Deutsches Institut für Bautechnik DIBt

Member of EOTA
www.eota.eu

Public-law institution jointly founded by the federal states and the Federation

European Technical Assessment Body for construction products

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

European Technical Assessment

ETA-17/0196 of 15 September 2025

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	Injection System HB-VMU plus for masonry
Product family to which the construction product belongs	Metal Injection anchors for use in masonry
Manufacturer	Leviat GmbH Liebigstraße 14 40764 Langenfeld DEUTSCHLAND
Manufacturing plant	Leviat Herstellwerke HB1, HB3
This European Technical Assessment contains	81 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 330076-01-0604, Edition 10/2022
This version replaces	ETA-17/0196 issued on 10 March 2017

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.

Communication of this European Technical Assessment, including transmission by electronic means, shall be in full. However, partial reproduction may only be made with the written consent of the issuing Technical Assessment Body. Any partial reproduction shall be identified as such.

This European Technical Assessment may be withdrawn by the issuing Technical Assessment Body, in particular pursuant to information by the Commission in accordance with Article 25(3) of Regulation (EU) No 305/2011.

Specific Part

1 Technical description of the product

The "Injection System HB-VMU plus for masonry" is a bonded anchor (injection type) consisting of a mortar cartridge with injection mortar HB-VMU plus or HB-VMU plus Polar, a perforated sleeve and an anchor rod with hexagon nut and washer or an Internal threaded rod. The steel elements are made of zinc coated steel, stainless steel or high corrosion resistant 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 fastener 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 fastener 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 for static and quasi-static loading	See Annexes B6, B7 C1 to C60
Characteristic resistance and displacements for seismic loading	No performance assessed

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire under tension and shear loading with and without lever arm. Minimum edge distances and spacing	See Annexes C4, C9, C10, C15, C16, C19, C21, C22, C23, C40, C42, C47, C48, C49, C50, C55 and C56

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 330076-01-0604 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.

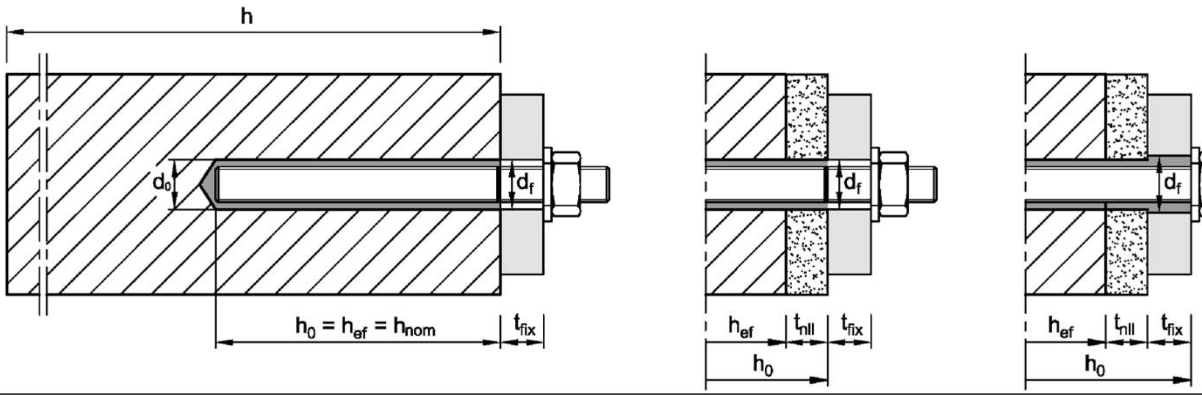
Issued in Berlin on 15 September 2025 by Deutsches Institut für Bautechnik

Dipl.-Ing. Beatrix Wittstock	*beglaubigt:*
Head of Section	Baderschneider

Installation in <u>solid brick</u> with or without non-loadbearing layer

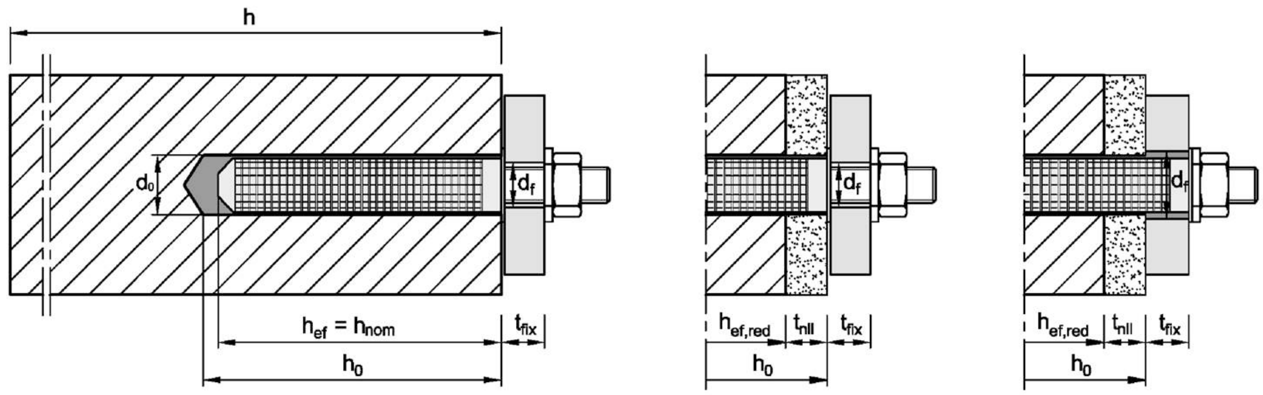
Threaded rod M8 – M16 / Internally threaded anchor rod IG-M6 – IG-M10

Pre-setting installation **Through-setting installation**



Threaded rod M8 – M16 / Internally threaded anchor rod IG-M6 – IG-M10 <u>with</u> sleeve

Pre-setting installation **Through-setting installation**



For through-setting installation, the annular gap between the anchor rod and the fixture must be filled with mortar.

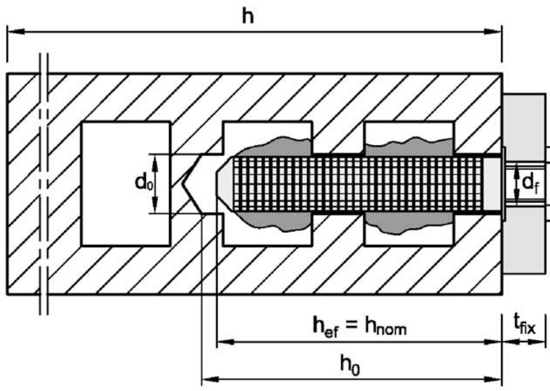
Legend (Annex A1 and Annex A2):

h_{ef}	= effective anchorage depth
h_{nom}	= overall anchor embedment depth
h_0	= depth of drill hole
h	= thickness of masonry member
d_0	= nominal drill hole diameter
d_f	= diameter of clearance hole in the fixture
t_{fix}	= thickness of fixture
t_{nll}	= thickness of non-loadbearing layer

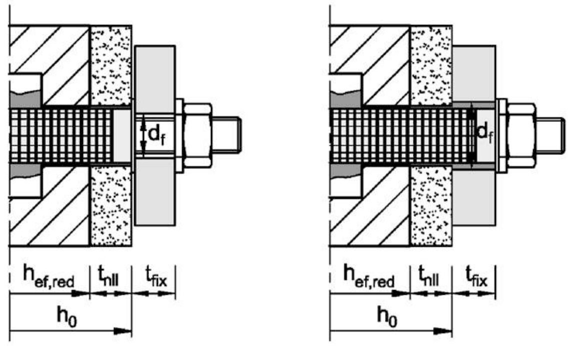
Installation in <u>hollow brick</u> with or without non-loadbearing layer

Threaded rod M8 – M16 / Internally threaded anchor rod IG-M6 – IG-M10 <u>with</u> sleeve

Pre-setting installation



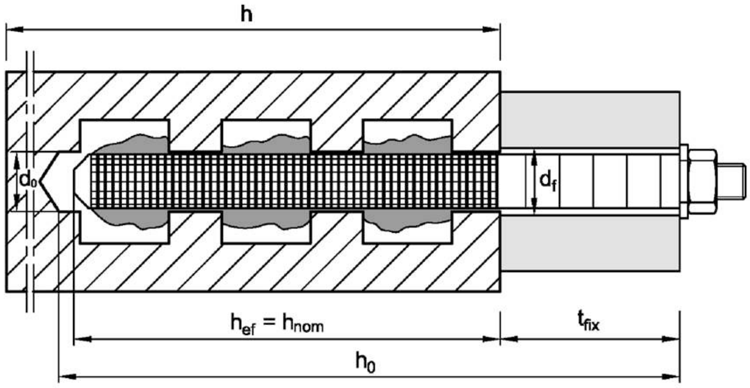
Through-setting installation



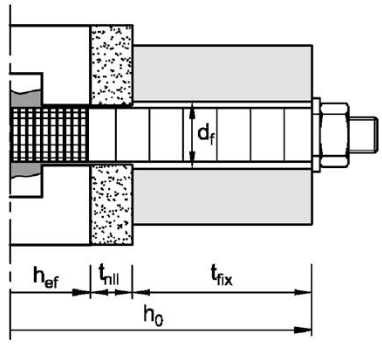
Installation in <u>hollow brick</u> with or without non-loadbearing layer and/or thermal isolation

Threaded rod M8 – M10 / Internally threaded anchor rod IG-M6 with sleeve SH 16x130/330

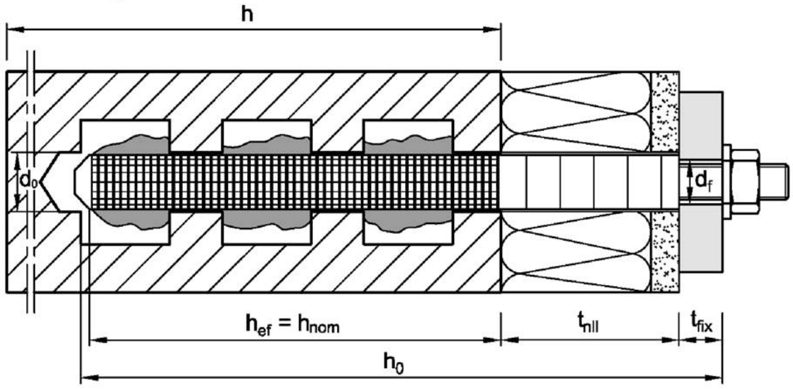
Pre-setting installation



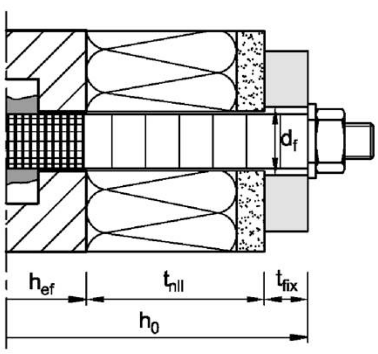
Through-setting installation



Pre-setting installation



Through-setting installation



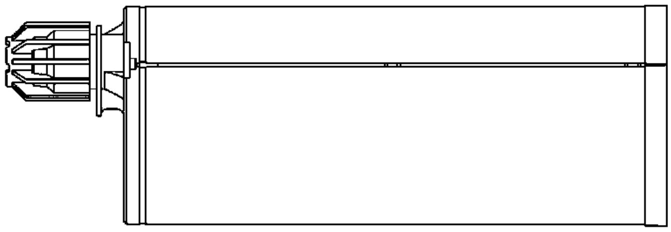
Injection System HB-VMU plus for masonry	Annex A2
Product description Installation condition – hollow brick	

Deutsches Institut für Bautechnik

Cartridge: Injection mortar HB-VMU plus or HB-VMU plus Polar

Coaxial cartridge
150 ml, 160ml, 280 ml,
300 ml to 330 ml,
380 ml to 420 ml

Side-by-side cartridge
235 ml,
345 ml to 360 ml,
825 ml

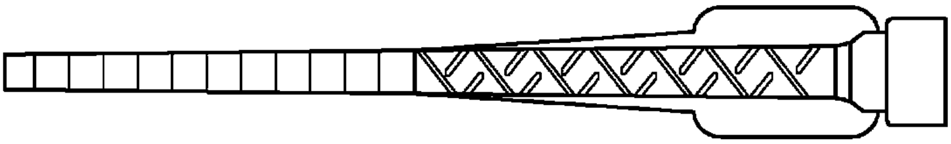


Foil tube cartridge
165 ml
300 ml

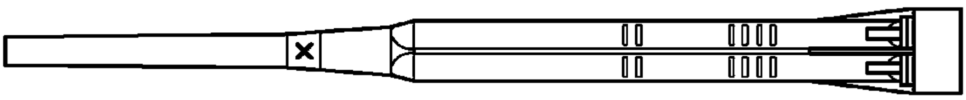
Cartridge imprint:
HB-VMU plus or HB-VMU plus Polar
processing and safety instructions, shelf life, charge number, manufacturer's information, quantity information

Static mixer

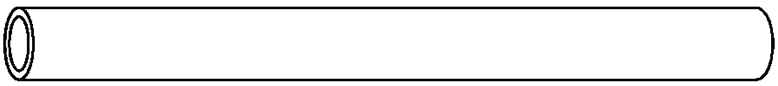
HB-VM-X



HB-VM-XHP



Mixer extension



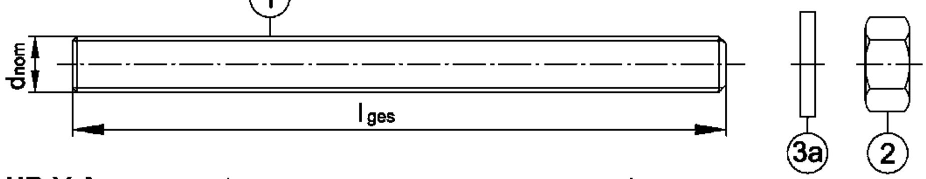
Injection System HB-VMU plus for masonry	**Annex A3**
Product description Injection system	

Threaded rod

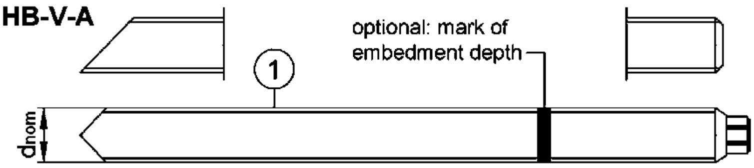
Threaded rod HB-VMU-A and HB-V-A

M8, M10, M12, M16 (zinc plated, A4, HCR)
with washer and hexagon nut

HB-VMU-A



HB-V-A



Marking e.g.: ◇ M10

◇	identifying mark of manufacturing plant
M10	size of thread

additional marking:

-8	strength class 8.8
A4	stainless steel
HC	high corrosion resistant steel

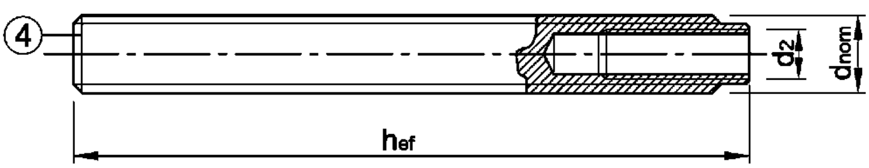
Threaded rod HB-VM-A (material sold by the metre, to be cut at the required length)
M8, M10, M12, M16 (zinc plated, A2, A4, HCR)
- Materials, dimensions and mechanical properties see Table A1

Commercial standard threaded rod with:
M8, M10, M12, M16 (zinc plated, A2, A4, HCR)
- Materials, dimensions and mechanical properties see Table A1
- Inspection certificate 3.1 acc. to EN 10204:2004 (documents must be retained)

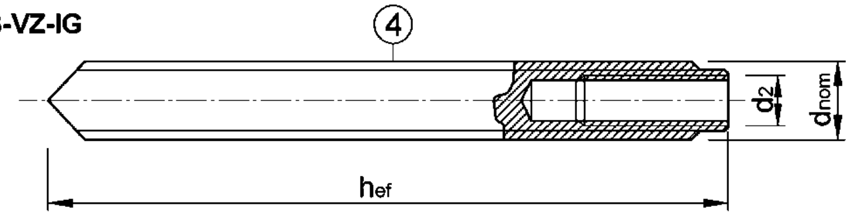
Internally threaded anchor rod HB-VMU-IG and HB-VZ-IG

IG M6, IG M8, IG M10
(zinc plated, A4, HCR)

HB-VMU-IG



HB-VZ-IG



Marking e.g.: ◇ M8

◇	identifying mark of manufacturing plant
I	internal thread (optional)
M8	size of internal thread

additional marking:

-8	strength class 8.8
A4	stainless steel
HCR	high corrosion resistant steel

Injection System HB-VMU plus for masonry	**Annex A4**
Product description Threaded rods and internally threaded anchor rods	

Table A1: Material

Part	Designation	Material and mechanical properties						
Steel, zinc plated electroplated ≥ 5 µm acc. to EN ISO 4042:2022 or hot-dip galvanized ≥ 50 µm in average acc. to EN ISO 1461:2022, EN ISO 10684:2004+AC:2009 or sherardized ≥ 45 µm acc. to EN ISO 17668:2016								
1	Threaded rod	Property class	characteristic ultimate strength		characteristic yield strength		fracture elongation	EN ISO 683-4:2018, EN 10263:2017 Commercial standard threaded rod: EN ISO 898-1:2013
		4.6	f_{uk} [N/mm²]	400	f_{yk} [N/mm²]	240	A_5 > 8 %	
		4.8		400		320	A_5 > 8 %	
		5.6		500		300	A_5 > 8 %	
		5.8		500		400	A_5 > 8 %	
		8.8		800		640	A_5 > 8 %	
2	Hexagon nut	4	for class 4.6 or 4.8 rods					EN ISO 898-2:2022
		5	for class 4.6, 4.8, 5.6 or 5.8 rods					
		8	for class 4.6, 4.8, 5.6, 5.8 or 8.8 rods					
3	Washer		e.g.: EN ISO 7089:2000, EN ISO 7093:2000, EN ISO 7094:2000, EN ISO 887:2006					
4	Internally threaded anchor rod[3]	5.8	Steel, electroplated or sherardized				A_5 > 8%	EN ISO 683-4:2018
		8.8					A_5 > 8%	
Stainless steel A2 [1] **CRC II** (1.4301 / 1.4307 / 1.4311 / 1.4567 / 1.4541) **Stainless steel A4** **CRC III** (1.4401 / 1.4404 / 1.4571 / 1.4578) **High corrosion resistant steel HCR** **CRC V** (1.4529 / 1.4565)								
1	Threaded rod	Property class	characteristic ultimate strength		characteristic yield strength		fracture elongation	EN 10088-1:2014 EN ISO 3506-1:2020
		50	f_{uk} [N/mm²]	500	f_{yk} [N/mm²]	210	A_5 > 8%	
		70		700		450 (560) [2]	A_5 > 8 %	
		80		800		600 (640) [2]	A_5 > 8 %	
2	Hexagon nut	50	for class 50 rods					EN 10088-1:2014 EN ISO 3506-2:2020
		70	for class 50 or 70 rods					
		80	for class 50, 70 or 80 rods					
3	Washer		e.g.: EN ISO 7089:2000, EN ISO 7093:2000, EN ISO 7094:2000; EN ISO 887:2006					EN 10088-1:2014
4	Internally threaded anchor rod [3]	70	stainless steel A4; high corrosion resistant steel HCR				A_5 > 8 %	EN 10088-1:2014
Perfo Sleeve HB-VM-SH			Polypropylene (PP)					

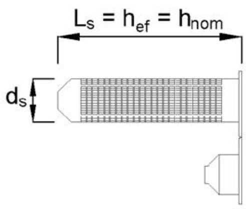
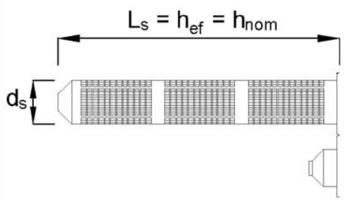
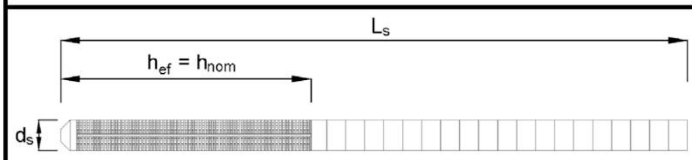
[1] Property class 50 and 70
[2] Value in brackets for anchor rods HB-VMU-A and HB-V-A
[3] Using HB-VMU-IG or HB-VZ-IG, screws or threaded rods (incl. nut and washer) must at least correspond to the material and strength class of the internally threaded anchor rod used.

Injection System HB-VMU plus for masonry	**Annex A5**
Product description Materials	

Table A2: Dimensions of threaded rods and internally threaded anchor rods

Threaded rod			**M8**	**M10**	**M12**	**M16**
Diameter	$d = d_{nom}$	[mm]	8	10	12	16
Total length	l_{ges}	[mm]	$h_{ef} + t_{fix}$ + 9,5	$h_{ef} + t_{fix}$ + 11,5	$h_{ef} + t_{fix}$ + 17,5	$h_{ef} + t_{fix}$ + 20,0
Internally threaded anchor rod			**-**	**IG M6**	**IG M8**	**IG M10**
Internal diameter	d_2	[mm]	-	6	8	10
Outer diameter	$d = d_{nom}$	[mm]	-	10	12	16
min. screw-in depth	$L_{IG,min}$	[mm]	-	8	10	10
Total length	l_{ges}	[mm]	-	with sleeve: h_{ef} – 5mm without sleeve: h_{ef}		

Table A3: Dimensions of sleeves HB-VM-SH

Type	**Size**	**d_s** [mm]	**L_s** [mm]	**$h_{ef} = h_{nom}$** [mm]
	**HB-VM-SH 12x80**	12	80	80
	HB-VM-SH 16x85	16	85	85
	HB-VM-SH 20x85	20	85	85
	**HB-VM-SH 16x130**	16	130	130
	HB-VM-SH 20x130	20	130	130
	HB-VM-SH 20x200	20	200	200
 for installation through insulation up to a thickness of 20 cm or through-setting installation	**HB-VM-SH 16x130/330[1)]**	16	330	130

[1)] In Annex C this sleeve is covered with the HB-VM-SH 16x130

Injection System HB-VMU plus for masonry	**Annex A6**
Product description Dimensions of threaded rods and sleeves	

Specifications of intended use

Anchorages subject to	Static and quasi-static loads		**M8 – M16** **IG M6 – IG M10** (with and without sleeve)
	Fire exposure		
	Tension and shear loads		
Base Material	Masonry group b:	Solid brick masonry	Annex B 3
	Masonry group c:	Hollow brick masonry	Annex B 3 to B 5
	Masonry group d:	Autoclaved Aerated Concrete	Annex B 3
	Mortar strength class of the masonry M2,5 at minimum according to EN 998-2:2016 For other bricks in solid masonry, hollow masonry or in autoclaved aerated concrete, the characteristic resistance of the anchor may be determined by job site tests according to EOTA TR 053, Edition July 2022 under consideration of the β-factor according to Annex C1, Table C1		
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)		
Hole drilling	See Annex C		
Use conditions (Environmental conditions):	Structures subject to dry internal conditions (all materials). For all other conditions acc. to EN 1993-1-4:2006+ A2:2020 corresponding to corrosion resistance classes Annex A (stainless steel and high corrosion resistant steel)		
Use category	• Condition d/d	Installation and use in dry masonry	
	• Condition w/w	Installation and use in dry or wet masonry (incl. w/d, installation in wet masonry and use in dry masonry)	

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.

Specifications of intended use (continued)

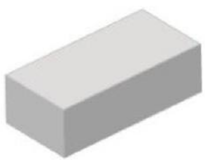
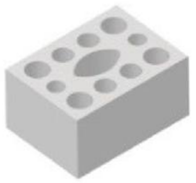
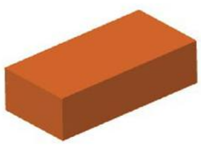
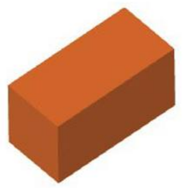
Design:

- 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 the EOTA TR 054, Edition July 2022, under the responsibility of an engineer experienced in anchorages and masonry work.
- Applies to all bricks if no other values are specified:
  - $N_{Rk} = N_{Rk,b} = N_{Rk,p} = N_{Rk,b,c} = N_{Rk,p,c}$
  - $V_{Rk} = V_{Rk,b} = V_{Rk,c,II} = V_{Rk,c,\perp}$
- For the calculation of pulling out a brick under tension loading $N_{Rk,pb}$ or pushing out a brick under shear loading $V_{Rk,pb}$ see EOTA Technical Report TR 054, Edition July 2022.
- $N_{Rk,s}$, $V_{Rk,s}$ and $M^0_{Rk,s}$ see annexes C2 – C4
- For application with 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 C)
  - $V_{Rk,c,j} = 0,15 * V_{Rk,c}$ and $V_{Rk,b,j} = 0,15 * V_{Rk,b}$ ($V_{Rk,b}$ see Annex C; and $V_{Rk,c}$ see Annex C5)
- Applications without sleeve installed in unfilled joints are not permitted.

Installation:

- Anchor Installation carried out by appropriately qualified personnel and under the supervision of the person responsible for technical matters of the site
- Using internally threaded anchor rod (HB-VMU-IG or HB-VZ-IG) screws and threaded rods (incl. nut and washer) must at least correspond to the material and strength class of the internally threaded anchor rod used.

