rk,c}$: c_{min} according to Technical Report TR 054

Table C82: Group factor for anchor group in case of tension loading

Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		c_{cr}	200	$\alpha_{g,N,II}$	[-]	2,0
⊥: anchors placed perpendicular to horizontal joint		c_{cr}	200	$\alpha_{g,N,\perp}$		2,0

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Performance - Clay hollow brick Brique creuse C40
Description of the brick, Spacing and edge distances, Group factor

Annex C33

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Brick type: Clay hollow brick Brique creuse C40

Table C83: Group factor for anchor group in case of shear loading parallel to free edge

Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		c_{cr}	500	$\alpha_{g,V,II}$	[-]	2,0
⊥: anchors placed perpendicular to horizontal joint		c_{cr}	200	$\alpha_{g,V,\perp}$		2,0

Table C84: Group factor for anchor group in case of shear load perpendicular to free edge

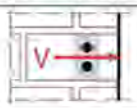
Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		c_{cr}	500	$\alpha_{g,V,II}$	[-]	2,0
⊥: anchors placed perpendicular to horizontal joint		c_{cr}	200	$\alpha_{g,V,\perp}$		2,0

Table C85: Characteristic values of resistance under tension and shear load

Anchor size	349 Alfa Sleeve	Effective Anchorage depth	Characteristic resistance			
			Use category			
			d/d w/d w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	All temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ [1]			$V_{Rk,b}$ [2)3)]
		[mm]	[kN]			[kN]
Compressive strength $f_b \geq 4$ N/mm²						
M8	12x80	80	0,6	0,6	0,6	0,9
M8 / M10/ IG-M6	16x85	85				
	16x130	130				
M12 / M16 / IG-M8 / IG-M10	20x85	85				
	20x130	130				
Compressive strength $f_b \geq 8$ N/mm²						
M8	12x80	80	0,9	0,9	0,75	1,2
M8 / M10/ IG-M6	16x85	85				
	16x130	130				
M12 / M16 / IG-M8 / IG-M10	20x85	85				
	20x130	130				

1) Values are valid for c_{cr} and c_{min}
2) Calculation of $V_{Rk,c}$ see Technical Report TR 054
3) The values are valid for steel 5.6 or higher. For steel 4.6 and 4.8 multiply $V_{Rk,b}$ by 0,8

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Performance - Clay hollow brick Brique creuse C40
Group factor, Characteristic values of resistance

Annex C34

Brick type: Clay hollow brick Brique creuse C40

Table C86: Characteristic values of resistance under tension and shear load (continue)

Anchor size	349 Alfa Sleeve	Effective Anchorage depth	Characteristic resistance			
			Use category			
			d/d w/d w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	All temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ [1]			$V_{Rk,b}$ [2)3)]
		[mm]	[kN]			[kN]
Compressive strength $f_b \geq 12$ N/mm²						
M8	12x80	80	1,2	1,2	0,9	1,5
M8 / M10/ IG-M6	16x85	85				
	16x130	130				
M12 / M16 / IG-M8 / IG-M10	20x85	85				
	20x130	130				

1) Values are valid for c_{cr} and c_{min}
2) Calculation of $V_{Rk,c}$ see Technical Report TR 054
3) The values are valid for steel 5.6 or higher. For steel 4.6 and 4.8 multiply $V_{Rk,b}$ by 0,8

Table C87: Displacements

Anchor size	349 Alfa Sleeve	h_{ef}	N	δ_N / N	δ_{N0}	$\delta_{N\infty}$	V	δ_{V0}	$\delta_{V\infty}$
		[mm]	[kN]	[mm/kN]	[mm]	[mm]	[kN]	[mm]	[mm]
M8	12x80	80	0,17	0,80	0,14	0,27	0,3	0,9	1,35
M8 / M10/ IG-M6	16x85	85							
	16x130	130	0,14		0,11	0,23			
M12 / M16 / IG-M8 / IG-M10	20x85	85	0,17		0,14	0,27			
	20x130	130	0,14		0,11	0,23			

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Brick type: Clay hollow brick Blocchi Leggeri

Table C88: Description of the brick

Brick type		Clay hollow brick Blocchi Leggeri
Bulk density	ρ [kg/dm^3]	0,6
Compressive strength	$f_b \geq$ [N/mm^2]	4, 6, 8 or 12
Code		EN 771-1
Producer (country code)		e.g. Wienerberger (IT)
Brick dimensions	[mm]	250 x 120 x 250
Drilling method		Rotary

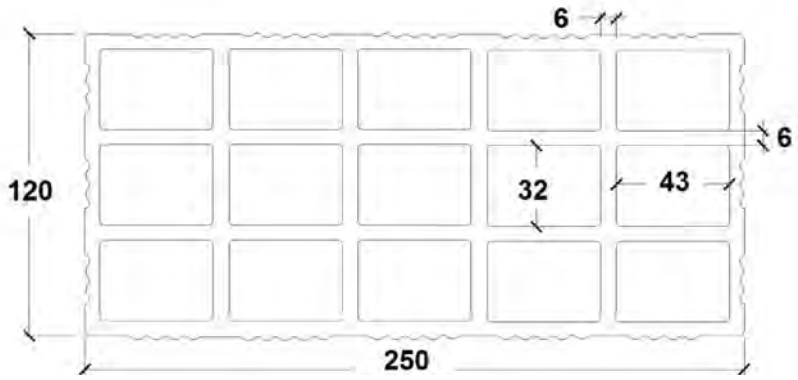
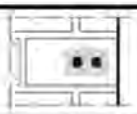


Table C89: Spacing and edge distances

Anchor size			**All sizes**
Edge distance	c_{cr}	[mm]	100 (120)[1)]
Minimum edge distance	c_{min}	[mm]	60
Spacing	$s_{cr,II}$	[mm]	250
	$s_{cr,\perp}$	[mm]	120
Minimum spacing	s_{min}	[mm]	100

1) Value in brackets for 349 Alfa Siebhülse 20x85; 349 Alfa Siebhülse 20x130 and 349 Alfa Siebhülse 20x200

Table C90: Group factor for anchor group in case of tension loading

Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		60	100	$\alpha_{g,N,II}$	[-]	1,0
		c_{cr}	250			2,0
⊥: anchors placed perpendicular to horizontal joint		60	100	$\alpha_{g,N,\perp}$		2,0

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Performance - Clay hollow brick Blocchi Leggeri
Description of the brick, Spacing and edge distances, Group factor

Annex C36

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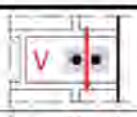
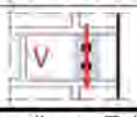
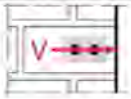
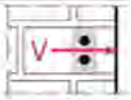
Brick type: Clay hollow brick Blocchi Leggeri

Table C91: Group factor for anchor group in case of shear loading parallel to free edge

Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		60[1)]	100[1)]	$\alpha_{g,V,II}$	[-]	1,0
		c_{cr}	250			2,0
⊥: anchors placed perpendicular to horizontal joint		60[1)]	100[1)]	$\alpha_{g,V,\perp}$		1,6
		c_{cr}	250			2,0

[1)] Only valid for $V_{Rk,b}$ according to Table C93 and C94 values in brackets

Table C92: Group factor for anchor group in case of shear load perpendicular to free edge

Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		60[1)]	100[1)]	$\alpha_{g,V,II}$	[-]	1,0
		c_{cr}	250			2,0
⊥: anchors placed perpendicular to horizontal joint		60[1)]	100[1)]	$\alpha_{g,V,\perp}$		1,6
		c_{cr}	250			2,0

[1)] Only valid for $V_{Rk,b}$ according to Table C93 and C94 values in brackets

Table C93: Characteristic values of resistance under tension and shear load

Anchor size	349 Alfa Sleeve	Effective Anchorage depth	Characteristic resistance			
			Use category			
			d/d w/d w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	All temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$[1)]			$V_{Rk,b}$[4)]
		[mm]	[kN]			[kN]
Compressive strength $f_b \geq 4$ N/mm²						
M8	12x80	80	0,4	0,4	0,3	2,0[2)] (0,9)[3)]
M8 / M10/ IG-M6	16x85	85				
	16x130	130				
M12 / M16 / IG-M8 / IG-M10	20x85	85				
	20x130	130				
	20x200	200				

1) Values are valid for c_{cr} and c_{min}
2) Calculation of $V_{Rk,c}$ see Technical Report TR 054, except for shear load parallel to free edge with c ≥ 125 mm: $V_{Rk,c,II} = V_{Rk,b}$
3) Values in brackets $V_{Rk,c} = V_{Rk,b}$ for anchors with c_{min}
4) The values are valid for steel 5.6 or higher. For steel 4.6 and 4.8 multiply $V_{Rk,b}$ by 0,8

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Performance - Clay hollow brick Blocchi Leggeri
Group factor, Characteristic values of resistance

Annex C37

Brick type: Clay hollow brick Blocchi Leggeri

Table C94: Characteristic values of resistance under tension and shear load (continue)

Anchor size	349 Alfa Sleeve	Effective Anchorage depth	Characteristic resistance			
			Use category			
			d/d w/d w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	All temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ [1]			$V_{Rk,b}$ [4]
		[mm]	[kN]			[kN]
Compressive strength $f_b \geq 6$ N/mm²						
M8	12x80	80	0,5	0,5	0,4	2,5 [2] (1,2) [3]
M8 / M10/ IG-M6	16x85	85				
	16x130	130				
M12 / M16 / IG-M8 / IG-M10	20x85	85				
	20x130	130				
	20x200	200				
Compressive strength $f_b \geq 8$ N/mm²						
M8	12x80	80	0,6	0,6	0,5	3,0 [2] (1,2) [3]
M8 / M10/ IG-M6	16x85	85				
	16x130	130				
M12 / M16 / IG-M8 / IG-M10	20x85	85				
	20x130	130				
	20x200	200				
Compressive strength $f_b \geq 12$ N/mm²						
M8	12x80	80	0,6	0,6	0,6	3,5 [2] (1,5) [3]
M8 / M10/ IG-M6	16x85	85				
	16x130	130				
M12 / M16 / IG-M8 / IG-M10	20x85	85				
	20x130	130				
	20x200	200				

1) Values are valid for c_{cr} and c_{min}
2) Calculation of $V_{Rk,c}$ see Technical Report TR 054, except for shear load parallel to free edge with c ≥ 125 mm: $V_{Rk,c,II} = V_{Rk,b}$
3) Values in brackets $V_{Rk,c} = V_{Rk,b}$ for anchors with c_{min}
4) The values are valid for steel 5.6 or higher. For steel 4.6 and 4.8 multiply $V_{Rk,b}$ by 0,8

Table C95: Displacements

Anchor size	349 Alfa Sleeve	h_{ef}	N	δ_N / N	δ_{N0}	$\delta_{N\infty}$	V	δ_{V0}	$\delta_{V\infty}$
		[mm]	[kN]	[mm/kN]	[mm]	[mm]	[kN]	[mm]	[mm]
All sizes	All sizes	All sizes	0,17	1,20	0,21	0,41	0,9	1,20	1,80

292 Alfa Injection mortar for masonry

Performance - Clay hollow brick Blocchi Leggeri
Characteristic values of resistance, Displacements

Annex C38

Deutsches Institut für Bautechnik DIBt

Brick type: Clay hollow brick Doppio Uni

Table C96: Description of the brick

Brick type		Clay hollow brick Doppio Uni
Bulk density	ρ [kg/dm^3]	0,9
Compressive strength	$f_b \geq$ [N/mm^2]	10, 16, 20 or 28
Code		EN 771-1
Producer (country code)		e.g. Wienerberger (IT)
Brick dimensions	[mm]	250 x 120 x 120
Drilling method		Rotary