Table B1: Overview brick types and properties

Designation Density [kg/dm³] Dimension LxBxH [mm]	Picture	Perfo Sleeve HB-VM-SH	Fire exposure	Annex	Designation Density [kg/dm³] Dimension LxBxH [mm]	Picture	Perfo Sleeve HB-VM-SH	Fire exposure	Annex
Hollow light weight concrete brick acc. to EN 771-4:2011+A1:2015					**Hollow light weight concrete brick acc. to EN 771-3:2011+A1:2015**				
AAC ρ = 0,35-0,60 ≥ 499x240x249		12x80 16x85 16x130 20x85 20x130 20x200	–	C6 – C8	VBL ρ ≥ 0,6 ≥240x300x113		12x80 16x85 16x130 20x85 20x130 20x200	–	C59 - C60
Hollow light weight concrete brick acc. to EN 771-3: 2011+A1:2015									
HBL 16DF ρ ≥ 1,0 500x250x240		16x85 16x130 20x85 20x130 20x200	✓	C55 - C56	Bloc creux B40 ρ ≥ 0,8 495x195x190		16x130 20x130	–	C57 - C58
Calcium silica bricks acc. to EN 771-2:2011+A1:2015									
KS-NF ρ ≥ 2,0 ≥ 240x115x71		12x80 16x85 16x130 20x85 20x130 20x200	✓	C9 – C10	KSL-3DF ρ ≥ 1,4 240x175x113		16x85 16x130 20x85 20x130	–	C11 - C12
KSL-8DF ρ ≥ 1,4 248x240x238		16x130 20x130 20x200	–	C13 - C14	KSL-12DF ρ ≥ 1,4 498x175x238		16x130 20x130	✓	C15 - C16
Solid clay bricks acc. to EN 771-1:2011+A1:2015									
MZ-1DF ρ ≥ 2,0 ≥ 240x115x55		12x80 16x85 16x130 20x85 20x130 20x200	–	C17 - C18	MZ – 2 DF ρ ≥ 2,0 ≥ 240x115x113		12x80 16x85 16x130 20x85 20x130 20x200	✓	C19 - C21

Injection System HB-VMU plus for masonry

Intended use
Brick types and properties

Annex B3

Continuation **Table B1: Overview brick types and properties**

Designation **Density** [kg/dm³] **Dimension** **LxBxH** [mm]	**Picture**	**Perfo Sleeve HB-VM-SH**	**Fire exposure**	**Annex**	**Designation** **Density** [kg/dm³] **Dimension** **LxBxH** [mm]	**Picture**	**Perfo Sleeve HB-VM-SH**	**Fire exposure**	**Annex**
Hollow clay bricks acc. to EN 771-1:2011+A1:2015									
Hlz-10DF ρ ≥ 1,25 300x240x249		12x80 16x85 16x130 20x85 20x130 20x200	✓	C22 - C23	Porotherm Homebric ρ ≥ 0,7 500x200x299		12x80 16x85 16x130 20x85 20x130	–	C24 - C25
BGV Thermo ρ ≥ 0,6 500x200x314		12x80 16x85 16x130 20x85 20x130	–-	C26 - C27	Brique creuse C40 ρ ≥ 0,7 500x200x200		12x80 16x85 16x130 20x85 20x130	–	C32 - C33
Calibric R+ ρ ≥ 0,6 500x200x314		12x80 16x85 16x130 20x85 20x130	–	C28 - C29	Blocchi Leggeri ρ ≥ 0,6 250x120x250		12x80 16x85 16x130 20x85 20x130	–	C34 - C35
Urbanbric ρ ≥ 0,7 560x200x274		12x80 16x85 16x130 20x85 20x130	–	C30 - C31	Doppio Uni ρ ≥ 0,9 250x120x120		12x80 16x85 16x130 20x85 20x130	–	C36 - C37
Hollow clay bricks with thermal insulation acc. to EN 771-1:2011+A1:2015									
Coriso WS07 ρ ≥ 0,55 248x365x249 Mineral wool		12x80 16x85 16x130 20x85 20x130 20x200	–	C38 - C39	T8 P ρ ≥ 0,56 248x365x249 Perlite		12x80 16x85 16x130 20x85 20x130 20x200	–	C43 - C44
T7 MW ρ ≥ 0,59 248x365x249 Mineral wool		12x80 16x85 16x130 20x85 20x130 20x200	✓	C40 - C42	MZ90-G ρ ≥ 0,68 248x365x249 Mineral wool		12x80 16x85 16x130 20x85 20x130 20x200	–	C45 - C46

Injection System HB-VMU plus for masonry

Intended use
Brick types and properties

Annex B4

Continuation **Table B1: Overview brick types and properties**

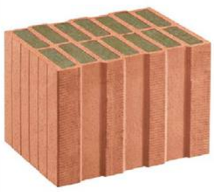
Designation Density [kg/dm³] **Dimension LxBxH** [mm]	**Picture**	**Perfo Sleeve HB-VM-SH**	**Fire exposure**	**Annex**	**Designation Density** [kg/dm³] **Dimension LxBxH** [mm]	**Picture**	**Perfo Sleeve HB-VM-SH**	**Fire exposure**	**Annex**
Hollow clay bricks with thermal insulation acc. to EN 771-1:2011+A1:2015									
Poroton FZ7,5 ρ ≥ 0,90 248x365x249 Mineral wool		12x80 16x85 16x130 20x85 20x130 20x200	✓	C47 - C48	Poroton FZ9 ρ ≥ 0,90 248x365x249 Mineral wool		12x80 16x85 16x130 20x85 20x130 20x200	✓	C49 - C50
Poroton S9 ρ ≥ 0,85 248x365x249 Perlite		12x80 16x85 16x130 20x85 20x130 20x200	–	C51 - C52	Thermopor TV8+ ρ ≥ 0,7 248x365x249 Mineral wool		12x80 16x85 16x130 20x85 20x130 20x200	–	C53 - C54

Table B2: Installation parameters for autoclaved aerated concrete AAC and solid masonry (<u>without</u> sleeve) for pre- or through-setting installation

Threaded rod			**M8**	**M10 IG-M6**	**M12 IG-M8**	**M16 IG-M10**
Nominal drill hole diameter	d_0	[mm]	10	12	14	18
Depth of drill hole	h_0	[mm]	$h_{ef} + t_{fix}$ 1)			
Effective anchorage depth	h_{ef}	[mm]	80	≥ 90	≥ 100	≥ 100
Diameter of clearance hole in the fixture – pre-setting installation	d_f ≤	[mm]	9	7 (IG-M6) 12 (M10)	9 (IG-M8) 14 (M12)	12 (IG-M10) 18 (M16)
Diameter of clearance hole in the fixture – through-setting installation	d_f ≤	[mm]	12	14	16	20
Brush		[-]	HB-RB 10	HB-RB 12	HB-RB 14	HB-RB 18
Minimum brush diameter	d_b	[mm]	10,5	12,5	14,5	18,5
Maximum installation torque	T_{inst}	[Nm]	see Annex C			
Minimum member thickness	h_{min}	[mm]	h_{ef} + 30			
Minimum spacing	s_{min}	[mm]	see Annex C			
Minimum edge distance	c_{min}	[mm]	see Annex C			

1) Consider t_{fix} in case of through-setting installation

Table B3: Installation parameters in solid and hollow masonry (<u>with</u> sleeve) for pre-setting Installation

Threaded rod			**M8**	**M8 / M10 IG-M6**			**M12 / M16 IG-M8 / IG-M10**		
Sleeve HB-VM-SH			**12x80**	**16x85**	**16x130**	**16x130 /330**	**20x85**	**20x130**	**20x200**
Nominal drill hole diameter	d_0	[mm]	12	16			20		
Depth of drill hole	h_0	[mm]	85	90	135	330	90	135	205
Effective anchorage depth	h_{ef}	[mm]	80	85	130	130	85	130	200
Diameter of clearance hole in the fixture	d_f ≤	[mm]	9	7 (IG-M6) 9 (M8) 12 (M10)			9 (IG-M8) 12 (IG-M10) 14 (M12) 18 (M16)		
Brush		[-]	HB-RB 12	HB-RB 16			HB-RB 20		
Minimum brush diameter	d_b	[mm]	12,5	16,5			20,5		
Maximum installation torque	T_{inst}	[Nm]	see Annex C						
Minimum member thickness	h_{min}	[mm]	115	115	195	195	115	195	240
Minimum spacing	s_{min}	[mm]	see Annex C						
Minimum edge distance	c_{min}	[mm]	see Annex C						

Injection System HB-VMU plus for masonry

Intended Use
Installation parameters

Annex B6

Table B4: Installation parameters in solid and hollow masonry (<u>with</u> sleeve) for pre-setting installation through non-load-bearing layers and/or through-setting installation

Threaded rod				**M8 / M10** **IG-M6**		**M12 / M16** **IG-M8 / IG-M10**	
Sleeve HB-VM-SH				**16x130**	**16x130/330**	**20x130**	**20x200**
Nominal drill hole diameter		d_0	[mm]	16		20	
Depth of drill hole		h_0	[mm]	h_{ef} + 5mm + t_{nll} + t_{fix} [1)]			
Effective anchorage depth	pre-setting installation	h_{ef}	[mm]	130	130	130	200
	through-setting installation	h_{ef}	[mm]	85	130	85	85
Maximum thickness of non-loadbearing layer		max. t_{nll}	[mm]	45	200	45	115
Diameter of clearance hole in the fixture	pre-setting installation	$d_f \leq$	[mm]	7 (IG-M6) 9 (M8) 12 (M10)		9 (IG-M8) 12 (IG-M10) 14 (M12) 18 (M16)	
	through-setting installation	$d_f \leq$	[mm]	18		22	
Brush			[-]	HB-RB 16		HB-RB 20	
Minimum brush diameter		d_b	[mm]	16,5		20,5	
Maximum installation torque		T_{inst}	[Nm]	see Annex C			
Minimum member thickness		h_{min}	[mm]	195 (115)	195	195 (115)	240 (115)
Minimum spacing		s_{min}	[mm]	see Annex C			
Minimum edge distance		c_{min}	[mm]	see Annex C			

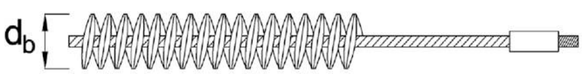
[1)] Consider t_{nll} and/or t_{fix} in case of non-loadbearing layers and/or through-setting installation.

Cleaning and installation tools

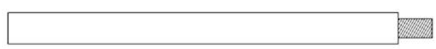
Compressed air tool (min. 6 bar)

Blow out pump (Volume ≥ 750 ml)

Brush HB-RB



Brush extension



Injection System HB-VMU plus for masonry	**Annex B7**
Intended use Installation parameters and cleaning and installation tools	

Table B5: Working and curing time – HB-VMU plus

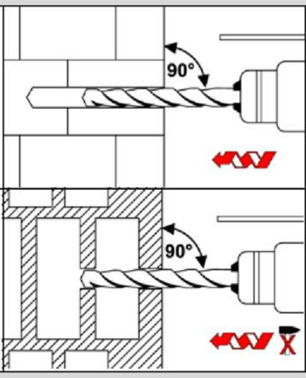
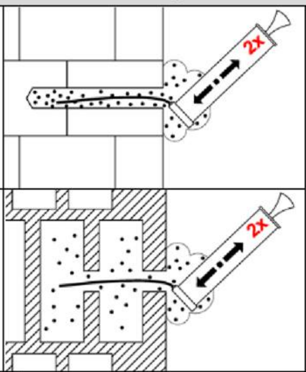
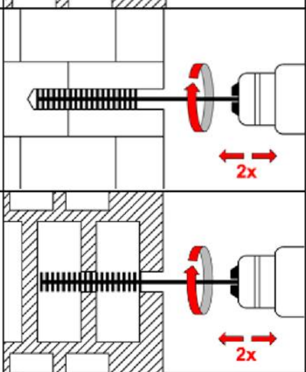
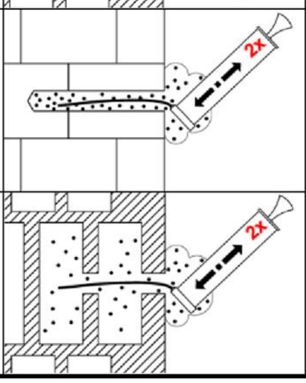
Temperature in the base material [°C]	Maximum working time	Minimum curing time in	
		in dry base material	in wet base material
- 10°C to - 6°C	90 min	24 h	48 h
- 5°C to - 1°C	90 min	14 h	28 h
0°C to + 4°C	45 min	7 h	14 h
+ 5°C to + 9°C	25 min	2 h	4 h
+ 10°C to + 19°C	15 min	80 min	160 min
+ 20°C to + 29°C	6 min	45 min	90 min
+ 30°C to + 34°C	4 min	25 min	50 min
+ 35°C to + 39°C	2 min	20 min	40 min
+ 40°C	1,5 min	15 min	30 min
Cartridge temperature 1)	+5°C to +40°C		

1) At temperatures in the base material of -10°C to -6°C, the cartridge temperature must be at least +15°C.

Table B6: Working and curing time – HB-VMU plus Polar

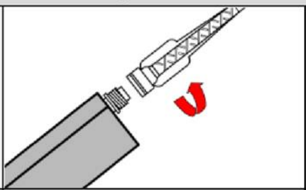
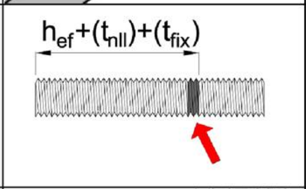
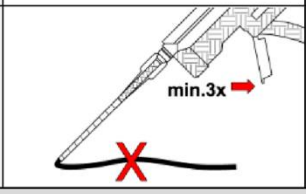
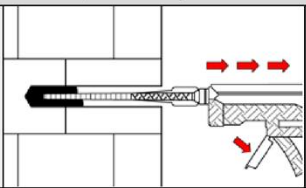
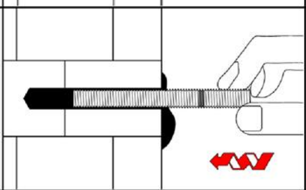
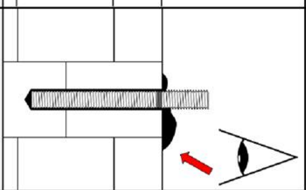
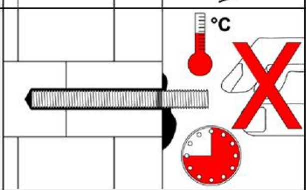
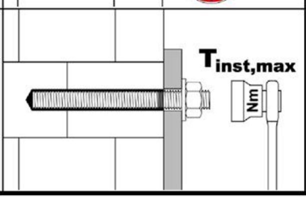
Temperature in the base material [°C]	Maximum working time	Minimum curing time	
		in dry base material	in dry base material
- 20°C to - 16°C	75 min	24 h	48 h
- 15°C to - 11°C	55 min	16 h	32 h
- 10°C to - 6°C	35 min	10 h	20 h
- 5°C to - 1°C	20 min	5 h	10 h
0°C to +4°C	10 min	2,5 h	5 h
+5°C to +9°C	6 min	80 min	160 min
+ 10°C	6 min	60 min	2 h
Cartridge temperature	-20°C to +10°C		

Installation instructions

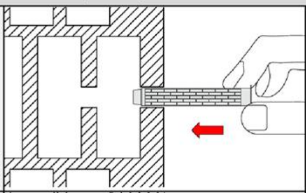
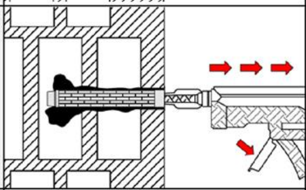
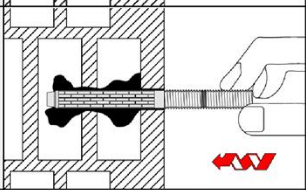
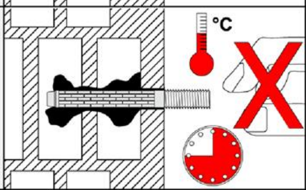
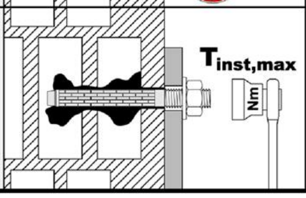
Drilling of the drill hole in solid masonry and hollow masonry			
1	solid masonry hollow masonry		Drill the hole perpendicular to the surface of the base material using the drilling method according to Annex C, with the specified drill hole diameter and depth of drill hole corresponding to the anchor size and anchorage depth of the selected anchor. In case of aborted drill hole, the drill hole shall be filled with mortar.
Cleaning in solid masonry and hollow masonry			
2a	solid masonry hollow masonry		Blow out from the bottom of the bore hole with the blow out pump (Annex B7) a minimum of **two** times. For applications in solid masonry with a bore hole depth h_0 > 100mm cleaning with compressed air is required.
2b	solid masonry hollow masonry		Brush the hole with an appropriately sized wire brush ≥ $d_{b,min}$ (Table B2, B3 and B4, check minimum brush diameter $d_{b,min}$) a minimum of **two** times using a drilling machine or battery screwdriver. If the drill hole ground is not reached, an appropriate brush extension must be used.
2c	solid masonry hollow masonry		Finally starting from the bottom or back of the drill hole blow out the hole with the blow out pump again a minimum of **two** times. For applications in solid masonry with a bore hole depth h_0 > 100mm cleaning with compressed air is required.

Injection System HB-VMU plus for masonry	**Annex B9**
Intended use Installation instruction: drilling of drill hole / cleaning in solid and hollow masonry	

Installation instructions - continuation

Preparation injection		
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 B5 and B6) as well as for new cartridges, a new static-mixer shall be used.
4		Mark position of embedment depth on the threaded rod. Consider t_{nll} and/or t_{fix} in case of installation through non-loadbearing layers and/or through setting installation. The threaded rod shall be free of dirt, grease, oil or other foreign material.
5		Prior to dispensing into the drill hole, squeeze out separately (a minimum of three full strokes, for foil tube cartridges at least 6 full strokes) and discard non-uniformly mixed adhesive components until the mortar shows a consistent grey color.
Installation <u>without</u> sleeve		
6		Starting at the bottom of the drill hole and fill the hole up to approximately two-thirds with adhesive. Slowly withdraw the static mixing nozzle as the hole fills to avoid air pockets. Use mixer extension if necessary. Observe temperature dependent working time (Table B5 or B6).
7		Insert fastener while turning slightly up to the embedment mark.
8		Annular gap between threaded rod and base material must be completely filled with mortar. For through setting installation the annular gap between threaded rod and fixture must also be filled with mortar. Otherwise, the installation must be repeated starting from step 6 before the maximum working time has expired.
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 or B6). After full curing time remove excess mortar.
10		Install the fixture using a torque wrench, observing the maximum installation torque T_{inst} according to Annex C.

Installation instructions - continuation

Installation with sleeve		
6		Insert the perforated sleeve flush with the surface of the masonry. Only use sleeves that have the right length. Never cut the sleeve in the anchoring area. For through-setting installation with perforated sleeve HB-VM SH 16x130/330 through a non-load-bearing layer and/or add-on part, the clamping area may be shortened to the thickness of the non-load-bearing layer and/or attachment.
7		Fill the perforated sleeve with mortar from the bottom or back. Use mixer extension if necessary. Refer to the cartridge label or the installation instructions for the exact quantity of mortar. For through setting installation, the perforated sleeve must be completely filled with mortar up to the fixture. Observe the working and curing times given in Table B5 and B6.
8		To optimize the distribution of the mortar, insert the fastener with slight rotation to the defined embedment depth.
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 and B6).
10		Install the fixture using a torque wrench, observing the maximum installation torque T_{inst} according to Annex C.

Injection System HB-VMU plus for masonry	**Annex B11**
Intended use Installation instruction: Installation with sleeve	

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

Brick type	Anchor size	Perfo sleeve HB-VM-SH	anchorage depth h_{ef}	β-factor T_a: 24°C / 40°C d/d	β-factor T_a: 24°C / 40°C w/d w/w	β-factor T_b: 50°C / 80°C d/d	β-factor T_b: 50°C / 80°C w/d w/w	β-factor T_c: 72°C/120°C d/d	β-factor T_c: 72°C/120°C w/d w/w
Autoclaved aerated concrete	all sizes	with or without HB-VM-SH	all	0,95	0,86	0,81	0,73	0,81	0,73
Calcium silica bricks	$d_0 \leq 14$ mm	HB-VM-SH	all	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
	$d_0 \leq 14$ mm	–	≤ 100mm	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
	all sizes		> 100mm	0,93	0,56	0,87	0,52	0,65	0,40
Clay bricks	all sizes	HB-VM-SH	all	0,86	0,86	0,86	0,86	0,73	0,73
		–	≤ 100mm	0,86	0,86	0,86	0,86	0,73	0,73
			> 100mm	0,86	0,43	0,86	0,43	0,73	0,37
Concrete bricks	$d_0 \leq 12$ mm	with or without HB-VM-SH	all	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

Table C2: Characteristic steel resistance under tension and shear load for threaded rods

Threaded rod				M 8	M 10	M 12	M 16
Steel failure							
Cross sectional area		A_s	[mm²]	36,6	58,0	84,3	157
Characteristic resistance under tension load 1)							
steel, zinc plated	Property class 4.6 and 4.8	$N_{Rk,s}$	[kN]	15 (13)1)	23 (21)1)	34	63
	Property class 5.6 and 5.8	$N_{Rk,s}$	[kN]	18 (17)1)	29 (27)1)	42	79
	Property class 8.8	$N_{Rk,s}$	[kN]	29 (27)1)	46 (43)1)	67	126
stainless steel	Property class 50 (A2/A4/HCR)	$N_{Rk,s}$	[kN]	18	29	42	79
	Property class 70 (A2/A4/HCR)	$N_{Rk,s}$	[kN]	26	41	59	110
	Property class 80 (A4/HCR)	$N_{Rk,s}$	[kN]	29	46	67	126
Partial factors 2)							
steel, zinc plated	Property class 4.6 and 5.6	$\gamma_{Ms,N}$	[-]	2,0			
	Property class 4.8, 5.8 and 8.8	$\gamma_{Ms,N}$	[-]	1,5			
stainless steel	Property class 50 (A2/A4/HCR)	$\gamma_{Ms,N}$	[-]	2,86			
	Property class 70 (A2/A4/HCR)	$\gamma_{Ms,N}$	[-]	1,87 (1,5)3)			
	Property class 80 (A4/HCR)	$\gamma_{Ms,N}$	[-]	1,6 (1,5)3)			
Characteristic resistance under shear load 1)							
Steel failure <u>without</u> lever arm							
steel, zinc plated	Property class 4.6 and 4.8	$V^0_{Rk,s}$	[kN]	7 (6)1)	12 (10)1)	17	31
	Property class 5.6 and 5.8	$V^0_{Rk,s}$	[kN]	9 (8)1)	15 (13)1)	21	39
	Property class 8.8	$V^0_{Rk,s}$	[kN]	15 (13)1)	23 (21)1)	34	63
stainless steel	Property class 50 (A2/A4/HCR)	$V^0_{Rk,s}$	[kN]	9	15	21	39
	Property class 70 (A2/A4/HCR)	$V^0_{Rk,s}$	[kN]	13	20	30	55
	Property class 80 (A4/HCR)	$V^0_{Rk,s}$	[kN]	15	23	34	63
Steel failure <u>with</u> lever arm – characteristic bending moment							
steel, zinc plated	Property class 4.6 and 4.8	$M^0_{Rk,s}$	[Nm]	15 (13)1)	30 (27)1)	52	133
	Property class 5.6 and 5.8	$M^0_{Rk,s}$	[Nm]	19 (16)1)	37 (33)1)	65	166
	Property class 8.8	$M^0_{Rk,s}$	[Nm]	30 (26)1)	60 (53)1)	105	266
stainless steel	Property class 50 (A2/A4/HCR)	$M^0_{Rk,s}$	[Nm]	19	37	65	166
	Property class 70 (A2/A4/HCR)	$M^0_{Rk,s}$	[Nm]	26	52	92	233
	Property class 80 (A4/HCR)	$M^0_{Rk,s}$	[Nm]	30	60	105	266
Partial factors 2)							
steel, zinc plated	Property class 4.6 and 5.6	$\gamma_{Ms,V}$	[-]	1,67			
	Property class 4.8, 5.8 and 8.8	$\gamma_{Ms,V}$	[-]	1,25			
stainless steel	Property class 50 (A2/A4/HCR)	$\gamma_{Ms,V}$	[-]	2,38			
	Property class 70 (A2/A4/HCR)	$\gamma_{Ms,V}$	[-]	1,56 (1,25)3)			
	Property class 80 (A4/HCR)	$\gamma_{Ms,V}$	[-]	1,33 (1,25)3)			

1) The characteristic resistances apply for all anchor rods with the cross-sectional area A_s specified here: HB-VMU-A, HB-V-A, HB-VM-A. For commercial standard threaded rods with a smaller cross-sectional area (e.g. hot-dip galvanized threaded rods M8, M10 according to EN ISO 10684:2004 + AC:2009), the value in bracket is valid.

2) In absence of national regulation

3) Value in bracket only valid for anchor rod HB-VMU-A or HB-V-A

Injection System HB-VMU plus for masonry

Performances
Characteristic steel resistance under tension and shear load for **threaded rods**

Annex C2

Table C3: Characteristic steel resistance under tension and shear load for internally threaded anchor rod

Internally threaded anchor rod				**IG-M6**	**IG-M8**	**IG-M10**
Steel failure [1]						
Characteristic resistance under tension load						
steel, zinc plated	Property class 5.8	$N_{Rk,s}$	[kN]	10	17	29
	Property class 8.8	$N_{Rk,s}$	[kN]	16	27	46
stainless steel	Property class 70 (A4/HCR)	$N_{Rk,s}$	[kN]	14	26	41
Partial factors [2]						
steel, zinc plated	Property class 5.8	$\gamma_{Ms,N}$	[-]	1,5		
	Property class 8.8	$\gamma_{Ms,N}$	[-]	1,5		
stainless steel	Property class 70 (A4/HCR)	$\gamma_{Ms,N}$	[-]	1,87		
Characteristic resistance under shear load						
Steel failure <u>without</u> lever arm						
steel, zinc plated	Property class 5.8	$V^0_{Rk,s}$	[kN]	5	9	15
	Property class 8.8	$V^0_{Rk,s}$	[kN]	8	14	23
stainless steel	Property class 70 (A4/HCR)	$V^0_{Rk,s}$	[kN]	7	13	20
Steel failure <u>with</u> lever arm – characteristic bending moment						
steel, zinc plated	Property class 5.8	$M^0_{Rk,s}$	[Nm]	8	19	37
	Property class 8.8	$M^0_{Rk,s}$	[Nm]	12	30	60
stainless steel	Property class 70 (A4/HCR)	$M^0_{Rk,s}$	[Nm]	11	26	52
Partial factors [2]						
steel, zinc plated	Property class 5.8	$\gamma_{Ms,V}$	[-]	1,25		
	Property class 8.8	$\gamma_{Ms,V}$	[-]	1,25		
stainless steel	Property class 70 (A4/HCR)	$\gamma_{Ms,V}$	[-]	1,56		

[1] Fastening screws or threaded rods (incl. nut and washer) must comply 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] In absence of national regulation

Injection System HB-VMU plus for masonry	**Annex C3**
Performances Characteristic steel resistance under tension and shear load for **internally threaded anchor rod**	

Table C4: Characteristic steel resistance under fire exposure - Threaded rod

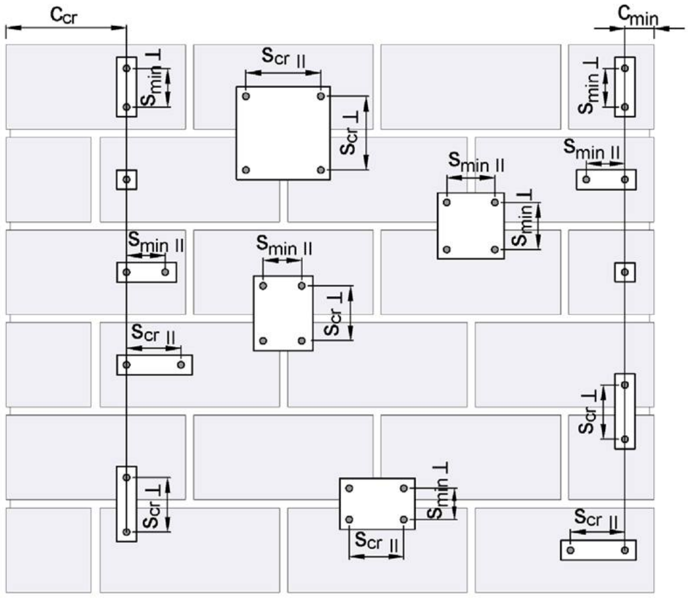
Threaded rod				M 8	M 10	M 12	M 16
Characteristic resistance under tension load							
Steel, property class 5.8 and 8.8; Stainless steel (A2/ A4/ HCR) property class ≥ 50	R30	$N_{Rk,s,fi}$	[kN]	1,1	1,7	3,0	5,7
	R60	$N_{Rk,s,fi}$	[kN]	0,9	1,4	2,3	4,2
	R90	$N_{Rk,s,fi}$	[kN]	0,7	1,0	1,6	3,0
	R120	$N_{Rk,s,fi}$	[kN]	0,5	0,8	1,2	2,2
Characteristic resistance under shear load [1)]							
Steel failure without lever arm							
Steel, property class 5.8 and 8.8; Stainless steel (A2/ A4/ HCR) property class ≥ 50	R30	$V^0_{Rk,s,fi}$	[kN]	1,1	1,7	3,0	5,7
	R60	$V^0_{Rk,s,fi}$	[kN]	0,9	1,4	2,3	4,2
	R90	$V^0_{Rk,s,fi}$	[kN]	0,7	1,0	1,6	3,0
	R120	$V^0_{Rk,s,fi}$	[kN]	0,5	0,8	1,2	2,2
Steel failure with lever arm – characteristic bending moment							
Steel, property class 5.8 and 8.8; Stainless steel (A2/ A4/ HCR) property class ≥ 50	R30	$M^0_{Rk,s,fi}$	[Nm]	1,1	2,2	4,7	12,0
	R60	$M^0_{Rk,s,fi}$	[Nm]	0,9	1,8	3,5	9,0
	R90	$M^0_{Rk,s,fi}$	[Nm]	0,7	1,3	2,5	6,3
	R120	$M^0_{Rk,s,fi}$	[Nm]	0,5	1,0	1,8	4,7
Partial factor	all	$\gamma_{Ms,fi}$	[-]	1,0			

Table C5: Characteristic steel resistance under fire exposure - Internally threaded anchor rod

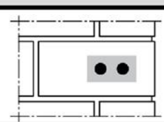
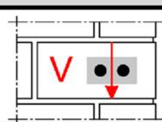
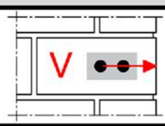
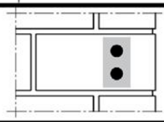
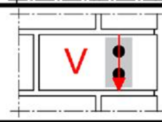
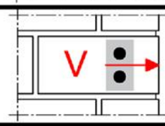
Internally threaded anchor rod				IG-M6	IG-M8	IG-M10
Characteristic resistance under tension load						
Steel, property class 5.8 and 8.8; Stainless steel (A4 / HCR) property class 70	R30	$N_{Rk,s,fi}$	[kN]	0,3	1,1	1,7
	R60	$N_{Rk,s,fi}$	[kN]	0,2	0,9	1,4
	R90	$N_{Rk,s,fi}$	[kN]	0,2	0,7	1,0
	R120	$N_{Rk,s,fi}$	[kN]	0,1	0,5	0,8
Characteristic resistance under shear load						
Steel failure without lever arm						
Steel, property class 5.8 and 8.8; Stainless steel (A4 / HCR) property class 70	R30	$V^0_{Rk,s,fi}$	[kN]	0,3	1,1	1,7
	R60	$V^0_{Rk,s,fi}$	[kN]	0,2	0,9	1,4
	R90	$V^0_{Rk,s,fi}$	[kN]	0,2	0,7	1,0
	R120	$V^0_{Rk,s,fi}$	[kN]	0,1	0,5	0,8
Steel failure with lever arm – characteristic bending moment						
Steel, property class 5.8 and 8.8; Stainless steel (A4 / HCR) property class 70	R30	$M^0_{Rk,s,fi}$	[Nm]	0,2	1,1	2,2
	R60	$M^0_{Rk,s,fi}$	[Nm]	0,2	0,9	1,8
	R90	$M^0_{Rk,s,fi}$	[Nm]	0,1	0,7	1,3
	R120	$M^0_{Rk,s,fi}$	[Nm]	0,1	0,5	1,0
Partial factor	all	$\gamma_{Ms,fi}$	[-]	1,0		

Edge distance and spacing

c_{cr}	=	Characteristic edge distance
c_{min}	=	Minimum edge distance
$c_{cr,fi}$	=	Characteristic edge distance under fire exposure
$s_{cr\,II}$ ($s_{min,II}$)	=	Characteristic (minimum) spacing for anchor placed parallel to horizontal joint
$s_{cr\,\perp}$ ($s_{min,\perp}$)	=	Characteristic (minimum) spacing for anchor placed perpendicular to horizontal joint
$s_{cr,fi,II}$ ($s_{cr,fi,\perp}$)	=	Characteristic spacing for anchor placed perpendicular to horizontal (perpendicular) joint



Definition of reduction- and group factors

Anchor position \ Load direction	Tension load		Shear load parallel to free edge V_{II}		Shear load perpendicular to free edge $V_{\perp}$	
Anchors parallel to horizontal joint $s_{cr,II}$ ($s_{min,II}$)		$\alpha_{g\,II,N}$		$\alpha_{g\,II,V\,II}$		$\alpha_{g\,II,V\,\perp}$
Anchors vertical to horizontal joint $s_{cr,\perp}$ ($s_{min,\perp}$)		$\alpha_{g\,\perp,N}$		$\alpha_{g\,\perp,V\,II}$		$\alpha_{g\,\perp,V\perp}$

$\alpha_{edge,N}$	=	Reduction factor for tension loads at the free edge (single anchor)	(for $c_{min} \le c < c_{cr}$)
$\alpha_{edge,V\perp}$	=	Reduction factor for shear loads perpendicular to the free edge (single anchor)	(for $c_{min} \le c < c_{cr}$)
$\alpha_{edge,VII}$	=	Reduction factor for shear loads parallel to the free edge (single anchor)	(for $c_{min} \le c < c_{cr}$)
$\alpha_{g\,II,N}$	=	Group factor for anchors parallel to horizontal joint under tension load	
$\alpha_{g\,\perp,N}$	=	Group factor for anchors perpendicular to horizontal joint under tension load	
$\alpha_{g\,II,V\,II}$	=	Group factor for anchors parallel to horizontal joint under shear load parallel to the free edge	
$\alpha_{g\,\perp,V\,II}$	=	Group factor for anchors perpendicular to horizontal joint under shear load parallel to the free edge	
$\alpha_{g\,II,V\,\perp}$	=	Group factor for anchors parallel to horizontal joint under shear load perpendicular to the free edge	
$\alpha_{g\,\perp,V\perp}$	=	Group factor for anchors perpendicular to hor. joint under shear load perpendicular to the free edge	

Single anchor at the edge:	$N_{Rk,b,c} = \alpha_{edge,N} * N_{Rk,b}$	resp.	$N_{Rk,p,c} = \alpha_{edge,N} * N_{Rk,p}$	
	$V_{Rk,c\,II} = \alpha_{edge,V\,II} * V_{Rk,b}$			
	$V_{Rk,c\,\perp} = \alpha_{edge,V\,\perp} * V_{Rk,b}$			
Group of 2 anchors:	$N^{g}_{Rk} = \alpha_{g,N} * N_{Rk,b}$			
	$V^{g}_{Rk\,II} = \alpha_{g,\,V\,II} * V_{Rk,b}$	resp.	$V^{g}_{Rk\perp} = \alpha_{g,V\perp} * V_{Rk,b}$	(for $c \ge c_{cr}$)
	$V^{g}_{Rk,c\,II} = \alpha_{g,\,V\,II} * V_{Rk,b}$	resp.	$V^{g}_{Rk,c\perp} = \alpha_{g,V\perp} * V_{Rk,b}$	(for $c \ge c_{min}$)
Group of 4 anchors:	$N^{g}_{Rk} = \alpha_{g\,II,N} * \alpha_{g\perp,N} * N_{Rk,b}$			
	$V^{g}_{Rk\,II} = \alpha_{g\,II,V\,II} * \alpha_{g\perp,V\,II} * V_{Rk,b}$	resp.	$V^{g}_{Rk\perp} = \alpha_{g\,II,V\perp} * \alpha_{g\perp,V\perp} * V_{Rk,b}$	(for $c \ge c_{cr}$)
	$V^{g}_{Rk,c\,II} = \alpha_{g\,II,V\,II} * \alpha_{g\perp,V\,II} * V_{Rk,b}$	resp.	$V^{g}_{Rk,c\perp} = \alpha_{g\,II,V\perp} * \alpha_{g\perp,V\perp} * V_{Rk,b}$	(for $c \ge c_{min}$)

Equations depend on anchor position and load direction (see table above). Reduction factor, group factor and resistances see Annex C. Reduction for installation in joints see Annex B1.