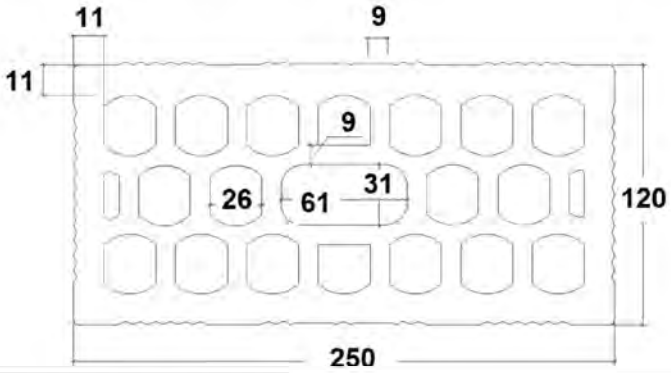
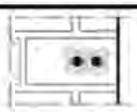
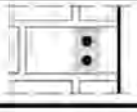


Table C97: Spacing and edge distances

Anchor size			**All sizes**
Edge distance	c_{cr}	[mm]	100 (120)[1]
Minimum edge distance	c_{min}[2]	[mm]	60
Spacing	$s_{cr,II}$	[mm]	250
	$s_{cr,\perp}$	[mm]	120
Minimum spacing	$s_{min,II}$	[mm]	100
	$s_{min,\perp}$	[mm]	120

1) Value in brackets for 349 Alfa Siebhülse; 349 Alfa Siebhülse 20x130 and 349 Alfa Siebhülse 20x200
2) For $V_{Rk,c}$: c_{min} according to Technical Report TR 054

Table C98: Group factor for anchor group in case of tension loading

Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		60	100	$\alpha_{g,N,II}$	[-]	1,0
		c_{cr}	250			2,0
⊥: anchors placed perpendicular to horizontal joint		60	120	$\alpha_{g,N,\perp}$		2,0

292 Alfa Injection mortar for masonry

Performance - Clay hollow brick Doppio Uni
Description of the brick, Spacing and edge distances, Group factor

Annex C39

Deutsches Institut für Bautechnik DIBt

Brick type: Clay hollow brick Doppio Uni

Table C99: Group factor for anchor group in case of shear loading parallel to free edge

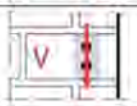
Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		c_{cr}	250	$\alpha_{g,V,II}$	[-]	2,0
⊥: anchors placed perpendicular to horizontal joint		c_{cr}	120	$\alpha_{g,V,\perp}$		2,0

Table C100: Group factor for anchor group in case of shear load perpendicular to free edge

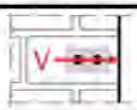
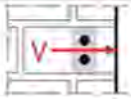
Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		c_{cr}	250	$\alpha_{g,V,II}$	[-]	2,0
⊥: anchors placed perpendicular to horizontal joint		c_{cr}	120	$\alpha_{g,V,\perp}$		2,0

Table C101: Characteristic values of resistance under tension and shear load

Anchor size	349 Alfa Sleeve	Effective Anchorage depth	Characteristic resistance			
			Use category			
			d/d w/d w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	All temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ [1]			$V_{Rk,b}$ [2)3)]
		[mm]	[kN]			[kN]
Compressive strength $f_b \geq 10$ N/mm²						
M8	12x80	80	0,6	0,6	0,5	1,5
M8 / M10/ IG-M6	16x85	85				
	16x130	130				
M12 / M16 / IG-M8 / IG-M10	20x85	85				
	20x130	130				
	20x200	200				

1) Values are valid for c_{cr} and c_{min}
2) Calculation of $V_{Rk,c}$ see Technical Report TR 054
3) The values are valid for steel 5.6 or higher. For steel 4.6 and 4.8 multiply $V_{Rk,b}$ by 0,8

292 Alfa Injection mortar for masonry

Performance - Clay hollow brick Doppio Uni
Group factor, Characteristic values of resistance

Annex C40

Brick type: Clay hollow brick Doppio Uni

Table C102: Characteristic values of resistance under tension and shear load (continue)

Anchor size	349 Alfa Sleeve	Effective Anchorage depth	Characteristic resistance			
			Use category			
			d/d w/d w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	All temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ [1]			$V_{Rk,b}$ [2)3)]
		[mm]	[kN]			[kN]
Compressive strength $f_b \geq 16$ N/mm²						
M8	12x80	80	0,75	0,75	0,6	2,0
M8 / M10/ IG-M6	16x85	85				
	16x130	130				
M12 / M16 / IG-M8 / IG-M10	20x85	85				
	20x130	130				
	20x200	200				
Compressive strength $f_b \geq 20$ N/mm²						
M8	12x80	80	0,9	0,9	0,75	2,0
M8 / M10/ IG-M6	16x85	85				
	16x130	130				
M12 / M16 / IG-M8 / IG-M10	20x85	85				
	20x130	130				
	20x200	200				
Compressive strength $f_b \geq 28$ N/mm²						
M8	12x80	80	1,2	1,2	0,9	2,5
M8 / M10/ IG-M6	16x85	85				
	16x130	130				
M12 / M16 / IG-M8 / IG-M10	20x85	85				
	20x130	130				
	20x200	200				

1) Values are valid for c_{cr} and c_{min}
2) Calculation of $V_{Rk,c}$ see Technical Report TR 054
3) The values are valid for steel 5.6 or higher. For steel 4.6 and 4.8 multiply $V_{Rk,b}$ by 0,8

Table C103: Displacements

Anchor size	349 Alfa Sleeve	h_{ef}	N	δ_N / N	δ_{N0}	$\delta_{N\infty}$	V	δ_{V0}	$\delta_{V\infty}$
		[mm]	[kN]	[mm/kN]	[mm]	[mm]	[kN]	[mm]	[mm]
All sizes	All sizes	All sizes	0,26	1,20	0,31	0,62	0,6	0,3	0,45

292 Alfa Injection mortar for masonry

Performance - Clay hollow brick Doppio Uni
Characteristic values of resistance, Displacements

Annex C41

Deutsches Institut für Bautechnik DIBt

Brick type: Hollow lightweight concrete Bloc creux B40

Table C104: Description of the brick

Brick type		Hollow Lightweight concrete Bloc creux B40
Bulk density	ρ [kg/dm^3]	0,8
Compressive strength	$f_b \geq$ [N/mm^2]	4
Code		EN 771-3
Producer (country code)		e.g. Sepa (FR)
Brick dimensions	[mm]	494 x 200 x 190
Drilling method		Rotary

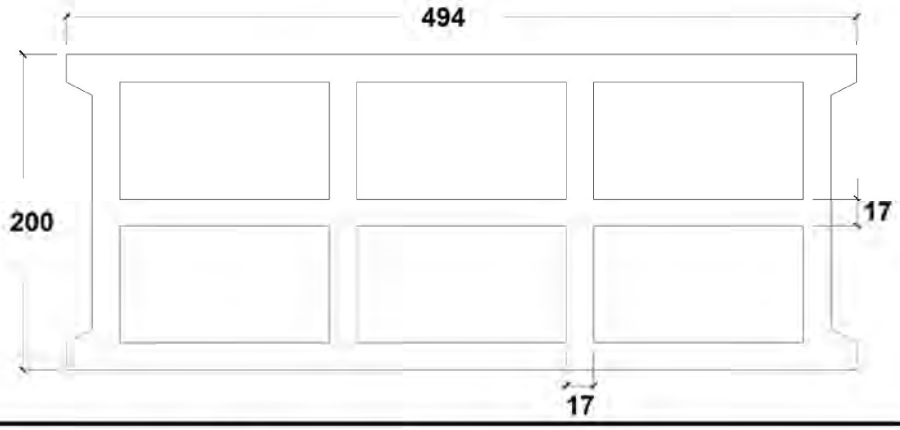
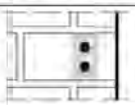


Table C105: Spacing and edge distances

Anchor size			**All sizes**
Edge distance	c_{cr}	[mm]	100 (120)[1]
Minimum edge distance	c_{min}[2]	[mm]	100 (120)[1]
Spacing	$s_{cr,II}$	[mm]	494
	$s_{cr,\perp}$	[mm]	190
Minimum spacing	s_{min}	[mm]	100

[1] Value in brackets for 349 Alfa Siebhülse 20x85 and 349 Alfa Siebhülse 20x130
[2] For $V_{Rk,c}$: c_{min} according to Technical Report TR 054

Table C106: Group factor for anchor group in case of tension loading

Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		100	100	$\alpha_{g,N,II}$	[-]	1,5
		c_{cr}	494			2,0
⊥: anchors placed perpendicular to horizontal joint		100	100	$\alpha_{g,N,\perp}$		1,0
		c_{cr}	190			2,0

292 Alfa Injection mortar for masonry

Performance - Hollow Lightweight concrete Bloc creux B40
Description of the brick, Spacing and edge distances, Group factor

Annex C42

Deutsches Institut für Bautechnik DIBt

Brick type: Hollow lightweight concrete Bloc creux B40

Table C107: Group factor for anchor group in case of shear loading parallel to free edge

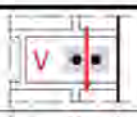
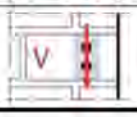
Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		50	100	$\alpha_{g,V,II}$	[-]	1,1
		c_{cr}	494			2,0
⊥: anchors placed perpendicular to horizontal joint		100	100	$\alpha_{g,V,\perp}$		1,1
		c_{cr}	190			2,0

Table C108: Group factor for anchor group in case of shear load perpendicular to free edge

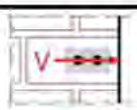
Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		c_{cr}	494	$\alpha_{g,V,II}$	[-]	2,0
⊥: anchors placed perpendicular to horizontal joint		c_{cr}	190	$\alpha_{g,V,\perp}$		2,0

Table C109: Characteristic values of resistance under tension and shear load

Anchor size	349 Alfa Sleeve	Effective anchorage depth	Characteristic resistance						
			Use category						
			d/d			w/d w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	40°C/24°C	80°C/50°C	120°C/72°C	All temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ [1]			$N_{Rk,b} = N_{Rk,p}$ [1]			$V_{Rk,b}$ [2)3)]
		[mm]	[kN]						
Compressive strength $f_b \geq 4$ N/mm²									
M8	12x80	80	1,2	0,9	0,75	0,9	0,9	0,75	3,0
M8 / M10/ IG-M6	16x85	85				1,2			
	16x130	130				1,2			
M12 / M16 / IG-M8 / IG-M10	20x85	85				1,2			
	20x130	130				1,2			

1) Values are valid for c_{cr} and c_{min}
2) Calculation of $V_{Rk,c}$ see Technical Report TR 054, except for shear load parallel to free edge with c ≥ 250 mm: $V_{Rk,c,II} = V_{Rk,b}$
3) The values are valid for steel 5.6 or higher. For steel 4.6 and 4.8 multiply $V_{Rk,b}$ by 0,8

Table C110: Displacements

Anchor size	349 Alfa Sleeve	h_{ef}	N	δ_N / N	δ_{N0}	$\delta_{N\infty}$	V	δ_{V0}	$\delta_{V\infty}$
		[mm]	[kN]	[mm/kN]	[mm]	[mm]	[kN]	[mm]	[mm]
All sizes	All sizes	All sizes	0,34	0,90	0,31	0,62	0,86	0,9	1,35

292 Alfa Injection mortar for masonry

Performance - Hollow lightweight concrete Bloc creux B40
Group factor, Characteristic values of resistance, Displacements

Annex C43

Deutsches Institut für Bautechnik DIBt

Brick type: Solid lightweight concrete - LAC

Table C111: Description of the brick

Brick type		Solid lightweight concrete LAC
Bulk density	ρ [kg/dm³]	0,6
Compressive strength	$f_b \geq$ [N/mm²]	2
Code		EN 771-3
Producer (country code)		e.g. Bisotherm (DE)
Brick dimensions	[mm]	300 x 123 x 248
Drilling method		Rotary

Table C112: Spacing and edge distances

Anchor size			All sizes
Edge distance	c_{cr}	[mm]	$1,5*h_{ef}$
Minimum edge distance	c_{min}	[mm]	60
Spacing	s_{cr}	[mm]	$3*h_{ef}$
Minimum spacing	s_{min}	[mm]	120

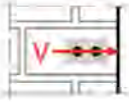
Table C113: Group factor for anchor group in case of tension loading

Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		90	120	$\alpha_{g,N,II}$	[-]	1,1
		1,5*hef	$3*h_{ef}$			2,0
⊥: anchors placed perpendicular to horizontal joint		124	120	$\alpha_{g,N,\perp}$		1,1
		1,5*hef	$3*h_{ef}$			2,0

Table C114: Group factor for anchor group in case of shear loading parallel to free edge

Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		60	120	$\alpha_{g,V,II}$	[-]	0,6
		90	120			2,0
⊥: anchors placed perpendicular to horizontal joint		60	120	$\alpha_{g,V,\perp}$		0,6
		124	120			2,0

Table C115: Group factor for anchor group in case of shear load perpendicular to free edge

Configuration		with c [mm] ≥	with s [mm] ≥			
II: anchors placed parallel to horizontal joint		60	120	$\alpha_{g,V,II}$	[-]	0,6
		90	120			2,0
⊥: anchors placed perpendicular to horizontal joint		60	120	$\alpha_{g,V,\perp}$		0,6
		1,5*hef	120			1,0
		1,5*hef	$3*h_{ef}$			2,0

292 Alfa Injection mortar for masonry

Performance - Solid lightweight concrete - LAC
Description of the brick, Spacing and edge distances, Group factor

Annex C44

Deutsches Institut für Bautechnik DIBt

Brick type: Solid lightweight concrete - LAC

Table C116: Characteristic values of resistance under tension and shear load

Anchor size	349 Alfa Sleeve	Effective anchorage depth	Characteristic resistance						
			Use category						
			d/d			w/d w/w			d/d w/d w/w
			40°C/24°C	80°C/50°C	120°C/72°C	40°C/24°C	80°C/50°C	120°C/72°C	All temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ [1]			$N_{Rk,b} = N_{Rk,p}$ [1]			$V_{Rk,b}$ [2)3)]
		[mm]	[kN]						
Compressive strength $f_b \geq 2$ N/mm²									
M8	-	80	3,0	2,5	2,0	2,5	2,0	1,5	3,0
M8 / M10/ IG-M6	-	90	3,0	3,0	2,0	2,5	2,5	2,0	3,0
M10 / IG-M8	-	100	3,5	3,0	2,5	3,0	2,5	2,0	3,0
M16 / IG-M10	-	100	3,0	3,0	2,0	3,0	3,0	2,0	3,0
M8	12x80	80	2,5	2,5	2,0	2,5	2,0	1,5	3,0
M8 / M10/ IG-M6	16x85	85	3,0	2,5	2,0	3,0	2,5	2,0	3,0
	16x130	130	3,0	2,5	2,0	3,0	2,5	2,0	3,0
M12 / M16 / IG-M8 / IG-M10	20x85	85	2,5	2,5	2,0	2,5	2,5	2,0	3,0
	20x130	130							
	20x200	200							

1) Values are valid for c_{cr}, values in brackets are valid for single anchors with c_{min}
2) For calculation of $V_{Rk,c}$ see Technical Report TR 054
3) The values are valid for steel 5.6 or higher. For steel 4.6 and 4.8 multiply $V_{Rk,b}$ by 0,8

Table C117: Displacements

Anchor size	349 Alfa Sleeve	h_{ef}	N	δ_N / N	δ_{N0}	$\delta_{N\infty}$	V	δ_{V0}	$\delta_{V\infty}$
		[mm]	[kN]	[mm/kN]	[mm]	[mm]	[kN]	[mm]	[mm]
M8	-	80	0,86	0,50	0,43	0,86	0,9	0,25	0,38
M8 / M10/ IG-M6	-	90							
M10 / IG-M8	-	100	1,00	0,35	0,35	0,70			
M16 / IG-M10	-	100	0,86		0,30	0,60			
M8	12x80	80	0,71	0,35	0,36	0,71	0,9	0,25	0,38
M8 / M10/ IG-M6	16x85	85			0,25	0,50			
	16x130	130							
M12 / M16 / IG-M8 / IG-M10	20x85	85							
	20x130	130							
	20x200	200							

292 Alfa Injection mortar for masonry

Performance - Solid lightweight concrete - LAC
Characteristic values of resistance, Displacements

Annex C45

Deutsches Institut für Bautechnik

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Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

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

European Technical Assessment ETA-18/1114 of 2 April 2019

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	292 Alfa Injection mortar for concrete
Product family to which the construction product belongs	Bonded fastener for use in concrete
Manufacturer	Alfa GmbH Ferdinand-Porsche-Straße 10 73479 Ellwangen DEUTSCHLAND
Manufacturing plant	Werk 1,D und Werk 2, D
This European Technical Assessment contains	29 pages including 3 annexes which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	EAD 330499-01-0601

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Specific Part

1 Technical description of the product

The "292 Alfa Injection mortar for concrete" is a bonded anchor consisting of a cartridge with injection mortar 292 Alfa and a steel element. The steel element consist of a threaded rod with washer and hexagon nut in the range of M8 to M30, reinforcing bar in the range of diameter ∅8 to ∅32 mm or internal threaded rod IG-M6 to IG-M20.

The steel element is placed into a drilled hole filled with injection mortar and is anchored via the bond between metal part, injection mortar and concrete.

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 to tension load (static and quasi-static loading)	See Annex C 1, C 2, C 3, C 6, C 7, C 9, C 10
Characteristic resistance to shear load (static and quasi-static loading)	See Annex C 1, C 4, C 8, C 11
Displacements (static and quasi-static loading)	See Annex C 13 and C 14
Characteristic resistance for seismic performance category C1	See Annex C 5 and C 12
Characteristic resistance and displacements for seismic performance category C2	No performance assessed

3.2 Hygiene, health and the environment (BWR 3)

Essential characteristic	Performance
Content, emission and/or release of dangerous substances	No performance assessed

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

In accordance with the European Assessment Document EAD 330499-01-0601 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 European Assessment Document

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

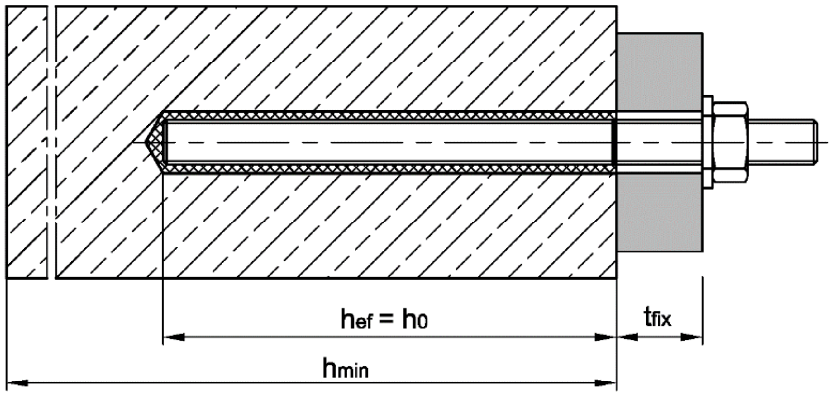
Issued in Berlin on 2 April 2019 by Deutsches Institut für Bautechnik

BD Dipl.-Ing. Andreas Kummerow
Head of Department

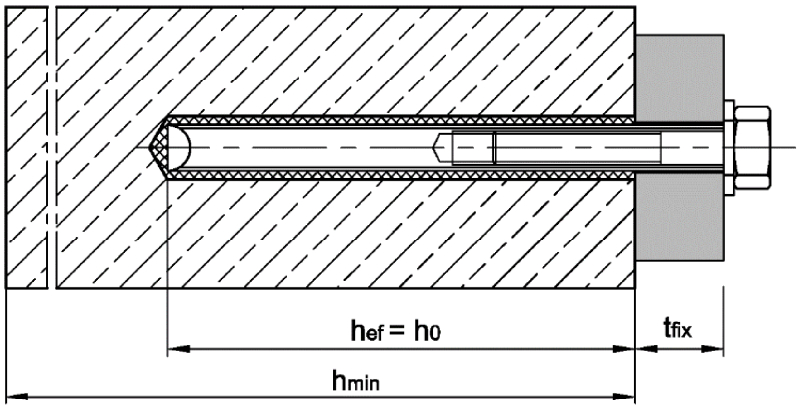
beglaubigt:
Baderschneider

Deutsches Institut für Bautechnik DIBt

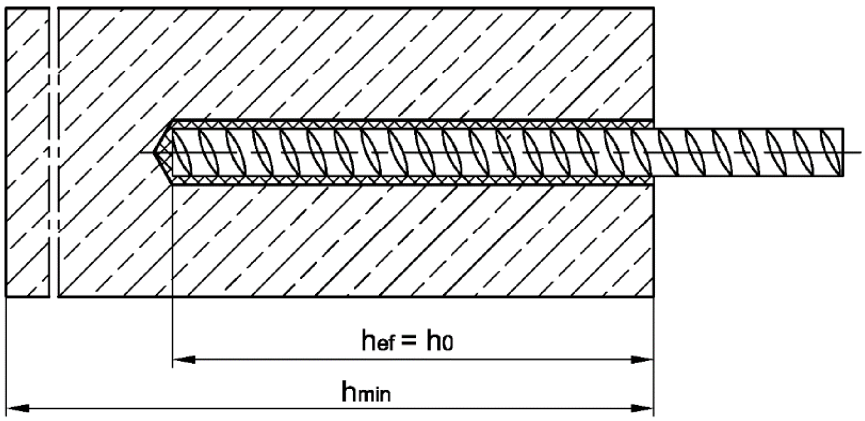
Installation threaded rod M8 to M30



Installation internally threaded anchor rod IG-M6 to IG-M20



Installation reinforcing bar Ø8 to Ø32



t_{fix} = thickness of fixture
h_{ef} = effective anchorage depth
h_0 = depth of drill hole
h_{min} = minimum thickness of member

292 Alfa Injectionmortar for concrete	Annex A1
Product description Installation situation	

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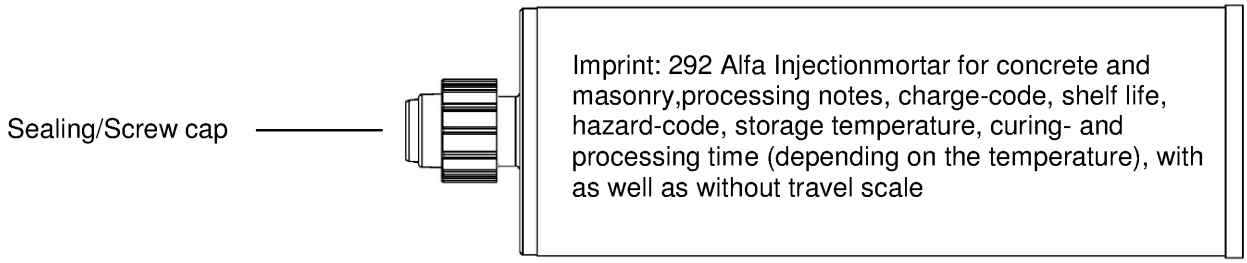
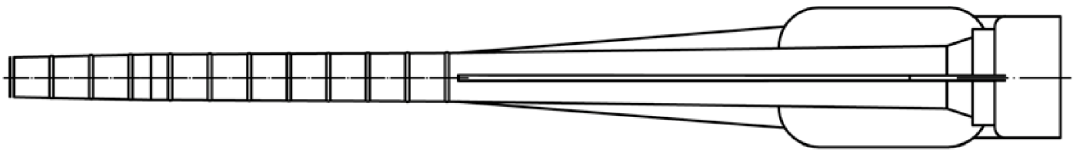
Cartridge 292 Alfa Injectionmortar