Injection System HB-VMU plus for masonry	**Annex C5**
Performance Definition of spacing and edge distance and reduction- and group factors α	

Brick type: Autoclaved aerated concrete AAC

Table C6: Description

Brick type			Autoclaved aerated concrete AAC
Density	ρ	[kg/dm^3]	0,35 – 0,6
Normalised mean compressive strength	$f_b \geq$	[N/mm^2]	2, 4 or 6
Norm		[-]	EN 771-4:2011+A1:2015
Producer (country code)		[-]	e.g. Porit (DE)
Brick dimensions		[mm]	≥ 499 x 240 x 249
Drilling method		[-]	Rotary drilling

Table C7: Installation parameter

Anchor size			M8	M10	M12	M16	IG-M6	IG-M8	IG-M10
Installation torque	T_{inst}	[Nm]	≤ 5	≤ 5	≤ 10	≤ 10	≤ 5	≤ 5	≤ 10
Edge distance	c_{cr}	[mm]	150 (for shear loads perpendicular to the free edge: c_{cr} = 210)						
Minimum edge distance	c_{min}	[mm]	50						
Spacing	$s_{cr,II}$	[mm]	300						
	$s_{cr,\perp}$	[mm]	250						
Minimum spacing	$s_{min,II}$	[mm]	50						
	$s_{min,\perp}$	[mm]							

Table C8: Reduction factors for single anchors at the edge

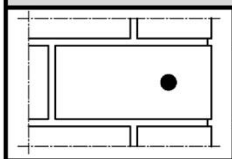
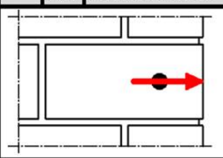
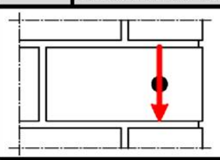
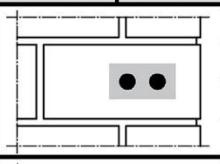
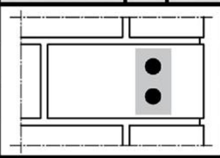
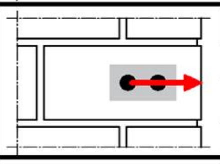
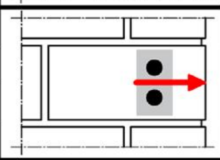
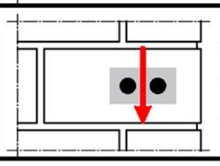
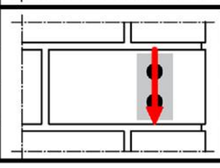
Tension load			Shear load perpendicular to the free edge			Shear load parallel to the free edge		
	with c ≥	$\alpha_{edge,N}$		with c ≥	$\alpha_{edge,V\perp}$		with c ≥	$\alpha_{edge,V II}$
	50	0,85		50	0,12		50	0,70
				125	0,50		125	0,85
	150	1,00		210	1,00		150	1,00

Table C9: Factors for anchor groups

	Position parallel to horizontal joint				Position perpendicular to horizontal joint			
Tension load		with c ≥	with s ≥	$\alpha_{g\,II,N}$		with c ≥	with s ≥	$\alpha_{g\perp,N}$
		50	50	1,10		50	50	0,75
		150	50	1,25		150	50	0,90
		1500,56	300	2,00		150	250	2,00
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\perp}$		with c ≥	with s ≥	$\alpha_{g\perp,V\perp}$
		50	50	0,20		50	50	0,25
		210	50	1,60		210	50	1,80
		210	300	2,00		210	250	2,00
Shear load parallel to the free edge		With c ≥	with s ≥	$\alpha_{g\,II,V\,II}$		with c ≥	with s ≥	$\alpha_{g\perp,V\,II}$
		50	50	1,15		50	50	0,80
		150	50	1,60		150	50	1,10
		150	300	2,00		150	250	2,00

Brick type: Autoclaved aerated concrete AAC - continuation

Table C10: Characteristic resistance under tension and shear load

Anchor size	Perforated Sleeve HB-	Effective anchorage depth	Characteristic resistance with $c \geq c_{cr}$ and $s \geq s_{cr}$						
			Use condition						
			d/d			w/d w/w			d/d w/d w/w
			24°C / 40°C	50°C / 80°C	72°C / 120°C	24°C / 40°C	50°C / 80°C	72°C / 120°C	all temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ [1]						$V_{Rk,b}$ [1]
		[mm]	[kN]						[kN]
Normalised mean compressive strength $f_b \geq 2$ N/mm²						**Density $\rho \geq 0{,}35$ kg/dm³**			
M8	-	80	1,2	0,9	0,9	0,9	0,9	0,9	1,5
M10 / IG-M6	-	90	1,2	0,9	0,9	0,9	0,9	0,9	2,5
M12 / M16 IG-M8 / IG-M10	-	100	2,0	1,5	1,5	1,5	1,5	1,5	2,5
M8	VM-SH 12	80	1,2	0,9	0,9	0,9	0,9	0,9	1,5
M8 / M10 IG-M6	VM-SH 16	≥ 85	1,2	0,9	0,9	0,9	0,9	0,9	2,5
M12 / M16 IG-M8 / IG-M10	VM-SH 20	≥ 85	2,0	1,5	1,5	1,5	1,5	1,5	2,5
Normalised mean compressive strength $f_b \geq 4$ N/mm²						**Density $\rho \geq 0{,}50$ kg/dm³**			
M8	-	80	3,0	2,5	2,0	2,5	2,0	2,0	4,5
M10 / IG-M6	-	90	3,0	2,5	2,0	2,5	2,0	2,0	7,5
M12 / M16 IG-M8 / IG-M10	-	100	5,0	4,5	4,0	4,5	4,0	4,0	7,5
M8	VM-SH 12	80	3,0	2,5	2,0	2,5	2,0	2,0	4,5
M8 / M10 IG-M6	VM-SH 16	≥ 85	3,0	2,5	2,0	2,5	2,0	2,0	7,5
M12 / M16 IG-M8 / IG-M10	VM-SH 20	≥ 85	5,0	4,5	4,0	4,5	4,0	4,0	7,5

[1] $N_{Rk,b,c} = N_{Rk,p,c}$ and $V_{Rk,c\,II} = V_{Rk,c\,\perp}$ according to Annex C5

Injection System HB-VMU plus for masonry	**Annex C7**
Performances - Autoclaved aerated concrete AAC Characteristic resistance	

Brick type: Autoclaved aerated concrete AAC - continuation

Characteristic resistance - continuation:

Anchor size	Sleeve HB-	Effective anchorage depth	Characteristic resistance with $c \geq c_{cr}$ and $s \geq s_{cr}$						
			Use condition						
			d/d			w/d w/w			d/d w/d w/w
			24°C / 40°C	50°C / 80°C	72°C / 120°C	24°C / 40°C	50°C / 80°C	72°C / 120°C	all temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ [1]						$V_{Rk,b}$ [1]
		[mm]	[kN]						[kN]
Normalised mean compressive strength $f_b \geq 6$ N/mm²						**Density $\rho \geq 0{,}60$ kg/dm³**			
M8	-	80	4,0	3,5	3,0	3,5	3,0	3,0	6,0
M10 / IG-M6	-	90	4,0	3,5	3,0	3,5	3,0	3,0	10,0
M12 / M16 IG-M8 / IG-M10	-	100	7,0	6,0	5,5	6,5	5,5	5,5	10,0
M8	VM-SH 12	80	4,0	3,5	3,0	3,5	3,0	3,0	6,0
M8 / M10 IG-M6	VM-SH 16	≥ 85	4,0	3,5	3,0	3,5	3,0	3,0	10,0
M12 / M16 IG-M8 / IG-M10	VM-SH 20	≥ 85	7,0	6,0	5,5	6,5	5,5	5,5	10,0

[1] $N_{Rk,b,c} = N_{Rk,p,c}$ and $V_{Rk,c\,II} = V_{Rk,c\perp}$ according to Annex C5

Table C11: Displacements

Anchor size	h_{ef}	δ_N / N	δ_{N0}	$\delta_{N\infty}$	δ_V / V	δ_{V0}	$\delta_{V\infty}$
	[mm]	[mm/kN]	[mm]	[mm]	[mm/kN]	[mm]	[mm]
M8 – M12 / IG-M6 – IG-M10	all	0,1	$0{,}1 \cdot N_{Rk} / 2{,}8$	$2 \cdot \delta_{N0}$	0,3	$0{,}3 \cdot V_{Rk} / 2{,}8$	$1{,}5 \cdot \delta_{V0}$
M16					0,1	$0{,}1 \cdot V_{Rk} / 2{,}8$	

Injection System HB-VMU plus for masonry

Performances - Autoclaved aerated concrete AAC
Characteristic resistance and displacements

Annex C8

Brick type: Solid calcium silica brick KS-NF

Table C12: Description

Brick type			Solid calcium silica brick KS-NF
Density	ρ	[kg/dm³]	≥ 2,0
Normalised mean compressive strength	f_b	[N/mm²]	≥ 28
Conversion factor for lower compressive strengths			$(f_b / 28)^{0,5} \leq 1,0$
Norm		[-]	EN 771-2: 2011+A1:2015
Producer (country code)		[-]	e.g. Wemding (DE)
Brick dimensions		[mm]	≥ 240 x 115 x 71
Drilling method		[-]	Hammer drilling

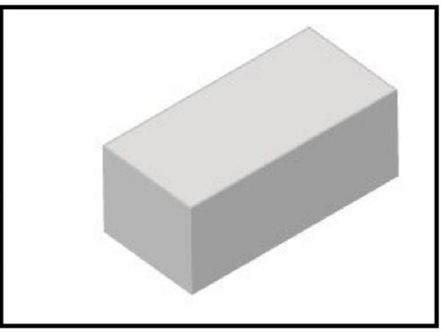
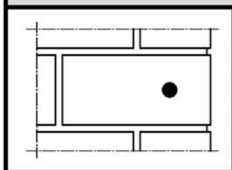
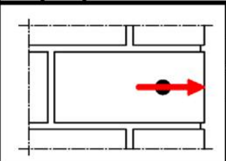
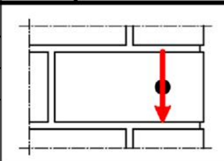


Table C13: Installation parameter

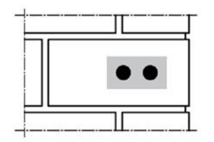
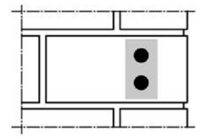
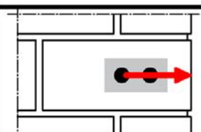
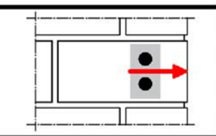
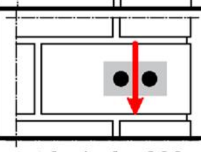
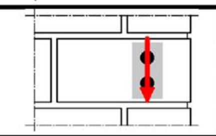
Anchor size			M8	M10	M12	M16	IG-M6	IG-M8	IG-M10
Installation torque	T_{inst}	[Nm]	≤ 10	≤ 10	≤ 15	≤ 15	≤ 10	≤ 10	≤ 10
Edge distance (under fire exposure)	c_{cr}; ($c_{cr,fi}$)	[mm]	150 (2 h_{ef}) (for shear loads perpendicular to the free edge: c_{cr} = 240)						
Minimum Edge Distance	c_{min}	[mm]	60						
Spacing (under fire exposure)	$s_{cr,II}$; ($s_{cr,fi,II}$)	[mm]	240 (4 h_{ef})						
	$s_{cr,\perp}$; ($s_{cr,fi,\perp}$)	[mm]	150 (4 h_{ef})						
Minimum Spacing	$s_{min,II}$; $s_{min,\perp}$	[mm]	75						

Table C14: Reduction factors for single anchors at the edge

Tension load			Shear load perpendicular to the free edge			Shear load parallel to the free edge		
	with c ≥	$\alpha_{edge,N}$		with c ≥	$\alpha_{edge,V\perp}$		with c ≥	$\alpha_{edge,V\,II}$
	60[1)]	0,50		60	0,30		60	0,60
	100[1)]	0,50		100	0,50		100	1,00
	150[1)]	1,00		240	1,00		150	1,00
	180	1,00						

[1)] All applications, except for hef = 200mm and without sleeve

Table C15: Factors for anchor groups

	Position parallel to horizontal joint				Position perpendicular to horizontal joint			
Tension load		with c ≥	with s ≥	$\alpha_{g\,II,N}$		with c ≥	with s ≥	$\alpha_{g\perp,N}$
		60[1)]	75	0,70		60[1)]	75	1,15
		150[1)]	75	1,40		150[1)]	75	2,00
		150[1)]	240	2,00		150[1)]	150	2,00
		180[2)]	75	1,00		180[2)]	75	1,15
		180[2)]	240	1,70		180[2)]	150	2,00
		240[2)]	240	2,00				
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\perp}$		with c ≥	with s ≥	$\alpha_{g\perp,V\perp}$
		60	75	0,75		60	75	0,90
		150	75	2,00		150	75	2,00
		150	250	2,00		150	150	2,00
Shear load parallel to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\,II}$		with c ≥	with s ≥	$\alpha_{g\perp,V\,II}$
		60	75	2,00		60	75	2,00
		150	75	2,00		150	75	2,00
		150	250	2,00		150	150	2,00

[1)] All applications, except for hef = 200mm and without sleeve
[2)] Only for application with h_{ef} = 200mm and without sleeve

Injection System HB-VMU plus for masonry	
Performance - Solid calcium silica brick KS-NF Description, installation parameters, reduction- and group factors	**Annex C9**

Brick type: Solid calcium silica brick KS-NF – continuation

Table C16: Characteristic resistance under tension and shear load

Anchor size	Sleeve HB-	Effective anchorage depth	Characteristic resistance with $c \geq c_{cr}$ and $s \geq s_{cr}$						
			Use condition						
			d/d			w/d w/w			d/d w/d w/w
			24°C / 40°C	50°C / 80°C	72°C / 120°C	24°C / 40°C	50°C / 80°C	72°C / 120°C	all temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ [1)]						$V_{Rk,b}$ [1)]
		[mm]	[kN]						[kN]
Normalised mean compressive strength $f_b \geq 28$ N/mm² [2)]									
M8	-	80	7,0	6,5	5,0	6,0	5,5	4,0	7,0
M10 / IG-M6	-	≥ 90	7,0	6,5	5,0	6,0	5,5	4,0	
M12 / IG-M8	-	≥ 100	7,0	6,5	5,0	6,0	5,5	4,0	
M16 / IG-M10	-	≥ 100	7,0	6,5	5,0	7,0	6,5	5,0	
M10 - M16 IG-M6 - IG-M10	-	200	9,0	8,5	6,5	5,5	5,0	4,0	
M8	VM-SH 12	80	7,0	6,5	5,0	6,0	5,5	4,0	
M8 / M10/ IG-M6	VM-SH 16	≥ 85	7,0	6,5	5,0	7,0	6,5	5,0	
M12 / M16 IG-M8 / IG-M10	VM-SH 20	≥ 85	7,0	6,5	5,0	7,0	6,5	5,0	

[1)] $N_{Rk,b,c} = N_{Rk,p,c}$ and $V_{Rk,c\,II} = V_{Rk,c\,\perp}$ according to Annex C5
[2)] For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C12. For stones with higher strengths, the shown values are valid without conversion.

Table C17: Displacements

Anchor size	h_{ef}	δ_N / N	δ_{N0}	$\delta_{N\infty}$	δ_V / V	δ_{V0}	$\delta_{V\infty}$
	[mm]	[mm/kN]	[mm]	[mm]	[mm/kN]	[mm]	[mm]
M8 – M12 / IG-M6 – IG-M10	all	0,1	0,1*N_{Rk} / 3,5	2*δ_{N0}	0,3	0,3*V_{Rk} / 3,5	1,5*δ_{V0}
M16					0,1	0,1*V_{Rk} / 3,5	

Table C18: Characteristic resistance under fire exposure

Anchor size	Sleeve HB-	Effective anchorage depth	Characteristic resistance $N_{Rk,b,fi} = N_{Rk,p,fi} = V_{Rk,b,fi}$			
		h_{ef}	R30	R60	R90	R120
		[mm]	[kN]			
M8	-	80	0,48	0,41	0,34	0,30
M10 / IG-M6	-	≥ 90				
M12 / IG-M8	-	≥ 100				
M16 / IG-M10	-	≥ 100				
M8	VM-SH 12	80	0,47	0,26	No performance assessed	No performance assessed
M8 / M10 / IG-M6	VM-SH 16	≥ 85				
M12 / M16 IG-M8 / IG-M10	VM-SH 20	≥ 85				

Injection System HB-VMU plus for masonry

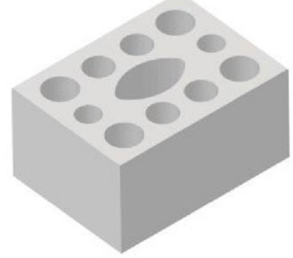
Performance
Characteristic resistance, displacements, characteristic resistance under fire exposure

Annex C10

Brick type: Hollow calcium silica brick KSL-3DF

Table C19: Description

Brick type			Hollow calcium silica brick KSL-3DF
Density	ρ	[kg/dm^3]	≥ 1,4
Normalised mean compressive strength	f_b	[N/mm^2]	≥ 14
Conversion factor for lower compressive strengths			$(f_b / 14)^{0,75} \leq 1,0$
Norm		[-]	EN 771-2:2011+A1:2015
Producer (country code)		[-]	e.g. KS-Wemding (DE)
Brick dimensions		[mm]	≥ 240 x 175 x 113
Drilling method		[-]	Rotary drilling



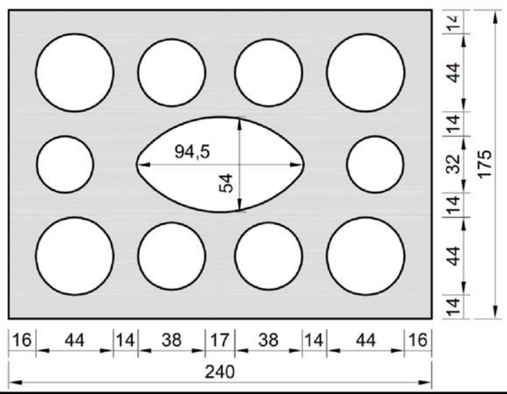
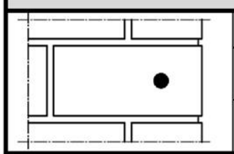
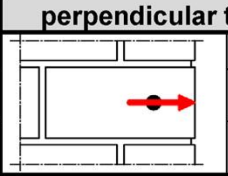
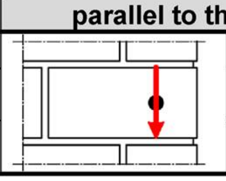


Table C20: Installation parameter

Anchor size			M8	M10	M12	M16	IG-M6	IG-M8	IG-M10
Installation torque	T_{inst}	[Nm]	≤ 5	≤ 5	≤ 8	≤ 8	≤ 5	≤ 8	≤ 8
Edge distance	c_{cr}	[mm]	120 (for shear loads perpendicular to the free edge: c_{cr} = 240)						
Minimum edge distance	c_{min}	[mm]	60						
Spacing	$s_{cr,II}$	[mm]	240						
	$s_{cr,\perp}$	[mm]	120						
Minimum spacing	$s_{min,II}$; $s_{min,\perp}$	[mm]	120						

Table C21: Reduction factors for single anchors at the edge

Tension load			Shear load perpendicular to the free edge			Shear load parallel to the free edge		
	with c ≥	$\alpha_{edge,N}$		with c ≥	$\alpha_{edge,V\perp}$		with c ≥	$\alpha_{edge,V II}$
	60	1,00		60	0,30		60	1,00
	120	1,00		240	1,00		120	1,00

Brick type: Hollow calcium silica brick KSL-3DF – continuation

Table C22: Factors for anchor groups

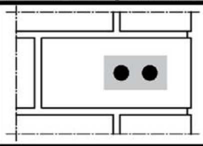
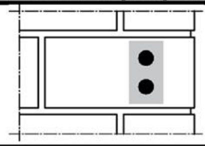
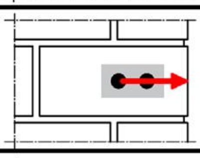
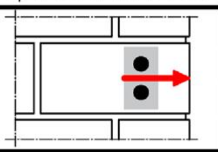
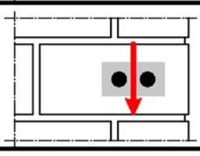
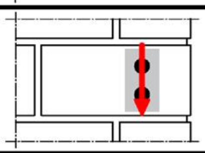
	Position parallel to horizontal joint				Position perpendicular to horizontal joint			
Tension load		with c ≥	with s ≥	$\alpha_{g\,II,\,N}$		with c ≥	with s ≥	$\alpha_{g\,\perp,\,N}$
		60	120	1,50		60	120	1,00
		120	120	2,00		60	120	1,00
		120	240	2,00		120	120	2,00
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\perp}$		with c ≥	with s ≥	$\alpha_{g\perp,V\perp}$
		60	120	0,30		60	120	0,30
		120	120	1,00		60	120	0,30
		120	240	2,00		240	120	2,00
Shear load parallel to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\,II}$		with c ≥	with s ≥	$\alpha_{g\perp,V\,II}$
		60	120	1,00		60	120	1,00
		120	120	1,60				
		120	240	2,00		120	120	2,00

Table C23: Characteristic resistance under tension and shear load

Anchor size	**Sleeve HB-**	**Effective anchorage depth**	**Characteristic resistance** with c ≥ c_{cr} and s ≥ s_{cr}						
			Use condition						
			d/d			**w/d w/w**			**d/d w/d w/w**
			24°C / 40°C	50°C / 80°C	72°C / 120°C	24°C / 40°C	50°C / 80°C	72°C / 120°C	all temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ 1)						$V_{Rk,b}$ 1)
		[mm]	[kN]						[kN]
Normalised mean compressive strength f_b ≥ 14 N/mm² 2)									
M8 / M10 IG-M6	VM-SH 16	≥ 85	2,5	2,5	1,5	2,5	2,5	1,5	6,0
		130	2,5	2,5	2,0	2,5	2,5	2,0	
M12 / M16 IG-M8 IG-M10	VM-SH 20	≥ 85	6,5	6,0	4,5	6,5	6,0	4,5	

1) $N_{Rk,b,c} = N_{Rk,p,c}$ and $V_{Rk,c\,II} = V_{Rk,c\,\perp}$ according to Annex C5
2) For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C19. For stones with higher strengths, the shown values are valid without conversion.

Table C24: Displacements

Anchor size	h_{ef}	δ_N / N	δ_{N0}	$\delta_{N\infty}$	δ_V / V	δ_{V0}	$\delta_{V\infty}$
	[mm]	[mm/kN]	[mm]	[mm]	[mm/kN]	[mm]	[mm]
M8 – M12 / IG-M6 – IG-M10	all	0,13	0,13*N_{Rk} / 3,5	2*δ_{N0}	0,55	0,55*V_{Rk} / 3,5	1,5*δ_{V0}
M16					0,31	0,31*V_{Rk} / 3,5	

Injection System HB-VMU plus for masonry

Performance - Hollow calcium silica brick KSL-3DF
Group factors, characteristic resistances and displacements

Annex C12

Brick type: Hollow calcium silica brick KSL-8DF

Table C25: Description

Brick type			Hollow calcium silica brick KSL-8DF
Density	ρ	[kg/dm³]	≥ 1,4
Normalised mean compressive strength	f_b	[N/mm²]	≥ 12
Conversion factor for lower compressive strengths			$(f_b / 12)^{0,75} \leq 1,0$
Norm		[-]	EN 771-2:2011+A1:2015
Producer (country code)		[-]	e.g. KS-Wemding (DE)
Brick dimensions		[mm]	≥ 248 x 240 x 238
Drilling method		[-]	Rotary drilling

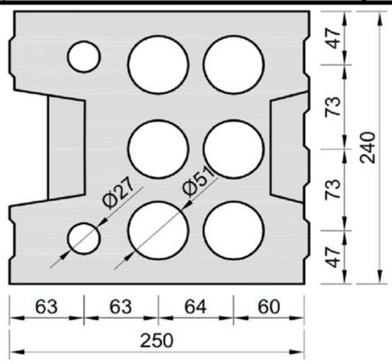
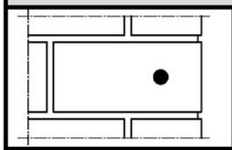
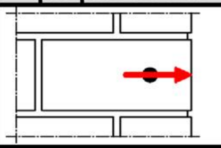
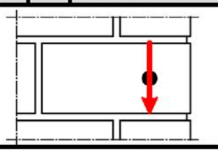


Table C26: Installation parameter

Anchor size			M8	M10	M12	M16	IG-M6	IG-M8	IG-M10
Installation torque	T_{inst}	[Nm]	≤ 5	≤ 5	≤ 8	≤ 8	≤ 5	≤ 8	≤ 8
Edge distance	c_{cr}	[mm]	120 (for shear loads perpendicular to the free edge: c_{cr} = 250)						
Minimum edge distance	c_{min}	[mm]	50						
Spacing	$s_{cr,II}$	[mm]	250						
	$s_{cr,\perp}$	[mm]	120						
Minimum spacing	$s_{min,II}$ $s_{min,\perp}$	[mm]	50						

Table C27: Reduction factors for single anchors at the edge

Tension load			Shear load					
			perpendicular to the free edge			perpendicular to the free edge		
	with c ≥	$\alpha_{edge,N}$		with c ≥	$\alpha_{edge,V\perp}$		with c ≥	$\alpha_{edge,V II}$
	50	1,00		50	0,30		50	1,00
	120	1,00		250	1,00		120	1,00

Injection System HB-VMU plus for masonry

Performances - Hollow calcium silica brick KSL-8DF
Description, installation parameters, reduction factors

Annex C13

Brick type: Hollow calcium silica brick KSL-8DF – continuation

Table C28: Factors for anchor groups

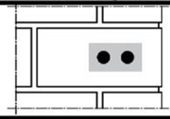
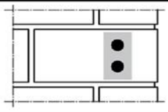
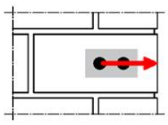
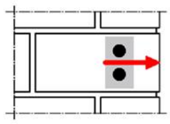
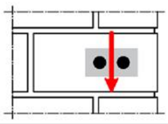
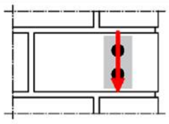
	Position parallel to horizontal joint				Position perpendicular to horizontal joint			
Tension load		with c ≥	with s ≥	$\alpha_{g\,II,\,N}$		with c ≥	with s ≥	$\alpha_{g\,\perp,\,N}$
		50	50	1,00		50	50	1,00
		120	250	2,00		120	120	2,00
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\perp}$		with c ≥	with s ≥	$\alpha_{g\perp,V\perp}$
		50	50	0,45		50	50	0,45
		250	50	1,15		250	50	1,20
		250	250	2,00		250	250	2,00
Shear load parallel to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\,II}$		with c ≥	with s ≥	$\alpha_{g\perp,V\,II}$
		50	50	1,30		50	50	1,00
		120	250	2,00		120	250	2,00

Table C29: Characteristic resistance under tension and shear load

Anchor size	Sleeve HB-	Effective anchorage depth	**Characteristic resistance** with $c \geq c_{cr}$ and $s \geq s_{cr}$						
			Use condition						
			d/d			**w/d w/w**			**d/d w/d w/w**
			24°C / 40°C	50°C / 80°C	72°C / 120°C	24°C / 40°C	50°C / 80°C	72°C / 120°C	all temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ 1)						$V_{Rk,b}$ 1)
		[mm]	[kN]						[kN]
Normalised mean compressive strength $f_b \geq 12$ N/mm² 2)									
M8 / M10 IG-M6	VM-SH 16	130	5,0	4,5	3,5	5,0	4,5	3,5	3,5
M12 / M16 IG-M8 IG-M10	VM-SH 20	≥ 130	5,0	4,5	3,5	5,0	4,5	3,5	6,0

1) $N_{Rk,b,c} = N_{Rk,p,c}$ and $V_{Rk,c\,II} = V_{Rk,c\,\perp}$ according to Annex C5
2) For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C25. For stones with higher strengths, the shown values are valid without conversion.