280 ml cartidge (Type: coaxial)



Static mixer



292 Alfa Injectionmortar for concrete

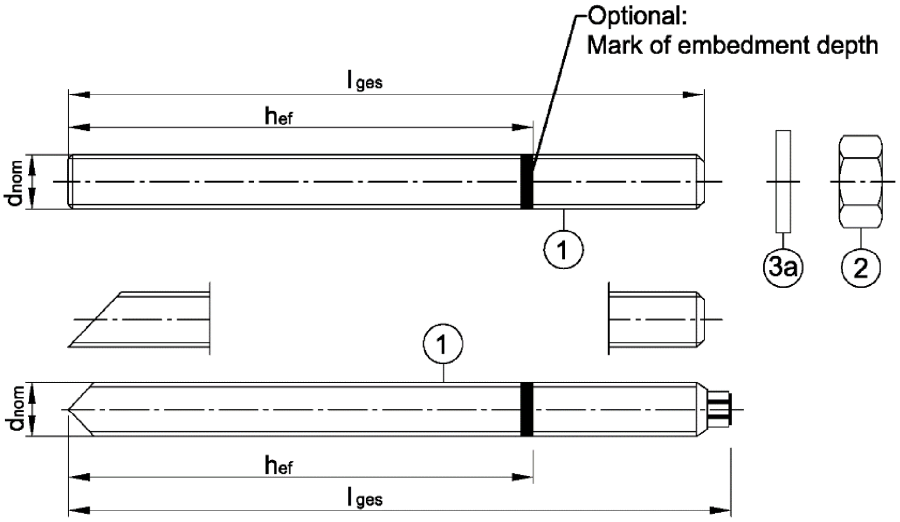
Product description
Cartridges and attachments

Annex A2

Anchor rods

302/314 Alfa anchor rods or anchor rods with hexagon head with washer and hexagon nut
M8, M10, M12, M16, M20, M24, M27, M30

3834/3837 Alfa threaded rod (material sold by the meter, to be cut at the required length)
M8, M10, M12, M16, M20, M24, M27, M30

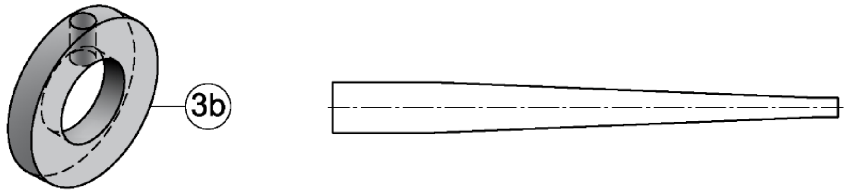


Marking: ◇ M10

◇	Identifying mark of manufacturing plant
M10	Size of thread
A4	additional marking for stainless steel
HCR	additional marking for High corrosion resistant steel

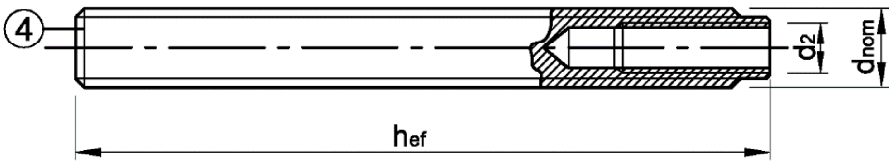
Commercial standard threaded rod with:
- Materials, dimensions and mechanical properties see Table A1
- Inspection certificate 3.1 acc. to EN 10204:2004

Washer with bore and reducing adapter for filling the gap between threaded rod and fixture



Internally threaded anchor rod

IG M6, IG M8, IG M10, IG M12, IG M16, IG M20



Marking e.g.: ◇ M8

◇	Identifying mark of manufacturing plant
I	Internal thread
M8	Size of internal thread
A4	additional marking for stainless steel
HCR	additional marking for high corrosion resistant steel

292 Alfa Injectionmortar for concrete	**Annex A3**
Product description Threaded rods and internally threaded anchor rod	

Deutsches Institut für Bautechnik DIBt

Table A1: Materials

Part	Designation		Material	
Steel, zinc plated electroplated ≥ 5 µm acc. to EN ISO 4042:1999 or hot-dip galvanised ≥ 40 µm acc. to EN ISO 1461:2009, EN ISO 10684:2004+AC:2009 or sherardized ≥ 40µm acc. to EN ISO 17668:2016				
1	Threaded rod	Property class 4.6	f_{uk}≥ 400 N/mm²; f_{yk}≥ 240 N/mm²; A_5 > 8 % fracture elongation	EN 10087:1998, EN 10263:2001; commercial standard threaded rod: EN ISO 898-1:2013
		Property class 4.8	f_{uk}≥ 400 N/mm²; f_{yk}≥ 320 N/mm²; A_5 > 8 % fracture elongation	
		Property class 5.6	f_{uk}≥ 500 N/mm²; f_{yk}≥ 300 N/mm²; A_5 > 8 % fracture elongation	
		Property class 5.8	f_{uk}≥ 500 N/mm²; f_{yk}≥ 400 N/mm²; A_5 > 8 % fracture elongation	
		Property class 8.8	f_{uk}≥ 800 N/mm²; f_{yk}≥ 640 N/mm²; A_5 > 8 % fracture elongation	
2	Hexagon nut		Steel, zinc plated Property class 4 (for class 4.6 or 4.8 rod) Property class 5 (for class 5.6 or 5.8 rod) Property class 8 (for class 8.8 rod)	EN ISO 898-2:2012
3a	Washer		Steel, zinc plated (e.g.: EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7094:2000)	
3b	Washer with bore		Steel, zinc plated	
4	Internally threaded anchor rod		Steel, electroplated, A_5 > 8 % fracture elongation Property class 5.8 and 8.8	EN 10087:1998
Stainless steel A4				
1	Threaded rod		Material 1.4401 / 1.4404 / 1.4571 / 1.4578 / 1.4362 / 1.4062	EN 10088-1:2014
		Property class 50	f_{uk}= 500 N/mm²; f_{yk}= 210 N/mm²; A_5 > 8 % fracture elongation	EN ISO 3506-1:2009
		Property class 70	f_{uk}= 700 N/mm²; f_{yk}= 450 N/mm²; A_5 > 8 % fracture elongation M8 to M24	
2	Hexagon nut		Stainless Steel A4 Property class 50 (for class 50 rod) Property class 70 (for class 70 rod; ≤ M24)	EN ISO 3506-2:2009
3a	Washer		Stainless Steel A4 (e.g.: EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7094:2000)	EN 10088-1: 2014
3b	Washer with bore		Material 1.4401 / 1.4404 / 1.4571 / 1.4362	
4	Internally threaded anchor rod		Material 1.4401 / 1.4404 / 1.4571 / 1.4362; A_5 > 8 % fracture elongation Property class 50 (IG-M20) Property class 70 (IG-M8 to IG-M16)	EN 10088-1: 2014
High corrosion resistant steel HCR				
1	Threaded rod		Material 1.4529 / 1.4565	EN 10088-1: 2014
		Property class 50	f_{uk}= 500 N/mm²; f_{yk}= 210 N/mm²; A_5 > 8 % fracture elongation	EN ISO 3506-1: 2009
		Property class 70	f_{uk}= 700 N/mm²; f_{yk}= 450 N/mm²; A_5 > 8 % fracture elongation M8 to M24	
2	Hexagon nut		Material 1.4529 / 1.4565 Property class 50 ((for class 50 rod) Property class 70 (for class 70 rod; ≤ M24)	EN 10088-1: 2014 EN ISO 3506-2:2009
3a	Washer		Material 1.4529 / 1.4565 (e.g.: EN ISO 7089:2000, EN ISO 7093:2000 or EN ISO 7094:2000)	EN 10088-1: 2014
3b	Washer with bore		Material 1.4529 / 1.4565	
4	Internally threaded anchor rod		Material 1.4529 / 1.4565, A_5 > 8 % fracture elongation Property class 50 (IG-M20) Property class 70 (IG-M8 to IG-M16)	EN 10088-1: 2014

292 Alfa Injectionmortar for concrete

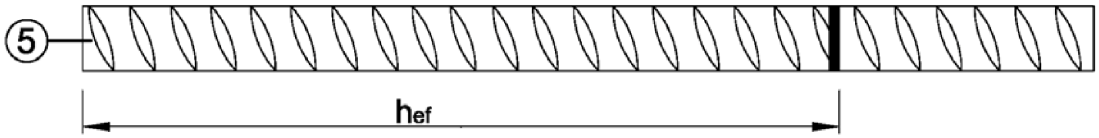
Product description
Materials threaded rods and internally threaded anchor rod

Annex A4

Deutsches Institut für Bautechnik DIBt

Reinforcing bar

Ø 8, Ø 10, Ø 12, Ø 14, Ø 16, Ø 20, Ø 25, Ø 28, Ø 32



- Minimum value of related rip area $f_{R,min}$ according to EN 1992-1-1:2004+AC:2010
- Rip height of the bar shall be in the range 0,05d ≤ h ≤ 0,07d
  (d: Nominal diameter of the bar; h: Rip height of the bar)

Table A2: Material rebar

Part	Designation	Material
Rebar		
5	Rebar EN 1992-1-1:2004+AC:2010, Annex C	Bars and de-coiled rods class B or C f_{yk} and k according to NDP or NCL of EN 1992-1-1/NA:2013 $f_{uk} = f_{tk} = k \cdot f_{yk}$

292 Alfa Injectionmortar for concrete

Product description
Product description and materials reinforcing bar

Annex A5

Deutsches Institut für Bautechnik DIBt

Specification of intended use

292 Alfa Injectionmortar for concrete	**Anchor rod**	**Internally threaded anchor rod**	**rebar**
	302/314 Alfa anchor rods, anchor rods wit hexagon head, 3834/3837 Alfa threaded rods, commercial standard threaded rod	IG	
Static or quasi-static action	M8 - M30 (zinc plated, A4, HCR)	IG-M6 - IG-M20 (electroplated, A4, HCR)	Ø8 - Ø32
Seismic action, category C1	M8 - M30 (zinc plated[1)], A4, HCR)	-	Ø8 - Ø32
Base materials	Compacted reinforced or unreinforced normal weight concrete without fibres acc. to EN 206:2013 Strength classes acc. to EN 206:2013 C20/25 to C50/60 Cracked and uncracked concrete		
Temperature Range I -40 °C to +40 °C	max long term temperature +24 °C and max short term temperature +40 °C		
Temperature Range II -40 °C to +80 °C	max long term temperature +50 °C and max short term temperature +80 °C		
Temperature Range III -40 °C to +120 °C	max long term temperature +72 °C and max short term temperature +120 °C		

[1)] except hot-dip galvanised

Use conditions (Environmental conditions):

- Structures subject to dry internal conditions
  (zinc coated steel, stainless steel or high corrosion resistant steel).
- Structures subject to external atmospheric exposure (including industrial and marine environment) and to permanently damp internal condition, if no particular aggressive conditions exist
  (stainless steel or high corrosion resistant steel).
- Structures subject to external atmospheric exposure and to permanently damp internal condition, if other particular aggressive conditions exist
  (high corrosion resistant steel).

  Note: 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).

Design:

- Verifiable calculation notes and drawings are prepared 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, etc.).
- Anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete work.
- Anchorages are designed in accordance with: EN 1992-4:2018 and EOTA Technical Report TR 055

Installation:

- Dry or wet concrete: M8 to M30, IG-M6 to IG-M20, Rebar Ø8 to Ø32.
- Flooded holes (not sea water): M8 to M16, IG-M6 to IG-M10, Rebar Ø8 to Ø16.
- Hole drilling by hammer or compressed air drill mode or vacuum drill mode.
- Overhead installation allowed.
- Anchor installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site.

292 Alfa Injectionmortar for concrete	**Annex B1**
Intended Use Specifications	

Deutsches Institut für Bautechnik DIBt

Table B1: Installation parameters for threaded rod

Threaded rod			M8	M10	M12	M16	M20	M24	M27	M30
Nominal drill hole diameter	d_0 =	[mm]	10	12	14	18	24	28	32	35
Effective anchorage depth	$h_{ef,min}$	[mm]	60	60	70	80	90	96	108	120
	$h_{ef,max}$	[mm]	160	200	240	320	400	480	540	600
Diameter of clearance hole in the fixture[1)]	$d_f \leq$	[mm]	9	12	14	18	22	26	30	33
Installation torque	$T_{inst} \leq$	[Nm]	10	20	40	80	120	160	180	200
Minimum thickness of member	h_{min}	[mm]	h_{ef} + 30 mm ≥ 100 mm			$h_{ef} + 2d_0$				
Minimum spacing	s_{min}	[mm]	40	50	60	80	100	120	135	150
Minimum edge distance	c_{min}	[mm]	40	50	60	80	100	120	135	150

[1)] for application under seismic loading the diameter of clearance hole in the fixture shall be at maximum d_{nom} + 1mm or alternatively the annular gap between fixture and threaded rod shall be completely filled with mortar

Table B2: Installation parameters for internally threaded anchor rod

Internally threaded anchor rod			IG-M 6	IG-M 8	IG-M 10	IG-M 12	IG-M 16	IG-M 20
Inner diameter of threaded rod	d_2 =	[mm]	6	8	10	12	16	20
Outer diameter of threaded rod[2)]	d_{nom} =	[mm]	10	12	16	20	24	30
Nominal drill hole diameter	d_0 =	[mm]	12	14	18	24	28	35
Effective anchorage depth	$h_{ef,min}$	[mm]	60	70	80	90	96	120
	$h_{ef,max}$	[mm]	200	240	320	400	480	600
Diameter of clearance hole in the fixture[1)]	$d_f \leq$	[mm]	7	9	12	14	18	22
Installation torque	$T_{inst} \leq$	[Nm]	10	10	20	40	60	100
Minimum screw-in depth	l_{IG}	[mm]	8	8	10	12	16	20
Minimum thickness of member	h_{min}	[mm]	h_{ef} + 30 mm ≥ 100 mm		$h_{ef} + 2d_0$			
Minimum spacing	s_{min}	[mm]	50	60	80	100	120	150
Minimum edge distance	c_{min}	[mm]	50	60	80	100	120	150

[1)] With metric thread acc. to EN 1993-1-8:2005+AC:2009

Table B3: Installation parameters for rebar

Rebar			Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 25	Ø 28	Ø 32
Nominal drill hole diameter	d_0 =	[mm]	12	14	16	18	20	24	32	35	40
Effective anchorage depth	$h_{ef,min}$	[mm]	60	60	70	75	80	90	100	112	128
	$h_{ef,max}$	[mm]	160	200	240	280	320	400	500	560	640
Minimum thickness of member	h_{min}	[mm]	h_{ef} + 30 mm ≥ 100 mm		$h_{ef} + 2d_0$						
Minimum spacing	s_{min}	[mm]	40	50	60	70	80	100	125	140	160
Minimum edge distance	c_{min}	[mm]	40	50	60	70	80	100	125	140	160

292 Alfa Injectionmortar for concrete

Intended Use
Installation parameters

Annex B2

Deutsches Institut für Bautechnik DIBt

Table B4: Parameter cleaning and setting tools

Threaded rod	Internally threaded anchor rod	Rebar	Drill bit Ø	Brush Ø	min. Brush Ø	Retaining washer			
							Installation direction and use of retaining washer		
[-]	[-]	Ø [mm]	d_0 [mm]	d_b [mm]	$d_{b,min}$ [mm]	[-]	⬇	➡	⬆
M8			10	12	10,5	No **retaining washer** required			
M10	IG M6	8	12	14	12,5				
M12	IG M8	10	14	16	14,5				
		12	16	18	16,5				
M16	IG M10	14	18	20	18,5	18	h_{ef} > 250mm	h_{ef} > 250mm	all
		16	20	22	20,5	20			
M20	IG M12	20	24	26	24,5	24			
M24	IG M16		28	30	28,5	28			
M27		25	32	34	32,5	32			
M30	IG M20	28	35	37	35,5	35			
		32	40	41,5	40,5	40			

Blow-out pump (volume 750ml)
Drill bit diameter (d_0): 10 mm to 20 mm
Anchorage depth (h_{ef}): ≤ 10 d_{nom}
for uncracked concrete

Recommended compressed air tool (min 6 bar)
All applications

Retaining washer for overhead or horizontal installation
Drill bit diameter (d_0):
18 mm to 40 mm

Steel brush
Drill bit diameter (d_0): all diameters

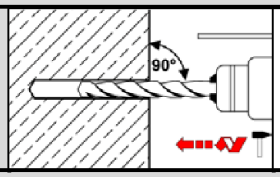
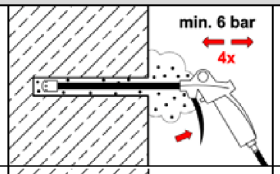
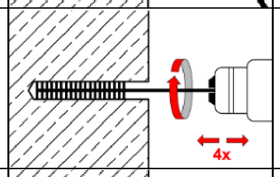
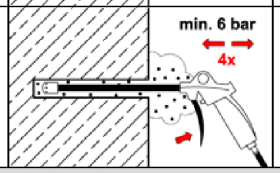
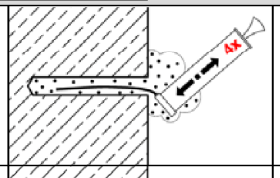
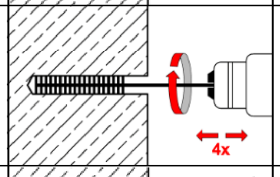
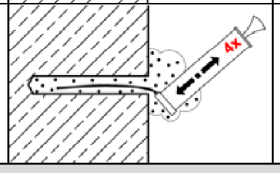
292 Alfa Injectionmortar for concrete

Intended Use
Cleaning and setting tools

Annex B3

Deutsches Institut für Bautechnik DIBt

Installation instructions

Drilling of the hole		
1.		Drill the borehole by apllying the drilling method acc. to Annex B1, the drill bit diameter (Table B4) and the selected borehole depth. In case of aborted drill hole, the drill hole shall be filled with mortar
Cleaning		
2.	**Attention! Standing water in the bore hole must be removed before cleaning!**	
	Cleaning with compressed air (all diameters, cracked and uncracked concrete)	
	2a. 	Starting from the bottom or back of the bore hole, blow out the hole with compressed air (min. 6 bar) **four** times. If the bore hole ground is not reached, an extension must be used.
	2b. 	Attach the brush to a drilling machine or a battery screwdriver. Brush the hole with an appropriate sized wire brush > $d_{b,min}$ (Table B4) **four** times. If the bore hole ground is not reached, a brush extension shall be used.
	2c. 	Finally blow the hole clean again with compressed air (min. 6 bar) **four** times. If the bore hole ground is not reached an extension shall be used.
	Manual cleaning Uncracked concrete: Bore hole diameter $d_0 \leq 20$mm and effective anchorage depth $h_{ef} \leq 10\ d_{nom}$ Cracked concrete: Bore hole diameter: 14mm $\leq d_0 \leq$ 20mm and effective anchorage depth $h_{ef} \leq 10\ d_{nom}$	
	2a. 	Starting from the bottom or back of the bore hole, blow the hole clean with the blow-out pump **four** times.
	2b. 	Attach the brush to a drilling machine or a battery screwdriver. Brush the hole with an appropriate sized wire brush > $d_{b,min}$ (Table B4) **four** times. If the bore hole ground is not reached, a brush extension shall be used.
	2c. 	Finally blow the hole clean again with the blow-out pump **four** times.
	After cleaning, the bore hole has to be protected against re-contamination in an appropriate way, until dispensing the mortar in the bore hole. If necessary, the cleaning has to be repeated directly before dispensing the mortar. In-flowing water must not contaminate the bore hole again.	

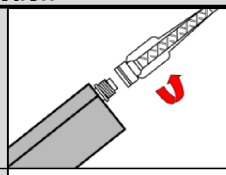
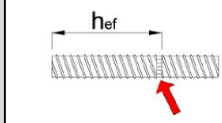
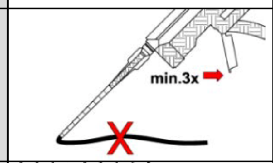
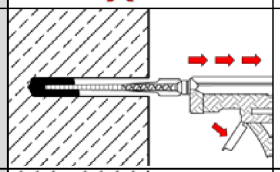
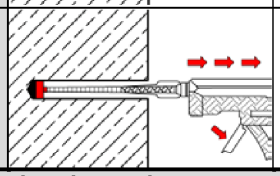
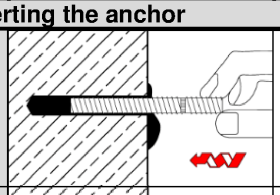
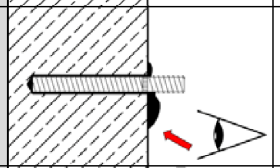
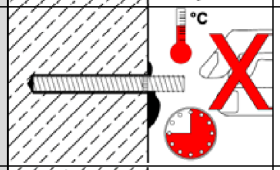
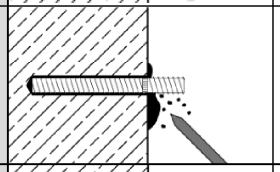
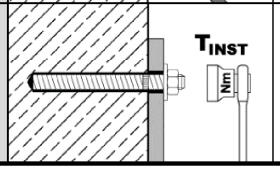
292 Alfa Injectionmortar for concrete

Intended Use
Installation instructions

Annex B4

Deutsches Institut für Bautechnik DIBt

Installation instructions (continuation)

Injection		
3.		Attach a supplied static-mixing nozzle to the cartridge and load the cartridge into the correct dispensing tool. For every working interruption longer than the recommended working time (Table B5) as well as for new cartridges, a new static-mixer shall be used.
4.		Before injecting the mortar, mark the required anchorage depth on the fastening element.
5.		Prior to dispensing into the drill hole, squeeze out separately a minimum of three full strokes and discard non-uniformly mixed adhesive components until the mortar shows a consistent grey colour. For tubular film cartridges dismiss a minimum of six full strokes.
6a.		Starting from the bottom or back of the cleaned drill hole fill the hole up to approximately two-thirds with adhesive. Slowly withdraw the static mixing nozzle as the hole fills to avoid air pockets. For embedment larger than 190mm an extension nozzle shall be used. Observe the gel-/ working times given in Table B5.
6b.		Retaining washer and mixer nozzle extensions shall be used according to Annex B3 for the following applications: • Horizontal installation (horizontal direction) and ground installation (vertical downwards direction): Drill bit-Ø $d_0 \geq 18$ mm and embedment depth $h_{ef} > 250$mm • Overhead installation: Drill bit-Ø $d_0 \geq 18$ mm
Inserting the anchor		
7.		Push the threaded rod into the hole while turning slightly to ensure proper distribution of the adhesive until the embedment depth is reached. The anchor shall be free of dirt, grease, oil or other foreign material.
8.		Make sure that the anchor is fully seated up to the full embedment depth and that excess mortar is visible at the top of the hole. If these requirements are not maintained, pull out the rod immediately and start again with step 6. For overhead installation, the anchor should be fixed (e.g. by wedges).
9.		Allow the adhesive to cure to the specified time prior to applying any load or torque. Do not move or load the anchor until it is fully cured (Table B5).
10.		Remove excess mortar.
11.		The fixture can be mounted after curing time. Apply installation torque Tinst according to Table B1or B2 by using a calibrated torque wrench. Optionally, the annular gap between anchor rod and attachment can be filled with mortar. Therefor replace the regular washer by washer with bore and plug on reducing adapter on static mixer. Annular gap is completely filled, when excess mortar seeps out.