Table C30: Displacements

Anchor size	h_{ef}	δ_N / N	δ_{N0}	$\delta_{N\infty}$	δ_V / V	δ_{V0}	$\delta_{V\infty}$
	[mm]	[mm/kN]	[mm]	[mm]	[mm/kN]	[mm]	[mm]
M8 – M12 / IG-M6 – IG-M10	all	0,13	$0{,}13 \cdot N_{Rk} / 3{,}5$	$2 \cdot \delta_{N0}$	0,55	$0{,}55 \cdot V_{Rk} / 3{,}5$	$1{,}5 \cdot \delta_{V0}$
M16					0,31	$0{,}31 \cdot V_{Rk} / 3{,}5$	

Brick type: Hollow calcium silica brick KSL-12DF

Table C31: Description

Brick type			Hollow calcium silica brick KSL-12DF
Density	ρ	[kg/dm^3]	≥ 1,4
Normalised mean compressive strength	f_b	[N/mm^2]	≥ 12
Conversion factor for lower compressive strengths			$(f_b / 12)^{0,75} \leq 1,0$
Norm		[-]	EN 771-2:2011+A1:2015
Producer (country code)		[-]	e.g. KS-Wemding (DE)
Brick dimensions		[mm]	≥ 498 x 175 x 238
Drilling method		[-]	Rotary drilling

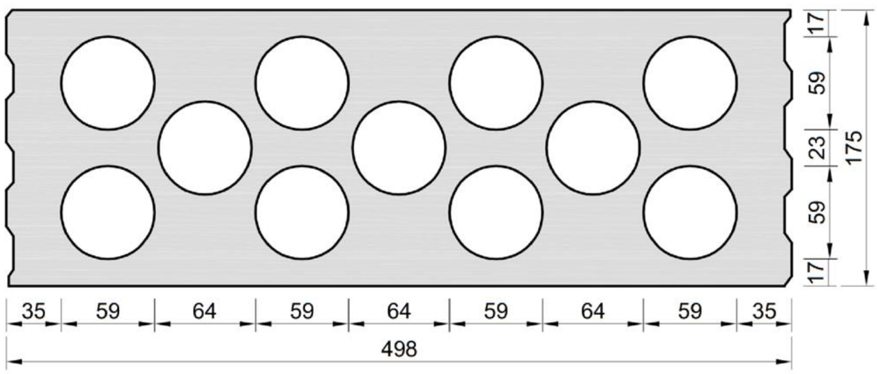
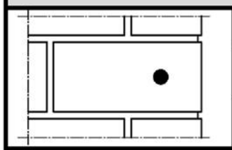
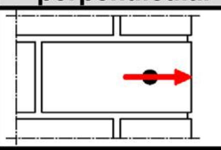
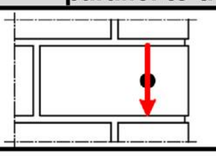


Table C32: Installation parameter

Anchor size			M8	M10	M12	M16	IG-M6	IG-M8	IG-M10
Installation torque	T_{inst}	[Nm]	≤ 4	≤ 4	≤ 5	≤ 5	≤ 4	≤ 5	≤ 5
Edge distance (under fire exposure)	c_{cr}; ($c_{cr,fi}$)	[mm]	120 (2 h_{ef}) (for shear loads perpendicular to the free edge: c_{cr} = 500)						
Minimum edge distance	c_{min}	[mm]	50						
Spacing (under fire exposure)	$s_{cr,II}$; ($s_{cr,fi,II}$)	[mm]	500 (4 h_{ef})						
	$s_{cr,\perp}$; ($s_{cr,fi,\perp}$)	[mm]	120 (4 h_{ef})						
Minimum spacing	$s_{min,II}$; $s_{min,\perp}$	[mm]	50						

Table C33: Reduction factors for single anchors at the edge

Tension load			Shear load					
			perpendicular to the free edge			parallel to the free edge		
	with c ≥	$\alpha_{edge,N}$		with c ≥	$\alpha_{edge,V\perp}$		with c ≥	$\alpha_{edge,V II}$
	50	1,00		50	0,45		50	1,00
	120	1,00		500	1,00		120	1,00

Brick type: Hollow calcium silica brick KSL-12DF – continuation

Table C34: Factors for anchor groups

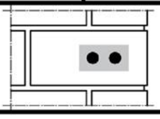
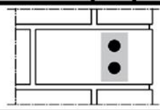
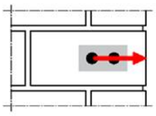
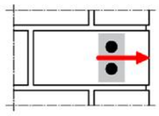
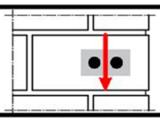
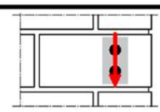
	Position parallel to horizontal joint				Position perpendicular to horizontal joint			
Tension load		with c ≥	with s ≥	$\alpha_{g\,II,\,N}$		with c ≥	with s ≥	$\alpha_{g\,\perp,\,N}$
		50	50	1,50		50	50	1,00
		120	500	2,00		120	240	2,00
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\,\perp}$		with c ≥	with s ≥	$\alpha_{g\,\perp,\,V\,\perp}$
		50	50	0,55		50	50	0,50
		500	50	1,00		500	50	1,00
		500	500	2,00		500	250	2,00
Shear load parallel to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\,II}$		with c ≥	with s ≥	$\alpha_{g\,\perp,V\,II}$
		50	50	2,00		50	50	1,30
		120	500	2,00		120	250	2,00

Table C35: Characteristic resistance under tension and shear load

Anchor size	Sleeve HB-	Effective anchorage depth	Characteristic resistance with $c \geq c_{cr}$ and $s \geq s_{cr}$						
			Use condition						
			d/d			w/d w/w			d/d w/d w/w
			24°C / 40°C	50°C / 80°C	72°C / 120°C	24°C / 40°C	50°C / 80°C	72°C / 120°C	all temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ 1)						$V_{Rk,b}$ 1)
		[mm]	[kN]						[kN]
Normalised mean compressive strength $f_b \geq 12$ N/mm² 2)									
M8 / M10 IG-M6	VM-SH 16	130	3,5	3,5	2,5	3,5	3,5	2,5	3,5
M12 / M16 IG-M8 / IG-M10	VM-SH 20	≥ 130	3,5	3,5	2,5	3,5	3,5	2,5	7,0

1) $N_{Rk,b,c} = N_{Rk,p,c}$ and $V_{Rk,c\,II} = V_{Rk,c\,\perp}$ according to Annex C5
2) For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C31. For stones with higher strengths, the shown values are valid without conversion.

Table C36: Displacements

Anchor size	h_{ef}	δ_N / N	δ_{N0}	$\delta_{N\infty}$	δ_V / V	δ_{V0}	$\delta_{V\infty}$
	[mm]	[mm/kN]	[mm]	[mm]	[mm/kN]	[mm]	[mm]
M8 – M12 / IG-M6 – IG-M10	all	0,13	$0{,}13 \cdot N_{Rk} / 3{,}5$	$2 \cdot \delta_{N0}$	0,55	$0{,}55 \cdot V_{Rk} / 3{,}5$	$1{,}5 \cdot \delta_{V0}$
M16					0,31	$0{,}31 \cdot V_{Rk} / 3{,}5$	

Table C37: Characteristic resistance under fire exposure

Anchor size	Sleeve HB-	Effective anchorage depth	Characteristic resistance $N_{Rk,b,fi} = N_{Rk,p,fi} = V_{Rk,b,fi}$			
		h_{ef}	R30	R60	R90	h_{ef}
		[mm]	[kN]			
M8/M10/IG-M6	VM-SH 16	130	0,37	0,27	0,17	no performance assessed
M12/ IG-M8	VM-SH 20	≥ 130				
M16/IG-M10	VM-SH 20	≥ 130				0,12

Brick type: Solid clay brick MZ-1DF

Table C38: Description

Brick type			Solid clay brick MZ-1DF
Density	ρ	[kg/dm^3]	≥ 2,0
Normalised mean compressive strength	f_b	[N/mm^2]	≥ 20
Conversion factor for lower compressive strengths			$(f_b / 20)^{0,5} \leq 1,0$
Norm		[-]	EN 771-1:2011+A1:2015
Producer (country code)		[-]	e.g. Wienerberger (DE)
Brick dimensions		[mm]	≥ 240 x 115 x 55
Drilling method		[-]	Hammer drilling

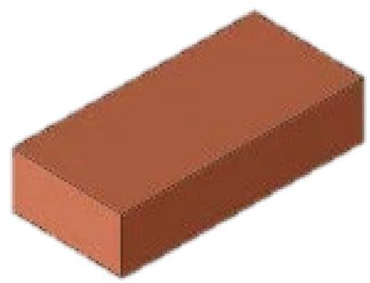


Table C39: Installation parameter

Anchor size			M8	M10	M12	M16	IG-M6	IG-M8	IG-M10
Installation torque	T_{inst}	[Nm]	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10
Edge distance	c_{cr}	[mm]	150 (for shear loads perpendicular to the free edge: c_{cr} = 240)						
Minimum edge distance	c_{min}	[mm]	60						
Spacing	$s_{cr,II}$	[mm]	240						
	$s_{cr,\perp}$	[mm]	130						
Minimum spacing	$s_{min,II}$; $s_{min,\perp}$	[mm]	65						

Table C40: Reduction factors for single anchors at the edge

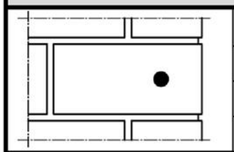
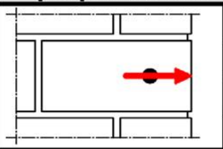
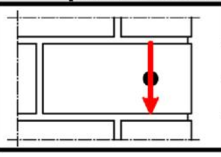
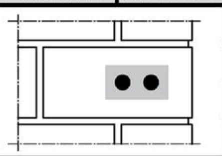
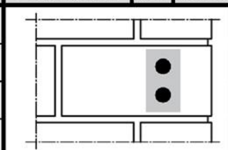
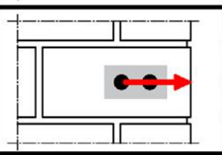
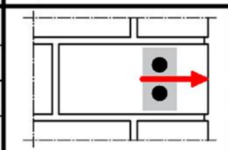
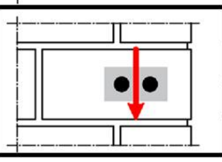
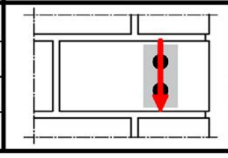
Tension load			Shear load perpendicular to the free edge			Shear load parallel to the free edge		
	with c ≥	$\alpha_{edge,N}$		with c ≥	$\alpha_{edge,V\perp}$		with c ≥	$\alpha_{edge,V II}$
	60	0,75		60	0,10		60	0,30
	150	1,00		100	0,50		100	0,65
	180	1,00		240	1,00		150	1,00

Table C41: Factors for anchor groups

	Position parallel to horizontal joint				Position perpendicular to horizontal joint			
Tension load		with c ≥	with s ≥	$\alpha_{g II,N}$		with c ≥	with s ≥	$\alpha_{g \perp,N}$
		60	65	0,85		60	65	1,00
		150	65	1,15		150	65	1,20
		150	240	2,00		150	130	2,00
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g II,V\perp}$		with c ≥	with s ≥	$\alpha_{g\perp,V\perp}$
		60	65	0,40		60	65	0,30
		240	65	2,00		240	65	2,00
		240	240	2,00		240	130	2,00
Shear load parallel to the free edge		with c ≥	with s ≥	$\alpha_{g II,V II}$		with c ≥	with s ≥	$\alpha_{g\perp,V II}$
		60	65	1,75		60	65	1,10
		150	65	2,00		150	65	2,00
		150	240	2,00		150	130	2,00

Brick type: Solid clay brick MZ-1DF – continuation

Table C42: Characteristic resistance under tension and shear load

Anchor size	Sleeve HB-	Effective anchorage depth	Characteristic resistance with $c \geq c_{cr}$ and $s \geq s_{cr}$						
			Use condition						
			d/d			w/d w/w			d/d w/d w/w
			24°C / 40°C	50°C / 80°C	72°C / 120°C	24°C / 40°C	50°C / 80°C	72°C / 120°C	all temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ [1)]						$V_{Rk,b}$ [1)]
		[mm]	[kN]						[kN]
Normalised mean compressive strength $f_b \geq 20$ N/mm² [2)]									
M8	-	80	7,0	6,0	6,0	7,0	6,0	6,0	8,0
M10 / IG-M6	-	≥ 90	7,0	6,0	6,0	7,0	6,0	6,0	8,0
M12 / IG-M8	-	≥ 100	7,0	6,0	6,0	7,0	6,0	6,0	8,0
M16 / IG-M10	-	≥ 100	8,0	6,5	6,5	8,0	6,5	6,5	12,0
M8	VM-SH 12	80	7,0	6,0	6,0	7,0	6,0	6,0	8,0
M8 / M10 IG-M6	VM-SH 16	≥ 85	7,0	6,0	6,0	7,0	6,0	6,0	8,0
M12 IG-M8	VM-SH 20	≥ 85	7,0	6,0	6,0	7,0	6,0	6,0	8,0
M16 IG-M10	VM-SH 20	≥ 85	8,0	6,5	6,5	8,0	6,5	6,5	12,0

1) $N_{Rk,b,c} = N_{Rk,p,c}$ and $V_{Rk,c\,II} = V_{Rk,c\,\perp}$ according to Annex C5
2) For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C38. For stones with higher strengths, the shown values are valid without conversion.

Table C43: Displacements

Anchor size	h_{ef}	δ_N / N	δ_{N0}	$\delta_{N\infty}$	δ_V / V	δ_{V0}	$\delta_{V\infty}$
	[mm]	[mm/kN]	[mm]	[mm]	[mm/kN]	[mm]	[mm]
M8 – M12 / IG-M6 – IG-M10	all	0,1	$0{,}1 \cdot N_{Rk}$ / 3,5	$2 \cdot \delta_{N0}$	0,3	$0{,}3 \cdot V_{Rk}$ / 3,5	$1{,}5 \cdot \delta_{V0}$
M16					0,1	$0{,}1 \cdot V_{Rk}$ / 3,5	

Injection System HB-VMU plus for masonry

Performances - Solid clay brick MZ-1DF
Characteristic resistance and displacements

Annex C18

Brick type: Solid clay brick MZ-2DF

Table C44: Description

Brick type			Solid clay brick MZ-2DF
Density	ρ	[kg/dm³]	≥ 2,0
Normalised mean compressive strength	f_b	[N/mm²]	≥ 28
Conversion factor for lower compressive strengths			$(f_b / 28)^{0,5} \leq 1,0$
Norm		[-]	EN 771-1:2011+A1:2015
Producer (country code)		[-]	e.g. Wienerberger (DE)
Brick dimensions		[mm]	≥ 240 x 115 x 113
Drilling method		[-]	Hammer drilling

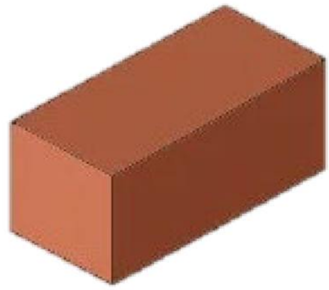


Table C45: Installation parameter

Anchor size			M8	M10	M12	M16	IG-M6	IG-M8	IG-M10
Installation torque	T_{inst}	[Nm]	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10
Edge distance (under fire exposure)	c_{cr}; ($c_{cr,fi}$)	[mm]	150 (2 h_{ef}) (for shear loads perpendicular to the free edge: c_{cr} = 240)						
Minimum edge distance	c_{min}	[mm]	50						
Spacing (under fire exposure)	$s_{cr,II}$ ($s_{cr,fi,II}$)	[mm]	240 (4 h_{ef})						
	$s_{cr,\perp}$ ($s_{cr,fi,\perp}$)	[mm]	240 (4 h_{ef})						
Minimum spacing	$s_{min,II}$; $s_{min,\perp}$	[mm]	50						

Table C46: Reduction factors for single anchors at the edge

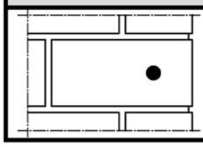
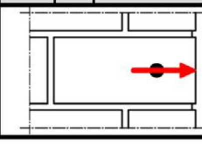
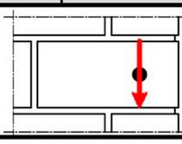
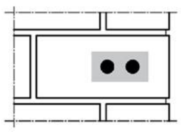
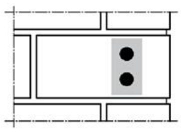
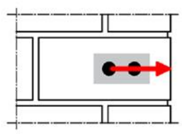
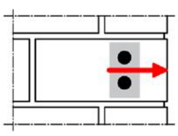
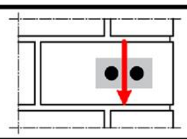
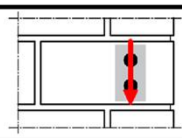
Tension load			Shear load perpendicular to the free edge			Shear load parallel to the free edge		
	with c ≥	$\alpha_{edge,N}$		with c ≥	$\alpha_{edge,V\perp}$		with c ≥	$\alpha_{edge,V II}$
	50[1]	1,00		50	0,20		50	1,00
	150[1]	1,00		125	0,50			
	150	1,00		240	1,00		150	1,00

Table C47: Factors for anchor groups

	Position parallel to horizontal joint				Position perpendicular to horizontal joint			
Tension load		with c ≥	with s ≥	$\alpha_{g II, N}$		with c ≥	with s ≥	$\alpha_{g \perp, N}$
		50[1]	50	1,50		50[1]	50	0,80
		150[1]	240	2,00		150[1]	240	2,00
		180[2]	60	1,00		180[2]	60	1,00
		180[2]	240	1,55		180[2]	120	2,00
		240[2]	240	2,00		180[2]	120	2,00
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g II,V\perp}$		with c ≥	with s ≥	$\alpha_{g\perp,V\perp}$
		50	50	0,40		50	50	0,20
		240	50	1,20		240	50	0,60
		240	240	2,00		240	125	1,00
						240	240	2,00
Shear load parallel to the free edge		with c ≥	with s ≥	$\alpha_{g II,V II}$		with c ≥	with s ≥	$\alpha_{g\perp,V II}$
		50	50	1,20		50	50	1,00
		150	240	2,00		50	125	1,00
						150	240	2,00

[1] All applications, except for h_{ef} = 200mm and without sleeve (for Table C46 and C47)

[2] Only for application with h_{ef} = 200mm and without sleeve

Injection System HB-VMU plus for masonry

Performances – Solid clay brick MZ-2DF
Description, installation parameters, reduction- and group factors

Annex C19

Brick type: Solid clay brick MZ-2DF – continuation

Table C48: Characteristic resistance under tension and shear load

Anchor size	Sleeve HB-	Effective anchorage depth	Characteristic resistance with $c \geq c_{cr}$ and $s \geq s_{cr}$						
			Use condition						
			d/d			w/d w/w			d/d w/d w/w
			24°C / 40°C	50°C / 80°C	72°C / 120°C	24°C / 40°C	50°C / 80°C	72°C / 120°C	all temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ 1)						$V_{Rk,b}$ 1)
		[mm]	[kN]						[kN]
Normalised mean compressive strength $f_b \geq 28$ N/mm² 2)									
M8	-	80	9,0	9,0	7,5	9,0	9,0	7,5	9,5
M10 / IG-M6	-	≥ 90	9,0	9,0	7,5	9,0	9,0	7,5	9,5
M12 / IG-M8	-	≥ 100	9,0	9,0	7,5	9,0	9,0	7,5	12,0
M16 / IG-M10	-	≥ 100	9,0	9,0	7,5	9,0	9,0	7,5	12,0 3)
M10 / M12 IG-M6 / IG-M8	-	200	11,5	11,5	10,0	6,0	6,0	5,0	8,0
M16 / IG-M10	-	200	11,5	11,5	10,0	6,0	6,0	5,0	12,0
M8	VM-SH 12	80	9,0	9,0	7,5	9,0	9,0	7,5	9,5
M8 / M10 IG-M6	VM-SH 16	≥ 85	9,0	9,0	7,5	9,0	9,0	7,5	9,5
M12 / IG-M8	VM-SH 20	≥ 85	9,0	9,0	7,5	9,0	9,0	7,5	12,0
M16 / IG-M10	VM-SH 20	≥ 85	9,0	9,0	7,5	9,0	9,0	7,5	12,0 3)

1) $N_{Rk,b,c} = N_{Rk,p,c}$ and $V_{Rk,c\,II} = V_{Rk,c\,\perp}$ according to Annex C5
2) For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C44. For stones with higher strengths, the shown values are valid without conversion.
3) Valid for all stone strengths with min. 10 N/mm²

Table C49: Displacements

Anchor size	h_{ef}	δ_N / N	δ_{N0}	$\delta_{N\infty}$	δ_V / V	δ_{V0}	$\delta_{V\infty}$
	[mm]	[mm/kN]	[mm]	[mm]	[mm/kN]	[mm]	[mm]
M8 – M12 / IG-M6 – IG-M10	all	0,1	$0,1 \cdot N_{Rk} / 3,5$	$2 \cdot \delta_{N0}$	0,3	$0,3 \cdot V_{Rk} / 3,5$	$1,5 \cdot \delta_{V0}$
M16	all	0,1	$0,1 \cdot N_{Rk} / 3,5$	$2 \cdot \delta_{N0}$	0,1	$0,1 \cdot V_{Rk} / 3,5$	$1,5 \cdot \delta_{V0}$

Injection System HB-VMU plus for masonry

Performance - Solid clay brick MZ-2DF
Characteristic resistance and displacements

Annex C20

Table C50: Characteristic resistance under fire exposure

Anchor size	Sleeve HB-	Effective anchorage depth h_{ef} [mm]	Characteristic resistance $N_{Rk,b,fi} = N_{Rk,p,fi} = V_{Rk,b,fi}$ [kN] R30	R60	R90	R120
M8	-	80	0,51	0,44	0,36	0,33
M10 / IG-M6	-	≥ 90				
M12 / IG-M8	-	≥ 100				
M16 / IG-M10	-	≥ 100				
M8	VM-SH 12	80	0,36	0,26	0,15	0,10
M8 / M10 / IG-M6	VM-SH 16	≥ 85	0,36	0,26	0,15	0,10
		130	0,92	0,74	0,57	0,49
M12 / M16 IG-M8 / IG-M10	VM-SH 20	≥ 85	0,36	0,26	0,15	0,10
		≥ 130	0,92	0,74	0,57	0,49

Brick type: Hollow clay brick HLZ-10 DF

Table C51: Description

Brick type			**Hollow clay brick HLZ-10 DF**
Density	ρ	[kg/dm³]	≥ 1,25
Normalised mean compressive strength	f_b	[N/mm²]	≥ 20
Conversion factor for lower compressive strengths			$(f_b / 20)^{0,5} \leq 1,0$
Norm		[-]	EN 771-1:2011+A1:2015
Producer (country code)		[-]	e.g. Wienerberger (DE)
Brick dimensions		[mm]	300 x 240 x 249
Drilling method		[-]	Rotary drilling

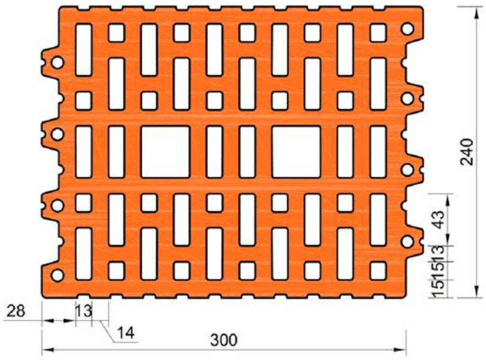
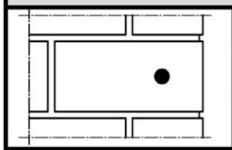
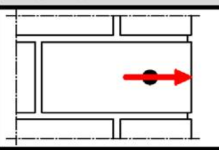
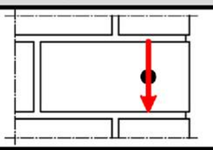


Table C52: Installation parameter

Anchor size			**M8**	**M10**	**M12**	**M16**	**IG-M6**	**IG-M8**	**IG-M10**
Installation torque	T_{inst}	[Nm]	≤ 5	≤ 10	≤ 10	≤ 10	≤ 5	≤ 5	≤ 10
Edge distance (under fire exposure)	c_{cr}; ($c_{cr,fi}$)	[mm]	120 (2 h_{ef}) (for shear loads perpendicular to the free edge: c_{cr} = 300)						
Minimum edge distance	c_{min}	[mm]	50						
Characteristic spacing (under fire exposure)	$s_{cr,II}$ ($s_{cr,fi,II}$)	[mm]	300 (4 h_{ef})						
	$s_{cr,\perp}$ ($s_{cr,fi,\perp}$)	[mm]	250 (4 h_{ef})						
Minimum spacing	$s_{min,II}$; $s_{min,\perp}$	[mm]	50						

Table C53: Reduction factors for single anchors at the edge

Tension load			**Shear load**					
			perpendicular to the free edge			**parallel to the free edge**		
	with c ≥	$\alpha_{edge,N}$		with c ≥	$\alpha_{edge,V\perp}$		with c ≥	$\alpha_{edge,V II}$
	50	1,00		50	0,20		50	1,00
	120	1,00		300	1,00		120	1,00

Brick type: Hollow clay brick HLZ-10 DF – continuation

Table C54: Factors for anchor groups

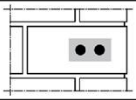
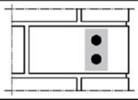
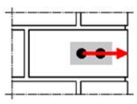
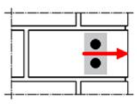
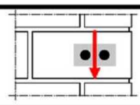
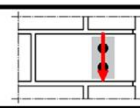
	Position parallel to horizontal joint				Position perpendicular to horizontal joint			
Tension load		with c ≥	with s ≥	$\alpha_{g\,II,N}$		with c ≥	with s ≥	$\alpha_{g\perp,N}$
		50	50	1,55		50	50	1,00
		120	300	2,00		120	250	2,00
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\perp}$		with c ≥	with s ≥	$\alpha_{g\perp,V\perp}$
		50	50	0,30		50	50	0,20
		300	50	1,40		300	50	1,00
		300	300	2,00		300	250	2,00
Shear load parallel to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\,II}$		with c ≥	with s ≥	$\alpha_{g\perp,V\,II}$
		50	50	1,85		50	50	1,00
		120	300	2,00		120	250	2,00

Table C55: Characteristic resistance under tension and shear load

Anchor size	**Sleeve HB-**	**Effective anchorage depth**	**Characteristic resistance** with $c \geq c_{cr}$ and $s \geq s_{cr}$						
			Use condition						
			d/d			**w/d w/w**			**d/d w/d w/w**
			24°C / 40°C	50°C / 80°C	72°C / 120°C	24°C / 40°C	50°C / 80°C	72°C / 120°C	all temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ 1)						$V_{Rk,b}$ 1)
		[mm]	[kN]						[kN]
Normalised mean compressive strength $f_b \geq 20$ N/mm² 2)									
M8	VM-SH 12	80	2,5	2,5	2,0	2,5	2,5	2,0	8,0
M8 / M10 /IG-M6	VM-SH 16	≥ 85	2,5	2,5	2,0	2,5	2,5	2,0	8,0
M12 / IG-M8	VM-SH 20	≥ 85	5,0	5,0	4,5	5,0	5,0	4,5	8,0
M16 / IG-M10	VM-SH 20	≥ 85	5,0	5,0	4,5	5,0	5,0	4,5	11,5

1) $N_{Rk,b,c} = N_{Rk,p,c}$ and $V_{Rk,c\,II} = V_{Rk,c\,\perp}$ according to Annex C5

2) For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C51. For stones with higher strengths, the shown values are valid without conversion.