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Intended Use
Installation instructions (continuation)

Annex B5

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Table B5: Maximum processing time and minimum curing time, 292 Alfa Injectionmortar

Concrete temperature	Maximum processing time	Minimum curing time in dry concrete[1)]
-10°C to -6°C	90 min[2)]	24 h[2)]
-5°C to -1°C	90 min	14 h
0°C to +4°C	45 min	7 h
+5°C to +9°C	25 min	2 h
+10°C to +19°C	15 min	80 min
+20°C to +29°C	6 min	45 min
+30°C to +34°C	4 min	25 min
+35°C to +39°C	2 min	20 min
+ 40°C	1,5 min	15 min
Cartridge temperature	+ 5°C to + 40°C	

[1)] In wet concrete the curing time must be doubled.
[2)] Cartridge temperature must be at min. + 15°C.

292 Alfa Injectionmortar for concrete

Intended Use
Processing time and curing time

Annex B6

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Table C1: Characteristic **steel resistances** for **threaded rods** under tension and shear loads

Threaded rod				**M 8**	**M 10**	**M 12**	**M 16**	**M 20**	**M 24**	**M 27**	**M 30**
Steel failure											
Tension load											
Characteristic tension resistance	Steel, Property class 4.6 and 4.8	$N_{Rk,s}$	[kN]	15	23	34	63	98	141	184	224
	Steel, Property class 5.6 and 5.8	$N_{Rk,s}$	[kN]	18	29	42	78	122	176	230	280
	Steel, Property class 8.8	$N_{Rk,s}$	[kN]	29	46	67	125	196	282	368	449
	Stainless steel A4 and HCR, Property class 50	$N_{Rk,s}$	[kN]	18	29	42	79	123	177	230	281
	Stainless steel A4 and HCR, Property class 70	$N_{Rk,s}$	[kN]	26	41	59	110	171	247	-	-
Partial factor	Steel, Property class 4.6	$\gamma_{Ms,N}$	[-]	2,0							
	Steel, Property class 4.8	$\gamma_{Ms,N}$	[-]	1,5							
	Steel, Property class 5.6	$\gamma_{Ms,N}$	[-]	2,0							
	Steel, Property class 5.8	$\gamma_{Ms,N}$	[-]	1,5							
	Steel, Property class 8.8	$\gamma_{Ms,N}$	[-]	1,5							
	Stainless steel A4 and HCR, Property class 50	$\gamma_{Ms,N}$	[-]	2,86							
	Stainless steel A4 and HCR, Property class 70	$\gamma_{Ms,N}$	[-]	1,87						-	-
Shear load											
Steel failure <u>without</u> lever arm											
Characteristic shear resistance	Steel, Property class 4.6 and 4.8	$V^0_{Rk,s}$	[kN]	7	12	17	31	49	71	92	112
	Steel, Property class 5.6 and 5.8	$V^0_{Rk,s}$	[kN]	9	15	21	39	61	88	115	140
	Steel, Property class 8.8	$V^0_{Rk,s}$	[kN]	15	23	34	63	98	141	184	224
	Stainless steel A4 and HCR, Property class 50	$V^0_{Rk,s}$	[kN]	9	15	21	39	61	88	115	140
	Stainless steel A4 and HCR, Property class 70	$V^0_{Rk,s}$	[kN]	13	20	30	55	86	124	-	-
Steel failure <u>with</u> lever arm											
Characteristic bending moment	Steel, Property class 4.6 and 4.8	$M^0_{Rk,s}$	[Nm]	15	30	52	133	260	449	666	900
	Steel, Property class 5.6 and 5.8	$M^0_{Rk,s}$	[Nm]	19	37	65	166	324	560	833	1123
	Steel, Property class 8.8	$M^0_{Rk,s}$	[Nm]	30	60	105	266	519	896	1333	1797
	Stainless steel A4 and HCR, Property class 50	$M^0_{Rk,s}$	[Nm]	19	37	66	167	325	561	832	1125
	Stainless steel A4 and HCR, Property class 70	$M^0_{Rk,s}$	[Nm]	26	52	92	232	454	784	-	-
Partial factor	Steel, Property class 4.6	$\gamma_{Ms,V}$	[-]	1,67							
	Steel, Property class 4.8	$\gamma_{Ms,V}$	[-]	1,25							
	Steel, Property class 5.6	$\gamma_{Ms,V}$	[-]	1,67							
	Steel, Property class 5.8	$\gamma_{Ms,V}$	[-]	1,25							
	Steel, Property class 8.8	$\gamma_{Ms,V}$	[-]	1,25							
	Stainless steel A4 and HCR, Property class 50	$\gamma_{Ms,V}$	[-]	2,38							
	Stainless steel A4 and HCR, Property class 70	$\gamma_{Ms,V}$	[-]	1,56						-	-

292 Alfa Injectionmortar for concrete

Performance
Characteristic steel resistances for **threaded rods** under **tension** and **shear loads**

Annex C1

Deutsches Institut für Bautechnik DIBt

Table C2: Characteristic values for **threaded rods** under **tension loads** in **cracked concrete**

Threaded rod				**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Steel failure											
Characteristic tension resistance		$N_{Rk,s}$	[kN]	see table C1							
Combined pull-out and concrete cone failure											
Characteristic bond resistance in cracked concrete C20/25											
Temperature range I: 40°C/24°C	dry and wet concrete	$\tau_{Rk,cr}$	[N/mm²]	4,0	5,0	5,5	5,5	5,5	5,5	6,5	6,5
	flooded bore hole	$\tau_{Rk,cr}$	[N/mm²]	4,0	4,0	5,5	5,5	no performance determined (NPD)			
Temperature range II: 80°C/50°C	dry and wet concrete	$\tau_{Rk,cr}$	[N/mm²]	2,5	3,5	4,0	4,0	4,0	4,0	4,5	4,5
	flooded bore hole	$\tau_{Rk,cr}$	[N/mm²]	2,5	3,0	4,0	4,0	no performance determined (NPD)			
Temperature range III: 120°C/72°C	dry and wet concrete	$\tau_{Rk,cr}$	[N/mm²]	2,0	2,5	3,0	3,0	3,0	3,0	3,5	3,5
	flooded bore hole	$\tau_{Rk,cr}$	[N/mm²]	2,0	2,5	3,0	3,0	no performance determined (NPD)			
Increasing factor for $\tau_{Rk,cr}$		ψ_c	C25/30	1,02							
			C30/37	1,04							
			C35/45	1,07							
			C40/50	1,08							
			C45/55	1,09							
			C50/60	1,10							
Concrete cone failure											
Factor k_1		$k_{cr,N}$	[-]	7,7							
Edge distance		$c_{cr,N}$	[mm]	1,5 h_{ef}							
Axial distance		$s_{cr,N}$	[mm]	3,0 h_{ef}							
Installation factor (dry and wet concrete)		γ_{inst}	[-]	1,0	1,2						
Installation factor (flooded bore hole)		γ_{inst}	[-]	1,4				no performance determined (NPD)			

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Table C3: Characteristic values for **threaded rods** under **tension loads** in **uncracked concrete**

Threaded rod				**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Steel failure											
Characteristic tension resistance		$N_{Rk,s}$	[kN]	see table C1							
Combined pull-out and concrete cone failure											
Characteristic bond resistance in uncracked concrete C20/25											
Temperature range I: 40°C/24°C	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	10	12	12	12	12	11	10	9
	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	7,5	8,5	8,5	8,5	no performance determined (NPD)			
Temperature range II: 80°C/50°C	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	7,5	9	9	9	9	8,5	7,5	6,5
	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	5,5	6,5	6,5	6,5	no performance determined (NPD)			
Temperature range III: 120°C/72°C	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	5,5	6,5	6,5	6,5	6,5	6,5	5,5	5,0
	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	4,0	5,0	5,0	5,0	no performance determined (NPD)			
Increasing factor for $\tau_{Rk,ucr}$		ψ_c	C25/30	1,02							
			C30/37	1,04							
			C35/45	1,07							
			C40/50	1,08							
			C45/55	1,09							
			C50/60	1,10							
Concrete cone failure											
Factor k_1		$k_{ucr,N}$	[-]	11,0							
Edge distance		$c_{cr,N}$	[mm]	1,5 h_{ef}							
Axial distance		$s_{cr,N}$	[mm]	3,0 h_{ef}							
Splitting failure											
Edge distance for		$c_{cr,sp}$	[mm]	$1{,}0 \cdot h_{ef} \le 2 \cdot h_{ef}\left(2{,}5-\frac{h}{h_{ef}}\right) \le 2{,}4 \cdot h_{ef}$							
Axial distance		$s_{cr,sp}$	[mm]	2 $c_{cr,sp}$							
Installation factor (dry and wet concrete)		γ_{inst}	[-]	1,0	1,2						
Installation factor (flooded bore hole)		γ_{inst}	[-]	1,4				no performance determined (NPD)			

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Performance
Characteristic values for **threaded rods** under **tension loads** in **uncracked concrete**

Annex C3

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Table C4: Characteristic values for **threaded rods** under **shear loads** in **cracked and uncracked concrete**

Threaded rod			**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Steel failure without lever arm										
Characteristic shear resistance	$V^0_{Rk,s}$	[kN]	see table C1							
Ductility factor	k_7	[-]	0,8							
Steel failure with lever arm										
Characteristic bending moment	$M^0_{Rk,s}$	[Nm]	see table C1							
Concrete pry-out failure										
Pry-out Faktor	k_8	[-]	2,0							
Concrete edge failure										
Effective length of anchor	l_f	[mm]	$l_f = \min(h_{ef}; 8\ d_{nom})$							
Outside diameter of anchor	d_{nom}	[mm]	8	10	12	16	20	24	27	30
Installation factor	γ_{inst}	[-]	1,0							

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Performance
Characteristic value for **threaded rods** under **shear loads**

Annex C4

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Table C5: Characteristic values for **threaded rods** under **seismic action**, category **C1**

Threaded rod				**M8**	**M10**	**M12**	**M16**	**M20**	**M24**	**M27**	**M30**
Tension load											
Steel failure											
Characteristic tension resistance		$N_{Rk,s,eq}$	[kN]	$1,0 \cdot N_{Rk,s}$ (see table C1)							
Combined pull-out and concrete cone failure											
Characteristic bond resistance in concrete C20/25 to C50/60											
Temperature range I: 40°C/24°C	dry and wet concrete	$\tau_{Rk,eq}$	[N/mm²]	2,5	3,1	3,7	3,7	3,7	3,8	4,5	4,5
	flooded bore hole	$\tau_{Rk,eq}$	[N/mm²]	2,5	2,5	3,7	3,7	no performance determined (NPD)			
Temperature range II: 80°C/50°C	dry and wet concrete	$\tau_{Rk,eq}$	[N/mm²]	1,6	2,2	2,7	2,7	2,7	2,8	3,1	3,1
	flooded bore hole	$\tau_{Rk,eq}$	[N/mm²]	1,6	1,9	2,7	2,7	no performance determined (NPD)			
Temperature range III: 120°C/72°C	dry and wet concrete	$\tau_{Rk,eq}$	[N/mm²]	1,3	1,6	2,0	2,0	2,0	2,1	2,4	2,4
	flooded bore hole	$\tau_{Rk,eq}$	[N/mm²]	1,3	1,6	2,0	2,0	no performance determined (NPD)			
Increasing factor for $\tau_{Rk,seis}$		ψ_c	[-]	1,0							
Installation factor (dry and wet concrete)		γ_{inst}	[-]	1,0	1,2						
Installation factor (flooded bore hole)		γ_{inst}	[-]	1,4				no performance determined (NPD)			
Shear load											
Steel failure without lever arm											
Characteristic shear resistance		$V_{Rk,s,eq}$	[kN]	$0,7 \cdot V^0_{Rk,s}$ (see table C1)							
Steel failure with lever arm											
Characteristic bending moment		$M^0_{Rk,s,eq}$	[Nm]	No Performance Determined (NPD)							