Table C56: Displacements

Anchor size	h_{ef}	δ_N / N	δ_{N0}	$\delta_{N\infty}$	δ_V / V	δ_{V0}	$\delta_{V\infty}$
	[mm]	[mm/kN]	[mm]	[mm]	[mm/kN]	[mm]	[mm]
M8 – M12 / IG-M6 – IG-M10	all	0,13	$0{,}13 \cdot N_{Rk} / 3{,}5$	$2 \cdot \delta_{N0}$	0,55	$0{,}55 \cdot V_{Rk} / 3{,}5$	$1{,}5 \cdot \delta_{V0}$
M16					0,31	$0{,}31 \cdot V_{Rk} / 3{,}5$	

Table C57: Characteristic resistance under fire exposure

Anchor size	**Sleeve HB-**	**Effective anchorage depth**	**Characteristic resistance** $N_{Rk,b,fi} = N_{Rk,p,fi} = V_{Rk,b,fi}$			
		h_{ef}	**R30**	**R60**	**R90**	**R120**
		[mm]	[kN]			
M8 / M10 / IG-M6	VM-SH 16	130	0,57	0,39	0,21	0,12
M12 / M16 IG-M8 / IG-M10	VM-SH 20	≥ 130				

Brick type: Hollow clay brick Porotherm Homebric

Table C58: Description

Brick type			Hollow clay brick Porotherm Homebric
Density	ρ	[kg/dm³]	≥ 0,70
Normalised mean compressive strength	f_b	[N/mm²]	≥ 10
Conversion factor for lower compressive strengths			$(f_b / 10)^{0,5} \leq 1,0$
Norm		[-]	EN 771-1:2011+A1:2015
Producer (country code)		[-]	e.g. Wienerberger (FR)
Brick dimensions		[mm]	500 x 200 x 299
Drilling method		[-]	Rotary drilling

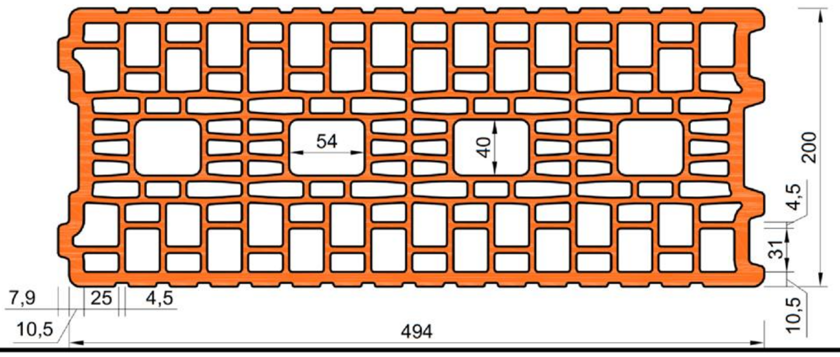
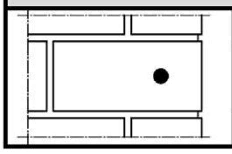
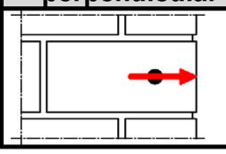
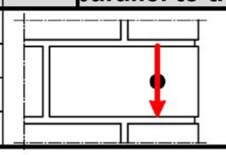


Table C59: Installation parameter

Anchor size			M8	M10	M12	M16	IG-M6	IG-M8	IG-M10
Installation torque	T_{inst}	[Nm]	≤ 2	≤ 2	≤ 2	≤ 2	≤ 2	≤ 2	≤ 2
Edge distance	c_{cr}	[mm]	120 (for shear loads perpendicular to the free edge: c_{cr} = 500)						
Minimum edge distance	c_{min}	[mm]	120						
Spacing	$s_{cr,II}$	[mm]	500						
	$s_{cr,\perp}$	[mm]	300						
Minimum spacing	$s_{min,II}$ $s_{min,\perp}$	[mm]	120						

Table C60: Reduction factors for single anchors at the edge

Tension load			Shear load perpendicular to the free edge			Shear load parallel to the free edge		
	with c ≥	$\alpha_{edge,N}$		with c ≥	$\alpha_{edge,V\perp}$		with c ≥	$\alpha_{edge,V II}$
	120	1,00		120	0,30		120	0,60
				250	0,60			
	120	1,00		500	1,00		200	1,00

Brick type: Hollow clay brick Porotherm Homebric – continuation

Table C61: Factors for anchor groups

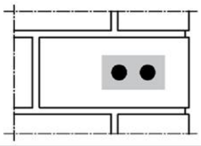
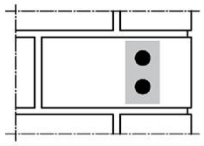
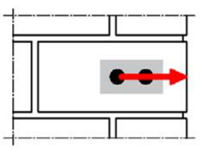
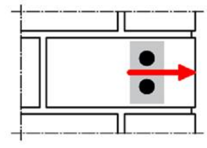
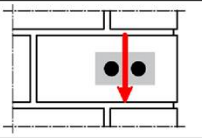
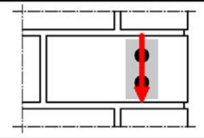
	Position parallel to horizontal joint				Position perpendicular to horizontal joint			
Tension load		with c ≥	with s ≥	$\alpha_{g\,II,N}$		with c ≥	with s ≥	$\alpha_{g\perp,N}$
		120	100	1,00		120	100	1,00
		200	100	2,00		200	100	1,20
		120	500	2,00		120	300	2,00
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\perp}$		with c ≥	with s ≥	$\alpha_{g\perp,V\perp}$
		120	100	0,30		120	100	0,30
		250	100	0,60		250	100	0,60
		500	100	1,00		120	300	2,00
		120	500	2,00				
Shear load parallel to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\,II}$		with c ≥	with s ≥	$\alpha_{g\perp,V\,II}$
		120	100	1,00		120	100	1,00
		120	500	2,00		120	300	2,00

Table C62: Characteristic resistance under tension and shear load

Anchor size	Sleeve HB-	Effective anchorage depth	**Characteristic resistance** with c ≥ c_{cr} and s ≥ s_{cr}						
			Use condition						
			d/d			**w/d w/w**			**d/d w/d w/w**
			24°C / 40°C	50°C / 80°C	72°C / 120°C	24°C / 40°C	50°C / 80°C	72°C / 120°C	all temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ [1)]						$V_{Rk,b}$ [1)]
		[mm]	[kN]						[kN]
Normalised mean compressive strength $f_b \geq 10$ N/mm² [2)]									
M8	VM-SH 12	80	1,2						3,0
M8 / M10/ IG-M6	VM-SH 16	≥ 85	1,2						3,0
		130	1,5						3,5
M12 / M16/ IG-M8 / IG-M10	VM-SH 20	≥ 85	1,2						4,0
		≥ 130	1,5						4,0

1) $N_{Rk,b,c} = N_{Rk,p,c}$ and $V_{Rk,c\,II} = V_{Rk,c\,\perp}$ according to Annex C5
2) For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C58. For stones with higher strengths, the shown values are valid without conversion.

Table C63: Displacements

Anchor size	h_{ef}	δ_N / N	δ_{N0}	$\delta_{N\infty}$	δ_V / V	δ_{V0}	$\delta_{V\infty}$
	[mm]	[mm/kN]	[mm]	[mm]	[mm/kN]	[mm]	[mm]
M8 – M12 / IG-M6 – IG-M10	all	0,13	$0{,}13 \cdot N_{Rk} / 3{,}5$	$2 \cdot \delta_{N0}$	0,55	$0{,}55 \cdot V_{Rk} / 3{,}5$	$1{,}5 \cdot \delta_{V0}$
M16					0,31	$0{,}31 \cdot V_{Rk} / 3{,}5$	

Injection System HB-VMU plus for masonry

Performances – Hollow clay brick Porotherm Homebric
Group factors, characteristic resistance and displacements

Annex C25

Brick type: Hollow clay brick BGV Thermo

Table C64: Description

Brick type			Hollow clay brick BGV Thermo
Density	ρ	[kg/dm³]	≥ 0,60
Normalised mean compressive strength	f_b	[N/mm²]	≥ 10
Conversion factor for lower compressive strengths			$(f_b / 10)^{0,5} \leq 1,0$
Norm		[-]	EN 771-1:2011+A1:2015
Producer (country code)		[-]	e.g. Leroux (FR)
Brick dimensions		[mm]	500 x 200 x 314
Drilling method		[-]	Rotary drilling

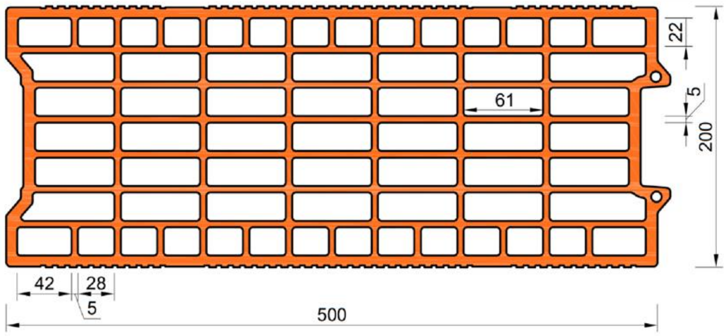
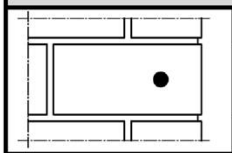
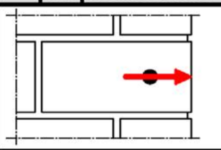
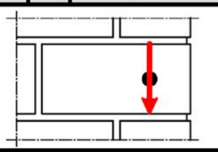


Table C65: Installation parameter

Anchor size			M8	M10	M12	M16	IG-M6	IG-M8	IG-M10
Installation torque	T_{inst}	[Nm]	≤ 2	≤ 2	≤ 2	≤ 2	≤ 2	≤ 2	≤ 2
Edge distance	c_{cr}	[mm]	120 (for shear loads perpendicular to the free edge: c_{cr} = 500)						
Minimum edge distance	c_{min}	[mm]	120						
Spacing	$s_{cr,II}$	[mm]	500						
	$s_{cr,\perp}$	[mm]	315						
Minimum spacing	$s_{min,II}$ $s_{min,\perp}$	[mm]	120						

Table C66: Reduction factors for single anchors at the edge

Tension load			Shear load perpendicular to the free edge			Shear load perpendicular to the free edge		
	with c ≥	$\alpha_{edge,N}$		with c ≥	$\alpha_{edge,V\perp}$		with c ≥	$\alpha_{edge,V II}$
	120	1,00		120	0,30		120	0,60
				250	0,60			
	120	1,00		500	1,00		250	1,00

Brick type: Hollow clay brick BGV Thermo – continuation

Table C67: Factors for anchor groups

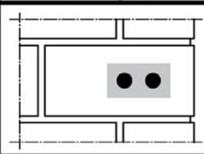
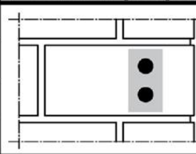
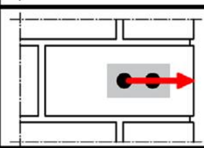
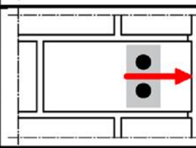
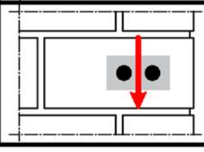
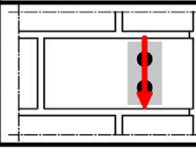
	Position parallel to horizontal joint				Position perpendicular to horizontal joint			
Tension load		with c ≥	with s ≥	$\alpha_{g\,II,N}$		with c ≥	with s ≥	$\alpha_{g\perp,N}$
		120	100	1,00		120	100	1,00
		200	100	1,70		200	100	1,10
		120	500	2,00		120	315	2,00
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\perp}$		with c ≥	with s ≥	$\alpha_{g\perp,V\perp}$
		120	100	1,00		120	100	1,00
		120	500	2,00		120	315	2,00
Shear load parallel to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\,II}$		with c ≥	with s ≥	$\alpha_{g\perp,V\,II}$
		120	100	1,00		120	100	1,00
		120	500	2,00		120	315	2,00

Table C68: Characteristic resistance under tension and shear load

Anchor size	Sleeve HB-	Effective anchorage depth	Characteristic resistance with $c \geq c_{cr}$ and $s \geq s_{cr}$						
			Use condition						
			d/d			w/d w/w			d/d w/d w/w
			24°C / 40°C	50°C / 80°C	72°C / 120°C	24°C / 40°C	50°C / 80°C	72°C / 120°C	all temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ 1)						$V_{Rk,b}$ 1)
		[mm]	[kN]						[kN]
Normalised mean compressive strength $f_b \geq 10$ N/mm² 2)									
M8	VM-SH 12	80	0,9						3,5
M8 / M10/ IG-M6	VM-SH 16	≥ 85	0,9						3,5
		130	2,0	2,0	1,5	2,0	2,0	1,5	4,0
M12 / M16/ IG-M8 / IG-M10	VM-SH 20	≥ 85	0,9						4,0
		≥ 130	2,0	2,0	1,5	2,0	2,0	1,5	4,0

1) $N_{Rk,b,c} = N_{Rk,p,c}$ and $V_{Rk,c\,II} = V_{Rk,c\,\perp}$ according to Annex C5
2) For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C64. For stones with higher strengths, the shown values are valid without conversion.

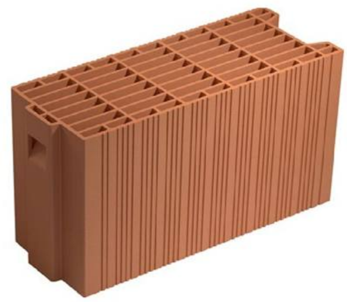
Table C69: Displacements

Anchor size	h_{ef}	δ_N / N	δ_{N0}	$\delta_{N\infty}$	δ_V / V	δ_{V0}	$\delta_{V\infty}$
	[mm]	[mm/kN]	[mm]	[mm]	[mm/kN]	[mm]	[mm]
M8 – M12 / IG-M6 – IG-M10	all	0,13	$0,13 \cdot N_{Rk} / 3,5$	$2 \cdot \delta_{N0}$	0,55	$0,55 \cdot V_{Rk} / 3,5$	$1,5 \cdot \delta_{V0}$
M16					0,31	$0,31 \cdot V_{Rk} / 3,5$	

Brick type: Hollow clay brick Calibric R+

Table C70: Description

Brick type			**Hollow clay brick Calibric R+**
Density	ρ	[kg/dm³]	≥ 0,60
Normalised mean compressive strength	f_b	[N/mm²]	≥ 12
Conversion factor for lower compressive strengths			$(f_b / 12)^{0,5} \leq 1,0$
Norm		[-]	EN 771-1:2011+A1:2015
Producer (country code)		[-]	e.g. Leroux (FR)
Brick dimensions		[mm]	500 x 200 x 314
Drilling method		[-]	Rotary drilling



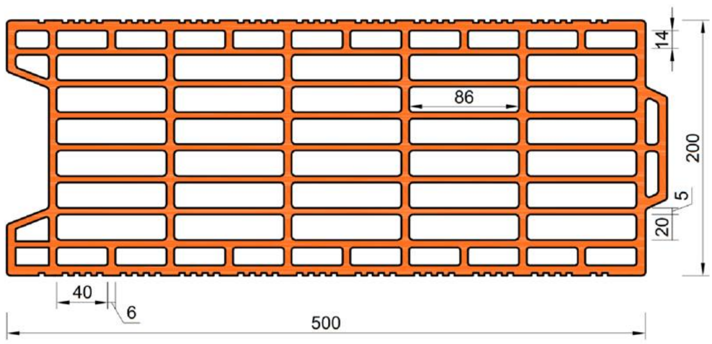
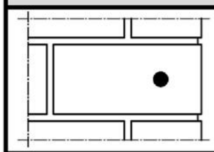
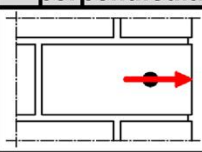
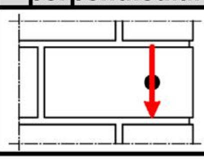


Table C71: Installation parameter

Anchor size			**M8**	**M10**	**M12**	**M16**	**IG-M6**	**IG-M8**	**IG-M10**
Installation torque	T_{inst}	[Nm]	≤ 2	≤ 2	≤ 2	≤ 2	≤ 2	≤ 2	≤ 2
Edge distance	c_{cr}	[mm]	120 (for shear loads perpendicular to the free edge: c_{cr} = 500)						
Minimum edge distance	c_{min}	[mm]	120						
Spacing	$s_{cr,II}$	[mm]	500						
	$s_{cr,\perp}$	[mm]	315						
Minimum spacing	$s_{min,II}$ $s_{min,\perp}$	[mm]	120						

Table C72: Reduction factors for single anchors at the edge

Tension load			**Shear load** perpendicular to the free edge			perpendicular to the free edge		
	with c ≥	$\alpha_{edge,N}$		with c ≥	$\alpha_{edge,V\perp}$		with c ≥	$\alpha_{edge,V II}$
	120	1,00		120	0,15		120	0,30
				250	0,30			
	120	1,00		500	1,00		250	1,00

Brick type: Hollow clay brick Calibric R+ – continuation

Table C73: Factors for anchor groups

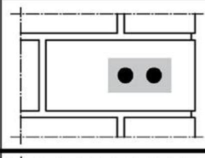
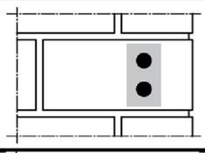
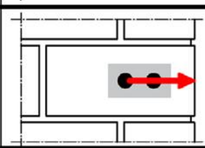
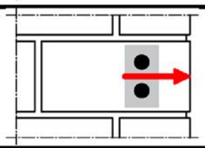
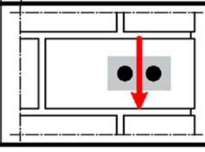
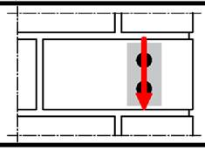
	Position parallel to horizontal joint				Position perpendicular to horizontal joint			
Tension load		with c ≥	with s ≥	$\alpha_{g\,II,N}$		with c ≥	with s ≥	$\alpha_{g\perp,N}$
		120	100	1,00		120	100	1,00
		175	100	1,70		175	100	1,10
		120	500	2,00		120	315	2,00
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\perp}$		with c ≥	with s ≥	$\alpha_{g\perp,V\perp}$
		120	100	1,00		120	100	1,00
		120	500	2,00		120	315	2,00
Shear load parallel to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\,II}$		with c ≥	with s ≥	$\alpha_{g\perp,VII}$
		120	100	1,00		120	100	1,00
		120	500	2,00		120	315	2,00

Table C74: Characteristic resistance under tension and shear load

Anchor size	**Sleeve HB-**	**Effective anchorage depth**	**Characteristic resistance** with $c \geq c_{cr}$ and $s \geq s_{cr}$						
			Use condition						
			d/d			**w/d w/w**			**d/d w/d w/w**
			24°C / 40°C	50°C / 80°C	72°C / 120°C	24°C / 40°C	50°C / 80°C	72°C / 120°C	all temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ [1)]						$V_{Rk,b}$ [1)]
		[mm]	[kN]						[kN]
Normalised mean compressive strength $f_b \geq 12$ N/mm² [2)]									
M8	VM-SH 12	80	1,2	1,2	0,9	1,2	1,2	0,9	4,0
M8 / M10/ IG-M6	VM-SH16	≥ 85	1,2	1,2	0,9	1,2	1,2	0,9	5,5
		130	1,5	1,5	1,2	1,5	1,5	1,2	5,5
M12 / M16 IG-M8 /IG-M10	VM-SH20	≥ 85	1,2	1,2	0,9	1,2	1,2	0,9	8,5
		≥ 130	1,5	1,5	1,2	1,5	1,5	1,2	8,5

1) $N_{Rk,b,c} = N_{Rk,p,c}$ and $V_{Rk,c\,II} = V_{Rk,c\perp}$ according to Annex C5
2) For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C70. For stones with higher strengths, the shown values are valid without conversion.

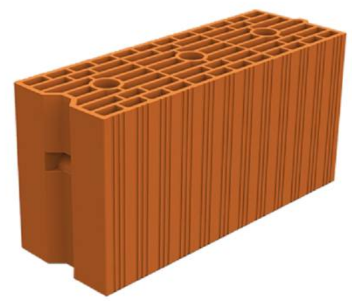
Table C75: Displacements

Anchor size	h_{ef}	δ_N / N	δ_{N0}	$\delta_{N\infty}$	δ_V / V	δ_{V0}	$\delta_{V\infty}$
	[mm]	[mm/kN]	[mm]	[mm]	[mm/kN]	[mm]	[mm]
M8 – M12 / IG-M6 – IG-M10	all	0,13	$0{,}13 \cdot N_{Rk} / 3{,}5$	$2 \cdot \delta_{N0}$	0,55	$0{,}55 \cdot V_{Rk} / 3{,}5$	$1{,}5 \cdot \delta_{V0}$
M16					0,31	$0{,}31 \cdot V_{Rk} / 3{,}5$	

Brick type: Hollow clay brick Urbanbric

Table C76: Description

Brick type			Hollow clay brick Urbanbric
Density	ρ	[kg/dm³]	≥ 0,70
Normalised mean compressive strength	f_b	[N/mm²]	≥ 12
Conversion factor for lower compressive strengths			$(f_b / 12)^{0,5} \leq 1,0$
Norm		[-]	EN 771-1:2011+A1:2015
Producer (country code)		[-]	e.g. Imerys (FR)
Brick dimensions		[mm]	560 x 200 x 274
Drilling method		[-]	Rotary drilling



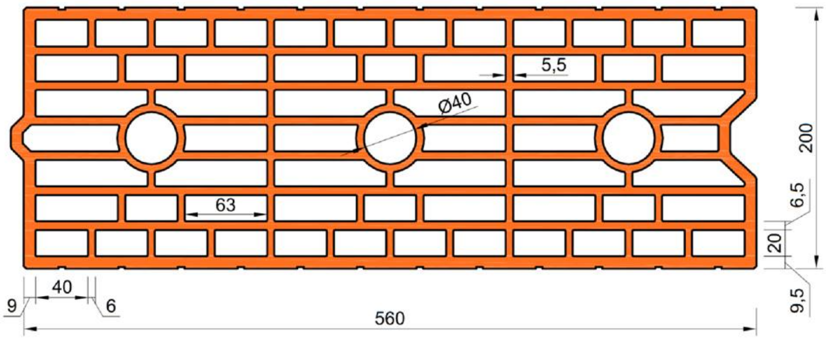
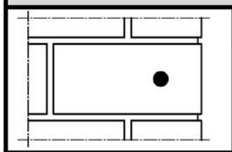
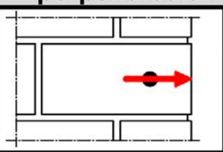
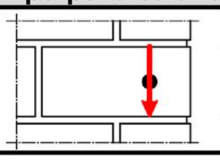


Table C77: Installation parameter

Anchor size			M8	M10	M12	M16	IG-M6	IG-M8	IG-M10
Installation torque	T_{inst}	[Nm]	≤ 2	≤ 2	≤ 2	≤ 2	≤ 2	≤ 2	≤ 2
Edge distance	c_{cr}	[mm]	120 (for shear loads perpendicular to the free edge: c_{cr} = 500)						
Minimum edge distance	c_{min}	[mm]	120						
Spacing	$s_{cr,II}$	[mm]	560						
	$s_{cr,\perp}$	[mm]	275						
Minimum spacing	$s_{min,II}$ $s_{min,\perp}$	[mm]	100						

Table C78: Reduction factors for single anchors at the edge

Tension load			Shear load					
			perpendicular to the free edge			perpendicular to the free edge		
	with c ≥	$\alpha_{edge,N}$		with c ≥	$\alpha_{edge,V\perp}$		with c ≥	$\alpha_{edge,V II}$
	120	1,00		120	0,25		120	0,50
				250	0,50			
	120	1,00		500	1,00		250	1,00

Brick type: Hollow clay brick Urbanbric – continuation

Table C79: Factors for anchor groups

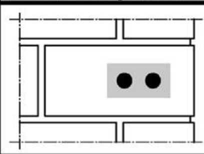
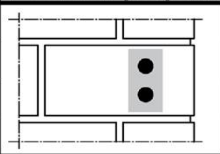
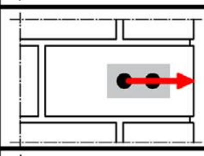
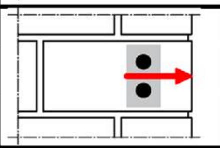
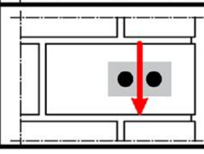
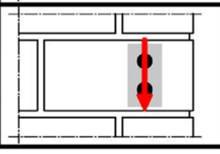
	Position parallel to horizontal joint				Position perpendicular to horizontal joint			
Tension load		with c ≥	with s ≥	$\alpha_{g\,II,N}$		with c ≥	with s ≥	$\alpha_{g\perp,N}$
		120	100	1,00		120	100	1,00
		185	100	1,90		185	100	1,10
		120	560	2,00		120	275	2,00
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\perp}$		with c ≥	with s ≥	$\alpha_{g\perp,V\perp}$
		120	100	1,00		120	100	1,00
		120	560	2,00		120	275	2,00
Shear load parallel to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\,II}$		with c ≥	with s ≥	$\alpha_{g\perp,V\,II}$
		120	100	1,00		120	100	1,00
		120	560	2,00		120	275	2,00

Table C80: Characteristic resistance under tension and shear load

Anchor size	Sleeve HB-	Effective anchorage depth	Characteristic resistance with $c \geq c_{cr}$ and $s \geq s_{cr}$						
			Use condition						
			d/d			w/d w/w			d/d w/d w/w
			24°C / 40°C	50°C / 80°C	72°C / 120°C	24°C / 40°C	50°C / 80°C	72°C / 120°C	all temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ 1)						$V_{Rk,b}$ 1)
		[mm]	[kN]						[kN]
Normalised mean compressive strength $f_b \geq 12$ N/mm² 2)									
M8	VM-SH 12	80	1,2	1,2	0,9	1,2	1,2	0,9	4,5
M8 / M10/ IG-M6	VM-SH 16	≥ 85	1,2	1,2	0,9	1,2	1,2	0,9	4,5
		130	3,0	3,0	2,5	3,0	3,0	2,5	4,5
M12 / M16 IG-M8 / IG-M10	VM-SH 20	≥ 85	1,2	1,2	0,9	1,2	1,2	0,9	5,0
		≥ 130	3,0	3,0	2,5	3,0	3,0	2,5	5,0

1) $N_{Rk,b,c} = N_{Rk,p,c}$ and $V_{Rk,c\,II} = V_{Rk,c\,\perp}$ according to Annex C5
2) For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C76. For stones with higher strengths, the shown values are valid without conversion.