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Performance
Characteristic values for **threaded rods** under **seismic action**, category **C1**

Annex C5

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Table C6: Characteristic values of **tension loads** for **internally threaded anchor rods** in **cracked concrete**

Internally threaded anchor rod				**IG-M 6**	**IG-M 8**	**IG-M 10**	**IG-M 12**	**IG-M 16**	**IG-M20**
Steel failure [1]									
Characteristic shear resistance Steel, strength class 5.8		$N_{Rk,s}$	[kN]	10	18	29	42	79	123
Partial factor		$\gamma_{Ms,N}$	[-]	1,5					
Characteristic shear resistance Steel, strength class 8.8		$N_{Rk,s}$	[kN]	16	27	46	67	121	196
Partial factor		$\gamma_{Ms,N}$	[-]	1,5					
Characteristic shear resistance Stainless steel A4 / HCR, strength class 70		$N_{Rk,s}$	[kN]	14	26	41	59	110	124 [2]
Partial factor		$\gamma_{Ms,N}$	[-]	1,87					2,86
Combined pull-out and concrete cone failure									
Characteristic bond resistance in **cracked** concrete C20/25									
Temperature range I: 40°C/24°C	dry and wet concrete	$\tau_{Rk,cr}$	[N/mm²]	5,0	5,5	5,5	5,5	5,5	6,5
	flooded bore hole	$\tau_{Rk,cr}$	[N/mm²]	4,0	5,5	5,5	no performance determined (NPD)		
Temperature range II: 80°C/50°C	dry and wet concrete	$\tau_{Rk,cr}$	[N/mm²]	3,5	4,0	4,0	4,0	4,0	4,5
	flooded bore hole	$\tau_{Rk,cr}$	[N/mm²]	3,0	4,0	4,0	no performance determined (NPD)		
Temperature range III: 120°C/72°C	dry and wet concrete	$\tau_{Rk,cr}$	[N/mm²]	2,5	3,0	3,0	3,0	3,0	3,5
	flooded bore hole	$\tau_{Rk,cr}$	[N/mm²]	2,5	3,0	3,0	no performance determined (NPD)		
Increasing factor for $\tau_{Rk,cr}$		ψ_c	C25/30	1,02					
			C30/37	1,04					
			C35/45	1,07					
			C40/50	1,08					
			C45/55	1,09					
			C50/60	1,10					
Concrete cone failure									
Factor k_1		$k_{cr,N}$	[-]	7,7					
Edge distance		$c_{cr,N}$	[mm]	1,5 h_{ef}					
Spacing		$s_{cr,N}$	[mm]	3,0 h_{ef}					
Installation factor (dry and wet concrete)		γ_{inst}	[-]	1,2					
Installation factor (flooded bore hole)		γ_{inst}	[-]	1,4			no performance determined (NPD)		

[1] Fastening screws or threaded rods (incl. nut and washer) must compley with the appropriate material and property class of the internally threaded anchor rod. The characteristic tension resistance for steel failure of the given strength class are valid for the internally threaded anchor rod and the fastening element

[2] For IG M20: Internally threaded rod: strength class 50; Fastening screws or threaded rods (incl. nut and washer): strength class 70

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Performance
Characteristic values for **internally threaded anchor rods** under **tension loads** in **cracked concrete**

Annex C6

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Table C7: Characteristic values of **tension loads** for **internally threaded anchor rods** in **uncracked concrete**

Internally threaded anchor rod				**IG-M 6**	**IG-M 8**	**IG-M 10**	**IG-M 12**	**IG-M 16**	**IG-M 20**
Steel failure [1]									
Characteristic shear resistance Steel, strength class 5.8		$N_{Rk,s}$	[kN]	10	18	29	42	79	123
Partial factor		$\gamma_{Ms,N}$	[-]	1,5					
Characteristic shear resistance Steel, strength class 8.8		$N_{Rk,s}$	[kN]	16	27	46	67	121	196
Partial factor		$\gamma_{Ms,N}$	[-]	1,5					
Characteristic shear resistance Stainless steel A4 / HCR, strength class 70		$N_{Rk,s}$	[kN]	14	26	41	59	110	124 [2]
Partial factor		$\gamma_{Ms,N}$	[-]	1,87					2,86
Combined pull-out and concrete cone failure									
Characteristic bond resistance in **uncracked** concrete C20/25									
Temperature range I: 40°C/24°C	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	12	12	12	12	11	9,0
	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	8,5	8,5	8,5	no performance determined		
Temperature range II: 80°C/50°C	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	9,0	9,0	9,0	9,0	8,5	6,5
	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	6,5	6,5	6,5	no performance determined		
Temperature range III: 120°C/72°C	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	6,5	6,5	6,5	6,5	6,5	5,0
	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	5,0	5,0	5,0	no performance determined		
Increasing factor for $\tau_{Rk,ucr}$		ψ_c	C25/30	1,02					
			C30/37	1,04					
			C35/45	1,07					
			C40/50	1,08					
			C45/55	1,09					
			C50/60	1,10					
Concrete cone failure									
Factor k_1		$k_{ucr,N}$	[-]	11,0					
Edge distance		$c_{cr,N}$	[mm]	1,5 h_{ef}					
Spacing		$s_{cr,N}$	[mm]	3,0 h_{ef}					
Splitting failure									
Edge distance	$h/h_{ef} \geq 2,0$	$c_{cr,sp}$	[mm]	1,0 h_{ef}					
	$2,0 > h/h_{ef} > 1,3$			2 * h_{ef} (2,5 – h / h_{ef})					
	$h/h_{ef} \leq 1,3$			2,4 h_{ef}					
Spacing		$s_{cr,sp}$	[mm]	2 $c_{cr,sp}$					
Installation factor (dry and wet concrete)		γ_{inst}	[-]	1,2					
Installation factor (flooded bore hole)		γ_{inst}	[-]	1,4			no performance determined		

[1] Fastening screws or threaded rods (incl. nut and washer) must compley with the appropriate material and property class of the internally threaded anchor rod. The characteristic tension resistance for steel failure of the given strength class are valid for the internally threaded anchor rod and the fastening element.

[2] For IG M20: Internally threaded rod: strength class 50; Fastening screws or threaded rods (incl. nut and washer): strength class 70

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Performance
Characteristic values for **internally threaded anchor rods** under **tension loads** in **uncracked concrete**

Annex C7

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Table C8: Characteristic values for **internally threaded anchor rods** under **shear loads** in **cracked and uncracked concrete**

Internally threaded anchor rod			**IG-M 6**	**IG-M 8**	**IG-M 10**	**IG-M 12**	**IG-M 16**	**IG-M 20**
Steel failure without lever arm[1]								
Characteristic shear resistance Steel, strength class 5.8	$V^0_{Rk,s}$	[kN]	5	9	15	21	39	61
Partial factor	$\gamma_{Ms,V}$	[-]	1,25					
Characteristic shear resistance Steel, strength class 8.8	$V^0_{Rk,s}$	[kN]	8	14	23	34	60	98
Partial factor	$\gamma_{Ms,V}$	[-]	1,25					
Characteristic shear resistance Stainless steel A4 / HCR, strength class 70	$V^0_{Rk,s}$	[kN]	7	13	20	30	55	62 [2]
Partial factor	$\gamma_{Ms,V}$	[-]	1,56					2,38
Ductility factor	k_7	[-]	0,8					
Steel failure with lever arm[1]								
Characteristic bending moment, Steel, strength class 5.8	$M^0_{Rk,s}$	[Nm]	8	19	37	66	167	325
Partial factor	$\gamma_{Ms,V}$	[-]	1,25					
Characteristic bending moment, Steel, strength class 8.8	$M^0_{Rk,s}$	[Nm]	12	30	60	105	267	519
Partial factor	$\gamma_{Ms,V}$	[-]	1,25					
Characteristic bending moment, Stainless steel A4 / HCR, strength class 70	$M^0_{Rk,s}$	[Nm]	11	26	53	92	234	643 [2]
Partial factor	$\gamma_{Ms,V}$	[-]	1,56					2,38
Concrete pry-out failure								
Pry-out Faktor	k_8	[-]	2,0					
Concrete edge failure								
Effective length of anchor	l_f	[mm]	$l_f = \min(h_{ef}; 8\ d_{nom})$					
Outside diameter of anchor	d_{nom}	[mm]	10	12	16	20	24	30
Installation factor	γ_{inst}	[-]	1,0					

[1] Fastening screws or threaded rods (incl. nut and washer) must compley with the appropriate material and property class of the internally threaded anchor rod. The characteristic shear resistance for steel failure of the given strength class are valid for the internally threaded anchor rod and the fastening element

[2] For IG M20: Internally threaded rod: strength class 50; Fastening screws or threaded rods (incl. nut and washer): strength class 70

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Table C9: Characteristic values for **rebar** under **tension loads** in **cracked concrete**

Rebar				**Ø 8**	**Ø 10**	**Ø 12**	**Ø 14**	**Ø 16**	**Ø 20**	**Ø 25**	**Ø 28**	**Ø 32**
Steel failure												
Characteristic tension resistance		$N_{Rk,s}$	[kN]	$A_s \cdot f_{uk}$ [1)]								
Combined pull-out and concrete cone failure												
Characteristic bond resistance in cracked concrete C20/25												
Temperature range I: 40°C/24°C	dry and wet concrete	$\tau_{Rk,cr}$	[N/mm²]	4,0	5,0	5,5	5,5	5,5	5,5	5,5	6,5	6,5
	flooded bore hole	$\tau_{Rk,cr}$	[N/mm²]	4,0	4,0	5,5	5,5	5,5	no performance determined (NPD)			
Temperature range II: 80°C/50°C	dry and wet concrete	$\tau_{Rk,cr}$	[N/mm²]	2,5	3,5	4,0	4,0	4,0	4,0	4,0	4,5	4,5
	flooded bore hole	$\tau_{Rk,cr}$	[N/mm²]	2,5	3,0	4,0	4,0	4,0	no performance determined (NPD)			
Temperature range III: 120°C/72°C	dry and wet concrete	$\tau_{Rk,cr}$	[N/mm²]	2,0	2,5	3,0	3,0	3,0	3,0	3,0	3,5	3,5
	flooded bore hole	$\tau_{Rk,cr}$	[N/mm²]	2,0	2,5	3,0	3,0	3,0	no performance determined (NPD)			
Increasing factors for $\tau_{Rk,cr}$		ψ_c	C25/30	1,02								
			C30/37	1,04								
			C35/45	1,07								
			C40/50	1,08								
			C45/55	1,09								
			C50/60	1,10								
Concrete cone failure												
Factor k_1		$k_{cr,N}$	[-]	7,7								
Edge distance		$c_{cr,N}$	[mm]	1,5 h_{ef}								
Axial distance		$s_{cr,N}$	[mm]	3,0 h_{ef}								
Installation factor (dry and wet concrete)		γ_{inst}	[-]	1,0	1,2							
Installation factor (flooded bore hole)		γ_{inst}	[-]	1,4					no performance determined (NPD)			

[1)] $f_{uk} = f_{tk} = k \cdot f_{yk}$

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Characteristic values for **rebar** under **tension loads** in **cracked concrete**

Annex C9

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Table C10: Characteristic values for **rebar** under **tension loads** in **uncracked concrete**