Table C81: Displacements

Anchor size	h_{ef}	δ_N / N	δ_{N0}	$\delta_{N\infty}$	δ_V / V	δ_{V0}	$\delta_{V\infty}$
	[mm]	[mm/kN]	[mm]	[mm]	[mm/kN]	[mm]	[mm]
M8 – M12 / IG-M6 – IG-M10	all	0,13	$0,13 \cdot N_{Rk} / 3,5$	$2 \cdot \delta_{N0}$	0,55	$0,55 \cdot V_{Rk} / 3,5$	$1,5 \cdot \delta_{V0}$
M16					0,31	$0,31 \cdot V_{Rk} / 3,5$	

Brick type: Hollow Clay brick Brique Creuse C40

Table C82: Description

Brick type			Hollow clay brick Brique Creuse C40
Density	ρ	[kg/dm³]	≥ 0,70
Normalised mean compressive strength	f_b	[N/mm²]	≥ 12
Conversion factor for lower compressive strengths			$(f_b / 12)^{0,5} \le 1,0$
Norm		[-]	EN 771-1:2011+A1:2015
Producer (country code)		[-]	e.g. Terreal (FR)
Brick dimensions		[mm]	500 x 200 x 200
Drilling method		[-]	Rotary drilling

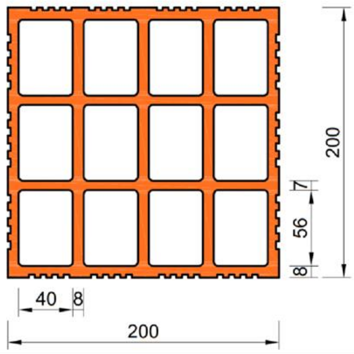
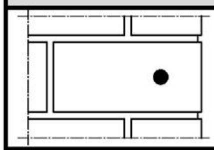
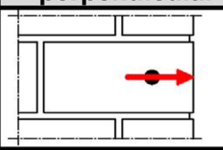
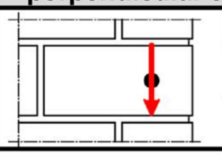


Table C83: Installation parameter

Anchor size			M8	M10	M12	M16	IG-M6	IG-M8	IG-M10
Installation torque	T_{inst}	[Nm]	≤ 2	≤ 2	≤ 2	≤ 2	≤ 2	≤ 2	≤ 2
Edge distance	c_{cr}	[mm]	120 (for shear loads perpendicular to the free edge: c_{cr} = 500)						
Minimum edge distance	c_{min}	[mm]	120						
Spacing	$s_{cr,II}$	[mm]	500						
	$s_{cr,\perp}$	[mm]	200						
Minimum spacing	$s_{min,II}$ $s_{min,\perp}$	[mm]	200						

Table C84: Reduction factors for single anchors at the edge

Tension load			Shear load					
			perpendicular to the free edge			perpendicular to the free edge		
	with c ≥	$\alpha_{edge,N}$		with c ≥	$\alpha_{edge,V\perp}$		with c ≥	$\alpha_{edge,V II}$
	120	1,00		120	0,83		120	1,00
	120	1,00		500	1,00		250	1,00

Brick type: Hollow Clay brick Brique Creuse C40 – continuation

Table C85: Factors for anchor groups

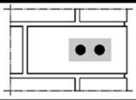
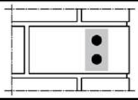
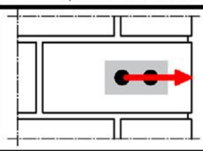
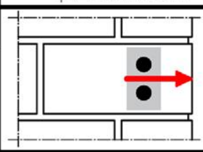
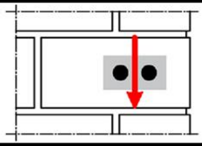
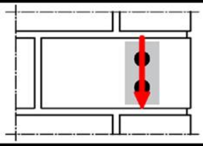
	Position parallel to horizontal joint				Position perpendicular to horizontal joint			
Tension load		with c ≥	with s ≥	$\alpha_{g\,II,N}$		with c ≥	with s ≥	$\alpha_{g\perp,N}$
		120	500	2,00		120	200	2,00
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\perp}$		with c ≥	with s ≥	$\alpha_{g\perp,V\perp}$
		120	500	2,00		120	200	2,00
Shear load parallel to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\,II}$		with c ≥	with s ≥	$\alpha_{g\perp,V\,II}$
		120	500	2,00		120	200	2,00

Table C86: Characteristic resistance under tension and shear load

Anchor size	**Sleeve HB-**	**Effective anchorage depth**	**Characteristic resistance** with c ≥ c_{cr} and s ≥ s_{cr}						
			Use condition						
			d/d			**w/d w/w**			**d/d w/d w/w**
			24°C / 40°C	50°C / 80°C	72°C / 120°C	24°C / 40°C	50°C / 80°C	72°C / 120°C	all temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ [1)]						$V_{Rk,b}$ [1)]
		[mm]	[kN]						[kN]
Normalised mean compressive strength f_b ≥ 12 N/mm² [2)]									
M8	VM-SH 12	80	1,2	1,2	0,9	1,2	1,2	0,9	1,5
M8 / M10/ IG-M6	VM-SH 16	≥ 85							
M12 / M16 / IG-M8 / IG-M10	VM-SH 20	≥ 85							

1) $N_{Rk,b,c} = N_{Rk,p,c}$ and $V_{Rk,c\,II} = V_{Rk,c\,\perp}$ according to Annex C5
2) For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C82. For stones with higher strengths, the shown values are valid without conversion.

Table C87: Displacements

Anchor size	h_{ef}	δ_N / N	δ_{N0}	$\delta_{N\infty}$	δ_V / V	δ_{V0}	$\delta_{V\infty}$
	[mm]	[mm/kN]	[mm]	[mm]	[mm/kN]	[mm]	[mm]
M8 – M12 / IG-M6 – IG-M10	all	0,13	0,13*N_{Rk} / 3,5	2*δ_{N0}	0,55	0,55*V_{Rk} / 3,5	1,5*δ_{V0}
M16					0,31	0,31*V_{Rk} / 3,5	

Injection System HB-VMU plus for masonry

Performances – Hollow clay brick Brique Creuse C40
Group factors, characteristic resistance and displacements

Annex C33

Brick type: Hollow clay brick Blocchi Leggeri

Table C88: Description

Brick type			Hollow clay brick Blocchi Leggeri
Density	ρ	[kg/dm³]	≥ 0,60
Normalised mean compressive strength	f_b	[N/mm²]	≥ 12
Conversion factor for lower compressive strengths			$(f_b / 12)^{0,5} \leq 1,0$
Norm		[-]	EN 771-1:2011+A1:2015
Producer (country code)		[-]	e.g. Wienerberger (IT)
Brick dimensions		[mm]	250 x 120 x 250
Drilling method		[-]	Rotary drilling

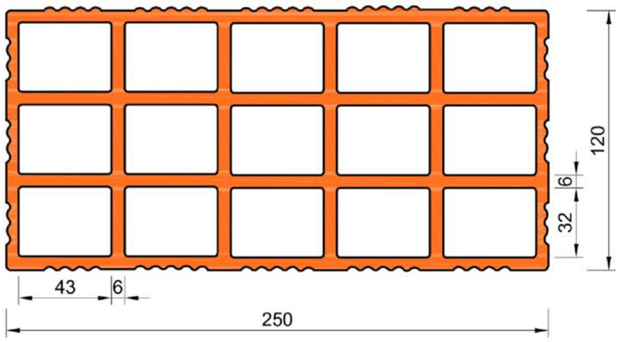
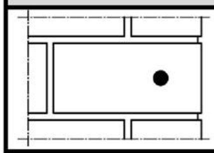
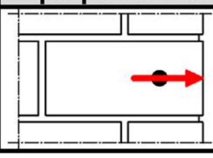
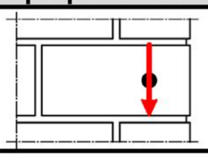


Table C89: Installation parameter

Anchor size			M8	M10	M12	M16	IG-M6	IG-M8	IG-M10
Installation torque	T_{inst}	[Nm]	≤ 2	≤ 2	≤ 2	≤ 2	≤ 2	≤ 2	≤ 2
Edge distance	c_{cr}	[mm]	120 (for shear loads perpendicular to the free edge: c_{cr} = 250)						
Minimum edge distance	c_{min}	[mm]	60						
Spacing	$s_{cr,II}$	[mm]	250						
	$s_{cr,\perp}$	[mm]	250						
Minimum spacing	$s_{min,II}$ / $s_{min,\perp}$	[mm]	100						

Table C90: Reduction factors for single anchors at the edge

Tension load			Shear load perpendicular to the free edge			perpendicular to the free edge		
	with c ≥	$\alpha_{edge,N}$		with c ≥	$\alpha_{edge,V\perp}$		with c ≥	$\alpha_{edge,V II}$
	60	1,00		60	0,40		60	0,40
	120	1,00		250	1,00		120	1,00

Injection System HB-VMU plus for masonry

Performances – Hollow clay brick Blocchi Leggeri
Description, installation parameters, reduction factors

Annex C34

Brick type: Hollow clay brick Blocchi Leggeri – continuation

Table C91: Factors for anchor groups

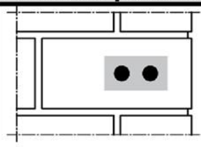
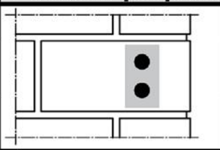
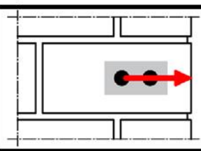
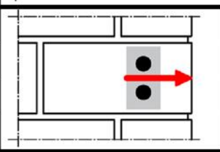
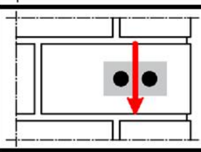
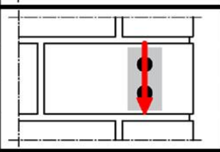
	Position parallel to horizontal joint				Position perpendicular to horizontal joint			
Tension load		with c ≥	with s ≥	$\alpha_{g\,II,N}$		with c ≥	with s ≥	$\alpha_{g\perp,N}$
		60	100	1,00		60	100	2,00
		120	250	2,00		120	250	2,00
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\perp}$		with c ≥	with s ≥	$\alpha_{g\perp,V\perp}$
		60	100	0,40		60	100	0,40
		250	100	1,00		250	100	1,00
		250	250	2,00		250	250	2,00
Shear load parallel to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\,II}$		with c ≥	with s ≥	$\alpha_{g\perp,V\,II}$
		60	100	0,40		60	100	0,40
		120	100	1,00		120	100	1,00
		120	250	2,00		120	250	2,00

Table C92: Characteristic resistance under tension and shear load

Anchor size	**Sleeve HB-**	**Effective anchorage depth**	**Characteristic resistance** with $c \geq c_{cr}$ and $s \geq s_{cr}$						
			Use condition						
			d/d			**w/d w/w**			**d/d w/d w/w**
			24°C / 40°C	50°C / 80°C	72°C / 120°C	24°C / 40°C	50°C / 80°C	72°C / 120°C	all temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ 1)						$V_{Rk,b}$ 1)
		[mm]	[kN]						[kN]
Normalised mean compressive strength $f_b \geq 12$ N/mm² 2)									
M8	VM-SH 12	80	0,6	0,6	0,6	0,6	0,6	0,6	3,5
M8 / M10/ IG-M6	VM-SH 16	≥ 85							
M12 / M16 / IG-M8 / IG-M10	VM-SH 20	≥ 85							

1) $N_{Rk,b,c} = N_{Rk,p,c}$ and $V_{Rk,c\,II} = V_{Rk,c\perp}$ according to Annex C5
2) For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C88. For stones with higher strengths, the shown values are valid without conversion.

Table C93: Displacements

Anchor size	h_{ef}	δ_N / N	δ_{N0}	$\delta_{N\infty}$	δ_V / V	δ_{V0}	$\delta_{V\infty}$
	[mm]	[mm/kN]	[mm]	[mm]	[mm/kN]	[mm]	[mm]
M8 – M12 / IG-M6 – IG-M10	all	0,13	$0{,}13 \cdot N_{Rk} / 3{,}5$	$2 \cdot \delta_{N0}$	0,55	$0{,}55 \cdot V_{Rk} / 3{,}5$	$1{,}5 \cdot \delta_{V0}$
M16					0,31	$0{,}31 \cdot V_{Rk} / 3{,}5$	

Brick type: Hollow Clay brick Doppio Uni

Table C94: Description

Brick type			Hollow clay brick Doppio Uni
Density	ρ	[kg/dm³]	≥ 0,90
Normalised mean compressive strength	f_b	[N/mm²]	≥ 28
Conversion factor for lower compressive strengths			$(f_b / 28)^{0,5} \leq 1,0$
Norm		[-]	EN 771-1:2011+A1:2015
Producer (country code)		[-]	e.g. Wienerberger (IT)
Brick dimensions		[mm]	250 x 120 x 120
Drilling method		[-]	Rotary drilling

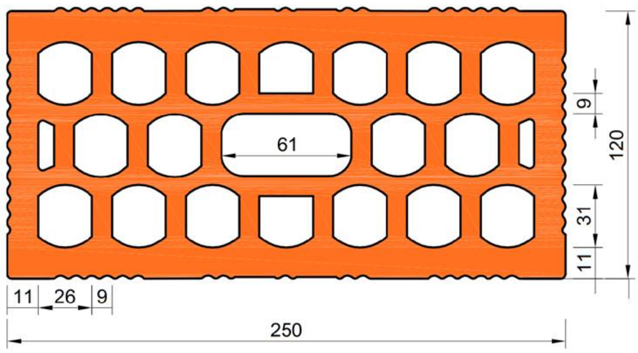
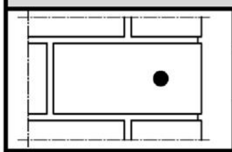
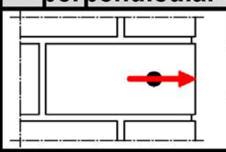
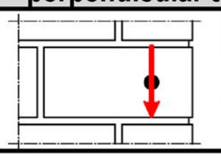


Table C95: Installation parameter

Anchor size			M8	M10	M12	M16	IG-M6	IG-M8	IG-M10
Installation torque	T_{inst}	[Nm]	≤ 2	≤ 2	≤ 2	≤ 2	≤ 2	≤ 2	≤ 2
Edge distance	c_{cr}	[mm]	120 (for shear loads perpendicular to the free edge: c_{cr} = 250)						
Minimum edge distance	c_{min}	[mm]	100						
Spacing	$s_{cr,II}$	[mm]	250						
	$s_{cr,\perp}$	[mm]	120						
Minimum spacing	$s_{min,II}$ $s_{min,\perp}$	[mm]	100						

Table C96: Reduction factors for single anchors at the edge

Tension load			Shear load					
			perpendicular to the free edge			perpendicular to the free edge		
	with c ≥	$\alpha_{edge,N}$		with c ≥	$\alpha_{edge,V\perp}$		with c ≥	$\alpha_{edge,V II}$
	100	1,00		100	0,50		100	1,00
	120	1,00		250	1,00		120	1,00

Brick type: Hollow Clay brick Doppio Uni – continuation

Table C97: Factors for anchor groups

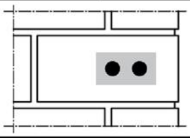
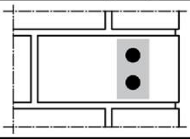
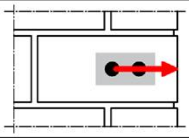
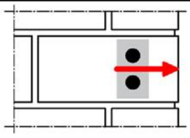
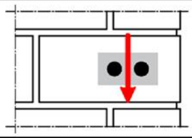
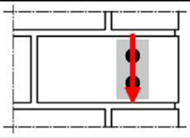
	Position parallel to horizontal joint				Position perpendicular to horizontal joint			
Tension load		with c ≥	with s ≥	$\alpha_{g\,II,N}$		with c ≥	with s ≥	$\alpha_{g\perp,N}$
		100	100	1,00		100	120	2,00
		120	250	2,00		120	120	2,00
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\perp}$		with c ≥	with s ≥	$\alpha_{g\perp,V\perp}$
		100	100	1,00		100	100	1,00
		250	250	2,00		250	120	2,00
Shear load parallel to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\,II}$		with c ≥	with s ≥	$\alpha_{g\perp,V\,II}$
		100	100	1,00		100	100	1,00
		120	250	2,00		120	120	2,00

Table C98: Characteristic resistance under tension and shear load

Anchor size	**Sleeve HB-**	**Effective anchorage depth**	**Characteristic resistance** with $c \geq c_{cr}$ and $s \geq s_{cr}$						
			Use condition						
			d/d			**w/d w/w**			**d/d w/d w/w**
			24°C / 40°C	50°C / 80°C	72°C / 120°C	24°C / 40°C	50°C / 80°C	72°C / 120°C	all temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ [1)]						$V_{Rk,b}$ [1)]
		[mm]	[kN]						[kN]
Normalised mean compressive strength $f_b \geq 28$ N/mm² [2)]									
M8	VM-SH 12	80	1,2	1,2	0,9	1,2	1,2	0,9	2,5
M8 / M10/ IG-M6	VM-SH 16	≥ 85							
M12 / M16 / IG-M8 / IG-M10	VM-SH 20	≥ 85							

1) $N_{Rk,b,c} = N_{Rk,p,c}$ and $V_{Rk,c\,II} = V_{Rk,c\perp}$ according to Annex C5
2) For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C94. For stones with higher strengths, the shown values are valid without conversion.

Table C99: Displacements

Anchor size	h_{ef}	δ_N / N	δ_{N0}	$\delta_{N\infty}$	δ_V / V	δ_{V0}	$\delta_{V\infty}$
	[mm]	[mm/kN]	[mm]	[mm]	[mm/kN]	[mm]	[mm]
M8 – M12 / IG-M6 – IG-M10	all	0,13	$0{,}13 \cdot N_{Rk} / 3{,}5$	$2 \cdot \delta_{N0}$	0,55	$0{,}55 \cdot V_{Rk} / 3{,}5$	$1{,}5 \cdot \delta_{V0}$
M16					0,31	$0{,}31 \cdot V_{Rk} / 3{,}5$	

Brick type: Hollow clay brick Coriso WS07 with insulation

Table C100: Description

Brick type			Hollow clay brick Coriso WS07
Insulation material			Rock wool
Density	ρ	[kg/dm³]	≥ 0,55
Normalised mean compressive strength	f_b	[N/mm²]	≥ 6
Conversion factor for lower compressive strengths			$(f_b / 6)^{0,5} \leq 1,0$
Norm		[-]	EN 771-1:2011+A1:2015
Producer (country code)		[-]	e.g. Unipor (DE)
Brick dimensions		[mm]	248 x 365 x 249
Drilling method		[-]	Rotary drilling

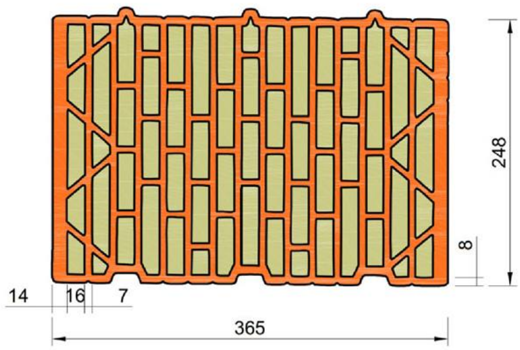
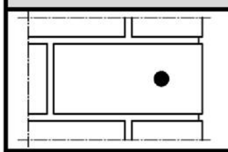
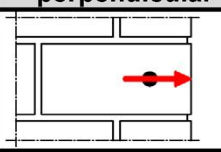
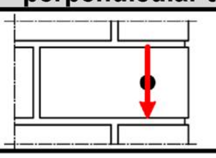


Table C101: Installation parameter

Anchor size			M8	M10	M12	M16	IG-M6	IG-M8	IG-M10
Installation torque	T_{inst}	[Nm]	≤ 5	≤ 5	≤ 10	≤ 10	≤ 5	≤ 5	≤ 5
Edge distance	c_{cr}	[mm]	120 (for shear loads perpendicular to the free edge: c_{cr} = 250)						
Minimum edge distance	c_{min}	[mm]	50						
Spacing	$s_{cr,II}$	[mm]	250						
	$s_{cr,\perp}$	[mm]	250						
Minimum spacing	$s_{min,II}$ $s_{min,\perp}$	[mm]	50						

Table C102: Reduction factors for single anchors at the edge

Tension load			Shear load					
			perpendicular to the free edge			perpendicular to the free edge		
	with c ≥	$\alpha_{edge,N}$		with c ≥	$\alpha_{edge,V\perp}$		with c ≥	$\alpha_{edge,V II}$
	50	1,00		50	0,30		50	1,00
	120	1,00		250	1,00		120	1,00

Brick type: Hollow clay brick Coriso WS07 with insulation – continuation

Table C103: Factors for anchor groups

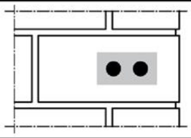
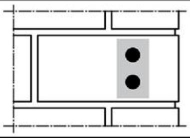
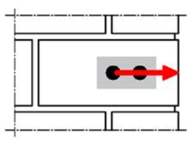
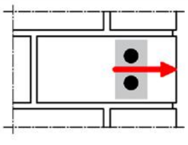
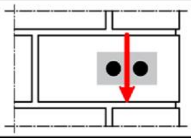
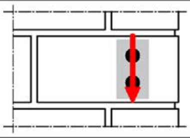
	Position parallel to horizontal joint				Position perpendicular to horizontal joint			
Tension load		with c ≥	with s ≥	$\alpha_{g\,II,N}$		with c ≥	with s ≥	$\alpha_{g\perp,N}$
		50	50	1,50		50	50	1,00
		120	250	2,00		120	250	2,00
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\perp}$		with c ≥	with s ≥	$\alpha_{g\perp,V\perp}$
		50	50	0,40		50	50	0,40
		250	50	1,00		250	50	1,20
		250	250	2,00		250	250	2,00
Shear load parallel to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\,II}$		with c ≥	with s ≥	$\alpha_{g\perp,V\,II}$
		50	50	1,65		50	50	1,00
		120	250	2,00		120	250	2,00

Table C104: Characteristic resistance under tension and shear load

Anchor size	Sleeve HB-	Effective anchorage depth	Characteristic resistance with $c \geq c_{cr}$ and $s \geq s_{cr}$						
			Use condition						
			d/d			w/d w/w			d/d w/d w/w
			24°C / 40°C	50°C / 80°C	72°C / 120°C	24°C / 40°C	50°C / 80°C	72°C / 120°C	all temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ 1)						$V_{Rk,b}$ 1)
		[mm]	[kN]						[kN]
Normalised mean compressive strength $f_b \geq 6$ N/mm² 2)									
M8	VM-SH 12	80	1,5	1,5	1,5	1,5	1,5	1,5	5,0
M8 / M10/ IG-M6	VM-SH 16	≥ 85							
M12 / M16 / IG-M8 / IG-M10	VM-SH 20	≥ 85							

1) $N_{Rk,b,c} = N_{Rk,p,c}$ and $V_{Rk,c\,II} = V_{Rk,c\,\perp}$ according to Annex C5
2) For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C100. For stones with higher strengths, the shown values are valid without conversion.

Table C105: Displacements

Anchor size	h_{ef}	δ_N / N	δ_{N0}	$\delta_{N\infty}$	δ_V / V	δ_{V0}	$\delta_{V\infty}$
	[mm]	[mm/kN]	[mm]	[mm]	[mm/kN]	[mm]	[mm]
M8 – M12 / IG-M6 – IG-M10	all	0,13	$0,13 \cdot N_{Rk} / 3,5$	$2 \cdot \delta_{N0}$	0,55	$0,55 \cdot V_{Rk} / 3,5$	$1,5 \cdot \delta_{V0}$
M16					0,31	$0,31 \cdot V_{Rk} / 3,5$	

Deutsches Institut für Bautechnik DIBt

Brick type: Hollow clay brick T7 MW with insulation

Table C106: Description

Brick type			Hollow clay brick T7 MW
Insulation material			Rock wool
Density	ρ	[kg/dm³]	≥ 0,59
Normalised mean compressive strength	f_b	[N/mm²]	≥ 8
Conversion factor for lower compressive strengths			$(f_b / 8)^{0,5} \leq 1,0$
Norm		[-]	EN 771-1:2011+A1:2015
Producer (country code)		[-]	e.g. Wienerberger (DE)
Brick dimensions		[mm]	248 x 365 x 249
Drilling method		[-]	Rotary drilling

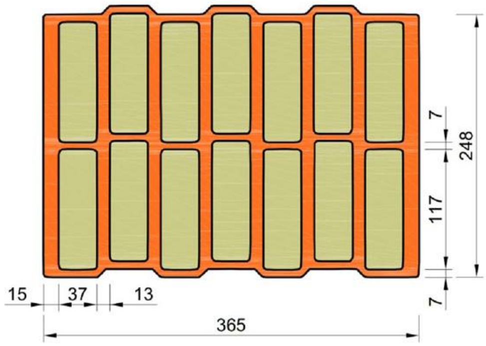
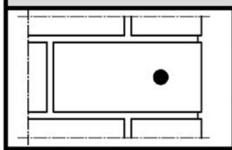
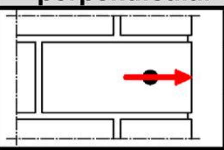
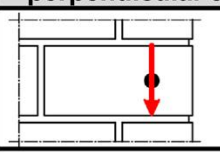


Table C107: Installation parameter

Anchor size			M8	M10	M12	M16	IG-M6	IG-M8	IG-M10
Installation torque	T_{inst}	[Nm]	≤ 5	≤ 5	≤ 10	≤ 10	≤ 5	≤ 5	≤ 5
Edge distance (under fire exposure)	c_{cr}; ($c_{cr,fi}$)	[mm]	120 (2 h_{ef}) (for shear loads perpendicular to the free edge: c_{cr} = 250)						
Minimum edge distance	c_{min}	[mm]	50						
Spacing (under fire exposure)	$s_{cr,II}$ ($s_{cr,fi,II}$)	[mm]	250 (4 h_{ef})						
	$s_{cr,\perp}$ ($s_{cr,fi,\perp}$)	[mm]	250 (4 h_{ef})						
Minimum spacing	$s_{min,II}$; $s_{min,\perp}$	[mm]	50						

Table C108: Reduction factors for single anchors at the edge

Tension load			Shear load perpendicular to the free edge			Shear load perpendicular to the free edge		
	with c ≥	$\alpha_{edge,N}$		with c ≥	$\alpha_{edge,V\perp}$		with c ≥	$\alpha_{edge,V II}$
	50	1,00		50	0,35		50	1,00
	120	1,00		250	1,00		120	1,00

Injection System HB-VMU plus for masonry

Performances – Hollow clay brick T7 MW
Description, installation parameters, reduction factors

Annex C40

Brick type: Hollow clay brick T7 MW with insulation – continuation

Table C109: Factors for anchor groups

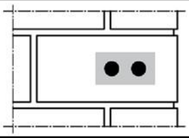
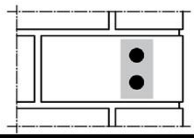
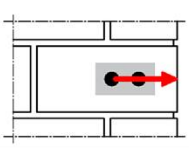
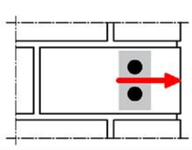
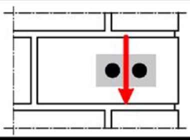
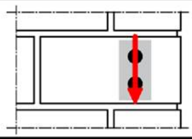
	Position parallel to horizontal joint				Position perpendicular to horizontal joint			
Tension load		with c ≥	with s ≥	$\alpha_{g\,II,N}$		with c ≥	with s ≥	$\alpha_{g\perp,N}$
		50	50	1,40		50	50	1,15
		120	250	2,00		120	250	2,00
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\perp}$		with c ≥	with s ≥	$\alpha_{g\perp,V\perp}$
		50	50	0,60		50	50	0,40
		250	50	1,55		250	50	1,00
		250	250	2,00		250	250	2,00
Shear load parallel to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\,II}$		with c ≥	with s ≥	$\alpha_{g\perp,V\,II}$
		50	50	2,00		50	50	1,20
		120	250	2,00		120	250	2,00

Table C110: Characteristic resistance under tension and shear load

Anchor size	**Sleeve HB-**	**Effective anchorage depth**	**Characteristic resistance** with c ≥ c_{cr} and s ≥ s_{cr}						
			Use condition						
			d/d			**w/d w/w**			**d/d w/d w/w**
			24°C / 40°C	50°C / 80°C	72°C / 120°C	24°C / 40°C	50°C / 80°C	72°C / 120°C	all temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ 1)						$V_{Rk,b}$ 1)
		[mm]	[kN]						[kN]
Normalised mean compressive strength $f_b \geq 8$ N/mm² 2)									
M8	VM-SH 12	80	2,0	2,0	1,5	2,0	2,0	1,5	3,0
M8 / M10/ IG-M6	VM-SH 16	≥ 85							
M12 / IG-M8	VM-SH 20	≥ 85							
M16 / IG-M10	VM-SH 20	≥ 85							4,5

1) $N_{Rk,b,c} = N_{Rk,p,c}$ and $V_{Rk,c\,II} = V_{Rk,c\perp}$ according to Annex C5
2) For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C106. For stones with higher strengths, the shown values are valid without conversion.

Table C111: Displacements

Anchor size	h_{ef}	δ_N / N	δ_{N0}	$\delta_{N\infty}$	δ_V / V	δ_{V0}	$\delta_{V\infty}$
	[mm]	[mm/kN]	[mm]	[mm]	[mm/kN]	[mm]	[mm]
M8 – M12 / IG-M6 – IG-M10	all	0,13	$0{,}13 \cdot N_{Rk} / 3{,}5$	$2 \cdot \delta_{N0}$	0,55	$0{,}55 \cdot V_{Rk} / 3{,}5$	$1{,}5 \cdot \delta_{V0}$
M16					0,31	$0{,}31 \cdot V_{Rk} / 3{,}5$	

Table C112: Characteristic resistance under fire exposure

Anchor size	Sleeve HB-	Effective anchorage depth h_{ef} [mm]	Characteristic resistance $N_{Rk,b,fi} = N_{Rk,p,fi} = V_{Rk,b,fi}$ R30 [kN]	R60 [kN]	R90 [kN]	R120 [kN]
M8 / M10 /IG-M6	VM-SH 16	130	0,64	0,37	0,11	no performance assessed
M12 / M16 / IG-M8 IG-M10	VM-SH 20	≥ 130				

Brick type: Hollow clay brick T8 P with insulation

Table C113: Description

Brick type		Hollow clay brick T8 P
Insulation material		Perlite
Density	ρ [kg/dm^3]	≥ 0,56
Normalised mean compressive strength	f_b [N/mm^2]	≥ 6
Conversion factor for lower compressive strengths		$(f_b / 6)^{0,5} \leq 1,0$
Norm	[-]	EN 771-1:2011+A1:2015
Producer (country code)	[-]	e.g. Wienerberger (DE)
Brick dimensions	[mm]	248 x 365 x 249
Drilling method	[-]	Rotary drilling

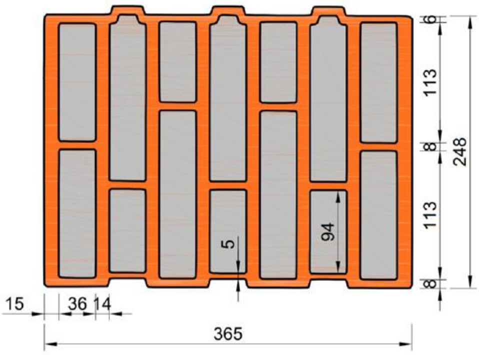
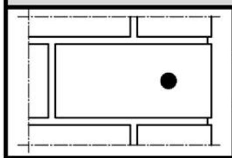
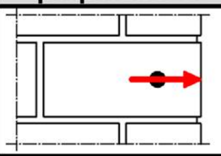
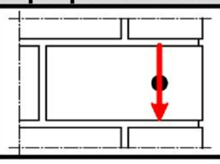


Table C114: Installation parameter

Anchor size			M8	M10	M12	M16	IG-M6	IG-M8	IG-M10
Installation torque	T_{inst}	[Nm]	≤ 4	≤ 4	≤ 10	≤ 10	≤ 4	≤ 4	≤ 4
Edge distance	c_{cr}	[mm]	120 (for shear loads perpendicular to the free edge: c_{cr} = 250)						
Minimum edge distance	c_{min}	[mm]	50						
Spacing	$s_{cr,II}$	[mm]	250						
	$s_{cr,\perp}$	[mm]	250						
Minimum spacing	$s_{min,II}$ $s_{min,\perp}$	[mm]	50						

Table C115: Reduction factors for single anchors at the edge

Tension load			Shear load perpendicular to the free edge			Shear load perpendicular to the free edge		
	with c ≥	$\alpha_{edge,N}$		with c ≥	$\alpha_{edge,V\perp}$		with c ≥	$\alpha_{edge,V II}$
	50	1,00		50	0,25		50	1,00
	120	1,00		250	1,00		120	1,00

Brick type: Hollow clay brick T8 P– continuation

Table C116: Factors for anchor groups

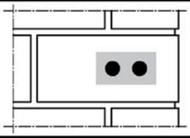
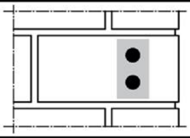
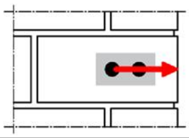
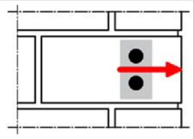
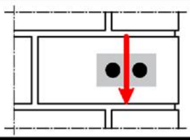
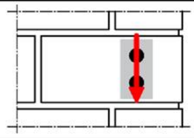
	Position parallel to horizontal joint				Position perpendicular to horizontal joint			
Tension load		with c ≥	with s ≥	$\alpha_{g\,II,N}$		with c ≥	with s ≥	$\alpha_{g\perp,N}$
		50	50	1,30		50	50	1,10
		120	250	2,00		120	250	2,00
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\perp}$		with c ≥	with s ≥	$\alpha_{g\perp,V\perp}$
		50	50	0,40		50	50	0,30
		250	50	1,35		250	50	1,20
		250	250	2,00		250	250	2,00
Shear load parallel to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\,II}$		with c ≥	with s ≥	$\alpha_{g\perp,V\,II}$
		50	50	1,70		50	50	1,00
		120	250	2,00		120	250	2,00

Table C117: Characteristic resistance under tension and shear load

Anchor size	Sleeve HB-	Effective anchorage depth	**Characteristic resistance** with $c \geq c_{cr}$ and $s \geq s_{cr}$						
			Use condition						
			d/d			**w/d w/w**			**d/d w/d w/w**
			24°C / 40°C	50°C / 80°C	72°C / 120°C	24°C / 40°C	50°C / 80°C	72°C / 120°C	all temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ 1)						$V_{Rk,b}$ 1)
		[mm]	[kN]						[kN]
Normalised mean compressive strength $f_b \geq 6$ N/mm² 2)									
M8	VM-SH 12	80	1,5	1,5	1,5	1,5	1,5	1,5	4,5
M8 / M10/ IG-M6	VM-SH 16	≥ 85							
M12 / IG-M8	VM-SH 20	≥ 85							
M16 / IG-M10	VM-SH 20	≥ 85	2,5	2,5	2,0	2,5	2,5	2,0	7,0

1) $N_{Rk,b,c} = N_{Rk,p,c}$ and $V_{Rk,c\,II} = V_{Rk,c\,\perp}$ according to Annex C5
2) For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C113. For stones with higher strengths, the shown values are valid without conversion.

Table C118: Displacements

Anchor size	h_{ef}	δ_N / N	δ_{N0}	$\delta_{N\infty}$	δ_V / V	δ_{V0}	$\delta_{V\infty}$
	[mm]	[mm/kN]	[mm]	[mm]	[mm/kN]	[mm]	[mm]
M8 – M12 / IG-M6 – IG-M10	all	0,13	$0{,}13 \cdot N_{Rk} / 3{,}5$	$2 \cdot \delta_{N0}$	0,55	$0{,}55 \cdot V_{Rk} / 3{,}5$	$1{,}5 \cdot \delta_{V0}$
M16					0,31	$0{,}31 \cdot V_{Rk} / 3{,}5$	

Injection System HB-VMU plus for masonry

Performances – Hollow Clay brick T8 P with insulation
Group factors, characteristic resistance and displacements

Annex C44

Brick type: Hollow clay brick Thermoplan MZ90-G with insulation

Table C119: Installation parameter

Brick type			Hollow clay brick Thermoplan MZ90-G
Insulation material			Rock wool
Density	ρ	[kg/dm³]	≥ 0,68
Normalised mean compressive strength	f_b	[N/mm²]	≥ 12
Conversion factor for lower compressive strengths			$(f_b / 12)^{0,5} \leq 1,0$
Norm		[-]	EN 771-1:2011+A1:2015
Producer (country code)		[-]	e.g. Mein Ziegelhaus (DE)
Brick dimensions		[mm]	248 x 365 x 249
Drilling method		[-]	Rotary drilling

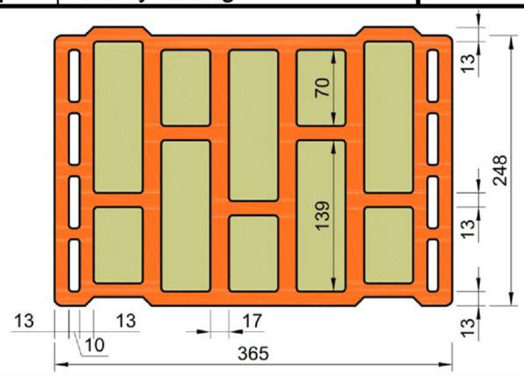
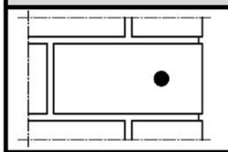
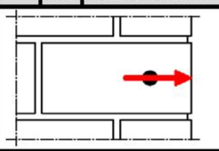
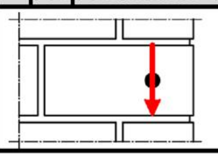


Table C120: Installation parameter

Anchor size			M8	M10	M12	M16	IG-M6	IG-M8	IG-M10
Installation torque	T_{inst}	[Nm]	≤ 4	≤ 4	≤ 10	≤ 10	≤ 4	≤ 4	≤ 4
Edge distance	c_{cr}	[mm]	120 (for shear loads perpendicular to the free edge: c_{cr} = 250)						
Minimum edge distance	c_{min}	[mm]	50						
Spacing	$s_{cr,II}$	[mm]	250						
	$s_{cr,\perp}$	[mm]	250						
Minimum spacing	$s_{min,II}$ $s_{min,\perp}$	[mm]	50						

Table C121: Reduction factors for single anchors at the edge

Tension load			Shear load perpendicular to the free edge			perpendicular to the free edge		
	with c ≥	$\alpha_{edge,N}$		with c ≥	$\alpha_{edge,V\perp}$		with c ≥	$\alpha_{edge,V II}$
	50	1,00		50	0,25		50	1,00
	120	1,00		250	1,00		120	1,00

Brick type: Lochziegel Thermoplan MZ90-G – continuation

Table C122: Factors for anchor groups

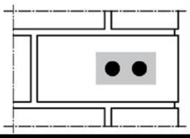
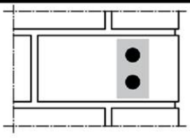
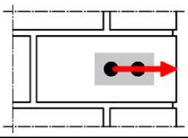
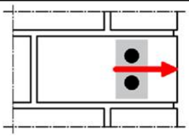
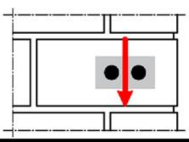
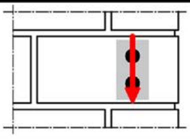
	Position parallel to horizontal joint				Position perpendicular to horizontal joint			
Tension load		with c ≥	with s ≥	$\alpha_{g\,II,N}$		with c ≥	with s ≥	$\alpha_{g\perp,N}$
		50	50	1,00		50	50	1,00
		120	250	2,00		120	250	2,00
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\perp}$		with c ≥	with s ≥	$\alpha_{g\perp,V\perp}$
		50	50	0,75		50	50	0,50
		250	50	2,00		250	50	1,70
		250	250	2,00		250	250	2,00
Shear load parallel to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\,II}$		with c ≥	with s ≥	$\alpha_{g\perp,V\,II}$
		50	50	1,65		50	50	1,15
		120	250	2,00		120	250	2,00

Table C123: Characteristic resistance under tension and shear load

Anchor size	Sleeve HB-	Effective anchorage depth	Characteristic resistance with $c \geq c_{cr}$ and $s \geq s_{cr}$						
			Use condition						
			d/d			**w/d w/w**			**d/d w/d w/w**
			24°C / 40°C	50°C / 80°C	72°C / 120°C	24°C / 40°C	50°C / 80°C	72°C / 120°C	all temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ 1)						$V_{Rk,b}$ 1)
		[mm]	[kN]						[kN]
Normalised mean compressive strength $f_b \geq 12$ N/mm² 2)									
M8	VM-SH 12	80	3,0	3,0	2,5	3,0	3,0	2,5	4,0
M8 / M10/ IG-M6	VM-SH 16	≥ 85							
M12 / IG-M8	VM-SH 20	≥ 85							
M16 / IG-M10	VM-SH 20	≥ 85	3,5	3,5	3,0	3,5	3,5	3,0	7,5

1) $N_{Rk,b,c} = N_{Rk,p,c}$ and $V_{Rk,c\,II} = V_{Rk,c\,\perp}$ according to Annex C5
2) For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C119. For stones with higher strengths, the shown values are valid without conversion.

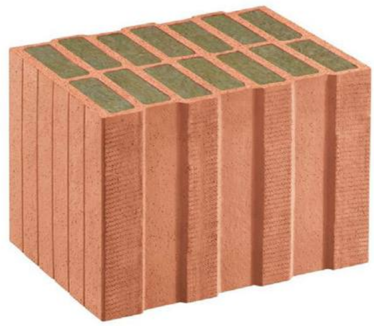
Table C124: Displacements

Anchor size	h_{ef}	δ_N / N	δ_{N0}	$\delta_{N\infty}$	δ_V / V	δ_{V0}	$\delta_{V\infty}$
	[mm]	[mm/kN]	[mm]	[mm]	[mm/kN]	[mm]	[mm]
M8 – M12 / IG-M6 – IG-M10	all	0,13	$0{,}13 \cdot N_{Rk} / 3{,}5$	$2 \cdot \delta_{N0}$	0,55	$0{,}55 \cdot V_{Rk} / 3{,}5$	$1{,}5 \cdot \delta_{V0}$
M16					0,31	$0{,}31 \cdot V_{Rk} / 3{,}5$	

Brick type: Hollow clay brick Poroton FZ7,5 with insulation

Table C125: Description

Brick type			**Hollow clay brick Poroton FZ7,5**
Insulation material			Rock wool
Density	ρ	[kg/dm³]	≥ 0,70
Normalised mean compressive strength	f_b	[N/mm²]	≥ 8
Conversion factor for lower compressive strengths			$(f_b / 8)^{0,5} \leq 1,0$
Norm		[-]	EN 771-1:2011+A1:2015
Producer (country code)		[-]	e.g. Schlagmann (DE)
Brick dimensions		[mm]	248 x 365 x 249
Drilling method		[-]	Rotary drilling



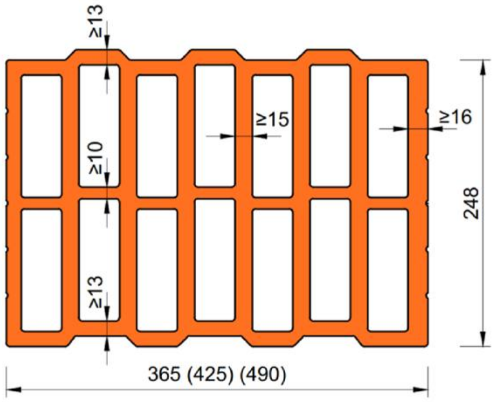
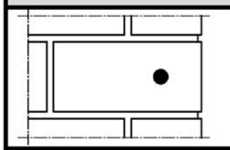
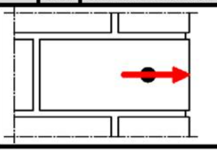
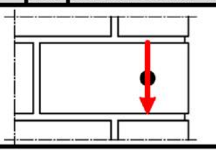


Table C126: Installation parameter

Anchor size			**M8**	**M10**	**M12**	**M16**	**IG-M6**	**IG-M8**	**IG-M10**
Installation torque	T_{inst}	[Nm]	≤ 5	≤ 5	≤ 10	≤ 10	≤ 5	≤ 5	≤ 5
Edge distance (under fire exposure)	c_{cr}; ($c_{cr,fi}$)	[mm]	120 (2 h_{ef}) (for shear loads perpendicular to the free edge: c_{cr} = 250)						
Minimum edge distance	c_{min}	[mm]	50						
Spacing (under fire exposure)	$s_{cr,II}$ ($s_{cr,fi,II}$)	[mm]	250 (4 h_{ef})						
	$s_{cr,\perp}$ ($s_{cr,fi,\perp}$)	[mm]	250 (4 h_{ef})						
Minimum Spacing	$s_{min,II}$; $s_{min,\perp}$	[mm]	50						

Table C127: Reduction factors for single anchors at the edge

Tension load			**Shear load** perpendicular to the free edge			perpendicular to the free edge		
	with c ≥	$\alpha_{edge,N}$		with c ≥	$\alpha_{edge,V\perp}$		with c ≥	$\alpha_{edge,V II}$
	50	1,00		50	0,35		50	1,00
	120	1,00		250	1,00		120	1,00

Brick type: Hollow clay brick FZ7,5 with insulation – continuation

Table C128: Factors for anchor groups

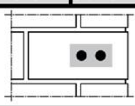
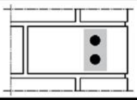
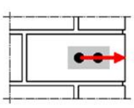
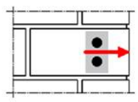
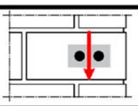
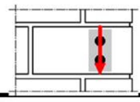
	Position parallel to horizontal joint				Position perpendicular to horizontal joint			
Tension load		with c ≥	with s ≥	$\alpha_{g\,II,N}$		with c ≥	with s ≥	$\alpha_{g\perp,N}$
		50	50	1,40		50	50	1,15
		120	250	2,00		120	250	2,00
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\perp}$		with c ≥	with s ≥	$\alpha_{g\perp,V\perp}$
		50	50	0,60		50	50	0,40
		250	50	1,55		250	50	1,00
		250	250	2,00		250	250	2,00
Shear load parallel to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\,II}$		with c ≥	with s ≥	$\alpha_{g\perp,V\,II}$
		50	50	2,00		50	50	1,20
		120	250	2,00		120	250	2,00

Table C129: Characteristic resistance under tension and shear load

Anchor size	Sleeve HB-	Effective anchorage depth	Characteristic resistance with $c \geq c_{cr}$ and $s \geq s_{cr}$						
			Use condition						
			d/d			w/d w/w			d/d w/d w/w
			24°C / 40°C	50°C / 80°C	72°C / 120°C	24°C / 40°C	50°C / 80°C	72°C / 120°C	all temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ [1)]						$V_{Rk,b}$ [1)]
		[mm]	[kN]						[kN]
Normalised mean compressive strength $f_b \geq 8$ N/mm² [2)]									
M8	VM-SH 12	80	2,0	2,0	1,5	2,0	2,0	1,5	3,0
M8 / M10/ IG-M6	VM-SH 16	≥ 85							
M12 / IG-M8	VM-SH 20	≥ 85							
M16 / IG-M10	VM-SH 20	≥ 85							4,5

1) $N_{Rk,b,c} = N_{Rk,p,c}$ and $V_{Rk,c\,II} = V_{Rk,c\,\perp}$ according to Annex C5
2) For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C125. For stones with higher strengths, the shown values are valid without conversion.

Table C130: Displacements

Anchor size	h_{ef}	δ_N / N	δ_{N0}	$\delta_{N\infty}$	δ_V / V	δ_{V0}	$\delta_{V\infty}$
	[mm]	[mm/kN]	[mm]	[mm]	[mm/kN]	[mm]	[mm]
M8 – M12 / IG-M6 – IG-M10	all	0,13	$0{,}13 \cdot N_{Rk} / 3{,}5$	$2 \cdot \delta_{N0}$	0,55	$0{,}55 \cdot V_{Rk} / 3{,}5$	$1{,}5 \cdot \delta_{V0}$
M16					0,31	$0{,}31 \cdot V_{Rk} / 3{,}5$	

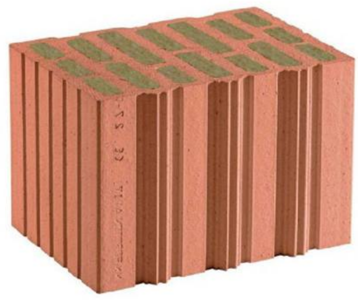
Table C131: Characteristic resistance under fire exposure

Anchor size	Sleeve HB-	Effective anchorage depth	Characteristic resistance $N_{Rk,b,fi} = N_{Rk,p,fi} = V_{Rk,b,fi}$			
		h_{ef}	R30	R60	R90	R120
		[mm]	[kN]			
M8 / M10 /IG-M6	VM-SH 16	130	0,64	0,37	0,11	no performance assessed
M12 / M16 / IG-M8 IG-M10	VM-SH 20	≥ 130				

Brick type: Hollow clay brick Poroton FZ9 with insulation

Table C132: Description

Brick type		Hollow clay brick Poroton FZ9
Insulation material		Rock wool
Density	ρ [kg/dm³]	≥ 0,90
Normalised mean compressive strength	f_b [N/mm²]	≥ 10
Conversion factor for lower compressive strengths		$(f_b / 10)^{0,5} \leq 1,0$
Norm	[-]	EN 771-1:2011+A1:2015
Producer (country code)	[-]	e.g. Schlagmann (DE)
Brick dimensions	[mm]	248 x 365 x 249
Drilling method	[-]	Rotary drilling



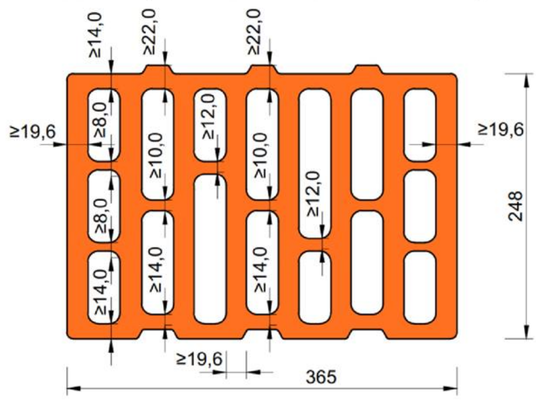
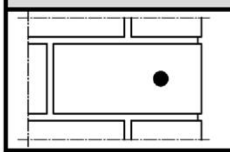
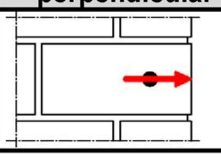
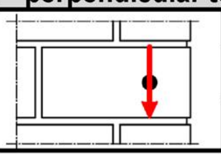


Table C133: Installation parameter

Anchor size			M8	M10	M12	M16	IG-M6	IG-M8	IG-M10
Installation torque	T_{inst}	[Nm]	≤ 5	≤ 5	≤ 10	≤ 10	≤ 5	≤ 5	≤ 5
Edge distance (under fire exposure)	c_{cr}; ($c_{cr,fi}$)	[mm]	120 (2 h_{ef}) (for shear loads perpendicular to the free edge: c_{cr} = 250)						
Minimum edge distance	c_{min}	[mm]	50						
Spacing (under fire exposure)	$s_{cr,II}$ ($s_{cr,fi,II}$)	[mm]	250 (4 h_{ef})						
	$s_{cr,\perp}$ ($s_{cr,fi,\perp}$)	[mm]	250 (4 h_{ef})						
Minimum spacing	$s_{min,II}$; $s_{min,\perp}$	[mm]	50						

Table C134: Reduction factors for single anchors at the edge

Tension load			Shear load perpendicular to the free edge			Shear load perpendicular to the free edge		
	with c ≥	$\alpha_{edge,N}$		with c ≥	$\alpha_{edge,V\perp}$		with c ≥	$\alpha_{edge,V II}$
	50	1,00		50	0,35		50	1,00
	120	1,00		250	1,00		120	1,00

Brick type: Hollow clay brick FZ9 with insulation – continuation

Table C135: Factors for anchor groups

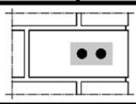
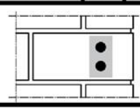
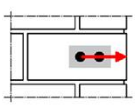
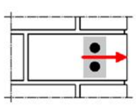
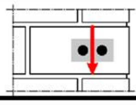
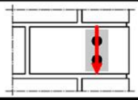
	Position parallel to horizontal joint				Position perpendicular to horizontal joint			
Tension load		with c ≥	with s ≥	$\alpha_{g\,II,N}$		with c ≥	with s ≥	$\alpha_{g\perp,N}$
		50	50	1,40		50	50	1,15
		120	250	2,00		120	250	2,00
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\perp}$		with c ≥	with s ≥	$\alpha_{g\perp,V\perp}$
		50	50	0,60		50	50	0,40
		250	50	1,55		250	50	1,00
		250	250	2,00		250	250	2,00
Shear load parallel to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\,II}$		with c ≥	with s ≥	$\alpha_{g\perp,V\,II}$
		50	50	2,00		50	50	1,20
		120	250	2,00		120	250	2,00

Table C136: Characteristic resistance under tension and shear load

Anchor size	Sleeve HB-	Effective anchorage depth	Characteristic resistance with $c \geq c_{cr}$ and $s \geq s_{cr}$						
			Use condition						
			d/d			w/d w/w			d/d w/d w/w
			24°C / 40°C	50°C / 80°C	72°C / 120°C	24°C / 40°C	50°C / 80°C	72°C / 120°C	all temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ [1)]						$V_{Rk,b}$ [1)]
		[mm]	[kN]						[kN]
Normalised mean compressive strength $f_b \geq 10$ N/mm² [2)]									
M8	VM-SH 12	80	2,0	2,0	1,5	2,0	2,0	1,5	3,0
M8 / M10/ IG-M6	VM-SH 16	≥ 85							
M12 / IG-M8	VM-SH 20	≥ 85							
M16 / IG-M10	VM-SH 20	≥ 85							4,5

1) $N_{Rk,b,c} = N_{Rk,p,c}$ and $V_{Rk,c\,II} = V_{Rk,c\,\perp}$ according to Annex C5
2) For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C132. For stones with higher strengths, the shown values are valid without conversion.

Table C137: Displacements

Anchor size	h_{ef}	δ_N / N	δ_{N0}	$\delta_{N\infty}$	δ_V / V	δ_{V0}	$\delta_{V\infty}$
	[mm]	[mm/kN]	[mm]	[mm]	[mm/kN]	[mm]	[mm]
M8 – M12 / IG-M6 – IG-M10	all	0,13	$0{,}13 \cdot N_{Rk} / 3{,}5$	$2 \cdot \delta_{N0}$	0,55	$0{,}55 \cdot V_{Rk} / 3{,}5$	$1{,}5 \cdot \delta_{V0}$
M16					0,31	$0{,}31 \cdot V_{Rk} / 3{,}5$	

Table C138: Characteristic resistance under fire exposure

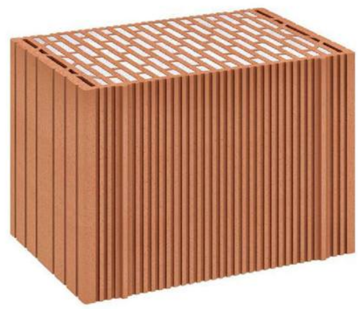
Anchor size	Sleeve HB-	Effective anchorage depth	Characteristic resistance $N_{Rk,b,fi} = N_{Rk,p,fi} = V_{Rk,b,fi}$			
		h_{ef}	R30	R60	R90	R120
		[mm]	[kN]			
M8 / M10 /IG-M6	VM-SH 16	130	0,64	0,37	0,11	no performance assessed
M12 / M16 / IG-M8 IG-M10	VM-SH 20	≥ 130				

Injection System HB-VMU plus for masonry	Annex C50
Performance – Hollow clay brick FZ9 Group factors, characteristic resistance and displacements	

Brick type: Hollow clay brick Poroton S9 with insulation

Table C139: Description

Brick type		Hollow clay brick Poroton S9
Insulation material		Perlite
Density	ρ [kg/dm^3]	≥ 0,85
Normalised mean compressive strength	f_b [N/mm^2]	≥ 12
Conversion factor for lower compressive strengths		$(f_b / 12)^{0,5} \leq 1,0$
Norm	[-]	EN 771-1:2011+A1:2015
Producer (country code)	[-]	e.g. Schlagmann (DE)
Brick dimensions	[mm]	248 x 365 x 249
Drilling method	[-]	Rotary drilling



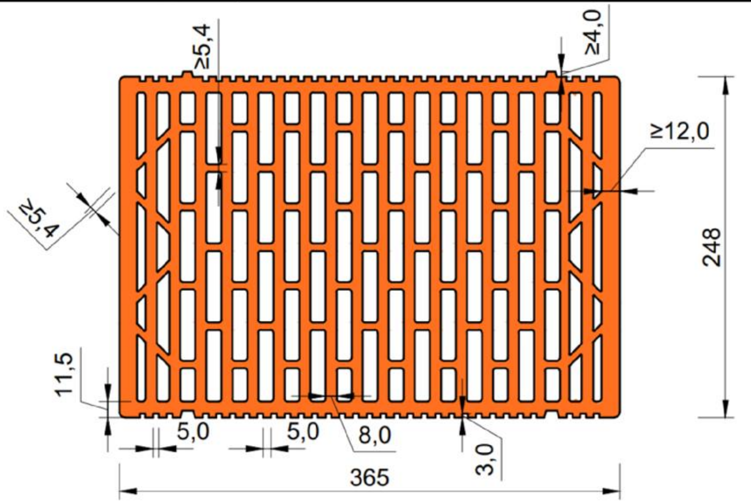
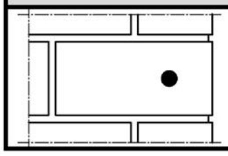
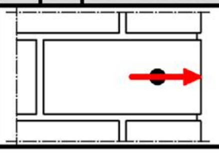
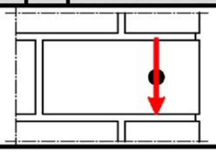


Table C140: Installation parameter

Anchor size			M8	M10	M12	M16	IG-M6	IG-M8	IG-M10
Installation torque	T_{inst}	[Nm]	≤ 5	≤ 5	≤ 10	≤ 10	≤ 5	≤ 5	≤ 5
Edge distance	c_{cr}	[mm]	120 (for shear loads perpendicular to the free edge: c_{cr} = 250)						
Minimum edge distance	c_{min}	[mm]	50						
Spacing	$s_{cr,II}$	[mm]	250						
	$s_{cr,\perp}$	[mm]	250						
Minimum spacing	$s_{min,II}$ $s_{min,\perp}$	[mm]	50						

Table C141: Reduction factors for single anchors at the edge

Tension load			Shear load					
			perpendicular to the free edge			perpendicular to the free edge		
	with c ≥	$\alpha_{edge,N}$		with c ≥	$\alpha_{edge,V\perp}$		with c ≥	$\alpha_{edge,V II}$
	50	1,00		50	0,30		50	1,00
	120	1,00		250	1,00		120	1,00

Brick type: Hollow clay brick Poroton S9 with insulation – continuation

Table C142: Factors for anchor groups

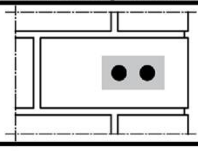
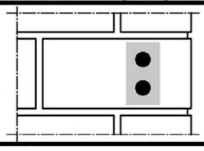
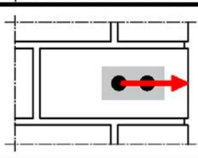
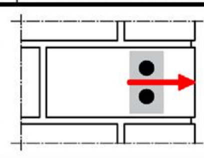
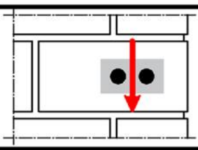
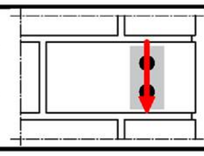
	Position parallel to horizontal joint				Position perpendicular to horizontal joint			
Tension load		with c ≥	with s ≥	$\alpha_{g\,II,N}$		with c ≥	with s ≥	$\alpha_{g\perp,N}$
		50	50	1,50		50	50	1,00
		120	250	2,00		120	250	2,00
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\perp}$		with c ≥	with s ≥	$\alpha_{g\perp,V\perp}$
		50	50	0,40		50	50	0,40
		250	50	1,00		250	50	1,20
		250	250	2,00		250	250	2,00
Shear load parallel to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\,II}$		with c ≥	with s ≥	$\alpha_{g\perp,V\,II}$
		50	50	1,65		50	50	1,00
		120	250	2,00		120	250	2,00

Table C143: Characteristic resistance under tension and shear load

Anchor size	Sleeve HB-	Effective anchorage depth	Characteristic resistance with $c \geq c_{cr}$ and $s \geq s_{cr}$						
			Use condition						
			d/d			w/d w/w			d/d w/d w/w
			24°C / 40°C	50°C / 80°C	72°C / 120°C	24°C / 40°C	50°C / 80°C	72°C / 120°C	all temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ 1)						$V_{Rk,b}$ 1)
		[mm]	[kN]						[kN]
Normalised mean compressive strength $f_b \geq 12$ N/mm² 2)									
M8	VM-SH 12	80	1,5	1,5	1,5	1,5	1,5	1,5	5,0
M8 / M10/ IG-M6	VM-SH 16	≥ 85							
M12 / M16 / IG-M8 / IG-M10	VM-SH 20	≥ 85							

1) $N_{Rk,b,c} = N_{Rk,p,c}$ and $V_{Rk,c\,II} = V_{Rk,c\perp}$ according to Annex C5
2) For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C139. For stones with higher strengths, the shown values are valid without conversion.