Rebar				Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 20	Ø 25	Ø 28	Ø 32
Steel failure												
Characteristic tension resistance		$N_{Rk,s}$	[kN]	$A_s \cdot f_{uk}$ [1)]								
Combined pull-out and concrete cone failure												
Characteristic bond resistance in uncracked concrete C20/25												
Temperature range I: 40°C/24°C	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	10	12	12	12	12	12	11	10	8,5
	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	7,5	8,5	8,5	8,5	8,5	no performance determined (NPD)			
Temperature range II: 80°C/50°C	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	7,5	9,0	9,0	9,0	9,0	9,0	8,0	7,0	6,0
	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	5,5	6,5	6,5	6,5	6,5	no performance determined (NPD)			
Temperature range III: 120°C/72°C	dry and wet concrete	$\tau_{Rk,ucr}$	[N/mm²]	5,5	6,5	6,5	6,5	6,5	6,5	6,0	5,0	4,5
	flooded bore hole	$\tau_{Rk,ucr}$	[N/mm²]	4,0	5,0	5,0	5,0	5,0	no performance determined (NPD)			
Increasing factors for $\tau_{Rk,ucr}$		ψ_c	C25/30	1,02								
			C30/37	1,04								
			C35/45	1,07								
			C40/50	1,08								
			C45/55	1,09								
			C50/60	1,10								
Concrete cone failure												
Factor k_1		$k_{ucr,N}$	[-]	11,0								
Edge distance		$c_{cr,N}$	[mm]	$1,5\ h_{ef}$								
Axial distance		$s_{cr,N}$	[mm]	$3,0\ h_{ef}$								
Splitting failure												
Edge distance for		$c_{cr,sp}$	[mm]	$1,0 \cdot h_{ef} \le 2 \cdot h_{ef}\left(2,5-\frac{h}{h_{ef}}\right) \le 2,4 \cdot h_{ef}$								
Axial distance		$s_{cr,sp}$	[mm]	$2\ c_{cr,sp}$								
Installation factor (dry and wet concrete)		γ_{inst}	[-]	1,0	1,2							
Installation factor (flooded bore hole)		γ_{inst}	[-]	1,4					no performance determined (NPD)			

[1)] $f_{uk} = f_{tk} = k \cdot f_{yk}$

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Performance
Characteristic values for **rebar** under **tension loads** in **uncracked concrete**

Annex C10

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Table C11: Characteristic values for **rebar** under **shear loads** in **cracked and uncracked concrete**

Rebar			**Ø 8**	**Ø 10**	**Ø 12**	**Ø 14**	**Ø 16**	**Ø 20**	**Ø 25**	**Ø 28**	**Ø 32**
Steel failure without lever arm											
Characteristic shear resistance	$V^0_{Rk,s}$	[kN]	$0{,}50 \cdot A_s \cdot f_{uk}$ [1)]								
Ductility factor	k_7	[-]	0,8								
Steel failure with lever arm											
Characteristic bending moment	$M^0_{Rk,s}$	[Nm]	$1{,}2 \cdot W_{el} \cdot f_{uk}$ [1)]								
Concrete pry-out failure											
Pry-out factor	k_8	[-]	2,0								
Concrete edge failure											
Effective length of anchor	l_f	[mm]	$l_f = \min(h_{ef}; 8\ d_{nom})$								
Outside diameter of anchor	d_{nom}	[mm]	8	10	12	14	16	20	25	28	32
Installation factor	γ_{inst}	[-]	1,0								

[1)] $f_{uk} = f_{tk} = k \cdot f_{yk}$

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Table C12: Characteristic values for **rebar** under **seismic action**, category **C1**

Rebar				**Ø 8**	**Ø 10**	**Ø 12**	**Ø 14**	**Ø 16**	**Ø 20**	**Ø 25**	**Ø 28**	**Ø 32**
Tension load												
Steel failure												
Characteristic tension resistance		$N_{Rk,s,eq}$	[kN]	$A_s \cdot f_{uk}$ [1)]								
Combined pull-out and concrete cone failure												
Characteristic bond resistance in concrete C20/25 to C50/60												
Temperature range I: 40°C/24°C	dry and wet concrete	$\tau_{Rk,eq}$	[N/mm²]	2,5	3,1	3,7	3,7	3,7	3,7	3,8	4,5	4,5
	flooded bore hole	$\tau_{Rk,eq}$	[N/mm²]	2,5	2,5	3,7	3,7	3,7	no performance determined (NPD)			
Temperature range II: 80°C/50°C	dry and wet concrete	$\tau_{Rk,eq}$	[N/mm²]	1,6	2,2	2,7	2,7	2,7	2,7	2,8	3,1	3,1
	flooded bore hole	$\tau_{Rk,eq}$	[N/mm²]	1,6	1,9	2,7	2,7	2,7	no performance determined (NPD)			
Temperature range III: 120°C/72°C	dry and wet concrete	$\tau_{Rk,eq}$	[N/mm²]	1,3	1,6	2,0	2,0	2,0	2,0	2,1	2,4	2,4
	flooded bore hole	$\tau_{Rk,eq}$	[N/mm²]	1,3	1,6	2,0	2,0	2,0	no performance determined (NPD)			
Increasing factor for $\tau_{Rk,seis}$		ψ_c	[-]	1,0								
Installation factor (dry and wet concrete)		γ_{inst}	[-]	1,0	1,2							
Installation factor (flooded bore hole)		γ_{inst}	[-]	1,4					no performance determined (NPD)			
Shear load												
Steel failure without lever arm												
Characteristic shear resistance		$V_{Rk,s,eq}$	[kN]	$0,35 \cdot A_s \cdot f_{uk}$ [1)]								
Steel failure with lever arm												
Characteristic bending moment		$M^0_{Rk,s,eq}$	[Nm]	no performance determined (NPD)								

[1)] $f_{uk} = f_{tk} = k \cdot f_{yk}$

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Performance
Characteristic values for **rebar** under **seismic action**, category **C1**

Annex C12

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Table C13: Displacements under tension loads[1)]
(threaded rod and internally threaded anchor rod)

Threaded rod			M8	M10 IG-M6	M12 IG-M8	M16 IG- M10	M20 IG-M12	M24 IG-M16	M27	M30 IG-M20
Uncracked concrete C20/25										
Temperature range I: 40°C/24°C	δ_{N0}-factor	[mm/(N/mm²)]	0,021	0,023	0,026	0,031	0,036	0,041	0,045	0,049
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,030	0,033	0,037	0,045	0,052	0,060	0,065	0,071
Temperature range II: 80°C/50°C	δ_{N0}-factor	[mm/(N/mm²)]	0,050	0,056	0,063	0,075	0,088	0,100	0,110	0,119
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,072	0,081	0,090	0,108	0,127	0,145	0,159	0,172
Temperature range III: 120°C/72°C	δ_{N0}-factor	[mm/(N/mm²)]	0,050	0,056	0,063	0,075	0,088	0,100	0,110	0,119
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,072	0,081	0,090	0,108	0,127	0,145	0,159	0,172
Cracked concrete C20/25										
Temperature range I: 40°C/24°C	δ_{N0}-factor	[mm/(N/mm²)]	0,090			0,070				
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,105			0,105				
Temperature range II: 80°C/50°C	δ_{N0}-factor	[mm/(N/mm²)]	0,219			0,170				
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,255			0,245				
Temperature range III: 120°C/72°C	δ_{N0}-factor	[mm/(N/mm²)]	0,219			0,170				
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,255			0,245				

[1)] Calculation of the displacement
$\delta_{N0} = \delta_{N0}$-Faktor $\cdot \tau$; τ: acting bond stress for tension load
$\delta_{N\infty} = \delta_{N\infty}$-Faktor $\cdot \tau$;

Table C14: Displacements under shear load[1)]
(threaded rod and internally threaded anchor rod)

Threaded rod			M8	M10 IG-M6	M12 IG-M8	M16 IG- M10	M20 IG-M12	M24 IG-M16	M27	M30 IG-M20
Uncracked concrete C20/25										
All temperature ranges	δ_{V0}-factor	[mm/(kN)]	0,06	0,06	0,05	0,04	0,04	0,03	0,03	0,03
	$\delta_{V\infty}$-factor	[mm/(kN)]	0,09	0,08	0,08	0,06	0,06	0,05	0,05	0,05
Cracked concrete C20/25										
All temperature ranges	δ_{V0}-factor	[mm/(kN)]	0,12	0,12	0,11	0,10	0,09	0,08	0,08	0,07
	$\delta_{V\infty}$-factor	[mm/(kN)]	0,18	0,18	0,17	0,15	0,14	0,13	0,12	0,10

[1)] Calculation of the displacement
$\delta_{V0} = \delta_{V0}$-factor $\cdot$ V; V: acting shear load
$\delta_{V\infty} = \delta_{V\infty}$-factor $\cdot$ V;

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Performance
Displacements (threaded rod and internally threaded anchor rod)

Annex C13

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Table C15: **Displacements** under **tension load**[1)] (rebar)

Rebar			**Ø 8**	**Ø 10**	**Ø 12**	**Ø 14**	**Ø 16**	**Ø 20**	**Ø 25**	**Ø 28**	**Ø 32**
Uncracked concrete C20/25											
Temperature range I: 40°C/24°C	δ_{N0}-factor	[mm/(N/mm²)]	0,021	0,023	0,026	0,028	0,031	0,036	0,043	0,047	0,052
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,030	0,033	0,037	0,041	0,045	0,052	0,061	0,071	0,075
Temperature range II: 80°C/50°C	δ_{N0}-factor	[mm/(N/mm²)]	0,050	0,056	0,063	0,069	0,075	0,088	0,104	0,113	0,126
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,072	0,081	0,090	0,099	0,108	0,127	0,149	0,163	0,181
Temperature range III: 120°C/72°C	δ_{N0}-factor	[mm/(N/mm²)]	0,050	0,056	0,063	0,069	0,075	0,088	0,104	0,113	0,126
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,072	0,081	0,090	0,099	0,108	0,127	0,149	0,163	0,181
Cracked concrete C20/25											
Temperature range I: 40°C/24°C	δ_{N0}-factor	[mm/(N/mm²)]	0,090			0,070					
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,105			0,105					
Temperature range II: 80°C/50°C	δ_{N0}-factor	[mm/(N/mm²)]	0,219			0,170					
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,255			0,245					
Temperature range III: 120°C/72°C	δ_{N0}-factor	[mm/(N/mm²)]	0,219			0,170					
	$\delta_{N\infty}$-factor	[mm/(N/mm²)]	0,255			0,245					

[1)] Calculation of the displacement
$\delta_{N0} = \delta_{N0}$-Faktor $\cdot \tau$; τ: acting bond stress for tension load
$\delta_{N\infty} = \delta_{N\infty}$-Faktor $\cdot \tau$;

Table C16: **Displacements** under **shear load**[1)] (rebar)

Rebar			**Ø 8**	**Ø 10**	**Ø 12**	**Ø 14**	**Ø 16**	**Ø 20**	**Ø 25**	**Ø 28**	**Ø 32**
Uncracked concrete C20/25											
All temperature ranges	δ_{V0}-factor	[mm/(kN)]	0,06	0,05	0,05	0,04	0,04	0,04	0,03	0,03	0,03
	$\delta_{V\infty}$-factor	[mm/(kN)]	0,09	0,08	0,08	0,06	0,06	0,05	0,05	0,04	0,04
Cracked concrete C20/25											
All temperature ranges	δ_{V0}-factor	[mm/(kN)]	0,12	0,12	0,11	0,11	0,10	0,09	0,08	0,07	0,06
	$\delta_{V\infty}$-factor	[mm/(kN)]	0,18	0,18	0,17	0,16	0,15	0,14	0,12	0,11	0,10

[1)] Calculation of the displacement
$\delta_{V0} = \delta_{V0}$-factor $\cdot$ V; V: acting shear load
$\delta_{V\infty} = \delta_{V\infty}$-factor $\cdot$ V;

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Performance
Displacements (rebar)

Annex C14