Table C144: Displacements

Anchor size	h_{ef}	δ_N / N	δ_{N0}	$\delta_{N\infty}$	δ_V / V	δ_{V0}	$\delta_{V\infty}$
	[mm]	[mm/kN]	[mm]	[mm]	[mm/kN]	[mm]	[mm]
M8 – M12 / IG-M6 – IG-M10	all	0,13	$0{,}13 \cdot N_{Rk} / 3{,}5$	$2 \cdot \delta_{N0}$	0,55	$0{,}55 \cdot V_{Rk} / 3{,}5$	$1{,}5 \cdot \delta_{V0}$
M16					0,31	$0{,}31 \cdot V_{Rk} / 3{,}5$	

Injection System HB-VMU plus for masonry	**Annex C52**
Performances – Hollow Clay brick Poroton S9 Group factors, characteristic resistance and displacements	

Brick type: Hollow clay brick Thermopor TV8+ with insulation

Table C145: Description

Brick type			**Hollow clay brick Thermopor TV8+**
Insulation material			Rock wool
Density	ρ	[kg/dm³]	≥ 0,70
Normalised mean compressive strength	f_b	[N/mm²]	≥ 10
Conversion factor for lower compressive strengths			$(f_b / 10)^{0,5} \leq 1,0$
Norm		[-]	EN 771-1:2011+A1:2015
Producer (country code)		[-]	e.g. THERMOPOR GmbH (DE)
Brick dimensions		[mm]	247 x 365 x 249
Drilling method		[-]	Rotary drilling

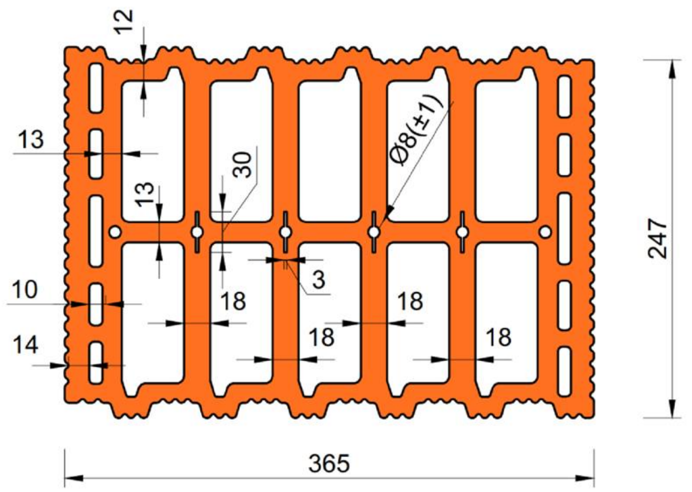
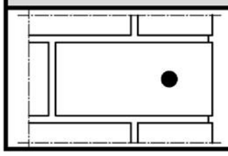
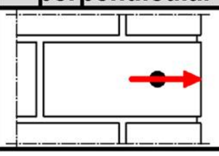
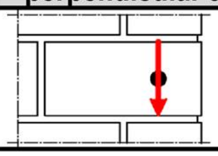


Table C146: Installation parameter

Anchor size			**M8**	**M10**	**M12**	**M16**	**IG-M6**	**IG-M8**	**IG-M10**
Installation torque	T_{inst}	[Nm]	≤ 4	≤ 4	≤ 10	≤ 10	≤ 4	≤ 4	≤ 4
Edge distance	c_{cr}	[mm]	120 (for shear loads perpendicular to the free edge: c_{cr} = 250)						
Minimum edge distance	c_{min}	[mm]	50						
Spacing	$s_{cr,II}$	[mm]	250						
	$s_{cr,\perp}$	[mm]	250						
Minimum spacing	$s_{min,II}$ $s_{min,\perp}$	[mm]	50						

Table C147: Reduction factors for single anchors at the edge

Tension load			**Shear load**					
			perpendicular to the free edge			**perpendicular to the free edge**		
	with c ≥	$\alpha_{edge,N}$		with c ≥	$\alpha_{edge,V\perp}$		with c ≥	$\alpha_{edge,V II}$
	50	1,00		50	0,25		50	1,00
	120	1,00		250	1,00		120	1,00

Injection System HB-VMU plus for masonry

Performances – Hollow Clay brick Thermopor TV8+
Description, installation parameters, reduction factors

Annex C53

Brick type: Hollow clay brick Thermopor TV8+ with insulation – continuation

Table C148: Factors for anchor groups

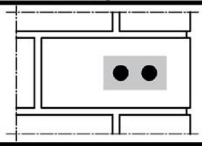
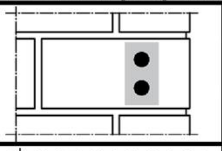
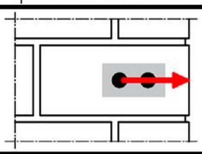
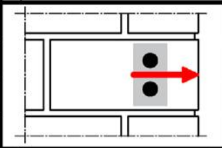
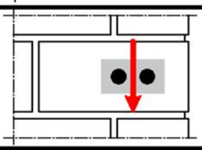
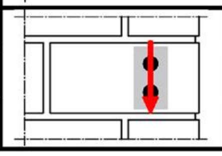
	Position parallel to horizontal joint				Position perpendicular to horizontal joint			
Tension load		with c ≥	with s ≥	$\alpha_{g\,II,N}$		with c ≥	with s ≥	$\alpha_{g\perp,N}$
		50	50	1,00		50	50	1,00
		120	250	2,00		120	250	2,00
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\perp}$		with c ≥	with s ≥	$\alpha_{g\perp,V\perp}$
		50	50	0,75		50	50	0,50
		250	50	2,00		250	50	1,70
		250	250	2,00		250	250	2,00
Shear load parallel to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\,II}$		with c ≥	with s ≥	$\alpha_{g\perp,V\,II}$
		50	50	1,65		50	50	1,15
		120	250	2,00		120	250	2,00

Table C149: Characteristic resistance under tension and shear load

Anchor size	Sleeve HB-	Effective anchorage depth	Characteristic resistance with $c \geq c_{cr}$ and $s \geq s_{cr}$						
			Use condition						
			d/d			w/d w/w			d/d w/d w/w
			24°C / 40°C	50°C / 80°C	72°C / 120°C	24°C / 40°C	50°C / 80°C	72°C / 120°C	all temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ 1)						$V_{Rk,b}$ 1)
		[mm]	[kN]						[kN]
Normalised mean compressive strength $f_b \geq 10$ N/mm² 2)									
M8	VM-SH 12	80	3,0	3,0	2,5	3,0	3,0	2,5	3,5
M8 / M10/ IG-M6	VM-SH 16	≥ 85							
M12 / IG-M8	VM-SH 20	≥ 85							
M16 / IG-M10	VM-SH 20	≥ 85	3,5	3,5	3,0	3,5	3,5	3,0	7,0

1) $N_{Rk,b,c} = N_{Rk,p,c}$ and $V_{Rk,c\,II} = V_{Rk,c\perp}$ according to Annex C5

2) For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C145. For stones with higher strengths, the shown values are valid without conversion.

Table C150: Displacements

Anchor size	h_{ef}	δ_N / N	δ_{N0}	$\delta_{N\infty}$	δ_V / V	δ_{V0}	$\delta_{V\infty}$
	[mm]	[mm/kN]	[mm]	[mm]	[mm/kN]	[mm]	[mm]
M8 – M12 / IG-M6 – IG-M10	all	0,13	$0{,}13 \cdot N_{Rk} / 3{,}5$	$2 \cdot \delta_{N0}$	0,55	$0{,}55 \cdot V_{Rk} / 3{,}5$	$1{,}5 \cdot \delta_{V0}$
M16					0,31	$0{,}31 \cdot V_{Rk} / 3{,}5$	

Injection System HB-VMU plus for masonry

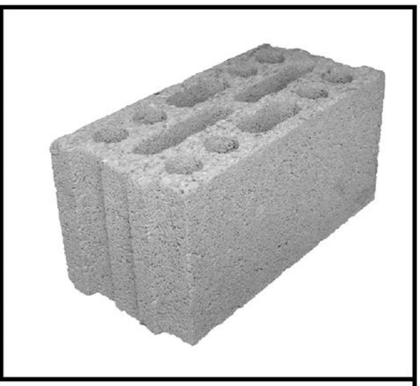
Performances – Hollow Clay brick Thermopor TV8+
Group factors, characteristic resistance and displacements

Annex C54

Brick type: Hollow light weight concrete brick HBL 16DF

Table C151: Description

Brick type			Hollow light weight concrete brick HBL 16DF
Density	ρ	[kg/dm³]	≥ 1,0
Normalised mean compressive strength	f_b	[N/mm²]	≥ 3,1
Conversion factor for lower compressive strengths			$(f_b / 3{,}1)^{0,5} \leq 1{,}0$
Norm		[-]	EN 771-3:2011+A1:2015
Producer (country code)		[-]	e.g. KLB Klimaleichtblock (DE)
Brick dimensions		[mm]	500 x 250 x 240
Drilling method		[-]	Rotary drilling



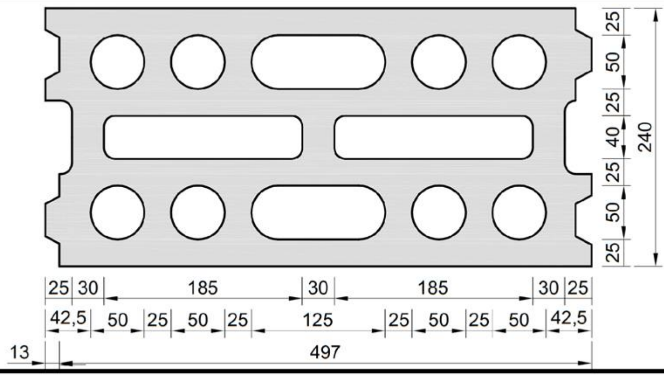
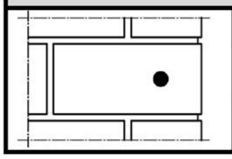
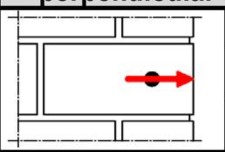
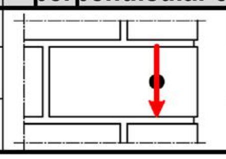


Table C152: Installation parameter

Anchor size			M8	M10	M12	M16	IG-M6	IG-M8	IG-M10
Installation torque	T_{inst}	[Nm]	≤ 2	≤ 2	≤ 5	≤ 5	≤ 2	≤ 5	≤ 5
Edge distance (under fire exposure)	c_{cr}; ($c_{cr,fi}$)	[mm]	120 ($2 h_{ef}$) (for shear loads perpendicular to the free edge: c_{cr} = 250)						
Minimum edge distance	c_{min}	[mm]	50						
Spacing (under fire exposure)	$s_{cr,II}$ ($s_{cr,fi,II}$)	[mm]	500 ($4 h_{ef}$)						
	$s_{cr,\perp}$ ($s_{cr,fi,\perp}$)	[mm]	250 ($4 h_{ef}$)						
Minimum spacing	$s_{min,II}$; $s_{min,\perp}$	[mm]	50						

Table C153: Reduction factors for single anchors at the edge

Tension load			Shear load					
			perpendicular to the free edge			perpendicular to the free edge		
	with c ≥	$\alpha_{edge,N}$		with c ≥	$\alpha_{edge,V\perp}$		with c ≥	$\alpha_{edge,V II}$
	50	1,00		50	0,30		50	1,00
	120	1,00		250	1,00		120	1,00

Brick type: Hollow light weight concrete brick HBL 16DF – continuation

Table C154: Factors for anchor groups

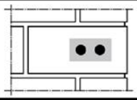
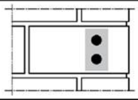
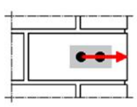
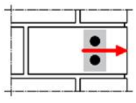
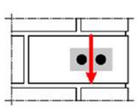
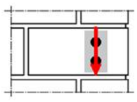
	Position parallel to horizontal joint				Position perpendicular to horizontal joint			
Tension load		with c ≥	with s ≥	$\alpha_{g\,II,N}$		with c ≥	with s ≥	$\alpha_{g\perp,N}$
		50	50	2,00		50	50	1,55
		120	500	2,00		120	250	2,00
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\perp}$		with c ≥	with s ≥	$\alpha_{g\perp,V\perp}$
		50	50	0,60		50	50	0,35
		120	50	2,00		120	50	1,15
		120	500	2,00		120	250	2,00
Shear load parallel to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\,II}$		with c ≥	with s ≥	$\alpha_{g\perp,V\,II}$
		50	50	1,30		50	50	1,00
		120	250	2,00				
		120	500	2,00		120	250	2,00

Table C155: Characteristic resistance under tension and shear load

Anchor size	Sleeve HB-	Effective anchorage depth	Characteristic resistance with c ≥ c_{cr} and s ≥ s_{cr}						
			Use condition						
			d/d			w/d w/w			d/d w/d w/w
			24°C / 40°C	50°C / 80°C	72°C / 120°C	24°C / 40°C	50°C / 80°C	72°C / 120°C	all temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ [1)]						$V_{Rk,b}$ [1)]
		[mm]	[kN]						[kN]
Normalised mean compressive strength $f_b \geq 3{,}1$ N/mm² [2)]									
M8 / M10/IG-M6	VM-SH 16	≥ 85	1,2	1,2	0,9	1,2	1,2	0,9	2,0
M12 / IG-M8	VM-SH 20	≥ 85	1,5	1,5	1,2	1,5	1,5	1,2	3,0
M16 / IG-M10	VM-SH 20	≥ 85							5,0

[1)] $N_{Rk,b,c} = N_{Rk,p,c}$ and $V_{Rk,c\,II} = V_{Rk,c\,\perp}$ according to Annex C5
[2)] For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C151. For stones with higher strengths, the shown values are valid without conversion.

Table C156: Displacements

Anchor size	h_{ef}	δ_N / N	δ_{N0}	$\delta_{N\infty}$	δ_V / V	δ_{V0}	$\delta_{V\infty}$
	[mm]	[mm/kN]	[mm]	[mm]	[mm/kN]	[mm]	[mm]
M8 – M12 / IG-M6 – IG-M10	all	0,13	0,13*N_{Rk} / 3,5	2*δ_{N0}	0,55	0,55*V_{Rk} / 3,5	1,5*δ_{V0}
M16					0,31	0,31*V_{Rk} / 3,5	

Table C157: Characteristic resistance under fire exposure

Anchor size	Sleeve HB-	Effective anchorage depth	Characteristic resistance $N_{Rk,b,fi} = N_{Rk,p,fi} = V_{Rk,b,fi}$			
		h_{ef}	R30	R60	R90	R120
		[mm]	[kN]			
M8 / M10 /IG-M6	VM-SH 16	130	0,29	0,21	no performance assessed	no performance assessed
M12 / IG-M8	VM-SH 20	≥ 130				
M16 / IG-M10	VM-SH 20	≥ 130	0,29	0,21	0,12	

Injection System HB-VMU plus for masonry	Annex C56
Performances – Hollow light weight concrete brick HBL 16DF Group factors, characteristic resistance and displacements	

Brick type: Hollow concrete brick Bloc Creux B40

Table C158: Description

Brick type			Hollow concrete brick Bloc Creux B40
Density	ρ	[kg/dm³]	≥ 0,8
Normalised mean compressive strength	f_b	[N/mm²]	≥ 5,2
Conversion factor for lower compressive strengths			$(f_b / 5,2)^{0,5} \leq 1,0$
Norm		[-]	EN 771-3:2011+A1:2015
Producer (country code)		[-]	e.g. Leroux (FR)
Brick dimensions		[mm]	500 x 200 x 200
Drilling method		[-]	Rotary drilling

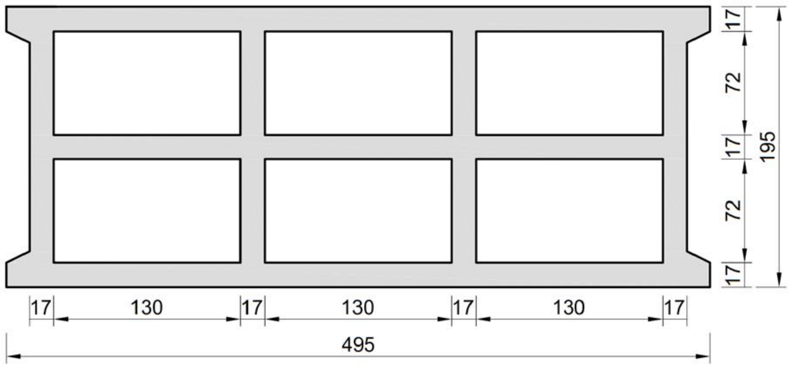
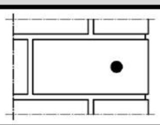
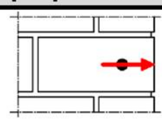
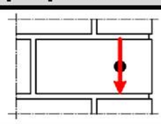


Table C159: Installation parameter

Anchor size			M8	M10	M12	M16	IG-M6	IG-M8	IG-M10
Installation torque	T_{inst}	[Nm]	≤ 4	≤ 4	≤ 4	≤ 4	≤ 4	≤ 4	≤ 4
Edge distance	c_{cr}	[mm]	120 (for shear loads perpendicular to the free edge: c_{cr} = 170)						
Minimum edge distance	c_{min}	[mm]	50						
Spacing	$s_{cr,II}$	[mm]	170						
	$s_{cr,\perp}$	[mm]	200						
Minimum spacing	$s_{min,II}$ $s_{min,\perp}$	[mm]	50						

Table C160: Reduction factors for single anchors at the edge

Tension load			Shear load					
			perpendicular to the free edge			perpendicular to the free edge		
	with c ≥	$\alpha_{edge,N}$		with c ≥	$\alpha_{edge,V\perp}$		with c ≥	$\alpha_{edge,V II}$
	50	1,00		50	0,35		50	1,00
	120	1,00		170	1,00		120	1,00

Brick type: Hollow concrete brick Bloc Creux B40 – continuation

Table C161: Factors for anchor groups

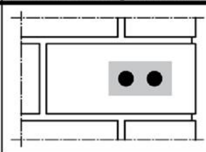
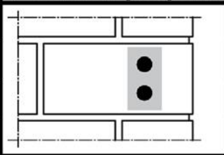
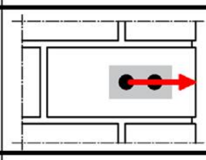
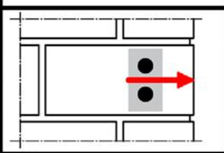
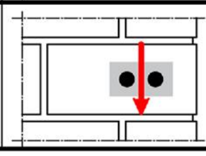
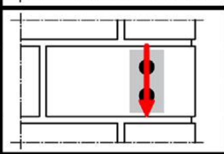
	Position parallel to horizontal joint				Position perpendicular to horizontal joint			
Tension load		with c ≥	with s ≥	$\alpha_{g\,II,N}$		with c ≥	with s ≥	$\alpha_{g\perp,N}$
		50	50	1,50		50	50	1,40
		50	170	2,00		50	200	2,00
		120	170	2,00		120	200	2,00
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\perp}$		with c ≥	with s ≥	$\alpha_{g\perp,V\perp}$
		50	50	0,55		50	50	0,35
		120	50	1,30		120	50	0,85
		120	170	2,00		120	200	2,00
Shear load parallel to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\,II}$		with c ≥	with s ≥	$\alpha_{g\perp,V\,II}$
		50	50	1,10		50	50	1,00
						50	200	2,00
		120	170	2,00		120	200	2,00

Table C162: Characteristic resistance under tension and shear load

Anchor size	Sleeve HB-	Effective anchorage depth	Characteristic resistance with $c \geq c_{cr}$ and $s \geq s_{cr}$						
			Use condition						
			d/d			w/d w/w			d/d w/d w/w
			24°C / 40°C	50°C / 80°C	72°C / 120°C	24°C / 40°C	50°C / 80°C	72°C / 120°C	all temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ 1)						$V_{Rk,b}$ 1)
		[mm]	[kN]						[kN]
Normalised mean compressive strength $f_b \geq 5{,}2$ N/mm² 2)									
M8 / M10 IG-M6	VM-SH 16	130	2,0	1,5	1,2	2,0	1,5	1,2	6,0
M12 / M16 IG-M8 /IG-M10	VM-SH 20	≥ 130							

1) $N_{Rk,b,c} = N_{Rk,p,c}$ and $V_{Rk,c\,II} = V_{Rk,c\,\perp}$ according to Annex C5
2) For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C158. For stones with higher strengths, the shown values are valid without conversion.

Table C163: Displacements

Anchor size	h_{ef}	δ_N / N	δ_{N0}	$\delta_{N\infty}$	δ_V / V	δ_{V0}	$\delta_{V\infty}$
	[mm]	[mm/kN]	[mm]	[mm]	[mm/kN]	[mm]	[mm]
M8 – M12 / IG-M6 – IG-M10	all	0,13	$0{,}13 \cdot N_{Rk} / 3{,}5$	$2 \cdot \delta_{N0}$	0,55	$0{,}55 \cdot V_{Rk} / 3{,}5$	$1{,}5 \cdot \delta_{V0}$
M16					0,31	$0{,}31 \cdot V_{Rk} / 3{,}5$	

Injection System HB-VMU plus for masonry

Performances – Hollow concrete brick Bloc Creux B40
Group factors, characteristic resistance and displacements

Annex C58

Brick type: Solid light weight concrete brick VBL

Table C164: Description

Brick type			Solid light weight concrete brick VBL
Density	ρ	[kg/dm³]	≥ 0,6
Normalised mean compressive strength	f_b	[N/mm²]	≥ 2
Conversion factor for lower compressive strengths			$(f_b / 2)^{0,5} \leq 1,0$
Norm		[-]	EN 771-3:2011+A1:2015
Producer (country code)		[-]	e.g. Bisotherm (DE)
Brick dimensions		[mm]	≥ 240 x 300 x 113
Drilling method		[-]	Rotary drilling

Table C165: Installation parameter

Anchor size			M8	M10	M12	M16	IG-M6	IG-M8	IG-M10
Installation torque	T_{inst}	[Nm]	≤ 2	≤ 2	≤ 2	≤ 2	≤ 2	≤ 2	≤ 2
Edge distance	c_{cr}	[mm]	150						
Minimum edge distance	c_{min}	[mm]	60						
Spacing	$s_{cr,II}$	[mm]	300						
	$s_{cr,\perp}$	[mm]	300						
Minimum spacing	$s_{min,II}$ $s_{min,\perp}$	[mm]	120						

Table C166: Reduction factors for single anchors at the edge

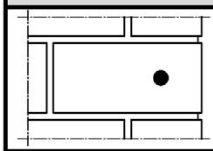
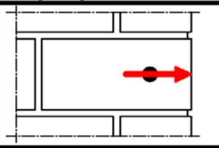
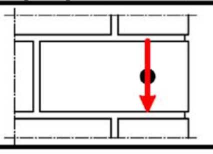
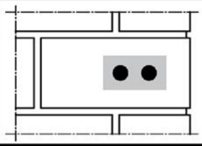
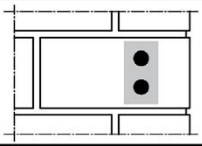
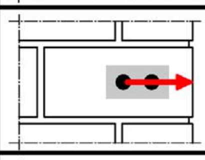
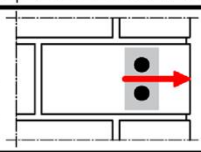
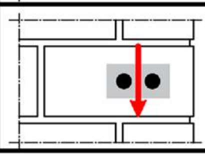
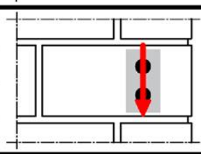
Tension load			Shear load					
			perpendicular to the free edge			perpendicular to the free edge		
	with c ≥	$\alpha_{edge,N}$		with c ≥	$\alpha_{edge,V\perp}$		with c ≥	$\alpha_{edge,V II}$
	60	1,00		60	0,25		60	0,40
	150	1,00		150	1,00		100	1,00

Table C167: Factors for anchor groups

	Position parallel to horizontal joint				Position perpendicular to horizontal joint			
Tension load		with c ≥	with s ≥	$\alpha_{g\,II,N}$		with c ≥	with s ≥	$\alpha_{g\perp,N}$
		60	120	1,00		60	120	1,00
		150	300	2,00		150	300	2,00
Shear load perpendicular to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\perp}$		with c ≥	with s ≥	$\alpha_{g\perp,V\perp}$
		60	120	0,25		60	120	0,25
		150	120	1,00		150	120	1,00
		150	300	2,00		150	300	2,00
Shear load parallel to the free edge		with c ≥	with s ≥	$\alpha_{g\,II,V\,II}$		with c ≥	with s ≥	$\alpha_{g\perp,V\,II}$
		60	120	0,40		60	120	0,40
		100	120	1,00		100	120	1,00
		150	300	2,00		150	300	2,00

Injection System HB-VMU plus for masonry

Performances – Solid light weight concrete brick VBL
Description, installation parameters, reduction- and group factors

Annex C59

Brick type: Solid light weight concrete brick VBL – continuation

Table C168: Characteristic resistance under tension and shear load

Anchor size	Sleeve HB-	Effective anchorage depth	Characteristic resistance with $c \geq c_{cr}$ and $s \geq s_{cr}$						
			Use condition						
			d/d			w/d w/w			d/d w/d w/w
			24°C / 40°C	50°C / 80°C	72°C / 120°C	24°C / 40°C	50°C / 80°C	72°C / 120°C	all temperature ranges
		h_{ef}	$N_{Rk,b} = N_{Rk,p}$ 1)						$V_{Rk,b}$ 1)
		[mm]	[kN]						[kN]
Normalised mean compressive strength $f_b \geq 2$ N/mm² 2)									
M8	-	80	3,0	2,5	2,0	2,5	2,0	1,5	3,0
M10 / IG-M6	-	90							
M12 / M16 / IG-M8 / IG-M10	-	100							
M8	VM-SH 12	80	2,5	2,5	2,0	2,5	2,0	1,5	
M8 / M10 IG-M6	VM-SH 16	≥ 85							
M12 / M16 / IG-M8 / IG-M10	VM-SH 20	≥ 85							

1) $N_{Rk,b,c} = N_{Rk,p,c}$ and $V_{Rk,c\,II} = V_{Rk,c\,\perp}$ according to Annex C5
2) For lower compressive strengths resistances must be multiplied by the conversion factor according to Table C164. For stones with higher strengths, the shown values are valid without conversion.

Table C169: Displacements

Anchor size	h_{ef}	δ_N / N	δ_{N0}	$\delta_{N\infty}$	δ_V / V	δ_{V0}	$\delta_{V\infty}$
	[mm]	[mm/kN]	[mm]	[mm]	[mm/kN]	[mm]	[mm]
M8 – M12 / IG-M6 – IG-M10	all	0,10	$0{,}10 \cdot N_{Rk} / 3{,}5$	$2 \cdot \delta_{N0}$	0,30	$0{,}30 \cdot V_{Rk} / 3{,}5$	$1{,}5 \cdot \delta_{V0}$
M16					0,10	$0{,}10 \cdot V_{Rk} / 3{,}5$	

Injection System HB-VMU plus for masonry

Performances – Solid light weight concrete brick VBL
Characteristic resistance and displacements

Annex C60